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The Geographical Journal

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January 1922

JOURNEYS THROUGH KAM (EASTERN TIBET)

Eric Teichman, C.I.E., B.A.

Read at the Meeting of the Society 6 June 1921. Map following p. 80.

Spelling of names is Tibetan, with alternative Chinese in brackets where necessary.

THAT part of Eastern Tibet dealt with in these notes, that is to say, roughly speaking, the basins of the Salween, Mekong, Yangtze, and Yalung rivers between the latitudes of Jyekundo and Atuntze, consists of the eastern portion of the great Tibetan plateau, here furrowed by the canyons of the above rivers and their affluents. These streams flow, in the northern part, through broad open grassy valleys (ice-formed), and in the southern part through deep narrow gorges (water-eroded). The general trend of the drainage being south and south-east, the roads, easiest in the north, become more and more difficult as one proceeds south; whence arises the great contrast between the two highways and their subsidiary branch roads, from Szechwan to Tibet—the north road from Tachienlu to Jyekundo, and the south road from Tachienlu *viâ* Batang to Chamdo. On the former, which might without great difficulty be made passable for cart traffic, one keeps at a comparatively high elevation all the way, and, although the passes are big, the gradients are not very steep; while on the latter one is constantly climbing in and out of deep narrow valleys, which bring one down to 8000 or 9000 feet, and scaling steep and difficult passes up to 15,000 and 16,000 feet.

Following down the headwaters of one of the big rivers, say the Mekong, from the north, cultivation begins generally at from 12,000 to 13,000 feet; the usual limit for barley being about 13,500 feet (except on certain favoured slopes), and for wheat 11,000 to 12,000 feet. Trees run up to 14,500 feet at least; but the big forests, of which there are many, are usually confined to the mountain slopes facing north; the same peculiarity being noticeable over a vast stretch of North-Eastern Asia from Shensi and Kansu across the Kokonor border into Tibet.

The wettest seasons of the year are the summer and autumn, which are followed by a period of extreme dryness (November, December, and January), when practically no snow falls at all, and hot days with a bright

sun shining out of a cloudless blue sky alternate with clear frosty nights. (These observations apply more particularly to the neighbourhood of Chamdo, *i.e.* the centre of Eastern Tibet.) As a result the snow-line is apt to be lower in the summer than in the winter; and we have crossed 17,000-foot passes which were practically free of snow in midwinter, and waded through drifts of newly fallen snow at 14,000 and 15,000 feet in midsummer. In South-Eastern Tibet, on the borders of Yunnan, Burma, and Assam, where the precipitation is probably greater, the line of perpetual snow appears to be considerably lower than in the dryer regions further north, thus giving the impression that the mountains are higher. In the spring another snowy season sets in, and as the weather is then still very cold, and the pasturage at its worst, this is the most difficult time of the year for travel. Generally speaking, however, one can cross almost any pass at any time of the year, though they may become blocked with snow for a few days at a time. The true line of perpetual snow in the neighbourhood of Chamdo is probably not far short of 18,000 feet.

The winter cold on the plateau country and on the high passes, though not often falling much below zero Fahrenheit, is rather severe, especially when a wind blows, and is felt all the more as one is there dependent on yak-dung for fuel. In the "Rong" (agricultural valley) country, on the other hand, the winter climate is perfect, while wood for fuel is also abundant.

Locally bred mules are by far the best animals for transport purposes (the mules of Szechwan and Yunnan being of a different breed and quite unable to stand the hardships of life in real Tibetan country for any length of time). The local pony is serviceable for riding purposes, but will always collapse before the mule when the pasturage gives out. Yak are very surefooted and strong, but are unsuited for long journeys except at a phenomenally slow rate of march; but they can usefully be hired from the nomads for a few days' march at a time in order to rest the mules when crossing grass country in the winter or spring, as is often done by the big Lhasa caravans. Yak do not and cannot eat grain; Tibetan mules and ponies will eat almost anything that is available, including tsamba, butter, and even meat at a pinch.

All this region from the Yalung to the Salween is known to the Tibetans as Kam, which, like Amdo in the north-east, is only a vague geographical term without any very definite significance. The Kamba-wa (natives of Kam) are considered rather a wild and barbarous race by the more highly civilized Tibetans of Central Tibet, and the swashbuckler from Kam is a familiar figure in Tibetan theatricals; yet the people of De-ge, for instance, are widely known for their skill in handicraft and their literary attainments. Probably the Kamba-wa owes his reputation for turbulence to his distance from the metropolis, which renders him uncouth in manner to the inhabitants of the latter. The real wild men of Tibet are the nomads of the north-east; while everywhere the house-

dwellers in the agricultural valleys (of which Kam has more than its share) are much more civilized than the tent-dwellers of the grass country.

The secret of successful and agreeable travel in Eastern Tibet is to depend as much as possible on the natives, the native animals, and the native products of the country. In a region where milk, butter, mutton, beef, barley, wheat, and game abounds, no tinned stores of any kind are needed; and the Chinese or other non-Tibetan element in one's caravan, both as regards animals or men, should be eliminated or reduced to a minimum. Fate has placed Szechwan, with its heavily manured and fertile lowlands and teeming millions of rice-eating inhabitants, next door to the bleak uplands of Eastern Tibet, inhabited by one of the hardiest races in the world; and, though the Chinese have of course a wonderful gift of adapting themselves to their surroundings, it is too much to expect that a Szechwanese should be able to adapt himself successfully to Tibetan conditions. The Kansu Mohammedans, on the other hand, who come into contact with the Tibetans further north in the Kokonor territory, are a hardy and virile race, and are much more at home in Tibetan country.

Eastern Tibet is so universally mountainous, and the troughs of the rivers, in which one is so often travelling, are so deep and narrow, that it is very difficult to describe the trend of the chief ranges; and the following observations on the subject are therefore of a somewhat tentative nature.

The Yü Chu (the river running south from the direction of Chamdo between the Mekong and the Salween) flows between two well-marked ranges with high rocky peaks rising in places far above the line of perpetual snow. These ranges appear to start from the high plateau, which, giving rise to the Yü Chu, lies between Chamdo on the Mekong and Shiyizamka (Chiayüchia) on the Salween. The eastern one probably runs right down to the huge snow massif which lies west of Atuntze (we only followed it down to the latitude of Tsakalo (Yenching)).

Another very prominent mountain feature in Kam is the big range which runs parallel to, and on the right-hand side of, the main road from Jyekundo to Tachienlu. It is a huge and imposing barrier wherever seen. South of Jyekundo it forms the divide between the basins of the Yangtze and of the headwater streams of the Mekong, and is here crossed by the Shung La, a high pass on one of the roads from Jyekundo to Chamdo. Proceeding south-east it is pierced by the gorges of the Yangtze below Chunkor Gomba (Tengko), and thence serves as the Yangtze-Yalung divide down to below Kantze. On this stretch of its course it contains some very high peaks and glaciers behind Dzogchen Gomba, below which it is crossed by the Tro La on the main road to De-ge. Further down it appears as the magnificent snow-capped range which stretches along the southern side of the Yalung plain from Rongbatsa to below Kanze; in this neighbourhood it is crossed by the Tsengu La and the Hön La on the road to Beyü and Southern De-ge, and by another high pass on a road to Nyarong. Below Kanze it is pierced by the gorges

of the Yalung, which are overlooked by a giant snow-peak, Kawalori, a sacred mountain of Nyarong. From here it continues south-east to Tachienlu, where it serves as a clear-cut ethnographical boundary between Chinese and Tibetan inhabited country; it is here split into two by the valley of the river of Tachienlu, which is overlooked by snows on both sides. From Tachienlu it continues south, containing here some very big peaks, towards the Yunnan border. I suspect this great range to be a south-easterly continuation of the Dang La mountains north of Lhasa, and to be therefore one of the principal features of the mountain system of Tibet.

There are some very high mountains on both sides of the Yangtze between De-ge Gonchen and Batang, including the giants immediately east of the latter; but I have not been able to distinguish the continuity of particular ranges in that neighbourhood.

It is to be hoped that the heights of the principal mountains of Kam will some day be ascertained by scientific measurement, the results of which will probably show the existence of some very high peaks. I believe that amongst the highest will prove to be the group of peaks behind Dzogchen Gomba (bearing roughly north from the Mizo La near Beyü); Kawalori on the Yalung below Kanze; some of the peaks on the Mekong-Salween divide between Chamdo and the latitude of Atuntze; the peaks east of Batang; and the peaks north and south of Tachienlu.

As regards big game in Eastern Tibet, the antelope (Tibetan go-wa, Chinese chitze) is constantly met with in the grass country. Burhel (wild sheep, na in Tibetan) and goral (wild goat) are very common in the mountains. There are at least two kinds of stag, one with spreading wapiti-like antlers found in the grass country, and another with single antlers with one brow tine found in the forests. On the grass lands round Jyekundo (which are really a portion of the Jang Tang, or northern plateau, of Tibet) we saw large herds of wild asses (chyong in Tibetan, yeh lotze in Chinese), and wild yak and long-horned antelope are found in the same country a little further north. The serow and the takin are not true Tibetan animals, and are found rather in the region of steep forest-clad mountains intervening between Szechwan and the Tibetan plateau. The above list might be greatly extended (bears, leopards, snow-leopards, etc.), but I mention only the animals with which we came into contact (which did not include Abbé Huc's unicorn). In Tzachuka (grass lands of the upper Yalung basin) and in the grass country about Jyekundo and Chamdo we found big game of all kinds remarkably tame and easily approached; this is because the big monasteries in those neighbourhoods do not permit shooting or hunting of any kind in their vicinities.

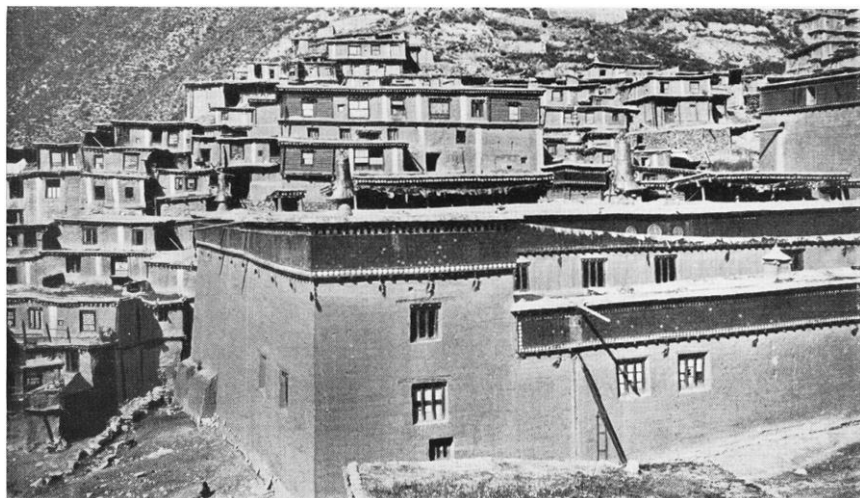
Of small game the common pheasant is confined to the border country between Szechwan and Tibet, as also are the gorgeous long-tailed varieties. Once in Tibet Proper one can get nothing but the huge white pheasant (very common and easily shot, but an indifferent table bird), a small



CAMP ON THE HLATO PLATEAU (14,000 FEET), GONJO GRASS COUNTRY



ON THE MAIN BATANG-CHAMDO ROAD, A FEW MILES SOUTH OF DRAYA-JYAMDUN



THE PRINTING ESTABLISHMENT IN THE MONASTERY AT DE-GE GONCHEN



SUNRISE ON THE SALWEEN-YÜ CHU DIVIDE, TSAWARONG



GORGES OF THE MEKONG, THREE MARCHES BELOW CHAMDO, ON CHAMDO-YUNNAN ROAD

partridge, and a kind of pheasant-partridge with a square tail (the latter at very high altitudes, perhaps a blood pheasant).

The following are some brief notes on the various routes which go to make up the attached map of Eastern Tibet :

(1) From Kanze *viâ* the Yalung valley to Dzogchen Gomba, and thence *viâ* Seshü and Tzachuka to Jyekundo.

The main road from Kanze to Dzogchen and Jyekundo, followed by Krishna, Rockhill, and other travellers, crosses the Yalung above Kanze and proceeds directly north-west *viâ* Rongbatsa and the Muri La. The road we took follows up the banks of the Yalung, which issues from a gorge in the mountains on to the Rongbatsa-Kanze plain about opposite the big monastery of Darjye Gomba.

We marched up the Yalung for about a week. It is here a swift dark green stream, flowing through alternate gorges and stretches of cultivated valley, at an average height of 11,000 to 12,000 feet. On either side lies the grass country, extending northwards for hundreds of miles to the distant Kansu border. The valley, forming a succession of cultivated oases in a desert of grass country, is thickly dotted with monasteries which serve as religious centres for the surrounding nomads. One of these monasteries, Denchin Gomba, is considered the most important establishment of the Bon sect in Eastern Tibet. This Bon sect is generally understood to be a relic of the old nature worship of Eastern Asia, whose followers in Tibet compromised with the invading Buddhism by adopting the gods and saints under different names and much of the lamaistic ritual reversed, *e.g.* turning wheels and circumambulating holy places in the reverse direction.

Several old Tibetan forts, the seats of small local officials, are passed on the way, such as Deji Podrang, Trötsang Podrang, Dema Podrang, and others. A "Podrang" in Eastern Tibet means a residence belonging to a chief, and occupied by him, or more usually by a district officer appointed by him. They correspond more or less to the "Dzong" of Central Tibet, where the word Podrang seems to be confined to the Dalai Lama's palace, *e.g.* Potala Podrang. They are always of the same architecture, a rough square several stories in height, with an open court in the middle.

At Denchin Gomba the Yalung is joined by an important tributary from the north, the Di Chu, up which lies the main road into the country of the independent Ngolo nomads. The valley of the Yalung above Kanze may be said to be the northern boundary of the settled and more or less civilized parts of Kam, and beyond it lie the unknown pasture lands of these Ngolo and other nomads, which extend from here across the Yellow River basin to the Kansu border. The Ngolo are noted for their horsemanship, their shaven heads, and their predatory habits. Apart from some large monasteries, mostly of the Red Sect, there are no settled habitations in their country, which is nowadays about the least-known region in Central Asia.

The Yalung valley from Deji Podrang up to Nando is known as Tzako, and above Nando as Tzachuka. These names mean, roughly, "basin of the Tza," the Yalung being known as the Tza Chu above Kanze, and the Nya Chu below; whence the name Nyarong (Chantui in Chinese) for the region along the river between Kanze and Nyachuka (Hokou).

At the hamlet of Nando (12,500 feet) we left the Yalung, and turned up the valley of a tributary stream which led us after a short march right up to the great monastery of Dzogchen. Our destination being Seshü in Tzachuka, we might have continued up the Yalung; but finding myself—unexpectedly according to the map—so close to Dzogchen, I proceeded there in order to connect my route survey with a well-known point.

Dzogchen is a cold, bleak spot, about 13,000 feet high, lying right under the snows and glaciers of the Yalung-Yangtze divide. We had here rejoined the main road to Jyekundo, which we followed for four marches, past Göze (Lintsung), a large Sajya monastery and seat of the Göze chief (who is a jyelbo, or king, though his territory is small), to a point on the Yangtze known to the Tibetans as Dröma Hlakang (the name of a famous temple there), and to the Chinese as Tengko. A cultivated plain (11,000 feet odd) here stretches along the Yangtze, on the opposite bank of which lies a large monastery called Chunkor Gomba.

From here the main road to Jyekundo continued up the Yangtze, crossing the river at Drenda Ferry a little further up. We turned north into the mountains, and crossing a high pass in the Yangtze-Yalung divide (Dzi La, 15,800 feet) found ourselves on an undulating grass plateau, a region of flat open valleys 14,000 to 15,000 feet high, sloping almost imperceptibly down towards the Yalung. Another three days' march across these grasslands brought us to Seshü Gomba, a very important Sajya monastery lying at an elevation of over 13,000 feet in a perfectly flat plain a few miles from the Yalung; the latter being here joined by a river from the north called the Marmu Chu (marked on the latest map of Tibet). Seshü (Shihchu) is also the name of the district, which forms the northernmost part of De-ge State. The population is purely nomadic, and from here one could travel north to Sining or Taochow and never see a house.

This road through Tzachuka *via* Seshü Gomba is much used by the trading caravans going in and out of Tibet in the summer in preference to the main road along the Yangtze, as by it they can secure good grazing and avoid the agricultural valleys all the way from Jyekundo to near Kanze.

Leaving Seshü Gomba and turning our backs on the Yalung, we travelled for two days in a westerly direction up one of the flat grassy valleys to reach an easy pass, the De-ge-Jyekundo boundary, whence we descended steeply into a ravine and so on down to the Yangtze; the latter is here, at low water, a clear blue stream, flowing in alternate rapids

and deep still pools at an elevation of about 11,700 feet. After crossing in skin coracles and marching up the river for a few miles, we turned up into the mountains at a small monastery called Gala Gomba, crossed a pass, and descended south-west to Jyekundo.

Jyekundo (Chinese Chiehku) is a straggling mud village lying in a small cultivated plain formed by the junction of two streams which combine to form a river flowing east to join the Yangtze. (The termination "do" always denotes a place so situated—as, for instance, Jyekundo, Chamdo, Dartsendo, etc.) The large Sajya monastery of Jyeku Gomba is built on the hillside overlooking the village. In spite of its mean appearance, due to its being a nomad rather than an agricultural centre, Jyekundo is perhaps the most important trade mart in Kam, lying as it does at the junction of the two great trade routes from Sining in Kansu and from Tachienlu in Szechwan to Lhasa and Central Tibet. Nearly all the caravans pass through it, and usually halt in the neighbourhood for a month or so to enable their animals to recuperate on the surrounding pastures. A big annual fair is held here in the month of August.

At Jyekundo one can buy candles and cigarettes from India, brass cooking-pots and vermicelli from Kansu, tea and silks from Szechwan, and sugar from Yunnan. Tracks radiate south-east to Tachienlu, south to Chamdo (for Yunnan), south-west to Lhasa, north to Sining, north-east to Labrang and Taochow, and east to Sungpan. All around stretches for enormous distances the best wool-raising country in Asia, the northernmost edge of which is tapped by the Sining–Yellow River–Tientsin export trade.

Foreign travellers who have visited Jyekundo include Krishna, Rockhill, Grenard and de Rhins, Rijnhart, and Kozloff.

(2) From Jyekundo *via* Nangchen (Lungchin) to Chamdo.

This route runs south-west from Jyekundo across the various head-water streams of the Mekong, and eventually descends the Ngom Chu, the most westerly branch of that river, in a south-easterly direction to Chamdo. Another road, running south-east from Jyekundo, seems to be that followed by the Russian explorer Kozloff.

The first day's march from Jyekundo took us over a pass to a camp in a flat grassy plain watered by a tributary of the Barung Chu, the river of Jyekundo. This plain is bounded on the south by a high rocky barrier range, the Yangtze–Mekong divide, which we crossed on the following day by a high pass (Shung La, 16,000 feet), deep under new-fallen snow in early May. From this pass we descended across grassy park-lands to the Dze Chu, one of the three principal headwater streams of the Mekong, which was just fordable when we crossed it. On the way down we passed a big and wealthy monastery called Rashi (also known as Lungshi) Gomba.

One of the most remarkable journeys ever made in Tibet was that of

the Dutch missionaries, Mr. and Mrs. Rijnhart, in 1898 (see 'With the Tibetans in Tent and Temple'). Starting from Sining in Kansu, without a proper caravan or any equipment for their long journey, they eventually reached the neighbourhood of Lhasa, where they were stopped and turned back along the Jyekundo road. Arrived at a camp on the banks of the Upper Mekong, Mr. Rijnhart left his wife to go and seek assistance or ask the way of some nomads. Mrs. Rijnhart watched him follow a path round a corner of rock, and never saw or heard of him again. From the spot where her husband disappeared, Mrs. Rijnhart travelled to a monastery she calls Rashi Gomba, whence she reached Jyekundo in three days. The Rijnharts left no geographical records of their journey, but I have no doubt that we were, just twenty years later, in the neighbourhood of the scene of the Rijnhart tragedy, and that the Rashi Gomba we passed is identical with the monastery of that name referred to in Mrs. Rijnhart's story. Mrs. Rijnhart eventually reached Tachienlu after undergoing the most terrible hardships, and, as Mrs. Moyes, was subsequently well known to missionaries and other foreigners in Western China. Her experiences had however permanently undermined her health, and she died not long after.

Leaving our camp on the banks of the Dze Chu, we spent the next few days crossing the low divide of rolling downland between it and the Dza Chu, the principal branch of the upper Mekong, eventually descending to the latter through a narrow gorge, a mere cleft in the limestone mountains. On the banks of the Dza Chu (12,000 feet) we met with trees, houses, and cultivation again.

(It should be mentioned that the Tibetan names Tza Chu and Dza Chu, for the upper Yalung and upper Mekong respectively, are identical in sound and often in spelling also ; but I have retained the above romanization to avoid confusion.)

The Dza Chu, where we debouched upon it, flows in a broad sandy bed between low hills of red sandstone. It is just fordable at low water, but we crossed by coracle ferry at a spot called Gurde Druka ; this is probably the same as the Gurtu-tuka, where Kozloff crossed coming from the north-east and proceeding south-east (Druka means "boat-place" or ferry).

Continuing south, we crossed a formidable pass (Manam La, 16,000 feet) and descended to Nangchen (Lungchin). This place consists of a Gajuba monastery, called Tsepchu Gomba, a huge heap of Mani stones, the chief's castle, and a hamlet of mud hovels, and lies hidden away at an elevation of 13,500 feet in a ravine on the southern slope of the precipitous Dza Chu - Bar Chu divide. It is the seat of the Tibetan chief (of the rank of *gyelbo* or king) ruling the state of the same name which covers a large area of grass-country in the upper Mekong and Yangtze basins, extending originally beyond Jyekundo. It is an important religious centre also, and big game, mostly antelope and wild sheep, are consequently remarkably tame in its vicinity.

Leaving Nangchen, we crossed the Bar Chu, down which runs an alternative trail to Chamdo (not that followed by Kozloff). The Bar Chu, which figures too prominently on some maps of Tibet, is here a mere stream (at low water), only a foot or two deep, and with its sources probably not more than 50 miles distant. Continuing south, we crossed an easy pass and descended on the following day through a winding gorge between towering walls of rock to the Dje Chu, where we camped opposite a small monastery called Nede Gomba.

This river, lower down known as the Ngom Chu, was, in May, a swift muddy torrent, unfordable, and of about the same size as the Dza Chu which it joins at Chamdo to form the Mekong. It is here found flowing from north-west to south-east in a cultivated valley (12,000 feet) between red hills dotted with pine trees. Crossing by coracle ferry, we followed down the valley to a monastery called Gushi Gomba, where the river is spanned by a frail iron suspension bridge, the only one we met with in Eastern Tibet (they are common in the Chinese border country); the hamlet near by is naturally called Ja-zamka.

A few miles below Gushi Gomba the Dje Chu takes an easterly bend through a gorge, and our trail turned south away from the river. During the next few days we crossed two more high passes, on one of which, the Dongma La, we found ourselves marching for a mile or two along the top of the watershed between the Dje Chu and the river of Riwoche. The country traversed in this neighbourhood is a pleasant region of grassy vales alternating with pine forests, in one of which we came upon a flock of monkeys hanging in the trees at an elevation of over 13,000 feet.

Eventually we rejoined the Ngom Chu (by which name the Dje Chu is known from here down to Chamdo) a short distance below its confluence with the Bar Chu, and marched down its valley past numerous hamlets and monasteries for the rest of the way to Chamdo.

We found both branches of the Mekong a thick reddish-yellow in colour as early as May; but by November they were again a clear blue. The discoloration in summer is due to the red sandstone formation of the elevated plateau country drained by the headwater streams. These freeze in the winter in the higher valleys, when the rivers are mainly fed by the more powerful and perennially clear streams issuing from the gorges in the underlying limestone.

During this journey from Jyekundo to Chamdo we crossed all the various branches which go to make up the Mekong, Dze Chu, Dza Chu, Bar Chu, Dje Chu, and others; it is really only from Chamdo down that the Mekong can take rank as one of the great rivers of Asia (whereas the Yangtze is a big river as far up as north of Jyekundo). The Tibetans apply the name Dza Chu to the Mekong above and below Chamdo; but lower down, at Tsakalo (Yenching) for instance, they call it the Da Chu and also the La Chu. (There is a great lack of continuity in the names of Tibetan rivers, as for instance Tza Chu and Nya Chu for different

parts of the Yalung.) The Chinese call it the Lantsang Kiang from Chamdo down, being largely unacquainted with the country further north.

(3) From Chamdo by the main road *viâ* Draya Jyamdun and Markam Gartok to Batang.

This is a portion of the main south road from Lhasa to China, and having been followed by various foreign travellers in the past, does not call for much description. A great number of passes have to be crossed, and it is not the least arduous portion of what is perhaps the most difficult highway in the world.

(4) From Batang *viâ* Jyase Gomba and the Ong Chu valley to Draya Jyamdun, and thence *viâ* Yemdo (Yentaitang) and the Me Chu valley to Chamdo.

This is an alternative route between Batang and Chamdo. As far as Draya Jyamdun it is practically a straight line, thus avoiding the *détour* made by the main road *viâ* the Bum La and Gartok.

The Yangtze below Batang flows in an immense canyon 7000 to 8000 feet deep, and this trail climbs from the water's edge straight up the mountain-side to cross the top of the range, descending into a narrow forested valley on the other side. Our camp here lay almost on the meeting point of Markam, Sangen, and Batang territories. Another big pass has to be crossed to reach the important monastery of Jyase Gomba in the valley of the Ong Chu, the large stream which, rising on the grass lands of Gonjo, drains Eastern Markam and joins the Yangtze just below Drubanang Druka (Chupalung).

The Ong Chu is followed up almost to its sources, where a small pass gives access to a basin-like plateau at an elevation of about 14,000 feet, a marshy plain surrounded by low hills. This neighbourhood is known as Hlato (to be distinguished from the state of Hlato north of De-ge), and forms here the Yangtze-Mekong divide; from it streams flow west to Draya, south to Markam, and north to Gonjo. From the Hlato plateau we turned west, and followed down one of the headwater streams of the Draya river to Draya Jyamdun.

From Draya Jyamdun, instead of following the main road over the big Gam La, which happened to be deep under snow, we took on this occasion the trail down the Me Chu valley past the ruined monastery of Yemdo (Yentaitang), formerly one of the residences of the lama ruler of Draya. The Me Chu is left just short of its confluence with the Mekong at Drentsa Druka, and the main road is eventually re-joined at the Ipi La, two short marches from Chamdo. This Ipi La is a curious mountain knot with streams flowing in four directions, north down to Bonde, west down to the Mekong, south down to Yemdo, and south-east down to Bagung, and is the end of the big range crossed by the Jape La on the Chamdo-De-ge road; we crossed it on several

occasions, and the only time the snow on it was at all deep was in midsummer.

(5) From Chamdo *viâ* Gangto Ferry to De-ge Gonchen, and thence *viâ* Mesho and Dzenko to Rongbatsa and Kanze.

This is the main road connecting Chamdo with De-ge, and is nowadays one of the most frequented trails in Eastern Tibet. After crossing two difficult passes on leaving Chamdo it traverses easy grass country for several days, passing over the Mekong-Yangtze divide at a low grass pass called the Lazhi La. The camping-ground called Chorzhung on the eastern side of this pass lies on the headwaters of a big stream called the Re Chu, which with its southern tributary the Mar Chu drains the whole of Gonjo province. A later journey enabled me to lay down the approximate course of this river on the map.

The descent to and ascent from the Yangtze, which is crossed by coracle ferry at Gangto Druka, is made through the usual precipitous gorges, which here as elsewhere lead down from the plateau country to the valleys of the big rivers.

What was formerly considered by the Chinese as the main road from De-ge Gonchen to Kanze, north-east across a big pass called the Tro La, and thence south-east *viâ* the Yilung grasslands to Rongbatsa (see Mr. Coales' route, 1916-17, in map published in the *Geographical Journal*, Oct. 1919), had for various reasons fallen into disuse at the time we were making this journey. We followed another road further south which passes through the heart of the best part of De-ge, traversing a series of fertile little valleys draining from the Yangtze-Yalung watershed range into the former river. The chief of these are called Mesho, Dehlung, and Dzenko. The latter is an important centre lying at the junction of several valleys, up which roads lead north-west to De-ge Gonchen, east to Rongbatsa and Kanze, south to Nyarong and Litang, and west to Beyü and Batang.

The distance from Dzenko to Rombatsa can be covered in two long marches. The trail crosses the Tsengu La, the big pass over the snow range which here serves as the Yangtze-Yalung divide, and descends across uninhabited grasslands to the cultivated plains along the Yalung and the village of Rongbatsa, whence Kanze can be reached in one long march by a level road along the river.

(6) From Rongbatsa, near Kanze, *viâ* Beyü and Gonjo to Draya Jyamdun.

On our way back to Dzenko our guides on this occasion took us over another pass, the Hön La, further north, the Tsengu La being temporarily blocked by snow. The former pass is equally high, but broader than the latter, and we were able to find a place where we could struggle over through the snow.

The higher grass valleys on the Rongbatsa side of the Yangtze-Yalung divide in this neighbourhood form a nomad district called Aser, and belong to Nyarong (Chantui), and that portion of the Yalung valley can be reached direct from here *viâ* a monastery called Norlong Gomba.

From Dzenko we followed down the wooded gorges of the Dzin Chu to the village of Horbo, situated just short of the latter's confluence with the Yangtze. This river, the Dzin Chu, is one of the three big streams (the other two being the Ba Chu of Batang and the Ngü Chu of Beyü) which drain the unknown stretch of country between the Yalung and the Yangtze north of the Litang-Batang road. It is said to take its rise on an extensive grass plateau called Trungko, which forms the Yangtze-Yalung watershed and the De-ge-Nyarong boundary in that direction. There is a trail leading directly from Dzenko to Nyarong, by following which one could probably discover its sources.

At Horbo we left the river and turned south into the mountains to reach Gato Gomba, a big Red Sect monastery strikingly situated near the top of a mountain ridge at an elevation of 13,500 feet, with pine-clad slopes falling away steeply into the valley thousands of feet below. On the next day a big pass, the Mizo La, over 16,000 feet high, is crossed to reach Beyü Gomba, a similar monastery to Gato Gomba, lying in the deep narrow valley of the Ngü Chu a few miles above its confluence with the Yangtze. This is all part of De-ge state, which probably contains more big and wealthy monasteries than any other part of Tibet.

From Beyü the main road to Batang, which we followed on another journey, runs south; on this occasion we took the Gonjo trail, which leads south-west over the mountains and down to the Yangtze. Crossing the big river by the usual coracle ferry, we marched up its right bank for a few miles to a small monastery called Polo Gomba, situated at the point where the Yangtze, making a right-angle bend from north-east to south-east, is joined by the river of Tungpu from the north-west. The three big bends of the Yangtze in De-ge were unknown to European geography before Mr. Coales placed them on the map as the result of his journey in 1916.

From Polo Gomba we turned west away from the Yangtze, and after crossing two passes, the second of which, the Nadzong La, is the boundary between De-ge and Gonjo, we emerged into the valley of the Re Chu. This river, which drains the whole of Gonjo, consists of two main branches, one from Chorzhung in the north, and one from Gonjo Dzong in the south, which unite at a place called Sharundo; local information tends to show that there is a third branch from the west. The combined stream flows to the Yangtze, which I was told it joined somewhere near Gaji. It is quite an important river and deserves to be correctly represented on the map.

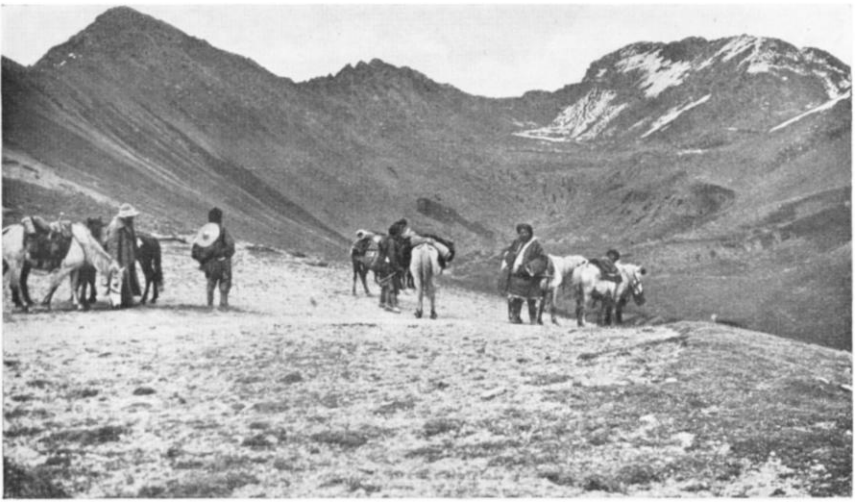
After following the Re Chu for a time and then crossing it, our trail worked away from the river, first through difficult forest country, and then



MONASTERY OF GATO GOMBA (13 500 FEET), ON MAIN ROAD FROM BATANG TO DE-GE



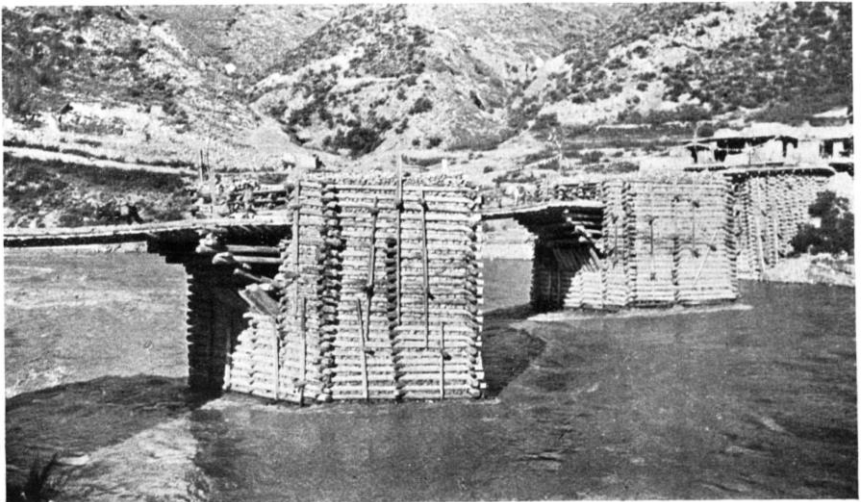
SNOW-PEAKS ON THE YÜ CHU-SALWEEN DIVIDE FROM NEAR DI IN TSAWARONG



SUMMIT OF TSENGU LA (15,800 FEET), DIVIDE BETWEEN YALUNG AND YANGTZE RIVERS, AND BOUNDARY BETWEEN DE-GE AND KANZE



VALLEY OF THE KARGUNG RIVER, WESTERN DE-GE



THE SZECHWAN BRIDGE OVER THE MEKONG AT CHAMDO

through a semi-desert region of red sandstone, eventually rejoining it a short distance below Gonjo Dzong. This place is the capital of the small Tibetan province of Gonjo.

I believe that M. Bonvalot must have visited Gonjo Dzong. Being deflected north of Chamdo, he seems to have come south probably from Toba to Gonjo Dzong, and thence to have continued south across the Hlato plateau to Tara in the Ong Chu valley, and so to Markam Gartok. If there is a detailed map of his route it would help to clear up some of the obscure points about the river system of Gonjo.

Draya Jyamdon is reached from Gonjo Dzong in two easy marches, crossing the grass country on the Yangtze-Mekong divide by two small passes.

(7) From Chamdo *via* Tsawarong to Tsakalo (Yenching) on the Mekong, and thence to Batang.

This route is known as the Yunnan Road, being the principal trade route from Yunnan into Tibet. For the first two marches the trail leads down the right bank of the Mekong, which flows in a barren gorge between mountains of sandstone until a few miles beyond the village of Wayo it leaves the river (the latter flowing south-east) and slants south across a low ridge to reach the valley of the Riwoche river, here called the Se Chu. Marching a few miles down the gorges of this stream we reached an open cultivated valley dotted with farms, called Jyedam, the seat of a small Tibetan official and the principal centre of trans-Mekong Draya. It commands the road we were travelling by, and also a road into Tibet from Drentsa Druka, the ferry across the Mekong below Yermdo, and is therefore considered an important point.

The Riwoche river (Dzi Chu and lower down Se Chu), which is here a stream of considerable size, with its valley eroded down nearly to the level of the Mekong, is incorrectly shown on British maps of Tibet as being a tributary of the Salween. As a matter of fact, it appears to follow a south-easterly course from Riwoche and Enda, and is found in this neighbourhood flowing in a deep gorge only a mile or two distant from and roughly parallel to the Mekong, from which it is divided by a narrow ridge less than 1000 feet above the two valleys. This curious configuration is characteristic of south-eastern Tibet, the land of deeply eroded parallel rivers.

Below Jyedam we left this river, which here turns south-east towards its confluence with the Mekong near by, and spent the next three days in crossing an elevated grass plateau in a south-westerly direction to a monastery called Bomda Gomba on the headwaters of the Yü Chu, a long and important tributary of the Salween. This plateau (elevation about 14,000 feet), from which another trail leads westwards and descends to the main Lhasa road at Shiyizamka (Chiayüchiao, the bridge over the Salween), forms here the Mekong-Salween divide, and belongs to

the Tibetan province of Bashü. We crossed it in very cold weather in the winter, no snow, but with the temperature below zero.

Two days' march down the flat grassy valley of the Yü Chu, past a monastery called Tendo Gomba, brought us to Dzogang (pronounced Dzogung or Dzogong). The elevation here is still about 13,000 feet, and the population scanty and for the most part nomadic.

Dzogang consists of a large monastery, a hamlet, and a Dzong, and is the seat of the Tibetan official, called the Dzogang Deba, who administers the Tibetan province of Tsawa Dzogang. His territory appears to comprise the greater portion of the basin of the Yü Chu from near its sources on the Bashü border on the plateau down to the neighbourhood of its confluence with the Salween at Menkung, the latter place lying within the territory ruled by the Tibetan official resident at Sangachu-Dzong (west of the Salween). The name Tsawarong, Tsarong, or Charong, which appears on maps of Tibet, means the "Rong," or agricultural valley part, of Tsawa.

From Tsawa Dzogang we travelled for five short marches down the valley of the Yü Chu, which is here thickly forested and very sparsely populated, to Drayü Gomba. It is to the valley of this river, trending in exactly the required direction, that the so-called Yunnan Road from Chamdo to Tsakalo and Atuntze owes its existence. It is one of the main arteries of communication in Eastern Tibet. As well as linking Yunnan with Chamdo, it connects with the main Lhasa road at Shiyizamka on the Salween, and it is the route generally followed by Yunnanese produce bound for Lhasa and Central Tibet; it is also much frequented by pilgrims from all parts of Kam bound to and from a sacred mountain in North-Western Yunnan. If the days of railway construction ever come in these parts the Yü Chu valley offers what is probably the easiest line of penetration for a railway from the direction of Burma up to the highlands of Central Kam.

Drayü Gomba (Dayul on our maps; the letter *r*, which is subjoined, is pronounced; while the letter *l* at the end is silent and serves only to modify the *u*, as in Beyü(1), Seshü(1), Tzayü(1), etc.) is an important monastery lying at the junction of the road we were following and one from Markam-Gartok, across the Mekong at Samba Druka, and *viâ* Drayü into the Salween valley; the Indian explorer Krishna visited it coming by the latter road. The monastery buildings lie on the right bank above the river at an elevation of slightly over 11,000 feet, backed by pine forests and a snow range. A small Tibetan military official resided here at the time of our visit.

Leaving Drayü Gomba we continued down and in the neighbourhood of the Yü Chu valley for another four marches (a march in Tibet under Tibetan conditions amounts usually to 12 to 15 miles as against 20 to 30 under Chinese conditions with posting stages, etc.) to a group of farms called Di, which lies at the junction of the trails of Tsakalo (Yen-

ching) and Atuntze (in Tibetan Jü) : a branch of the latter road leads to Menkong on the Salween, which is close by. One has here reached the difficult deeply eroded country of South-Eastern Tibet, the river flowing in a narrow forested canyon between two parallel ranges topped with eternal snow.

From Di we turned east into the mountains, leaving the Yü Chu flowing south towards its confluence with the Salween near by. The trail leads over a high pass (Di La, 15,200 feet) in the Mekong-Salween divide, and descends to the Mekong to reach Tsakalo; another pass, called the Beda La, lying a little further south on the same ridge, leads to Menkong (see Colonel F. M. Bailey's route from Batang to Assam, *Geogr. Journ.*, April 1912). The Mekong flows here, as elsewhere in Kam below Chamdo, in a deep narrow canyon hemmed in between mountains rising many thousands of feet almost from the water's edge.

Tsakalo is an important point owing to its brine wells, which lie along the banks of the Mekong, so low down that when the water rises in the summer they become flooded. The salt produced supplies all South-Eastern Tibet and North-Western Yunnan (further north the inhabitants of Kam draw their supplies of this indispensable commodity from the rock-salt deposits of the Kokonor). Tsakalo appears on most of our maps as Yakalo, or Yerkalo, which, meaning simply "the high ground" above the brine wells, is properly speaking the name of a hamlet near by where the Catholics have an establishment; this name is quite unknown to the Tibetans other than those of the locality, while the name Tsakalo is familiar to every one in South-East Kam. The Chinese call it Yenching, the meaning being much the same as the Tibetan Tsaka, *i.e.* brine wells.

Tsakalo lies in China, the Di La range being here the boundary; it was formerly a part of Batang territory, but is now a separate district. The population is partly Moso (a non-Tibetan race called by the Tibetans Djong); this is, I think, the most northerly point at which such people are found.

The main road from Tsakalo to Batang, five days' march, runs east across the Yangtze - Mekong divide by a pass called the Chia La to Tsongen (Chung-ai), and thence *viâ* Pamutang to Batang, keeping in Chinese territory all the way. Circumstances led to our following a different route, which took us north across the boundary into Markam, and then back into Batang territory, by the Bum La (Ningching Shan), and so down to Batang. The southern portion of Markam, which we traversed on this journey, is a pleasant park-like region of alternating forest and grass land, but at too high an elevation to be agreeable in mid-winter. It is all drained by the river of Gartok, the course of which, with all its tributaries, is usually very incorrectly portrayed on the map.

(8) From Batang to Beyü Gomba.

This is the main road from Batang to De-ge, and is, and always has

been, a much-travelled trail. It follows up and near the valley of the Batang river for two marches to the village of Hlamdo. This river is a comparatively large stream, comparable to the Ngü Chu and the Dzin Chu in size; as far as Hlamdo it flows north-west, and then makes a remarkable turn back on its tracks to flow south past Batang to the Yangtze. Its upper valley, inhabited by a particularly turbulent tribe of Tibetans, called Lengkashi, and its sources are unknown; it appears to flow roughly parallel to and north of the Batang-Litang road.

From Hlamdo the trail leads up a long forested valley and over a pass, the Ngupa La, into De-ge. The country round Batang is nominally under Chinese control, and the forests are full of Chagba (Tibetan brigands) from Lengkashi and Sangen, who harass travellers and ambush the caravans.

Descending from the Ngupa La we reached Gaji (Kaiyu), formerly the seat of an hereditary Tibetan official under the De-ge chief. Gaji lies in a valley parallel to and only a few miles distant from the Yangtze; the actual canyon of the latter lies in a territory called Sangen ("Bad Lands," transliterated by the Chinese as Sangai), the inhabitants of which, like the people of Lengkashi, have always been robbers and raid the Chinese and Tibetan inhabitants of Batang.

From Gaji the trail continues north up another side valley and over a pass, the Me La, which gives access to Beyü and the basin of the Ngü Chu, whence Kanze is reached by the route previously described.

Before the paper the PRESIDENT said: Our lecturer this evening, Mr. Teichman, belongs to the Consular Service of China, to which we in this Society are very much indebted. For many years members of that Service have made valuable explorations in unknown parts of the Chinese Empire, and we shall hear this evening, from the lecturer, of some work which he has done on the borders of Tibet. I will ask Mr. Teichman to give us his paper.

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

The PRESIDENT: Mr. Archibald Rose is here. He has made several journeys in that region, although not over exactly the same route. Perhaps he will very kindly speak.

Mr. ARCHIBALD ROSE: I am afraid I have little to add to the delightful lecture which Mr. Teichman has given us. I have never been in the mysterious red square shown on the map to-night, though I have bumped up against it from time to time in the course of my work and travels. Nearly twenty years ago I reached its eastern frontier, but at that time no British official was allowed to cross the border. Ten years later I was stationed near its southern frontier, and there then seemed some hope of getting in. But immediately after my arrival two travellers tried to penetrate it through the Salween gorges, and, as they were murdered by the tribesmen, further efforts were promptly discouraged. All who have had any experience of that remote corner of Asia will appreciate the fact that this lecture records a remarkable addition to our geographical knowledge. They will realize the dangers and difficulties, and the solid accom-

PART OF KAM in EASTERN TIBET

by
ERIC TEICHMAN, C.I.E., B.A.

Scale 1/1,000,000 or 1 Inch = 15.78 Stat. Miles.

Miles 10 20 30 40 Miles
Kilometres 10 20 30 40 50 60 Kilometres

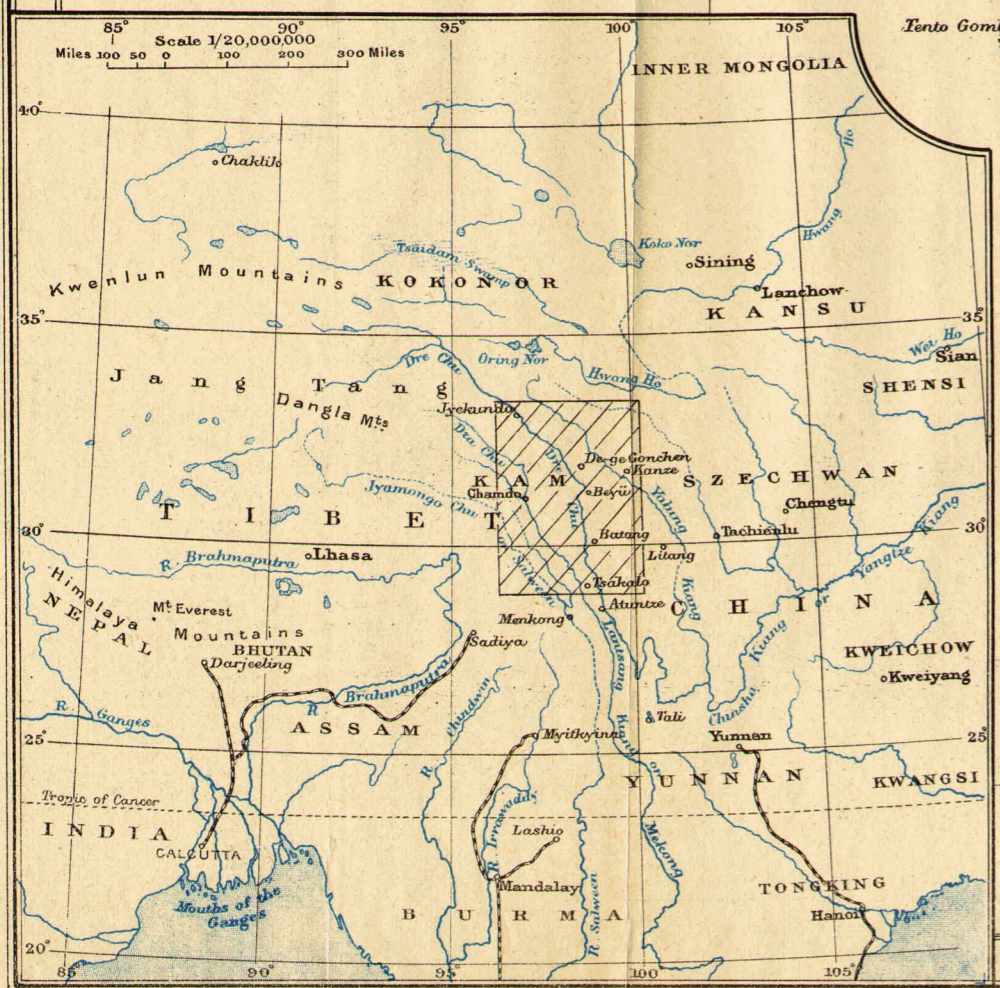
Reference

Routes followed by Mr. Teichman Pass x
Boundaries of states and provinces shown thus
Names are all given in Tibetan, with Chinese names, where
the latter are in common use, added in brackets.
Tibetan romanisation: vowels as in Italian and consonants as
in English, with j substituted for soft g.
Chinese romanisation according to Chinese Postal System.



East Tibetan Glossary.

- Chu = River
- Druka = Ferry
- Ho = River valley
- Ka = River valley (mouth)
- Ding = Flat in a river valley
- Gony = Cultivated slope above a river
- Do = Confluence of streams
- Sumdo = Confluence of three streams
- Zamka = Spot where river is bridged
- Jaxamka = With iron chain bridge
- Rong = Cultivated valley
- Podrang = Seat of native chief
- La = Pass
- Ri = Peak
- Kari = Snow peak
- Gomba = Monastery
- Tang = Plain
- Rawa = Hamlet
- Tsaka = Place where salt is produced
- Dzong = Fort, or seat of an official.



This map is based upon the prismatic compass traverses of Mr. Eric Teichman, adjusted, at the places indicated, to the astronomically determined latitudes of earlier travellers, whose names are given. In certain districts the route surveys of these travellers have also been used to supplement and complete the river systems. The longitudes depend upon the traverses as no reliable observations are available. Throughout the plotting comparatively little adjusting was necessary to Mr. Teichman's traverses to bring the points into agreement with the latitudes. Heights (in metres) are from aneroid readings, and must be considered as only approximate.

33°

32°





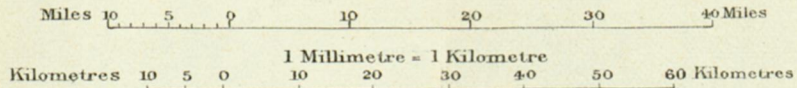
99°

100°

PART OF KAM in EASTERN TIBET

by
ERIC TEICHMAN, C.I.E., B.A.

Scale 1/1,000,000 or 1 Inch = 15.78 Stat. Miles.



Reference

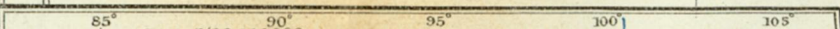
Routes followed by Mr. Teichman ----- Pass x
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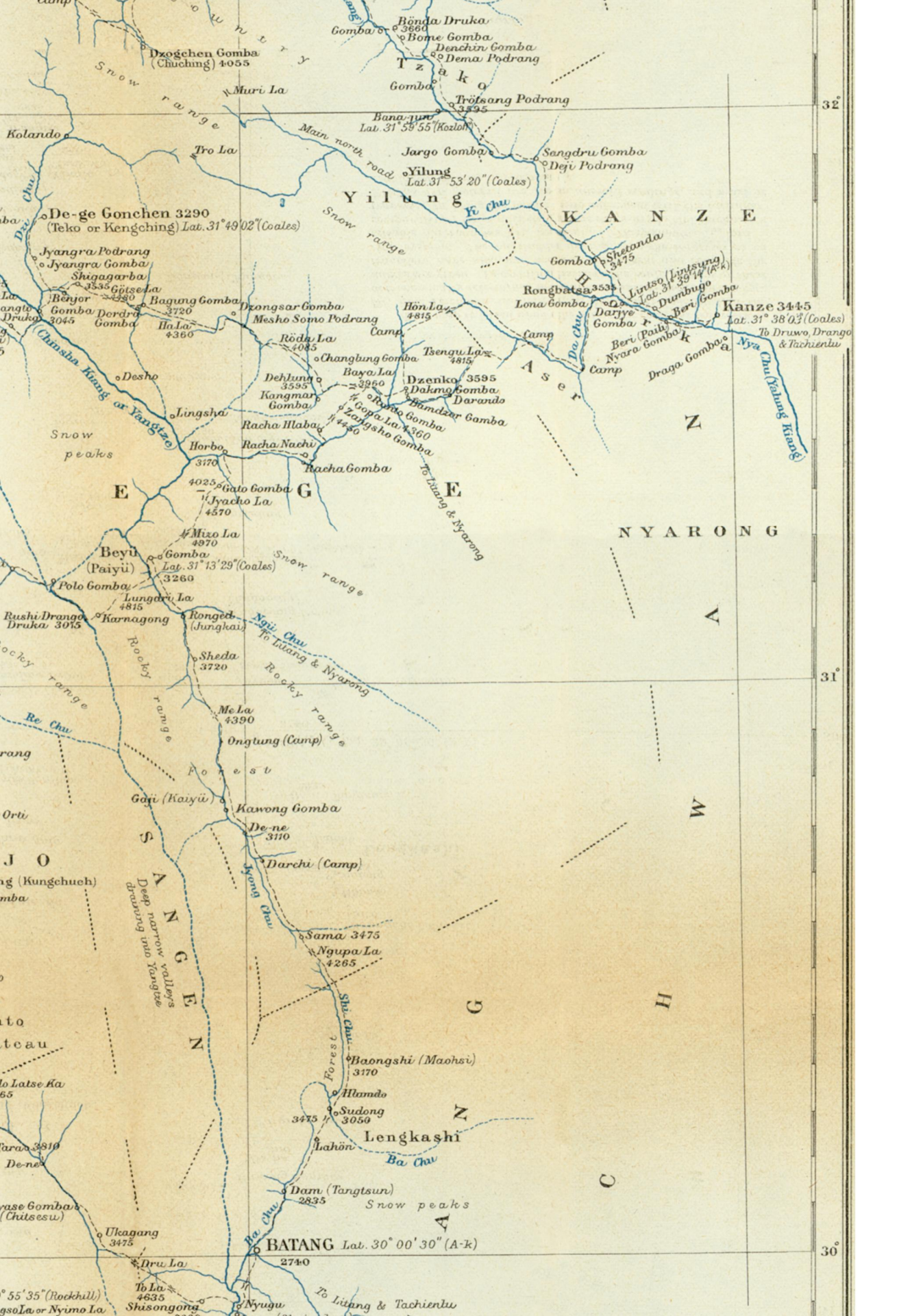


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Dzögenchen Gomba (Chuching) 4055

Bönda Druka 3660
Bome Gomba
Denchin Gomba
Dema Podrang

Tro La
Troisang Podrang 3795
Bana-yun 3795
Lat. 31° 59' 55" (Kozlöh)

Jargo Gomba
Yilung Lat. 31° 53' 20" (Coales)
Sangdrü Gomba
Deji Podrang

De-ge Gonchen 3290 (Teko or Kengching) Lat. 31° 49' 02" (Coales)

Jyangra Podrang
Jyangra Gomba
Shigagarba 3535
Götse La 3530
Beyor 3045
Gomba Dorra 3045
Ba La 4360

Chimsha Kiang or Yangtze
Desho
Lingsha
Horbo 3170

Snow peaks
E

Yilung
K A N Z E

Gomba Shetanda 3475
Rongbatsa 3535
Lona Gomba
Darye Gomba
Beri (Paik) Nyara Gomba
Draqa Gomba
Nya Chu (Yang Kiang)

Hön La 4815
Tsengu La 4815
Dzenko 3595
Dakung Gomba
Daranda
Bamdzar Gomba
Rachha Gomba
Rachha Nachi
Rachha Illaba
Zangsho Gomba 4450
Gopa La 4360

A S E R
Z

G E
To Litang & Nyarong

Mixo La 4970
Gomba Lat. 31° 13' 29" (Coales) 3260
Polo Gomba
Lungara La 4815
Rushu Drango Druka 3015
Karnagong
Konged (Jungkai)

Snow range
A

Me La 4390
Ongtung (Camp)
Forest
W

Gafi (Kaiyü)
Kawong Gomba
De-ne 3110
Darchi (Camp)

Sama 3475
Ngupa La 4265
Forest
H

Ba Chu
Baangshi (Maohsi) 3170
Hlamdo
Sudong 3050
Lengkashi
Lahön

Forest
C

Dam (Tangtsun) 2835
Snow peaks
A

BATANG Lat. 30° 00' 30" (A-K) 2740
Ba Chu

Dru La
To La 4635
Shisongong
Nyugu
To Litang & Tachientu

Ukagang 3475
To La 4635
Shisongong
Nyugu
To Litang & Tachientu

Ukagang 3475
To La 4635
Shisongong
Nyugu
To Litang & Tachientu

32°

31°

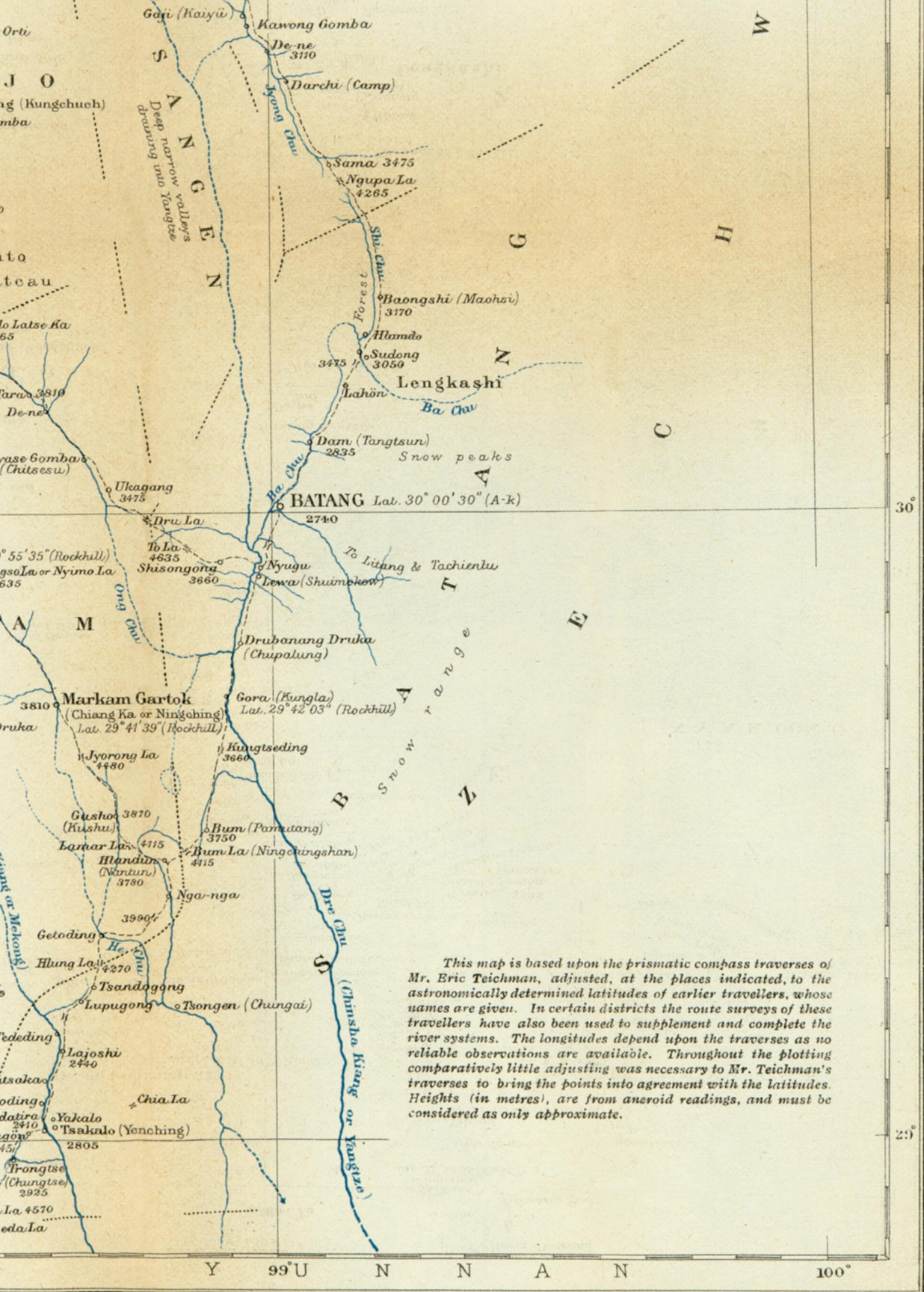
30°

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Projection of the 1/M. International Map.





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EASTERN TIBET.
Teichman.

plishments, of the hard journeys on which we have had the privilege of accompanying the lecturer from our comfortable chairs. We have seen a country where Nature is at its wildest, where the Yangtze, Salween, and Mekong run within 50 miles of one another, cutting their deep channels through the plateaux of Eastern Tibet, with scattered tribal villages on their rocky banks. Close at hand we have seen the craftsmen at work, the achievements of their arts and crafts, and a printing press distributing its products by caravan. Until a few years ago we knew practically nothing of those men, their lives, their work, or their country. Mr. Teichman has opened a window into a new world. We shall go away to-night with a memory of snow-clad peaks, open plains, deep gorges, yaks, and monasteries. But when they read the lecture in Peking, where the lecturer and I have recently been stationed together, they will find in it even another interest. They will read those pony stories with a deeper understanding. Mr. Teichman and I were partners in a Peking racing stable. He used to buy the ponies, transform them in a few months from creatures resembling woolly bears into miniature race-horses, and then ride them to victory. People wondered why they won. Some thought it was the early gallops, others surmised a mystery about the food. And now the secret is out. Mr. Teichman has discovered in his travels that ponies thrive on the Tibetan equivalent of tea, bread and butter, and cold meat.

The PRESIDENT: One of the most interesting parts of this lecture is about the trend of the great mountain ranges, and we have here this evening Sir Henry Hayden, who was the head of the Geological Survey in India, and who has written a very valuable work on the Himalaya mountains. We shall be glad if he will give us his views on the extension of the Himalaya in the direction of Kam.

Sir HENRY HAYDEN: I am afraid I know even less than Mr. Rose about Kam, but it is a region of great interest. It was at one time supposed that the Tsangpo flowed across that country and emptied into the Irrawaddy. One of the native surveyors of the Survey of India—A. K., I think—exploded that idea by his journey through the south-western parts of Kam and brought back information of great gorges between Tibet and Assam, thereby indicating that the Brahmaputra was the continuation of the Tsangpo. The question was finally set at rest during and after the Abor expedition, largely through the instrumentality of Major Bailey—whose name we meet at every turn in all matters connected with Tibet. As we have heard to-night, Kam is a country of high mountains, which, as will be seen from the map, appear to run approximately north and south, with large rivers in between. To the west of this area are the Sikkim and Bhutan Himalaya. The general trend of the tectonic elements of the latter mountains is easterly and westerly, although here, as in other parts of the Himalaya, the subordinate orographic features not infrequently appear to trend approximately N.—S. It is possible, therefore, than if Kam were examined from the geological point of view, the orographic and tectonic features might not be found to correspond. This region, however, is probably not far from the zone in which the Himalayan and Burmese systems of mountain-folding meet; the Himalayan system being approximately equatorial and the Burmese system meridional, that zone might be expected to show a passage from the one to the other, the trend of the geological formations in its western parts being more or less E.—W. and continuous with that of the rocks of the Bhutan Himalaya and Tibet, while that of the formations on the east would gradually take on a more southerly direction to conform to the strike of the allied sedimentary systems of Yunnan and Burma. But the solution of this

interesting problem in regional geology must await a geological examination of Kam.

Colonel WIGRAM: I was in charge of the yaks in the Tibetan expedition under the command of the President here, and my feelings can be better imagined than described if I tell you that the higher the yak goes the quicker he goes, and when working at an altitude of 15,000 to 18,000 feet the yak literally disappears into thin air, because he likes to go to the top of the hill as hard as he can, and man is left behind trying to get his breath. I endorse everything the lecturer said about them, and I do not think they are reliable animals for transport work, particularly military work, which postulates the delivery of a specific quantity of goods at a given place in a given time. Provided there is plenty of time and one can go one's own pace they are useful, but they require much time for grazing, and this they cannot get on military expeditions.

The PRESIDENT: But they were useful to us in Tibet, were they not?

Colonel WIGRAM: Undoubtedly they were useful: I do not know how we should have got on without them.

The PRESIDENT: I think you will have gathered from the lecturer's paper and from the observations of Mr. Archibald Rose and Sir Henry Hayden, that that part of Kam which the lecturer described is one of extraordinary geographical interest, and not only geographical but ethnographical and zoological as well. We have here the Himalaya mountains impinging against the great ranges of China, and we have the chief races of man as the lecturer has described: the Aryan, the Mongolians, and even the Negroes meeting one another. Here is a field for the geographer of greater interest than any other part of Asia—a splendid objective for an expedition which would unravel the course of the mountains, make accurate observations as to their height, and obtain full information about the peoples, the zoology, and the botany. One particularly interesting point which the lecturer referred to in the course of his lecture was with reference to that great range which extended from the north of Lhasa down towards China. He described how one of the great rivers cut through it just at a point where there is a very high mountain. Later on I heard him drop the remark that that particular mountain was probably the highest in the region. Now a few weeks ago we had a remarkable discussion at one of our afternoon meetings on a paper by Col. Sir Sidney Burrard on the origin of mountains, in which he drew attention to the fact that in a number of cases where great rivers cut through the Himalaya mountains it so happens that just where they cut through there is a remarkably high mountain. Sir Sidney Burrard mentioned the case where the Brahmaputra or Tsangpo cuts through the Himalaya mountains and showed there was a high peak there. At the other end of the Himalaya where the Indus cuts through there is also a high peak—that magnificent peak Nanga Parbat, 26,000 feet in height. Rising from the river (which is only 3000 feet above sea-level) is an almost continuous slope, probably the biggest slope there is. It is an interesting point to work out whether there is any direct connection between the river's passage through a mountain range and the height of the mountain. That is one point on which Sir Sidney Burrard is working at the present time, and every additional piece of information like that we have had this evening will be of value to him. The lecturer referred to French travellers who had travelled in that region, and he mentioned De Rhins. I well remember entertaining him and his companion, Grenard, at Kashgar in Central Asia, in the year 1890. De Rhins was a naval officer and a man of great physical capacity and

determination. He unfortunately lost his life in Tibet, but his companion carried on after his death and did an excellent piece of work in exploring that region. The lecturer has given us some valuable information about an exceptionally interesting region. We are very much indebted to the Consular Service for the valuable work which they do on the borders of the Chinese Empire. There is a wide field for their energies there, and we hope that more of them will come to the Geographical Society and be trained in surveying and other subjects, so that the information that they can bring back will be of all the more value. I ask you to give a very hearty vote of thanks to the lecturer this evening for his most interesting and valuable address.

THE INFLUENCE OF ITS GEOGRAPHY ON THE PEOPLE OF THE AURES MASSIF, ALGERIA

M. W. Hilton-Simpson

Read at the Meeting of the Society, 7 November 1921.

I CAN scarcely hope to lay before the Society any new facts in the topography of the Aures massif in South-Eastern Algeria, upon the borders of the great desert; an area which has been mapped to the scale of 1 : 200,000 by officers of the French Service Géographique de l'Armée.

This paper, therefore, can lay claim to be nothing more than an attempt to draw attention to the influence of the geography of the massif upon its Shawiya Berber inhabitants in the preservation of manners and customs, arts and crafts, many of which have disappeared from other more accessible regions of North Africa. In order to realize how such a conservative influence has been exercised by the country upon its inhabitants, we must call to mind the frontiers of the massif and the geography of its valleys, before proceeding to consider a few examples of those traces of ancient culture which are to be found among the Shawiya to-day.

The boundaries of the Aures are clearly defined. Its northern frontier, separating it from the high-level plateau some 2800 feet above sea, upon which stand the ruins of the Roman camp of Lambessa and city of Timgad, consists of a barrier of steep wooded slopes leading up to the ridge of Mahmel, 7620 feet, and the peaks of Ishmul, 6800 feet, and Shelya, 7630 feet above sea-level, which mountains, capped with snow during a great part of the year, form the watershed of the massif. This frontier provides the Shawiya with an excellent line of defence in the north, running from west to east between the modern French towns of Batna and Khenshela on the plateau.

The southern wall of the Aures, the barren rocks overlooking the Sahara, whose wonderful coloration at sunset delights the eye of the visitor to Biskra, offers scant hope of success to an invader approaching from the desert, for the streams flowing from the high northern ridges

which are invaluable to those who study native peoples in a more or less primitive condition of culture. He certainly has tact, which enabled him to prevail upon the French authorities to give him every facility, and also has a capacity for winning the confidence of the natives, which is of prime importance to the researcher. He exhibits a sympathy with the native point of view, without which I do not think that anybody can penetrate the native mind satisfactorily; and as a result of these qualities we have been given a very interesting picture of a very interesting people. When I say that the Shawiya are very interesting, I am sure you will agree with me, but I wish to urge one thing. I would like very much to persuade the French authorities in Algeria to delay the penetration of the Shawiya hills with well-made roads and other means of communication. These people are intensely instructive as they are. Will they continue to be so after intimate contact with civilization? When motor cars have raced through their country, will they even be as *happy* as they are to-day? Is there not a great risk they will become spoilt and sink down to a humdrum level of *quasi*-civilization? If I thought I were in order I would move a motion that the Royal Geographical Society approach the French authorities with a view to preserving the Aures massif as a reservation for ethnological study, at any rate for the next forty or fifty years. As has been well shown to-night, if you want to study classics you must go there to find illustrations and explanations. We have had several instances brought before us to-night showing how these people are maintaining customs and habits which were written about by Herodotus, Sallust, and others, and to see these practices still persisting means that we can study them in a living form, and by arguing from the known to the unknown can explain passages in the classics which otherwise might remain obscure.

The PRESIDENT: Mr. Hilton-Simpson has emphasized the importance of studying the country before it gets "spoilt" by railway and civilization, and while we are still able to see the people in their own natural state. I entirely agree; and I hope that others as well equipped as he was and as sympathetically disposed towards the people may go there before it is too late and bring us back accounts of the country and its inhabitants as they now are. I hope also future travellers may have as useful helps as Mrs. Hilton-Simpson. We would wish to convey to them both our warmest thanks for the useful contribution they have given to us this evening. We would also wish to thank the French Government for the help they so generously gave these British travellers.

THE NICOBAR ISLANDS

H. S. Montgomerie

THE Nicobar Islands form an archipelago of twelve inhabited and nine uninhabited islands lying between Sumatra and the Andamans. They straggle over a length of 163 miles, the northern end being 75 miles from the Little Andaman, and the southern end 91 miles from Sumatra. They are therefore in practice only reached by vessels of fair size and power; and consequently they have, till fairly recent times, had comparatively little intercourse with the outer world. Owing to this they have been able to evolve a civilization of their own of an effective if primitive

type, without undergoing much influence from more highly civilized races.

They are mentioned from time to time by writers from Ptolemy onwards; a legend of the natives having tails is persistent.

As early as 1688 mention is made of efforts to convert natives to Christianity, which continued off and on till the Danes took possession and encouraged the foundation of a Moravian Mission. The Danes (and for a short time the Austrians) tried their hands at it with poor results. They formally abandoned the islands in 1848, though for a long time before that their sovereignty had been nominal. The Austrians and the Prussians had schemes for exploiting the islands; but these came to nothing, and the islands were for practical purposes masterless.

These islands were noted for the number of ships lost in the neighbourhood. For long it was supposed that gales and cyclones were the cause; but at last it was discovered that during this masterless period the islands in the Nancowry group were the haunt of a gang of pirates. Naturally these people left inadequate records of their doings; but they seem to have been led by a deserter from the British Navy, who, with a gang probably composed partly of Malays, was able to dominate the natives. This deserter (one Worthington), who began work in the early part of the nineteenth century, not only operated successfully for years, but left behind him a school to carry on his traditions after he had gone. One reason why they were never suspected was that they had no ships of their own; and so the piratical schooner of schoolboy lore did not attract the suspicions of the Navy. Their *modus operandi* seems to have been to wait till vessels entered a harbour (usually the splendid harbour of Nancowry), get on board as peaceful traders or inhabitants, and presently massacre the whole crew, and plunder and scuttle the ships. Landing parties could be dealt with separately.

It is easy to see that, provided they never attacked a ship that was too vigilant or too strong, and never allowed a witness to escape, they might never even be suspected. Possibly on Mr. Worthington's retiring from business his successors relaxed some of his precautions, for on several occasions there were survivors who got off and lived to tell the tale. At last the British, in 1869, formally took possession. For nineteen years they kept up a penal settlement in Nancowry, but in 1888 they abandoned it. During that time a Chinese colony was tried, but failed. Since then the yoke of British sovereignty has been of the lightest.

The result of the British occupation seems not merely to have stopped the piracy, but to have shown that it was foreign to the Nicobarese, who are very peaceful and friendly; the only ferocity remaining is the ceremonial murder of persons supposed to be dangerous to society in some way, such as being possessed by spirits, practising the black arts, or, if a doctor, failing to cure patients as promised. The unfortunate victim usually had his arms and legs dislocated prior to his strangulation, so that

the spirit should not have an effective body to use. Even these murders became rarer as time went on, though one took place in the latter part of 1917.

It is probable that the leading pirates were interlopers and that the natives were merely more or less helpless tools in their hands, especially as they have very poor weapons and not much idea of using them.

The Nicobars are extremely interesting to students of Zoology, Botany, Ethnology, and other sciences, but it is not possible to go into those subjects here.

The most interesting aspect of the Nicobars seems to be the manner in which the natives have adapted their lives to their circumstances. It is, of course, difficult to give exact descriptions of the lives of people who, in general, not only do not understand one, but on every subject have ideas radically different from one's own; and mistakes are easily made. But the population concerned is only about eight thousand. They are largely homogeneous, and their civilization, though effective enough, is free from the complexity which makes any real knowledge of India almost impossible.

The group is under the British Chief Commissioner of the Andamans and Nicobars. There are two Government Agencies maintained, one at Car Nicobar and one at Camorta (Nancowry). The Agents collect fees from ships for licences to trade (the only forms of taxation), give clearances to ships, prevent the smuggling of liquor and guns, adjust disputes between natives and traders, and report unusual occurrences, but interfere very little with the transactions between the natives. The Agents are supervised immediately by the officers under the Chief Commissioner and ultimately by the Chief Commissioner himself.

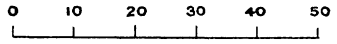
The bulk of the local government, if one may so call it, is done by the native headmen of the different villages (the village and not the island is the unit). These chiefs are in practice chosen by the natives, are assisted by one or two elders, and save for gross misconduct are not removed.

As long as all goes well the Nicobarese therefore are hardly conscious of the British rule. It protects them from any other nations, it is true, but they scarcely realize the fact. As the licence tax is paid by the traders, the Nicobarese are equally unaware of that, and the prohibition against importing firearms or firewater also seems to weigh more heavily on the traders than on the natives. The natives are therefore enabled to "live their own lives" to an extent not always possible in a low state of civilization, and they certainly seem to have adapted their lives to their environment in a wonderful way. I do not propose to do more than allude to their individual or family habits, but rather to consider them as a group of small polities all included in the same economic system.

The islands themselves, though they straggle over 163 miles, are not cut off one from another by stretches of sea as long as that between Sumatra and the southernmost, or that between the Andamans and the

NICOBAR ISLANDS

Miles



Car Nicobar

9°

Batti Malv
(Uninhabited)

Chowra

Tillanchong
(Uninhabited)

Teressa
(Bompoka)

Camorta
Trinkat

8°

Katchall

Nancowry

(Uninhabited)

Pulo Milo

Little Nicobar

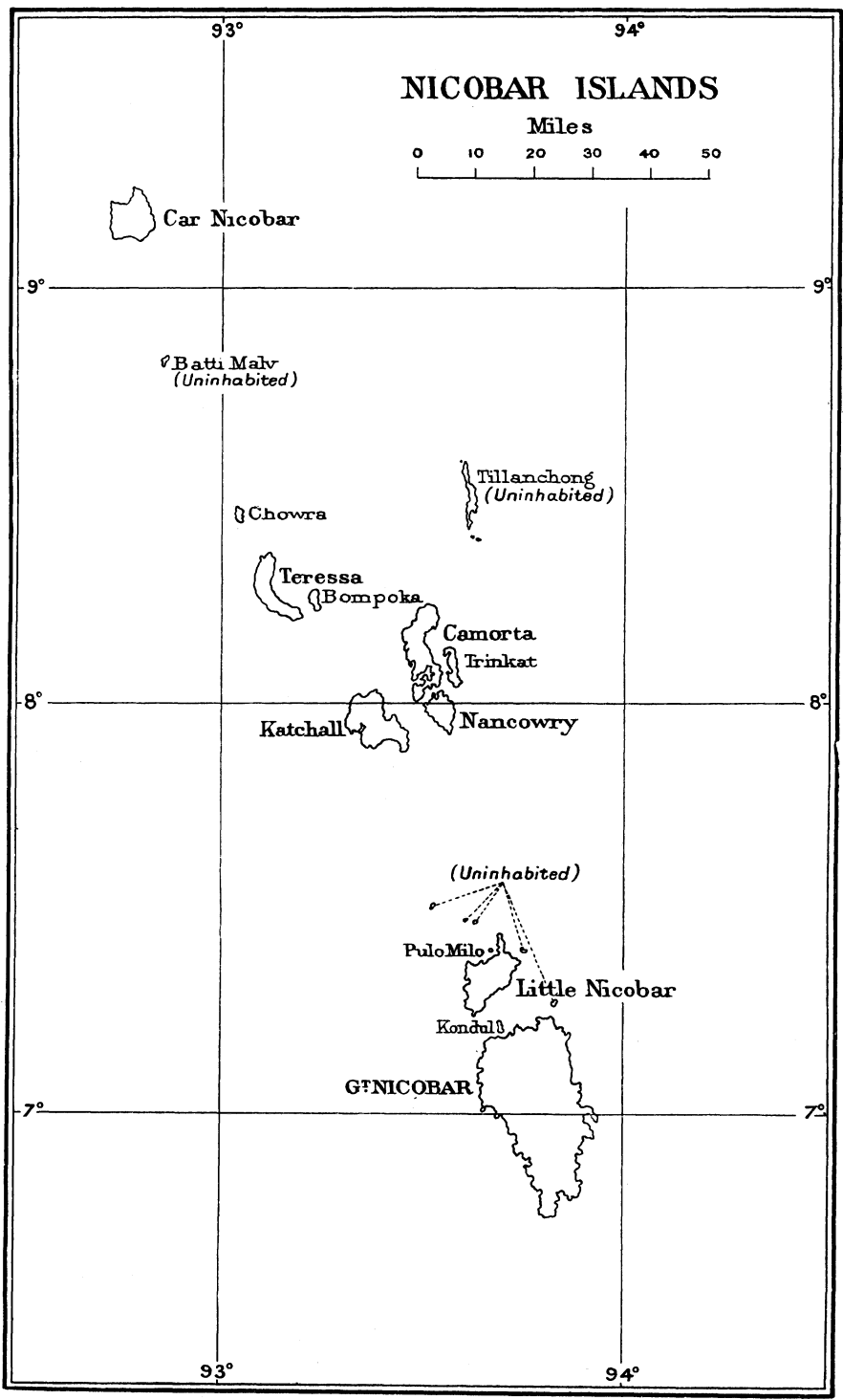
Kondul

7°

G^rNICOBAR

93°

94°



northernmost. This means that a good deal of inter-communication between the islands is possible, and is far easier to the natives than communication with the outer world. They can use their canoes for their home trade, while for trade with the outer world they have to depend on foreign ships. This makes a sharp distinction between inter-island and foreign trade which enables us to deal with the two trades separately.

The canoe is the dominant agent ; all the canoes have a common origin, and do not vary from island to island. Among themselves they differ in little but size. They are dug-outs of very slender and graceful proportions about eight, nine, or ten beams long, very gradually tapered on lines rather resembling those of a Thames racing boat. Nothing but wood is used in their construction.

They are light to paddle with beautiful single-bladed paddles, though at times you may see one rowed with oars. The movement is easy and pleasing ; they can with ease be hauled up on a beach ; they seldom leak, and can stand a good deal of bumping. Their low free-board matters little to a native who has not much clothing to wet, and if a canoe ships water it holds so little that baling out is easy. Even if by chance overturned in surf it can be righted and baled out, and its power of living in waves has to be seen to be believed. It is too shallow to go to windward well, though probably with a lee-board it would do well enough ; but, as the prevailing weather gives a "soldier's wind" along the length of the group, this perhaps matters little. All the Nicobarese, save one tribe, have great skill in their use of the canoes. The sails are nowadays usually lateen sails of cotton, though at one time leaf sails were used.

The Nicobarese are as light skinned as the Burmese and are very intelligent, picking up languages with ease, and having a great facility for figures.

In the northern island, Car Nicobar, each village has a second chief, but as we go further south it is more common to find one chief having more than one village, with no second chief, though one chief one village is the usual rule. The idea of an island as a political unit seems to be little developed, though the structure and position of the islands has had its effect upon their development, as each island is in a different economic position.

Car Nicobar is a flat coral-fringed island, tropical in appearance, with a deep fringe of coconut palms. Chowra is somewhat like it, but much smaller, with a conspicuous hill on the south end not unlike the Scuir of Eigg ; both are surfbeaten and offer only open roadsteads. The islands to the south are more hilly and jungly, but on the middle islands there is much green grass, giving them a cultivated look.

Nancowry has by far the best harbour, protected by four islands ; the rest have merely fairly sheltered open roadsteads, which confined older efforts at settlement to the central group. Possibly this helps to explain

their failure. The islands tend to increase in size towards the south; the people are not only more numerous but more intelligent as you go north.

Population and acreage were at the Census of 1911:

	<i>Population.</i>	<i>Area in sq. miles.</i>	<i>Density per sq. mile.</i>
1. Car Nicobar	5794	49	118
2. Chowra	348	3	116
3. Teressa and Bompoka	692	38	18
4. Central group of four	1231	145	8.5
5. Southern group Great and Little Nicobar (less Shompen)	272	170	1.6
6. Shompen (estimated)	375	222	1.7

In 1911 in the north the population was increasing, in the centre stationary, and in the south perhaps even slowly declining. A different dialect is used in each of the six groups.

The foreign trade is carried out on a basis of exchange of which the coconut is both the unit of calculation and by far the most important staple of export. There is some export of birds'-nest, split cane, areca nut, sea-slugs, ambergris, tortoiseshell, parrots, monkeys, etc., but these are trifling in amount compared with the coconut. The imports are chiefly articles of luxury, or, at the best, articles which could be replaced by local substitutes. Dahs (Burmese choppers) and iron generally are useful; but for the rest pottery, wooden boxes, tobacco, nets, sail-cloth, and the like merely replace local products, while ornaments of glass or silverware, beads, salts, castor-oil, coloured cloth, and the like are luxuries. Firearms and firewater are forbidden; matches are appreciated as everywhere in the East; but the art of producing fire by friction is not lost, though I have never heard of a burning glass being used.

From this it will be seen that at present the islands are by no means dependent on foreign trade. This has probably sprung up entirely since the British annexation, as before that the activities of Mr. Worthington and his myrmidons acted as a strong deterrent. The foreign trade seems to be in the hands of Asiatics: Indians from as far west as Cutch, Burmans, Malayans, and Chinese.

One would look first for the trade at the magnificent harbour of Nancowry, but it is not to be found there. The four islands round it are thinly populated and produce little, while coconuts, like the population, seem more numerous as one goes north. Not only that, but the retentive Eastern mind seems to retain dim memories of Mr. Worthington's friends, for even in the four islands Asiatic trading vessels seem to prefer an open roadstead under the lee of the land, whence, if need arose, they could escape with ease. Nancowry would not always be easy to leave, especially at night.

The total annual export of coconuts is thought to be about 6,000,000,

of which more than half comes from Car Nicobar with its 5000 odd inhabitants and thick coconut groves. Chowra has few attractions for the trader, as the great density of population compared with the number of trees means that the nuts are not more than sufficient for local consumption ; while the lack of good water, the surliness of the inhabitants, and the absence of good anchorage tend to discourage foreign trade ; besides, as we shall see presently, Chowra has other objects for its energies. Teressa and Bompoka produce a good many coconuts. As one goes south the supply dwindles to a very small amount. At Car Nicobar the trade has warranted the setting up of shops or small "factories" by the traders, and developments may be awaited with interest.

The system seems to be for the foreign trader and the native to agree what articles shall be exchanged for so many coconuts. The natives own the coconuts as individuals, and not in common, and so the bargains have to be made with individuals. In most of the islands the articles are then handed over, and the trader gets not the nuts but a licence to remove the nuts. He must collect them and carry them away for himself. If he wants to make the copra and take that away, he must make his own arrangements, and the same with the husks should he require them.

The progressive Car Nicobar folk, however, have reached the stage in which it is usual for the owner to have the nuts cut down and delivered at the stores, and the island even furnishes some labour for these purposes in other islands. In Car Nicobar also the natives build the huts for the traders.

The Nicobarese have no money as such. They like silver and other metals. The rupee is a foreign coin with which they are familiar, and they will buy it with their own currency—the coconut—which is their standard, thus inverting the usual relations of coined money and coconuts. The value of the rupee varies. In theory it was considered to equal 64 nuts, and at one time this may have been so, but it seems that 48 nuts are now more nearly equivalent to it. It is felt, however, that the natives are not getting the real value of their nuts, as they may have to receive cloth, etc., which they do not want, and which will be largely wasted. Although they are not stupid, many of them are not a match for the wily traders whose wits are sharpened by the Asiatic bazaars. The authorities therefore are trying tentatively to introduce money as currency ; but this is covertly opposed by the traders, who find it much easier to supervise their factories when the currency is coconuts than when it is coin.

It is of course impossible to arrive at exact figures, but those of 1893 census tend to show that of the 6,000,000 nuts sold only 1,000,000 nuts went for what may be called necessaries, viz. cutting instruments (such as dahs), iron, cloth for use, tobacco, rope, and rice. The rest went for coloured cloth, glass bottles, beads, etc., and other things, most of

which would not be used : almost all the coloured cloth (the largest item) would simply be destroyed at the next death feast. Even for the necessary things, the natives are not really dependent. Their bark and leaf clothes, such as they are, have suited them for ages. Their leaf sails will do, though certainly the cloth sails are better. The rattan canes do most of the work of ropes well enough. They can and do grow tobacco and rice. As for iron it is certainly nice to get dahs ready-made, but if the supply were cut off it could perhaps be dispensed with (though with difficulty). The quantity of iron needed is not very great, though a dah is a necessity of life. Almost the only other objects requiring iron are spear and arrow points, and it should not take much iron to supply 7000 or 8000 people with choppers and heads for spears and arrows. In Worthington's time the iron on board the ships scuttled was probably more than enough ; and perhaps even the legitimate wrecks would more than suffice, as the natives can work iron by heat though they cannot make it from ores. For instance, the chain and anchor of a two-hundred-ton boat should go a long way in making choppers and spear points for 8000 inhabitants, and in any respectable wreck there should be much more iron.

From this it will be seen that the Nicobarese are not really dependent on the foreign trade, but are in the happy position of satisfying their own needs themselves and obtaining their luxuries by the process of getting the trader to pay them royalties for leave to collect their nuts. Their only contribution is planting trees and fencing them in when young, though, where necessary, those of them who are not capitalists can hire their labour out to the traders. Therefore, even if they do not get the full value in luxuries from these royalties, they are still better off than the majority of the human race who have to work for both necessities and luxuries.

When we come to the inter-island trade, a curious state of things is revealed. The islands, which we are apt to look on as homogeneous, are in reality nothing of the sort ; each group seems to be dependent on one or more of the others for some of the necessities of life, as the products of each group differ. A little examination reveals threads of trade, tiny but vital to the system, and running in the strangest directions.

One of the most interesting of the islands is Chowra, with its dense population of 116 per square mile. The fact that it has no surplus coconuts or fresh water, the absence of a good harbour, and the surliness of its natives cause it to be neglected by and to stand, as it were, sullenly aloof from the foreign trade. It is, however, the head of the inter-island trade, as Car Nicobar is of the foreign trade, and has an importance out of all proportion to its size or even its numbers.

Chowra is looked upon by all the rest of the islands with a good deal of awe. It is considered to be the cradle and birthplace of the race, almost the holy land of the Nicobarese, and its inhabitants in general are

(like the Lapps) believed to be wizards. They had a good supply of clay on the island of Chowra, and have a practical monopoly of pottery, made by their women, who have hereditary skill. The monopoly is doubtless due chiefly to skill, but partly to a kind of tabu which discourages the making of pots elsewhere. The Chowra clay has come almost to an end in the last few years, but they still retain the monopoly, getting the raw clay from Teressa.

The Chowra folk also have some skill as blacksmiths in working iron, and, though seemingly they have no monopoly of this, they very likely are more adept than are the natives of many of the other islands.

These things and the aloofness of Chowra from the foreign trade differentiate its natives somewhat from the rest, but their wits seem to have been in no way blunted; in fact, they are sharper than the other islanders, and are not only the manufacturing island but the commercial centre, entrepôt, and exchange of the inter-island trade.

A curious feature is the existence of the Shompen. This race is considerably lower in the scale of civilization than the other Nicobarese, and apparently represents the Nicobarese of a previous epoch, much as if in the centre of England a Mercian kingdom existed to-day with the culture of the Heptarchy.

At some date unknown a tribe or race in Great Nicobar got cooped up in the interior away from the sea. Whether the lower state of civilization caused their being thus circumscribed, or *vice versa*, the fact is that they are shut off from the sea and are in a low state of civilization. They cannot work iron or make pottery.

It would be interesting to discover the approximate date of their seclusion. It is possible that it had taken place before Dampier's visit there in 1688, as he speaks of the inhabitants living all round the island by the seaside, and adds that there is no clear land further in on the island, for he observed that, when past the fruit trees, there were no paths going into the woods. This would quite fit in with the existence of a hostile tribe in the interior, and, as Dampier (though an observant man) was ignorant of the Nicobar language and not familiar with the people, he might quite well never have even suspected the existence of the Shompen. On the other hand, it is possible that his friends were the Shompen before their seclusion, but that seems less likely for several reasons. His friends were expert canoemen and fishermen, and he saw no difference between them and the natives of the other islands, some of whom came there. They had earthen vessels, which the Shompen have not, though they lute vessels of leaves and bark with clay, showing that they can procure the raw materials. Unless the Shompen were Dampier's natives, and have retrograded owing to their seclusion, it seems more likely that they were already at that date cooped up in the interior.

Their seclusion seems to have prevented their very existence from being recognized till quite lately, and even then it was thought that they

represented an aboriginal race, possibly of negrito origin ; but it seems now to be becoming more and more thought that racially they are one with the other Nicobarese, their differences of speech and habits being due to their primitive civilization.

The belief that they are more akin to the Chowra people, and that these and the Shompen belong to a race which, though flourishing in Chowra, was cooped up in the interior of Great Nicobar and wiped out in all the other islands, seems to rest on the fact that Chowra is looked on as the cradle of the race. I see little to support this view. The Chowra people seem as much above the average of the Nicobarese in wits as the Shompen are below it, and philologists, I am told, seem now pretty certain that all the Nicobarese have a common origin.

The Shompen, though cooped up in the interior, have, it is thought, rather been able to turn the tables on the coast tribes of late. Possibly the Shompen have increased relatively in numbers, or have obtained by trade enough iron-pointed spears, etc., to be a match for the coastal Nicobarese. The latter are afraid of the Shompen, who occasionally have attacked a coast village, and the natives of the central islands also express some fear of the Shompen.

The home trade of the Nicobars has grown up naturally from the fact that some islands possess goods which others cannot or do not grow, and that the inhabitants of some islands have what amounts to a monopoly of making certain goods. The trade is all carried out on a basis of coconut currency, though the nuts do not necessarily pass, and are often used merely as an instrument of reckoning and credit. Some of the transactions are barter reckoned on a basis of coconuts. The transactions, however, are not as a rule so simple. It might be necessary first to bargain what the price of one article reckoned in coconuts should be, and then to reckon what other goods required in exchange would have a value equalling that of the first.

Though the Nicobarese have strong individualistic views as to the ownership of coconuts, due weight is given to the claim of those of the rest of the family who have helped to grow them. A kindly custom allows any one going from one place to another to cut down nuts he needs to eat or drink on the spot, and it would be thought very churlish to refuse. This custom is the more valuable since in many places good drinking-water is very scarce. It would, however, be thought in the worst taste to carry any away without payment or to help yourself in the neighbourhood of your own dwelling, where it is supposed you have coconuts of your own. It is also etiquette, should the owner be present, to ask him from which tree he wishes you to help yourself.

The goods produced more or less exclusively by each group are roughly as follows :

Car Nicobar receives the great bulk of the foreign goods and makes baskets.

Chowra makes pottery and ironwork ; lime derived from coral ; drugs and charms.

Nancowry makes lime (from seashells) used for eating, and large canoes for the longer sea journeys ; the northern islands a small quantity of cloth from bark.

Teressa produces tobacco and raw clay.

The southern group makes bark cloth, thin split rattan cane, canoes rather smaller than those made in the Nancowry group.

Shompen produces best rattan canes, bark cloth, wooden spears, matting, honey, and half-made canoes.

The bulk of the home trade seems to be in the hands of the Chowra folk. The stretch from Car Nicobar to Chowra is about as much as canoes can normally do (43 miles) ; the stretch from Car Nicobar to Teressa (50 miles) would be too great as a rule. The chief wants of the southern group can be supplied from Car Nicobar, and *vice versa*. Exchanges between islands to the south of Chowra with which the Chowra people could not interfere are much less in volume and value than those between Car Nicobar and the others.

The Chowra people have, for semi-savages, quite good business heads ; they can carry out large commercial transactions with ease, having a facility for figures only rivalled by that of the Car Nicobar folk. The Chowra people also boycott all Car Nicobar canoes not bought through them, and so reduce their value. There are not many such, but there is one canoe at least known to have made the long journey from Teressa to Car Nicobar without landing at Chowra, and occasionally a ship which is carrying a native from the central or southern islands to Car Nicobar may allow him to take a canoe on board ; but I fancy that if a canoe not bought through Chowra was to go north and call at Chowra with a view to going on to Car Nicobar, its path would not be made easy and some evil would be likely to befall it. Moreover, it would be rigidly boycotted on subsequent visits. This system seems to have the effect of giving the Chowra folk a complete monopoly of the trade of canoe broking.

Even these advantages would perhaps not account for their economic position were it not for their repute as magicians. It is believed all through the islands that great ill luck will follow any attempt to manufacture pottery elsewhere than at Chowra, and the belief that even using such pottery brought ill luck is common, though perhaps dying out. The position of Chowra as an *entrepôt* depends therefore partly, but not wholly, on the Chowra pottery. The Chowra folk are not much liked by the other islanders, partly because of their surly manners and partly because of the belief that as middlemen they exact too high a percentage of profit.

People capable of dealing with figures running into tens of thousands can hardly be thought of as savages. The Chowra folk seem fully alive to their position. On one occasion when they were inclined

to give trouble the authorities threatened to distribute pottery gratis among the customers of Chowra ; the probable effect of this dumping was foreseen at once, and no more trouble was caused.

The rattan cane, which is grown chiefly in the southern group, is a necessity for the manufacture and repair of canoes, and is used also for houses and many other purposes. Though some of it goes "foreign," almost every canoe going northward takes a load of it. These rattan canes give the Shompen trade some importance, as the canoes and houses need them, and the canoes are almost as essential as houses. Apparently the Shompen have the best rattan canes, as these seem to be much sought for even for the foreign trade. The Shompen also can half make canoes, which the coast people finish. Bark cloth is another speciality of theirs.

In this trade the coastal Nicobarese act as intermediaries between the Shompen and the outer world, and though we know that they complain of the high charges of the middlemen at Chowra, their own charges are fairly comparable.

The Indian Government protects the islanders from alcohol, as the navy does from outside enemies. They do very little toiling or spinning, and their existence, pleasantly diversified by fishing, hunting, and sea travel, and full of leisure, seems as near that of the lotus-eaters as one can imagine.

This Eden is at times threatened by a serpent which hitherto the Indian Government has warded off. Various persons, thinking how good it would be to have monopolist concessions there, have put forward schemes for large blocks of freehold land and for the exclusive right to buy the nuts. So far all these have been rejected—and rightly. First, it is hard to see why the natives should be denied the right to sell their produce in free market just as other natives of India do, or why the rest of the King's subjects should be denied the right to deal with them. The trading is carried on with very little friction, and to put the island in the grip of a monopoly would be a very retrograde step. Apart from the disadvantages to the external trade of the Nicobars, it is to be feared that the monopoly would upset the ingenious and delicately balanced internal trade. The fabric of this trade is more intricate than appears at first sight, and it is almost certain that the insertion of clumsy or greedy fingers into its fine web would cause a great deal of misery to the islanders.

A grant of land seems equally unfair to the native. In two at least of the islands, with 116 people per square mile, it is out of the question. In the other islands it would work grave injustice. In the undeveloped state of the Nicobars, unquickered by competition, it is hard to arrive at any exact ideas of their views as to the tenure and ownership of land. It would seem that, speaking broadly, the dominant idea of the Nicobars is that of a large tract of land owned in common by the village. Some of this is tilled and some not. The untilled part is common property. If a

tree at some distance from the village, but on its common land, is cut down for a mast, payment would be claimed by the village through its chief. Overlying the communistic idea is the recognition within the village of individual rights in trees planted by a man or family. Absolute individual property, transferable and even heritable, is recognized in such trees and in other property.

It is, of course, possible that in a thinly populated island the rights over a piece of jungle far away from the village might not be jealously guarded; but none the less it would be an invasion of some one's rights to appropriate it. The fiction that all waste land is the property of the Crown is quite foreign to the Nicobarese, who if they could formulate their ideas, would be most likely to consider all the land as allodial land held by some village or other in common, subject to rights of individuals and families over trees planted by them or their predecessors, and over huts, vegetable gardens, etc. Perhaps the nearest approach we could have to a parallel case would be that of the waste land of a manor in which the custom of the manor allowed the lord or any commoner to plant trees for his exclusive use in any part of it, but where no stranger had any rights save by courtesy.

Perhaps substitution of coin for nuts as a standard of exchange is inevitable, as once the Nicobarese learn the purchasing power and indestructibility of coins, they will be far more able to make good bargains, and will not be tempted to buy rolls of cloth only to destroy them again at once. The division of the rupee into annas and pies might trouble them at first, but not for long. At present one nut buys about 4 pies, not long ago it was 3 pies, and if the Nicobarese could be got to think in pies the conversion to annas and rupees would come soon enough.

The Nicobarese systems of arithmetic are very curious. In the first place, all the record is by notches cut in a stick or occasionally by beads on a string. It is convenient to call the former system tallying, but in fact I have not come across any cases of the tally proper where the notched stick is split lengthways so as to give each party a record. Secondly, they have two main systems, one (A) for ordinary objects, and another (B) for the unit of currency the coconut. This we might liken to old-fashioned shepherds who would count their sheep by a special system of notation based on the score, but would count money in the usual way.

Thirdly, each group has its own notation in each system, though in each island the notations of the islands with which it deals direct are understood.

In the system for ordinary objects, each of the six groups has a slightly different form of notation ranging, as one would expect, from the simplest in the case of the Shompen to the most ample, that of Car Nicobar. The Shompen dialect does not cater for more than 600, the other dialects stop at 700, and Car Nicobar at 2000. Larger numbers in practice are not wanted. All the dialects have special words up to 10, thence by various

compounds to 1 score, thence by multiples of 1 score to 1 score of scores = 400; above that go the slightly more elaborate systems ending in Nicobar's 5 score scores = 2000. The differences between the six systems are not very marked.

In the system for coconuts as a unit of currency, complexity of notation varies as the amount of foreign or coasting trade. The Shompen, with no foreign trade and no inland trade save through the Nicobarese on the coast, use their ordinary system applied to pairs. One score = 20, 1 teo = 1 score of scores = 400; and they are easily able to grasp 10 score of teo = 80,000. The other groups have each different scales, some of which are alternative, so as to allow of intertrade, each pair of islands having at least one system in common. The scales vary in complexity, as do the trades of the different groups, culminating of course in Chowra and Car Nicobar, the centres of the coasting and foreign trades respectively. Car Nicobar and Chowra have each six standards, Teressa four, the central and southern three and the Shompen one.

For example, Car Nicobar, whose trade, though no more complicated than that of Chowra, runs to larger figures and deals more with the outer world, has a system :

10 pairs	= 1 score	=	20
10 score	= 1 ong	=	200
10 ong	= 1 kaine	=	2,000
10 kaine	= 1 lak	=	20,000

This system is usually described as dealing with scores, but that is misleading. They seem for this purpose to think of nuts in pairs as we think of pairs of boots or so many brace of pheasants. The nuts are usually carried in pairs for the sake of convenience, and I think that if you got a man to carry one nut for you he would promptly get another and loop the two together for his convenience. The unit numbers in some of the dialects run in pairs, 2 pair is four, 3 pair six, etc., and the Shompen use $\frac{1}{2}$ a pair for one and " $\frac{1}{2}$ a pair ten" for eleven. Again, the lak (clearly picked up from traders) is really 10,000, but the Car Nicobar people mean by it 10,000 pair = 20,000 nuts, and any trader thinking in pairs will have no difficulty.

In other ways, too, the Nicobarese show an aptitude for matters more or less connected with mathematics. They understand the points of the compass thoroughly, and have observed the southing and northing of the sun, which they attribute to its having been blown out of its course by the south-west and north-east winds which prevail in the summer and winter respectively, a more rational theory than many which have been put forward.

They count the days of the month in various ways, but all recognize four periods—dark, waxing, light, and waning. A month "tally" or calendar now in my possession is in the shape of a dah as used by the Nicobarese ;

it has 30 holes, 4 for the dark, 10 for the waxing, 6 for the bright, and 10 for the waning moon. A peg is provided which they move on day by day. They do not think of solar years, but only of lunar months and monsoons. The monsoons roughly are May–October (rainy) and November–April (dry), but are not exact to time. This enables a fresh start to be made at the beginning of each monsoon, so that the difference between their months of 30 days and the true lunar month of about 12 hours less does not accumulate much, the first moon in each monsoon being cut short so as to start right.

By these means the Nicobarese can foretell the state of the moon and the tides with sufficient accuracy for some time ahead. The power is very useful to them in arranging their long canoe voyages, as not only is the state of the moon important, but neap tides are very desirable. They know the pole star and the Southern Cross, but navigation by the heavenly bodies is thought to be wizard's work, and the young men prefer to leave it to the old men. All this knowledge is strictly practical and directed largely to the management of the canoe.

Even with this the long passages made by such tiny boats would be almost impossible were it not for certain physical facts. The islands are in a long chain running about N.N.W. and S.S.E. The prevailing winds are more or less S.W. and N.E., and usually provide a soldier's wind for a boat sailing along the group. The pole star and the Southern Cross are not so far out of the course that a boat cannot steer by them. The moon and the sun in these latitudes give a good idea of east and west when within three hours of rising and setting, and the periods of cloudy weather can as a rule be known long beforehand.

The canoes have, it is true, nothing to fear from shallow water, and even if they upset can be righted; but the soundings—often over 100 and sometimes 500 fathom—can give them no help, and the chart marks tides of 5 knots in places.

THE MOUNT EVEREST EXPEDITION

WITH the arrival of Colonel Howard-Bury in England on December 13 the first year's expedition is ended; and its members are to give a preliminary account of their work on December 20 at the Queen's Hall. These reports, with maps and photogravure illustrations, will be published in the *Journal* for February. A more complete narrative will be published for the Mount Everest Committee as early as possible in the spring by Mr. Edward Arnold. An exhibition of photographs from the expedition will be held in the Hall of the Alpine Club from January 9 to 28 inclusive. And a series of lectures in the principal cities of the country will be given on behalf of the Committee by Mr. Mallory during January and February.

The collections made by Mr. Wollaston came home with Mr. Raeburn on the *Delta* and were delivered at the Society's house on December 1, after some delay in the remarkable fog of that week. The birds, animals, and insects are being examined and named at the Natural History Museum. The Director of the Royal Gardens at Kew has already determined the greater part of the large collection of plants, and under his direction the flower seeds of many species have been distributed to subscribers for shares, to the Royal Gardens at Kew and Edinburgh, and to several specialists.

With the collections came a very fine series of negatives on glass taken with the principal cameras of the expedition; up to that time only films had been received by post. Some very fine enlargements from the latter have been shown at the Alpine Club's winter exhibition during the month: a much larger and finer series, especially from the glass plates, will be exhibited at the Alpine Club Hall in January; and in course of time a portfolio of the best will be put on sale.

The members of the expedition have received on their return the sincere congratulations of all those qualified to appreciate their success. The only discordant note comes from India, where certain newspapers, ill-informed, and perhaps ill-disposed, have written down the expedition as something of a failure, and put an absurdly wrong construction on the change of leadership for the second year. Modern facilities of communication, used recklessly, can thus cause great temporary disappointment and annoyance to the most successful of men, arriving weary from a long and exhausting expedition.

The necessity of a much earlier start next year, with a climbing party strong enough to conquer on the relatively easy yet terribly arduous route to the summit, has given much work to the Committee; but preparations are already well advanced. The expedition under General Bruce's leadership will include eight other climbers, a medical officer, a photographic officer, and a painter. Of the first year's party only Mr. Mallory from England and Major Morshead from the Survey of India will go again. Lieut.-Col. E. L. Strutt, D.S.O., will be second-in-command. Mr. George Finch and Mr. T. Howard Somervell have been already selected for the climbing party, and Capt. J. B. L. Noel will be photographic officer. The names of the rest will be announced shortly. General Bruce leaves for Darjeeling early in the new year; the main party about March 1, and by the end of March the whole expedition should be in the Chumbi Valley on the way to their base in Tibet.

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THE MOUNT EVEREST EXPEDITION

Lieut.-Colonel C. K. Howard-Bury, D.S.O., Chief of the Expedition

Read at the Joint Meeting of the Society and the Alpine Club at the Queen's Hall, 20 December 1921. Maps following p. 152.

OF Mount Everest and the country that surrounded it very little was previously known, and the maps of that district were vague and inaccurate. Mount Everest was discovered and measured from the plains of India from a distance of about 150 miles about the year 1850, but it was not given the name of Mount Everest until 1858, in honour of Colonel Everest, who was the Surveyor-General in India at the time of its discovery. The top of it can be seen from Sandak-phu and Phallut, places near Darjeeling, at a distance of about 90 miles, where it appears between the peaks of Makalu. In 1905 the late General Rawling and Colonel Ryder, the present Surveyor-General of India, following the course of the Brahmaputra, climbed up to the southern watershed of the Brahmaputra and had a distant view of Mount Everest from the north from about 80 to 90 miles. From this view-point they were able to see a great distance along the chain of the Himalayas, and were able to say that there was no doubt that it was the highest mountain in that range. Captain Noel tried to approach Mount Everest in 1913 through Tashirak, but was unable to get any near view of the mountain, and was stopped by the Tibetan authorities from approaching any nearer.

Political obstacles have always stood in the way of any exploration. Mount Everest is situated on the borders of Tibet and Nepal, both of which countries are closed to Europeans. The Gurkhas have always objected to Europeans coming into their country, and public feeling there is still very strong on the subject. In Tibet, too, there has been a great prejudice against the foreigner, and we also had a self-denying ordinance with Russia by which neither country would allow their subjects to enter Tibet. Last year, however, owing to the changed political conditions it became possible to approach the Tibetan Government with a request that permission be granted for an expedition to proceed to Mount Everest. Mr. Bell was at the time going to Lhasa on a special mission from the Government of India, and, thanks to his personal friendship with the

Dalai Lama, he was able to obtain permission for the expedition to start, and the Dalai Lama, besides giving the expedition a passport, sent written instructions to all the governors of the districts through which we were to pass that they were to give us all facilities, and were to help us in every way, which orders were carried out to our entire satisfaction, in spite of the fact that this policy was the very opposite to their traditional policy of the total exclusion of foreigners from the country.

The object of this year's expedition was to make a thorough reconnaissance of Mount Everest and of the approaches to it from the north, east, and west, and to find out whether a possible route existed that would lead to the summit, and that was not physically impossible. For the purely mountaineering part of the work we had Mr. H. Raeburn, the leader of the mountaineering party, Dr. Kellas, Messrs. Mallory and Bullock, all members of the Alpine Club. In addition to this object there was the very important work of surveying and mapping the unknown territory through which we were travelling and the very difficult mountainous regions that surrounded Mount Everest. For this purpose the Government of India had kindly lent the expedition two officers of the Survey of India, Major H. T. Morshead, D.S.O., and Major Wheeler, M.C., R.E. Major Morshead had already had a considerable experience of travelling in Tibet, having completed valuable travels and survey work in the Kham and eastern districts. Under him were three native surveyors, one of whom was left in Sikkim to revise the existing and out-of-date maps of that country; the other two, Lalbir Singh and Gujar Singh, accompanied us. Major Wheeler, the other surveyor, was an expert in the Canadian system of photo-survey, a method especially useful in difficult and mountainous country. The Indian Government had also lent the expedition the services of Dr. A. M. Heron, of the Geological Survey of India, to study the geology of the region, about which nothing was known. Mr. A. F. R. Wollaston, also a member of the Alpine Club, and well known for his journeys in Africa and New Guinea, accompanied the expedition in the capacity of doctor, naturalist, and botanist, and had brought out with him a complete collector's outfit.

At the beginning of the year, as soon as permission for the expedition had been granted, preparations were immediately begun to collect stores and to arrange for the Alpine and scientific equipment that was to accompany the expedition. Most of the stores were bought in England, and all the Alpine equipment, including skis and snow-shoes, rope, crampons, and Alpine tents; the ordinary tents and a certain amount of food stores were bought in India. The scientific equipment included maximum and minimum thermometers, black- and bright-bulb solar radiation thermometers, hypsometers, George barometer, and aneroids in pairs to read from 15,000 to 22,000 and from 22,000 to 30,000 feet. The photographic equipment consisted of three stand cameras, one $7\frac{1}{2} \times 5$ and two quarter-plate, all fitted with telephoto attachments. There was also a Panoram

Kodak and several small Kodaks for use at great heights, where it would be impossible to carry up the larger cameras. The Imperial Plate Company kindly presented all the dry-plates for the expedition. The members of the expedition left England at different times, arranging to meet at Darjeeling by the middle of May, when it was hoped that the expedition would be able to start. Mr. Raeburn was the first to arrive there, as he had gone ahead to collect coolies for the expedition. For high climbing a special type of coolie is needed, one who is strong and hardy and does not mind the cold and is also accustomed to live at great heights. The type of man who best fulfils these conditions is the Sherpa Bhotia, who comes from the north-east of Nepal from the districts that lie to the south of Mount Everest. He is a Buddhist by religion, and though at times quarrelsome and rather too fond of strong drink, yet he proved a very useful and capable type of man, who could be rapidly trained in snow and ice craft, and who was not afraid of the snow or the cold. We also picked up a few Tibetans from the Chumbi Valley on the way, and these proved to be as good as the best of the Sherpas; they were less trouble to manage, and could equally well carry loads at great heights. These coolies were all fitted with boots, and very difficult some of them were to fit with their broad feet—as broad as they were long. Blankets, cap comforters, fur gloves, socks, and warm clothing were issued to all of them, and for those that had to sleep at the highest camps, eiderdown sleeping-bags were taken. The expedition also took two interpreters with them, Gyalzen Kazi, a Kazi of Sikkim, who came from near Gangtok, and Chheten Wangdi, a Tibetan who had at one time been a captain in the Tibetan Army, and then had been with the Indian Army in Egypt during the War. They proved quite invaluable to the expedition. They were both of them very hard-working, and saved the expedition many thousands of rupees in expense; their tact and knowledge of Tibetan ways and customs were of the greatest use in keeping up the friendly relations established between the expedition and the Tibetans.

Lord Ronaldshay, the Governor of Bengal, showed the expedition every kindness and hospitality, and went out of his way to help it in every way possible at Darjeeling. The stores from England, which had gone round by sea, were unfortunately late in arriving, owing to congestion in the harbour at Calcutta, and insufficient dock accommodation there. However, once they were landed, every one was most helpful, and the Darjeeling Himalayan Railway, which had given a free pass for them over their line, had everything brought up to Darjeeling by May 16.

Arrangements had been made with *The Times* and with certain Indian newspapers to publish periodical telegrams dealing with the progress of the expedition, and though this news was available to all other Indian papers, they took no advantage of it, and preferred to boycott the expedition.

Before going up to Darjeeling I had been to Simla, where I had had

an interview with Lord Reading, the Viceroy, who had shown great interest in the expedition and had given a subscription of Rs.750 towards it. The Commander-in-Chief, Lord Rawlinson, I had also seen, and he had arranged to lend the expedition 100 Government mules. These arrived at Darjeeling early in May and were to be our main transport. The mules were a fine lot, sleek and fat, and we had great hopes of them. On May 18 and 19 the expedition left Darjeeling in two parties, with fifty mules and twenty coolies in each party. Major Morshead had left on May 13, travelling up the Teesta Valley, with his surveyors, and was to meet us at Kampa Dzong. We were unable to take all our stores at once, and left part of them behind, intending to make use of the Government mules in bringing them on later. Throughout the journey across Sikkim the weather was very wet, with heavy rain each day; the mountain tops and ridges were all covered with clouds and prevented our obtaining any views. Owing to its heavy rainfall Sikkim is a country with a lavish growth and a marvellous vegetation; the path that leads across to the Tibetan frontier is a very trying one, as it is a series of steep climbs followed by equally steep descents into steaming tropical valleys. Wonderful butterflies of every shade and hue flitted across the path, scarlet clerodendrons made brilliant patches of colour in the dark green of the luxuriant forest among huge tree ferns. Creepers and ferns hung from every tree; white, orange, mauve, or purple orchids grew among the mosses and ferns on the branches of the trees, and showed up in lovely clumps of colour. We passed big hedges of daturas on the way, 15 to 20 feet in height and covered with hundreds of great white trumpet-shaped blooms, quite 8 inches in diameter and fully a foot in length. At night they gave out a strangely sweet scent and seemed to gleam in the darkness with a curious kind of phosphorescence.

Ever since leaving Darjeeling our mules had been giving trouble, and two or three from each party had to be left behind after each march. After travelling for four days we stopped at Rongli, hoping they might recover after a day's rest. Ten mules had already been left behind and one had died. The next march to Sedonchen was a short one of only 9 miles, but the path climbed from 2700 feet to 7000 feet, and this completely finished the mules. For one party alone we had already hired twenty-two ponies to take some of the loads, and after Sedonchen we should have had to hire ponies to carry their own line-gear as well as all our loads, so that there was now nothing to be done except to send the mules back and rely on what local transport we could get. The marches ahead of us were longer and the climbing steeper than anything we had yet done. We were, however, on the main trade route to Tibet, and had passed hundreds of Tibetan mules coming down from Tibet laden with bales of wool and others returning with rice, grain, and cloth bought in exchange. We were, therefore, able to pick up sufficient mules to carry us to Yatung; if we had taken the shorter route up the Teesta valley this would have been impossible, as

villages there are small and there is practically no transport passing along that route.

The path is really only a steep stone causeway up the mountain side, a regular *via dolorosa* and most unpleasant to walk upon; but probably anything else would be washed away by the torrential rain that falls here during most of the year. Leeches abounded here, sitting up at the end of every leaf and fern and waving at the passers-by. From Sedonchen to Gnatong the path climbs 5000 feet in the first 5 miles, and as we rose higher we entered into the rhododendron forests after passing through the zone of oaks and magnolias. The rhododendrons at this time of the year were a glorious sight. No photograph could do justice to the scene—it needed a painter at least. The hillside was a blaze of colour—rhododendrons, orange, red, deep crimson, pink, white, cream-coloured, formed a glorious mixture of colours. Every yard of the path was a pure delight. Now appeared grassy fields carpeted with primulas and many others of the purely Alpine plants. Gnatong was a very wet and cold spot with a rainfall of 180 inches, and on the next day we crossed the Jelap La, 14,390 feet, in pouring rain. This was the frontier between Sikkim and Tibet, and on going a few hundred feet down on the Tibetan side we emerged into fine weather with blue skies, having left the rain behind us on the Sikkim side. Everywhere were primulas and rhododendrons, the former appearing the moment the winter snow had melted from the ground. It was a steep and a stony descent of over 5000 feet into the Chumbi Valley, but the rhododendrons in the great forest of fir trees showed up splendidly, the big pink blooms of *Aucklandi*, the orange bells of *cinnabarinum*, and many a white and yellow one too, in striking contrast to the dark green of the firs. We now met birch, sycamore, and willows, all pale green, with the tender green of early spring, white spiræas and clematis, yellow berberis, white and pink roses, purple iris, and a mass of other wild flowers. The Chumbi Valley is one of the most fertile and prosperous valleys in all Tibet; the houses are large and well built, reminding one very much of Tirolese villages. The rainfall here is but a quarter of that which falls on the other side of the Jelap La; potatoes, barley, wheat, apples and pears all grow well here. The air everywhere at this time of the year was scented by the wild roses. From Yatung to Phari was 28 miles, two days' easy march up the Chumbi Valley. We visited the Galinka and Donka monasteries on the way, both containing enormous prayer-wheels in which they said there were over one million prayers. Each time the wheel is turned a bell rings, and one million prayers have ascended to heaven. In other places we met prayer-wheels turned by water brought down in irrigation channels, and again in other parts the wind was used to do the same work, a kind of anemometer being fitted up to catch the wind. This latter was, perhaps, the most constant, as the wind blows both summer and winter in Tibet, whereas for six months in the year the water is frozen, and the water-wheel is silent

and can offer up no prayers. In the Donka monastery was a famous oracle, a regular Delphic oracle who was consulted far and wide, and his oracles had a great reputation for truth. Here we were given the usual Tibetan tea, poured out into agate and silver teacups and made with salt, tea, and butter, all churned up together. On a cold day this was a warming drink, but I never much took to it as a beverage, though I had to take many cups of it during the next few months and had to pretend to enjoy it.

Phari is a very dirty village, with a stone fort, and is situated at a height of 14,300 feet. It is always a cold windy spot, but it is an important trade mart, both to India and across the Tremo La to Bhutan. It lies at the foot of the sacred peak of Chomolhari—a very beautiful mountain, just under 24,000 feet, which stands at the entrance to the real Tibet, where the great plains and rolling downs begin with their far distant views. We left Phari on May 31 with a most marvellous collection of transport animals, comprising donkeys, bullocks, mules, ponies, and yaks. There is a short way from Phari to Kampa Dzong which takes only three days, but we were told that it was too early in the season to use that road, and that we would have to take the long way round. We afterwards found out that this was a lie, and that they had sent us the long way round in order to be able to charge us more. We had not yet got accustomed to Tibetan ways.

From Phari to Kampa Dzong by the long route took us six days. For the first two days we followed the ordinary trade route to Gyantse, over the Tang La, 15,200 feet, through Tuna to Dochen, keeping at a height of 14,800 all the way. Chomolhari was a magnificent sight the whole time, with its 7000 feet of precipices descending right on to the Tuna plain. Near Dochen was the large shallow lake of Bam-tso, a lake with the most lovely colours, the shades varying from deep blue through purple to a light blue-green. In other parts of it the waters were quite red from a weed that grew in it, and in the still morning light the whole of the range of glacier-covered mountains that formed the background to the picture were reflected in its calm waters and formed a charming picture. Many bar-headed geese were seen swimming about, also some Brahmany duck and a few terns. On the plains roamed herds of Kiang, the wild horse of Tibet, and many Goa, the Tibetan gazelle, were feeding there, but the latter were very wary and would not allow us to get within 500 yards of them. It was at Dochen that our cook tried to boil a tin of fish without opening it first, and when he tried to open it afterwards when it was hot, to his surprise and fright, it exploded like a bomb in his face, and he and all his assistants in the kitchen were covered with small pieces of fish.

From Dochen we crossed the Dug Pass, 16,400 feet, to Khe, which was the site of the once-important town of Khe-tam. In those days the Kala-tso must have extended right up to it, but everywhere were traces of rapid desiccation. Ruins extended for more than a mile in every direction, and some of the buildings must have been of considerable size,

but now there is no water in the valley, and all we could get that night came from a very dirty and muddy pond that was nearly dried up. From here we marched to Kheru, and camped at 15,700 feet with some nomads who were very friendly. The days were very warm, but at nights there were still sharp frosts. From Kheru there was a longer march of 16 miles to Tat-sang, crossing two small passes of 16,450 and 17,100 feet. Tat-sang lies at a height of 16,000 feet on the edge of a broad plain, where there were some excellent springs full of fish, and below a small nunnery, which stands on a commanding rock. That night, again, there was a sharp frost. The next day's march to Kampa Dzong led for 12 miles along a barren and dry valley to a pass 17,300 feet, and then gradually descended through a curious limestone gorge to Kampa Dzong, whose walls suddenly appeared towering above us on the cliffs. We passed many iris, light and dark blue, growing in the valley, and a curious pink trumpet-shaped flower that came straight out of the sand. Game was plentiful along the route, and I shot a gazelle and an *Ovis Ammon (Hodgsoni)* on the way. Here we met Morshead and his surveyors, who had come up the Teesta Valley and over the Serpo La.

Several of us, ever since leaving Phari, had not been feeling well, and had had stomach troubles owing to the change of climate and bad cooking on the part of our cooks. It took most of us some time to get acclimatized to the changed conditions. Dr. Kellas, however, instead of getting better, gradually grew worse and weaker every day, until on the last march before reaching Kampa Dzong, while being carried in a litter over a 17,000-foot pass, his heart failed him, and he passed quietly away. The following day we buried him at Kampa Dzong, within sight of the three great mountains he had climbed in Sikkim—Pawhunri, Kinchenjhow, and Chomiomo, and in view of Mount Everest, which he had so longed to approach. Mr. Raeburn, too, had been gradually getting worse, and there was no other alternative but to send him down with Mr. Wollaston to Lachen and put him under the care of the missionaries there until he could recover. This was a very serious blow to the expedition, the loss of two of the members of the climbing party.

After Kampa Dzong our route lay across broad plains and along the flat and swampy valley of the Yaru with the snowy chain of the Himalayas to the south of us; from these heights, for we were about 15,000 feet, they did not appear nearly as imposing as they do from the south, and for the most part the northern slopes were not as steep as those on the south. Game was plentiful all the way to Tinki Dzong, and we passed many ponds covered with teal, duck, and bar-headed geese. In these flat valleys the midges were very troublesome all day, surrounding us in clouds. Tinki Dzong was a picturesque old fort, situated on the banks of a large pond that swarmed with bar-headed geese, Brahmany duck, and teal. They were wonderfully tame and came waddling round our tents, knowing no fear of man, for they had never been shot or killed

here. For some years a Lama, who had been sent from Lhasa, had lived here and made it his special object to tame all the wild animals around. The Jongpen rode out to meet us and escorted us to tents which had been pitched for us, where he had ceremonial tea, sweetmeats, and chang—Tibetan beer—all ready for us. The Jongpen was very Mongolian in appearance, and was dressed in fine embroidered Chinese silks, and proved a most obliging and courteous host, presenting us with a couple of hundred eggs and four sheep. There were several large monasteries and prosperous-looking villages tucked away all around in the recesses of the hills. The barley here was just beginning to come up, for in Tibet it can be grown and ripened at heights of over 15,000 feet, and during the summer months I saw some of the finest crops that I have seen anywhere. It is nearly all irrigated, as they do not seem to put much faith in the rain.

On June 11 we left Tinki, and had the usual trouble in starting. Some forty-five families were supplying us with transport, and as each wanted the lightest loads for their animals, there was a babel of noise and nothing was done. The headman eventually settled the squabbling by taking a garter from each family, and after mixing them up, laid one on each load, and whoever was the owner of the garter had to take the load. Crossing the Tinki Pass we descended again into the Yaru Valley at Chusher Nango, passing on the way a curious dwarf gorse which carpeted the valley with yellow. Our yaks here proved very wild, and the plain was soon strewn with loads flung off by them as they careered away, tail in air, in every direction. We forded the Yaru here by a ford 3 feet deep and some 80 yards wide, and soon afterwards came to the fine country house of Gyanga Nangpa, which was the home of the Phari Jongpen. He rode out to meet us, and provided us with a very solid meal of soup and Tibetan dumplings with a chillie sauce. As we were given fifteen dumplings apiece we found some difficulty in making room for these. Europeans had never been seen before in any of these parts since leaving Kampa Dzong, so everywhere we were objects of the greatest interest to all the inhabitants who flocked out to see us.

Our next march proved a more exciting one, as after fording the Yaru again we had to cross a wide sandy plain full of shifting quicksands. When we arrived there a violent sandstorm was blowing, which our guides said would make the crossing easier. So off we started, dressed as though for a gas attack, with goggles over the eyes and with mouth and nose covered with handkerchiefs and mufflers. The sand was blowing in great clouds from off the sand-dunes, through which we wound our way, and under one we found some of our coolies halted and quite lost. After leaving the sand-dunes we had some wide stretches of wet sand to cross, over which the dry sand was blowing in smoke-like wisps, so that the whole ground appeared to be moving. In places where the wet sand shook and quivered we hurried on as fast as possible, and eventually we

got everything over in safety. It was too late now to go on, so we camped in a howling gale among the sand-dunes, and it was many days afterwards before we got rid of the sand which had penetrated everywhere.

Close to this camp the Bong Chu and Yaru rivers meet and flow south, cutting their way through the great Himalayan mountain range. Much to our surprise, there suddenly appeared just before sunset, and far away down the valley over the clouds, a lofty and very beautiful peak. This we eventually decided must be Mount Everest, and the next morning we were able to prove this was so by climbing one of the hills to the west of the camp, from which we could see the whole range of the Himalaya to the south of us. Our drivers called this peak Chomo-uri, the Goddess of the Turquoise Peak, but this can only be a very local name, as Everest is known and called by the Tibetans Chomo-lungma, Goddess Mother of the country. This is the official name in Lhasa, and this name was known throughout the country, so that this is apparently the correct Tibetan name for Mount Everest. From this point we now entered the valley of the Bhong Chu, and this we followed up to Tingri. Major Morshead and his surveyors were kept very busy all the time, mapping the country as they went along, for they were travelling now in unsurveyed country. From one peak to the north of the Bhong Chu we had a very extensive view, stretching from the snowy ranges beyond Chomolhari and 120 miles to the east of us to Kanchenjunga, and then on to Makalu and Everest, and from there passing on to the high snow peaks west of Everest and to Gosainthan, a range of some 250 miles of snow peaks; but above them all towered Mount Everest, several thousand feet above its neighbours.

Three days' march brought us to Shekar Dzong, where was the headquarters of the district with two Jongpens. There was also a large monastery here containing 400 monks. Shekar was a most remarkable place, on a rocky hill like a gigantic St. Michael's Mount. The town is at the base of the hill, but the monastery, consisting of innumerable buildings with narrow streets, was literally perched on stone terraces built out from the rocky sides of the hill and connected by walls and towers with the fort, which was built still higher up, and this again was connected by turreted walls with a Gothic-like structure at the summit, where incense was freely burnt every morning. Immense crowds came to see us and were most embarrassing in their attentions. While we were here we visited the monastery, which was a very rich one. In the largest temple, which, like all Buddhist structures, was very dark, were several life-sized gilded statues of Buddha, covered with precious stones and turquoises, and behind these was a colossal statue of Buddha fully 50 feet high. Round the temple were eight curious figures, about 10 feet in height, and dressed in quaint flounce dresses, which were the guardians of the shrine. From the entrance to the temple we climbed up a steep staircase, almost in complete darkness, until we came out on a platform almost opposite the gilded face of the great Buddha. Here were offerings of grain and butter and

some exquisitely carved bowls and teapots of silver. The abbot of this monastery was the reincarnation of a former abbot, and was looked upon as an extremely holy man. He had spent sixty-six years of his life in this monastery, and all the monks seemed to adore him for his gentle and charming personality. His attendants with much difficulty persuaded him to be photographed, as they wanted to have some picture of him, for they said that his time on earth could now only be short. They dressed him up in some beautiful gold brocades, and priceless silk hangings were put up for a background. This photograph proved afterwards most useful, and people hundreds of miles away used to beg for a print of it, as they put it in their shrines and worshipped it and burnt incense before it, and I could not give any one a more welcome present than the picture of the old abbot of Shekar-chöde.

Two days' march from here brought us to Tingri, which was a large village and trading centre, situated on a small hill in the middle of the great Tingri plain. This was to be our first base while reconnoitring the north-western approaches to Mount Everest. We could get no information about the country to the south of us, so that it was necessary to send out parties in different directions. Information on any subject was always hard to get in Tibet. Most of the people knew nothing beyond their own village, and of those that had travelled further no two would tell you the same story. It was the same with distances; they would have no real measure of distance or time. It would be a long day's journey or a short one, and for short distances it was expressed by cups of tea, which means the time that it would take to drink one, two, or three cups of tea. The representative of the Depon received us at Tingri, and put at our disposal the old Chinese Rest House, where we made ourselves quite comfortable. We had rooms in which to put away our stores, and another room we turned into a dark room to develop all the photographs that we were taking. It had taken the expedition just one month to get to Tingri from Darjeeling.

No time was lost, as it was not known when the monsoon might break, and how strong it might be in Tibet, and on June 23 Mallory and Bullock started off to find the easiest method of approaching Mount Everest from the north-west. Mount Everest was clearly visible from Tingri, about 40 miles away, and across a low range of hills and to the west of it were some fine snow peaks 25-27,000 feet in height, which dropped down to the Khombu Pass. It was just possible that a glacier might come from Mount Everest and join the Kyetrak River, so the following day Major Wheeler and Dr. Heron started off to go towards the Khombu Pass. From now on Dr. Heron was on the move all the summer, sometimes with one party, sometimes with another, and often by himself studying the geology of all the valleys and mountains. He travelled over more country than any other member of the expedition. Major Wheeler, too, began his photographic survey from the Khombu

Pass, and most of the summer he spent by himself in lonely camps 18-20,000 feet high. The weather was very provoking, and often he would spend day after day, over 20,000 feet, on the top of a mountain in bitter cold and driving snow, waiting for the clouds to lift, to enable him to take his photographs. I think that he had the hardest and most trying time of all of us, and deserves the greatest credit for his work.

On June 22 Mr. Wollaston rejoined the expedition, after having taken Mr. Raeburn down to Lachen and handed him over to the care of the lady missionaries there. After his arrival I was now able to go away for a few days, and see personally where the various parties were and the general lie of the land, and I also wanted to find a place for our second base when we were reconnoitring the other side of Mount Everest. I first went and joined Major Wheeler and Dr. Heron at Kyetrak, and climbed up to the Khombu Pass—a fine glacier-covered pass 19,000 feet—leading into Nepal and across which a certain amount of traffic comes. It is always a dangerous pass, but early in the season they appear to take yaks over it. To the east towered up the great cliffs of the 26,800-foot peak, and to the right were the icefalls of Chorabsang. From here, with Dr. Heron, we crossed over the Pusi La or Marmot Pass (17,700 feet), a quite easy pass into the Rongshahr Valley and down to its interesting gneiss gorges. The Tibetan frontier in many places extends for several days' march south of the main watershed of the Himalayas, as it is easier to get from Tibet over the passes into the upper reaches of the valley than it is from Nepal. At a certain distance down the valleys they narrow into steep precipitous gorges up or down which the going is very difficult and often impassable in the rainy season, as the rivers are quite unfordable. This is the case with the Nyanam Valley, the Rongshahr Valley and the Arun Valley. On the south side of the passes there is a considerable rainfall and the vegetation becomes quite luxuriant. Near Tazang the white roses covered the hillsides, while spiræas, small yellow and white rhododendrons, yellow primulas, wild gooseberries and currants grew everywhere, and the shady side of the hills were covered with forests of birch, while juniper covered the other slopes that faced south.

Owing to the amount of juniper which grows in it, and which is very aromatic and used as incense, the valley is looked upon as a sacred one, and there were several hermits that lived here in caves among the rocks. The nearest village supplied them with food, and morning and evening clouds of incense used to ascend from the mouths of their caves. After ten years of meditation the anchorite is supposed to acquire great holiness and to be able to support life on ten grains of barley a day. There was a female anchorite here, they told us, who had lived to 138 years, and was greatly revered. She forbade any killing of animals, and hence we found the wild sheep everywhere very tame. After returning to Keprak we travelled east to Zambu, a prosperous-looking village, owning some 3000 yaks, and with fine views looking up the Rongbuk

Valley to Mount Everest, which was now only about 20 miles away. This valley led apparently right up to the foot of the giant precipices that come down from its north-western face. A large and unfordable glacier stream came down this valley, but at the monastery of Chöbu, 3 miles from Zambu, there was a foot bridge across which the loads were carried by hand, while the yaks were swum across the river. Some of the yaks preferred to stop on an island in the middle of the stream. Throwing stones at them was no use as they refused to budge, but at length some one produced a sling, and the stones thrown by this method evidently stung the animals considerably more and produced the required effect. The Rongbuk Valley was wild and gloomy, with great cliffs coming down to the muddy glacier stream, but it was a strangely holy valley, too, for at a height of 16,500 feet there was a large monastery, and besides the inhabitants of the monastery they told us there were between three and four hundred hermits and nuns living in little solitary cells or caves. Here, far away from the outside world, under the shadow of the great precipices of Mount Everest, they could meditate in peace and in perfect seclusion. All the wild animals and birds in this valley were wonderfully tame. With my own eyes I watched the wild sheep coming down in the early morning to the hermits' cells and being fed not 100 yards from our camp, and I walked up openly to within 20 yards of a herd of burhel and they showed no signs of fear or paid the slightest attention to me. The rock pigeon would come and feed out of our hands, and so it was with all the other wild birds.

We found the Alpine climbers in a camp further up the valley, on a sunny terrace about 18,000 feet, above the left bank of the Rongbuk Glacier, and commanding magnificent views of Mount Everest about 7 miles away at the head of the valley. From here for a month they were able to train their coolies in snow and ice work, and to explore the side glaciers and the great spurs that come out to the west and north-west and which appeared so very impossible. At first, and up to July 7, the weather remained pretty fine; but then the monsoon broke and rain and snow hindered the work of reconnaissance very much and made all high climbing impossible. From this point Dr. Heron and I retraced our steps to Chöbu, and then in three marches, crossing the Doya La on the way, we reached Kharta and the main Arun Valley, or Bhong Chu, as the Tibetans call it as long as it remains in Tibet. The people here were at first very frightened of us. Villages were quite deserted when we approached, but after a while they crept back one by one. The Alpine flowers on the Doya La were exceptionally beautiful. The lovely blue poppy abounded and grew in clusters everywhere; pink, yellow, and white saxifrages covered the rocks, and several varieties of gentian were just beginning to come out. The Doya La marks a distinct barrier, the country to the north being barren, while on the south the moister currents of air penetrate up the Arun Valley and its tributaries, giving it a distinctly damper climate. This was very noticeable in the vegetation as we descended—

rhododendrons, willows, juniper, roses, clematis, currants, abounded, and the ground was in places carpeted with yellow and sweet-scented primulas.

After much trouble we at length found Kharta, for the old maps here were hopelessly wrong. It was really a large collection of villages, near where the Kharta River ran into the Arun. We rode up to see the Jongpen, who lives in the village of Kharta Shigar, some 3 miles up the Kharta Valley. He had a large Chinese tent pitched for us in his garden, which was well sheltered and shady with willow trees all round, and containing a large painted water prayer-wheel under a great poplar tree, turned by a gurgling little stream that ran through the garden. The Jongpen was quite a young man, though he had been there for some years, and was most friendly and hospitable. He insisted on giving us all our meals, but we were getting experienced now in the use of chop sticks, and the Tibetan cooking was often better than that done by our own servants. We were able to look round for a suitable place for our second base camp, as it would be necessary to explore the upper Kharta Valley and another valley that they told us about, that lay to the south of it. We eventually selected a house that stood all by itself on an old river terrace, and was surrounded by a shady garden of poplars and willows. The rent we had to pay for the house and garden amounted to $3\frac{1}{2}d.$ a day; but living is cheap in Tibet, and you can get a house-servant there for *2s. 8d.* a year!

The rains now broke in earnest, and we had a very wet journey back to Tingri, going to Lumeh, with its huge poplar, 40 feet in circumference, and crossing a dangerous ford over the Rongbuk river higher up at Tashi Dzong; but I got back in three days, riding 36 miles the last day in pouring rain. During my absence Major Morshead had been busy surveying the country to the north of Tingri, and on my return he and Mr. Wollaston started off on a journey of exploration to the south-west, having had an invitation from the Jongpens at Nyanam to visit them, and they were able to see the great peak of Gosainthan and Gaurisankar, which was for a long time confused with Mount Everest, though over 20 miles away from it and 5000 feet lower. It was a very striking and beautiful peak. They also visited Lapchi Kang, where the poet Mila Rapa had lived and which was a great place of pilgrimage. Its name was known far and wide, and some people even applied this name to Mount Everest. The weather, however, unfortunately spoilt their trip, as it rained nearly all the time. But Mr. Wollaston managed to collect many natural history specimens and a great variety of new flowers. At Tingri, too, during this time, we had heavy storms of rain and thunder every night, fresh snow coming down as low as 15,000 feet; but most of it melted again during the day. The plains around Tingri were rapidly becoming marshes and the rivers soon became unfordable. The storms always formed to the north of us along the Sipri limestone ridge and the watershed between the Brahmaputra

and Bhong Chu, and then gradually worked down towards the south. Fine weather came to us from the south, and when the south wind blew the rain stopped. It was seldom that the monsoon clouds brought rain directly to us. Every evening at Tingri we had brilliant lightning and loud thunder to the north, and our house proved to be very leaky. The rain poured in through the mud roofs.

On July 24 we started moving all our stores from Tingri to Kharta, and our first march was to Nezogu, where there was a bridge over the Kyetrak River. A couple of inches of snow fell during the night, and many of us who did not put on snow goggles soon enough suffered much the next two days from snow blindness. Wheeler, who had finished his survey of the Keprak and Khombu valleys, accompanied me as far as Chöbu, where he started to go up the Rongbuk Valley. Here he remained for a month, having a very trying time with constant bad weather. Mallory and Bullock, finding the bad weather too much for them, joined us and came along to Kharta, and their coolies were also in want of a rest. From Chöbu to Rebu was a pleasant march through a fertile valley full of fields of barley, peas, and yellow mustard, and the wild flowers were very beautiful along the irrigation channels—a black clematis, blue monkshood, and delphinium predominating. The next day we crossed the Doya La, and on the 28th reached Kharta, where we established our camp in the garden belonging to the house that we had hired, the house itself being used for all our stores and for a dark room. Here we were only at a height of 12,300 feet, and the valley was green with fields of peas and barley. Just below us flowed the Arun, now a majestic river over 100 yards wide, and a mile lower down it entered into its great gorges, where in the course of the next 20 miles it drops from 12,000 feet to 7500 feet, a fall of over 200 feet in the mile. Every day the monsoon clouds came up through the gorge in thin wisps, but melted away always at the same spot, and though it poured with rain a mile below us, yet every day with us the sun shone brightly and it was very rare for any rain to reach us. Twenty miles away to the north again were heavy clouds, and storms and rain fell there daily, so that we seemed to be in a dry zone between the two storms. The forests of fir and birch came up to the limit of the rainfall, and then ceased suddenly when the rain stopped a mile below us.

On August 2 Mallory and Bullock left Kharta to explore the eastern approach to Mount Everest. Neither the Jongpen nor any of the inhabitants could tell us where the Kharta river had its source, and whether it was possible to get to Mount Everest that way. They said, however, that in the next valley to the south it was possible to do so. I followed the Alpine climbers a couple of days later, as Mr. Wollaston and Major Morshead had returned from their trip to Lapchi Kang. After going for 7 miles up the Kharta Valley, which is very fertile, with every level space filled with barley-fields, and containing numerous villages and monasteries,

we turned up a side valley and then crossed over a chain of mountains to the south by the Langma La, a pass 18,000 feet in height. This led us into the wonderful Kama Valley, a valley unexcelled in beauty anywhere in the Himalayas, with the most stupendous scenery—gigantic rocky cliffs towering up to heaven, and immense cliffs of ice torn and riven, breaking off and falling with a thunderous roar far down into the valley below; there were smiling pastures right up amongst the ice and snow, with fields carpeted with many varieties of gentian; rhododendrons, birch and fir trees surrounded some of the lower glaciers, and forests of some of the most magnificent fir trees grew in the lower parts of the valley, the whole forming a combination of beauty not often seen.

At the extreme end of the valley towered up Mount Everest with its great buttresses forming a huge semicircle, and like a great snake, the Kangshung glacier, with its bands of black moraine, crept up to the foot of the rock walls and cliffs that formed the eastern side of Mount Everest. It did not need a long survey of these faces to satisfy the Alpine climbers that there was no practicable route up this side, but there was still an untried approach up the Kharta Valley, and to this valley they now turned their attention. But before we deal with the first reconnaissance of the Kharta Valley I should like to discuss the Kama Valley more fully; it was so very beautiful that I paid three visits to it at different times. From the upper Kharta Valley at the end of September, I paid my third visit with Major Wheeler and Mr. Wollaston. We crossed over a high pass well over 20,000 feet, and descended into the head of the valley. The weather was fine, and we were able to get some good photographs of Everest and Makalu—the latter a mountain only a little over 1000 feet below Mount Everest—yet a far finer mountain to look at and far more imposing. I was able to climb up on to a ridge between the two peaks, whence I got some superb views of the incredibly narrow peaks of Makalu, with its cliffs and formidable precipices often too steep even to be lightly powdered with snow. To the south we looked down over range upon range of snow mountains in Nepal. In the Kama Valley, Makalu is the most astonishing spectacle—its terrifically steep precipices descend sheer for 11,000 feet into the valley, and huge buttresses of perpendicular black rock support it with jagged black spires and towers. The Tibetans do not know the name of Makalu, but call the mountain Chomo Lönzo. From the northern peak the Kangdoshung glacier pours straight across the valley, forcing the stream that rises on Mount Everest itself to go under the glacier, entering it in an enormous black cavern. Rhododendrons, willows, mountain ash, blue poppies and iris now abound, and a few miles lower down begin the birch trees and the juniper, which grow with the greatest luxuriance, and in the autumn I never anywhere saw such beautiful colouring as the scarlet of the mountain ash and berberis, the yellow and gold of the birch and willows, and the deep red of the wild roses.

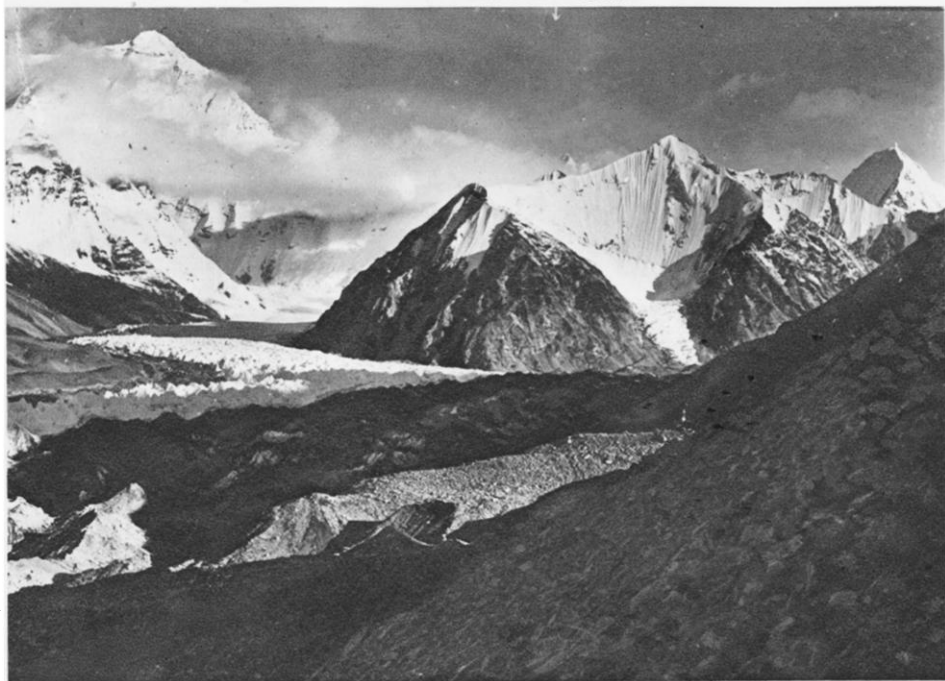
Towards the end of August, while waiting for the weather to improve,

Mr. Wollaston and I crossed over the Chog La and dropped down to Sakeding (the pleasant terrace), a small trade mart a little lower down in the Kama Valley, in order to pay a visit and investigate the lower parts of the valley. Here we entered at 12,000 feet into the zone of the real forests. Here were juniper trees of a size quite unknown, with stems 20 feet in circumference and rising for 50 and 60 feet without a branch. Then a little lower down we entered into the zone of the silver fir (*Abies webbiana*), where the trees grow 100 feet and more in height and with a girth of over 25 feet, and a little lower down at 9-10,000 feet the lovely feathery *brunoniana* grew over 150 feet in height, and with trunks over 30 feet in girth. In these zones grew also the great rhododendrons, *argenteum* and *Falconeri*, for here was a climate of constant rain. These high mountains seemed to draw up the monsoon currents towards them, and every tree and bush was covered with long grey lichens that hung down and gently swayed in the wind; the hillsides were running with water and the path was a morass of black leafy mud, except where logs had been laid down on which to walk. Such conditions were favourable to leeches, and they abounded in this valley and to heights over 12,000 feet. They had evidently never tasted European blood, and were anxious to do so, thinking that we were a new kind of food and a great delicacy, for they climbed up the tent walls, on our clothes and legs and faces; they got on to our plates and cups and into our food, and we never knew when we might not meet them. We travelled down to where the Kama River joins the Arun River, at a height of 7500 feet, below the first great gorges of the Arun and some 20 miles below Kharta. All this country is still in Tibet, as the Nepal frontier runs along the Everest-Makalu Ridge, and then continues eastwards, following the crest line of the ridge down to the spot where it joins the Arun. The ridge is crossed by one low pass of 14,000 feet, called the Popti La, and across this pass a certain amount of trade is carried on with Tibet by coolies during seven months of the year. For five months the pass is closed by snow, but chillies, dyes, and rice are sent over from Nepal and are exchanged at Sakeding for salt. It is all done by barter and no money changes hands.

Meanwhile Mr. Mallory and Mr. Bullock had been joined by Major Morshead, and had gone up to the headwaters of the Kharta Valley, and, after exploring it under bad conditions of weather and with very soft snow, had decided that there was a practicable means of getting on to Mount Everest by this route. The rainy season, however, was still in full swing; far more rain had fallen all through Tibet than we had ever expected to meet; the rivers everywhere were unfordable now, and all the bridges by which we had crossed in the spring had been washed away, so that there was nothing to do but wait until the weather improved. About the beginning of September the weather showed signs of improvement, and Mallory, Bullock, and Morshead moved up to the advanced base camp up the Kharta Valley, which was situated at a height of

Summit

End of N.W. Ridge



1. LINGTREN PEAKS, HEAD OF RONGBUK VALLEY, BETWEEN THE RONGBUK AND WEST RONGBUK GLACIERS



2. LOOKING DOWN WEST RONGBUK GLACIER ACROSS THE RONGBUK GLACIER TO THE PEAKS OF THE NORTH RIDGE

Phot. by G. L. Mallory

Lingtren

Summit

Lhotse

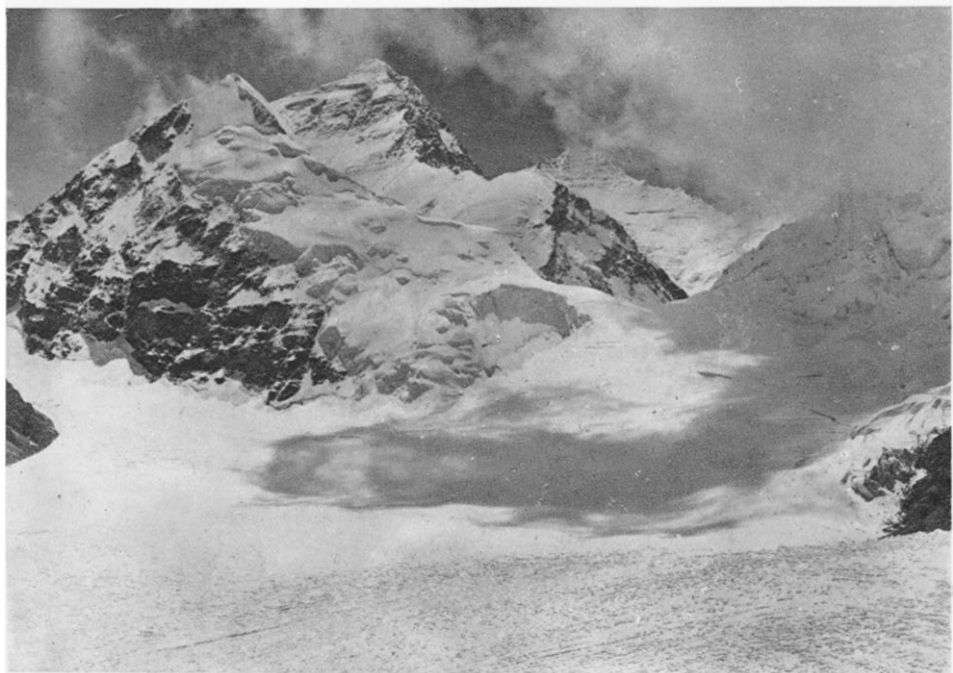
Western Cwm



3. MOUNT EVEREST, NORTH-WEST RIDGE, WESTERN CWM ON EXTREME RIGHT AND LINGTREN PEAKS

Summit

Lhotse

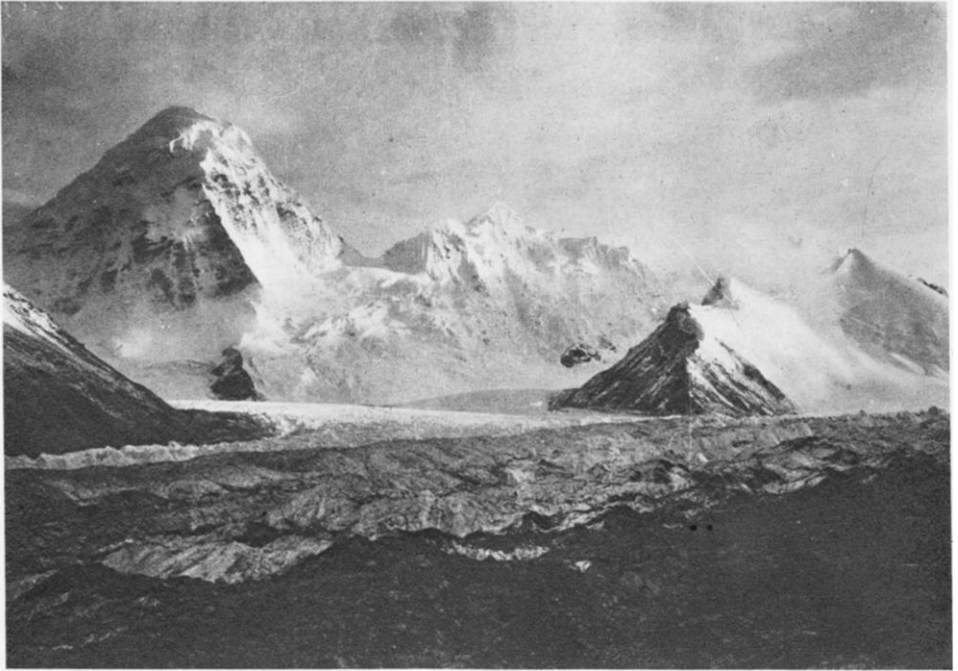


4. MOUNT EVEREST AND END OF NORTH-WEST RIDGE WITH SNOW PASS LEADING TO WESTERN CWM

Phot. by G. L. Mallory

Pumori

Lingtren-nup



5. PUMORI AND LINGTREN-NUP, LOOKING SOUTH ACROSS WEST RONGBUK GLACIER



6. LOOKING SOUTH INTO NEPAL FROM THE SNOW PASS LEADING TO THE WESTERN CWM GLACIER

Phot. by G. L. Mallory

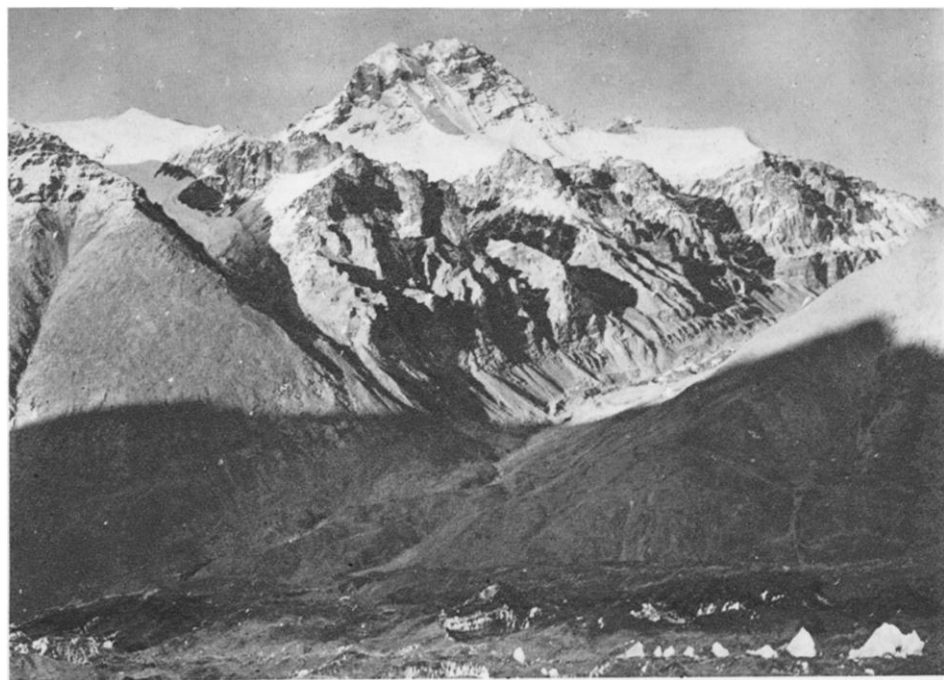


7. THE CHANGA LA FROM THE RONGBUK GLACIER HEAD



8. KARTSE AND MAKALU FROM THE WEST

Phot. by G. H. Bullock



9. ENTRANCE TO EAST RONGBUK VALLEY FROM WESTERN SLOPES OF RONGBUK VALLEY : THE UNNAMED PEAK IS THE "LIGHT ROCK PEAK" PHOTOGRAPHED BY DR. KELLAS FROM THE KANG LA

Phot. by G. L. Mallory



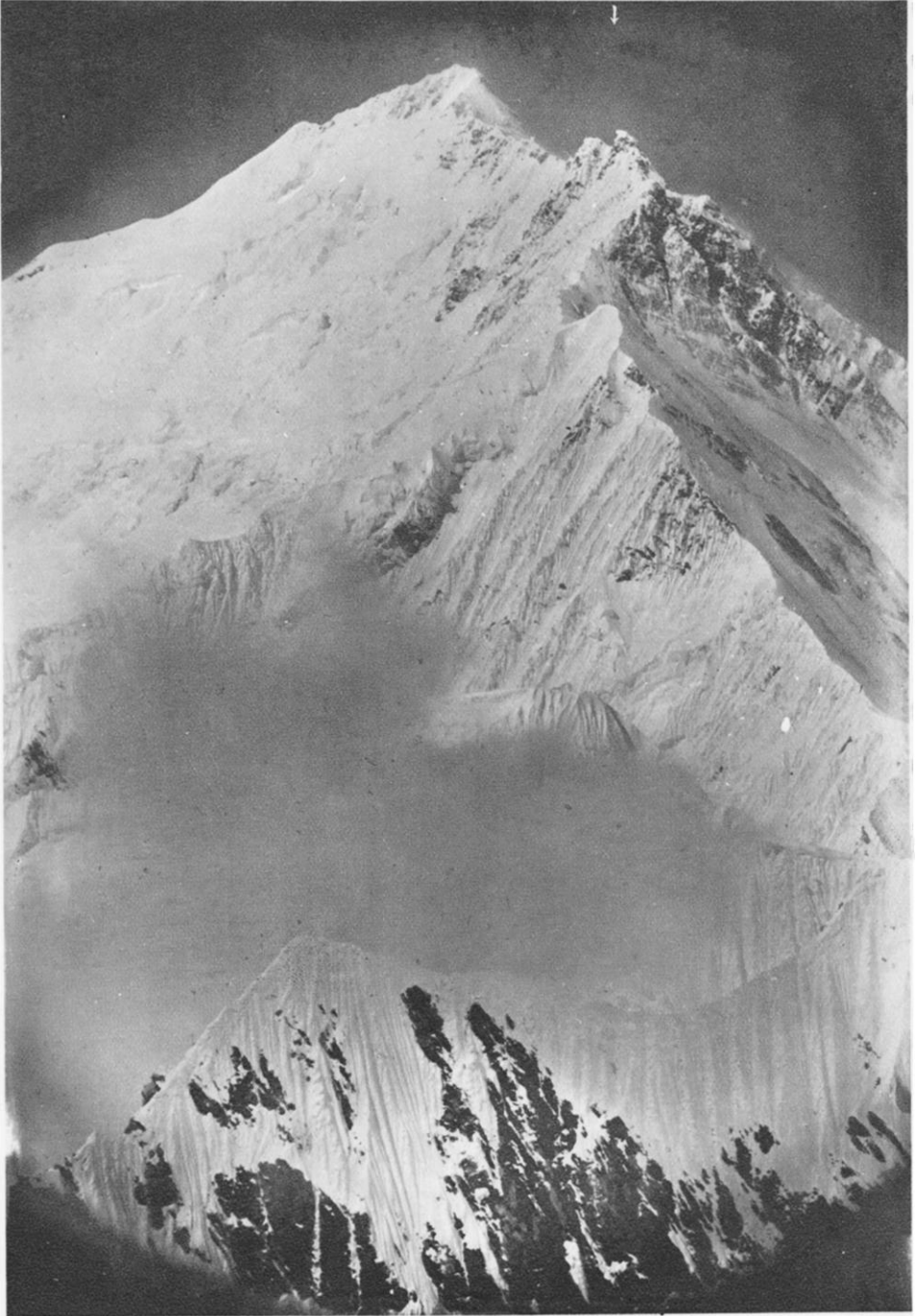
10. THE LOWER REACHES OF THE EAST RONGBUK GLACIER



11. LOOKING UP THE EAST RONGBUK GLACIER

Summit

N.E. Shoulder



12. THE NORTH-EAST ARÊTE OF MOUNT EVEREST

Phot. by A. F. R. Wollaston

Kangchenjunga



14. CAMP ON LHAKPA L

Kharta Valley

Makalu



15. PANOR.

Kangchenjunga

Chomo Lönzo Makalu

Pethangtse



13. PANORAMA FROM KAMACHANGRI (21,300 FEET)

Lhotse

N.E. Shoulder

Chang La

Changtse



14. CAMP ON LHAKPA LA (22,500 FEET), CHANG LA, CHANGTSE, AND HEAD OF EAST RONGBUK GLACIER

East R

Makalu

Summit

Lhakpa La

Khartaphu



15. PANORAMA FROM PEAK NORTH OF ADVANCED BASE CAMP, KHARTA VALLEY

Pethangtse

Summit

Khartaphu



der

Chang La

Changtse



EAST RONGBUK GLACIER

East Rongbuk Glacier

akpa La

Khartaphu

Khartichangri



HARTA VALLEY

Phot. by Col. Howard-Bury, D.S.O.

Chomo Lönzo

Makalu



16. CHOMO LÖNZO, MAKALU AND COUN

Kamachangri



17. PANORAMA

Makalu



16. CHOMO LÖNZO, MAKALU AND COUNTRY SOUTH OF MOUNT EVEREST FROM RIDGE AT 21,500 FEET SOUTH OF KAMA VALLEY

Pethang Ringmo

Langma La

Foot



17. PANORAMA OF THE KAMA VALLEY FROM SOUTH OF THE KANGSHUNG GLACIER

Cham Lang

Lhotse

Summit



1000 FEET SOUTH OF KAMA VALLEY

Foothills of Chomo Lönzo

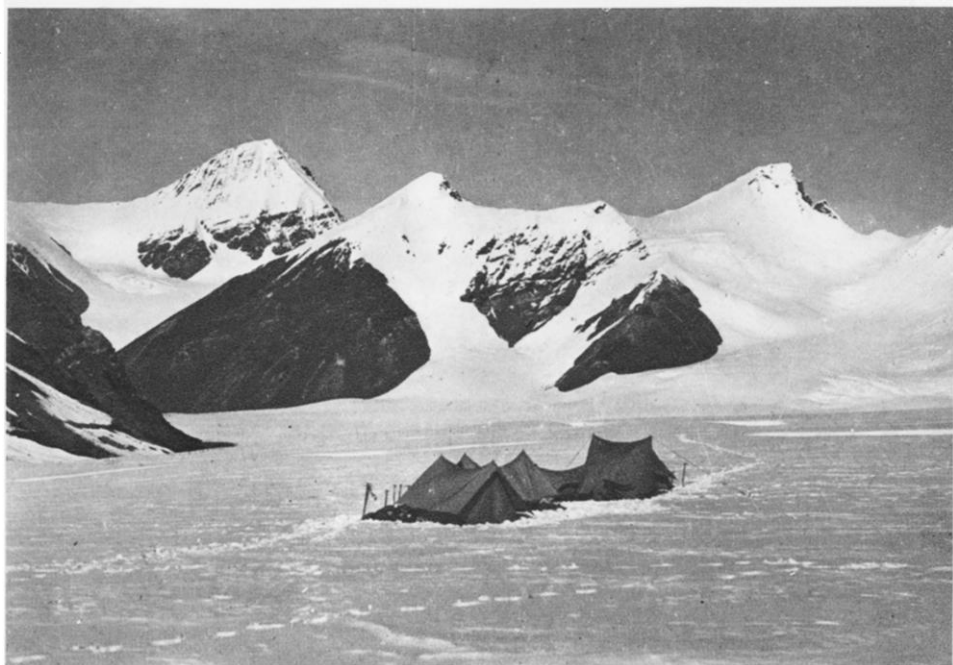


YUNG GLACIER

Phot. by Col. Howard-Bury, D.S.O.

Khartaphu

Lhakpa La



18 LOOKING BACK FROM THE LAST CAMP TO THE LHAKPA LA

N.E. Shoulder

Summit



19. LOOKING OBLIQUELY UP THE NORTH FACE OF MOUNT EVEREST
FROM THE CHANG LA

Phot. by G. L. Mallory

Lhotse

Summit

Lhakpa La



Kharta Glacier

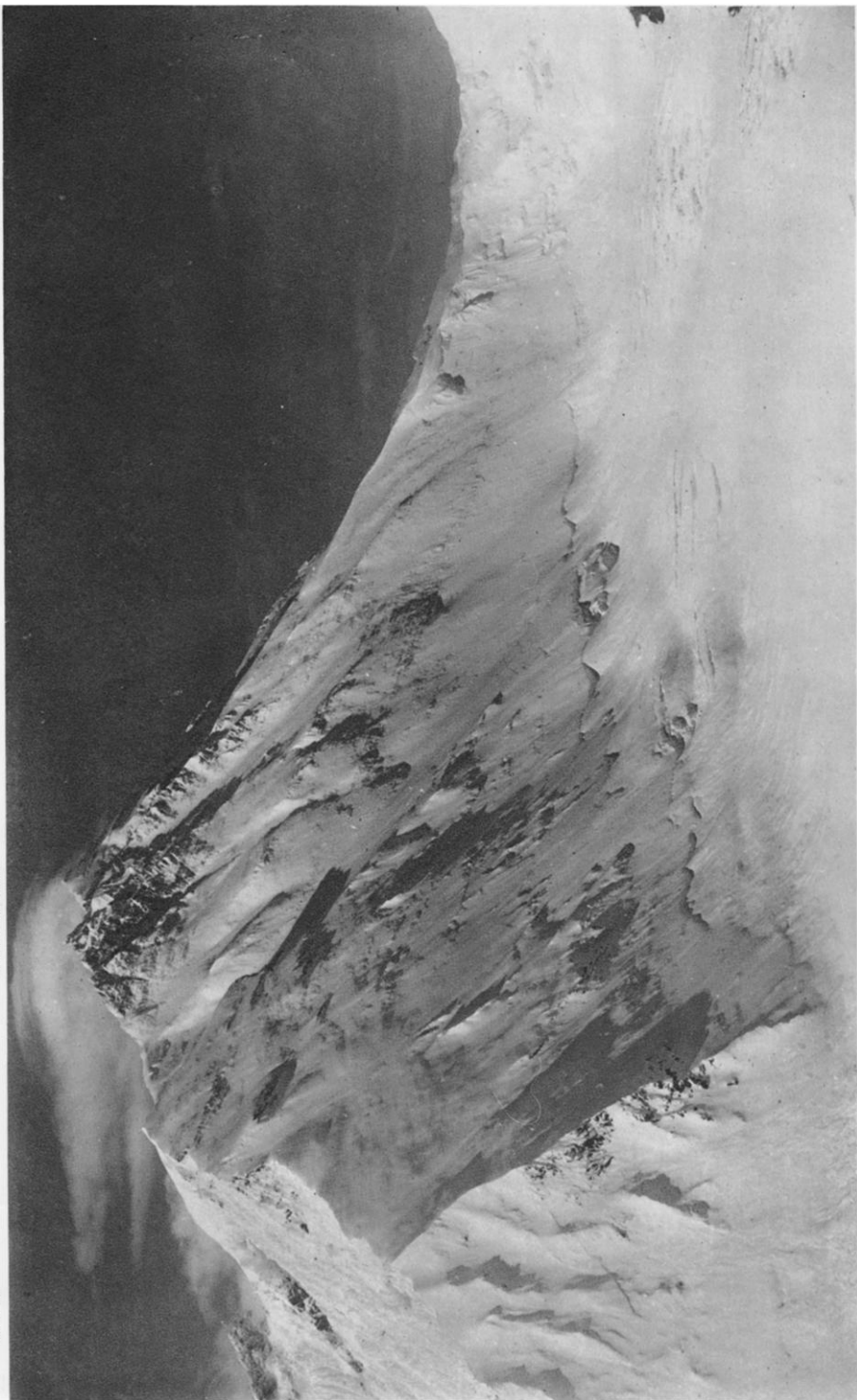
20. WIND BLOWING SNOW FROM THE MOUNTAIN, SEPT. 1921, FROM ABOVE 20,000 FEET CAMP

Phot. by A. F. R. Holliston

Lhotse

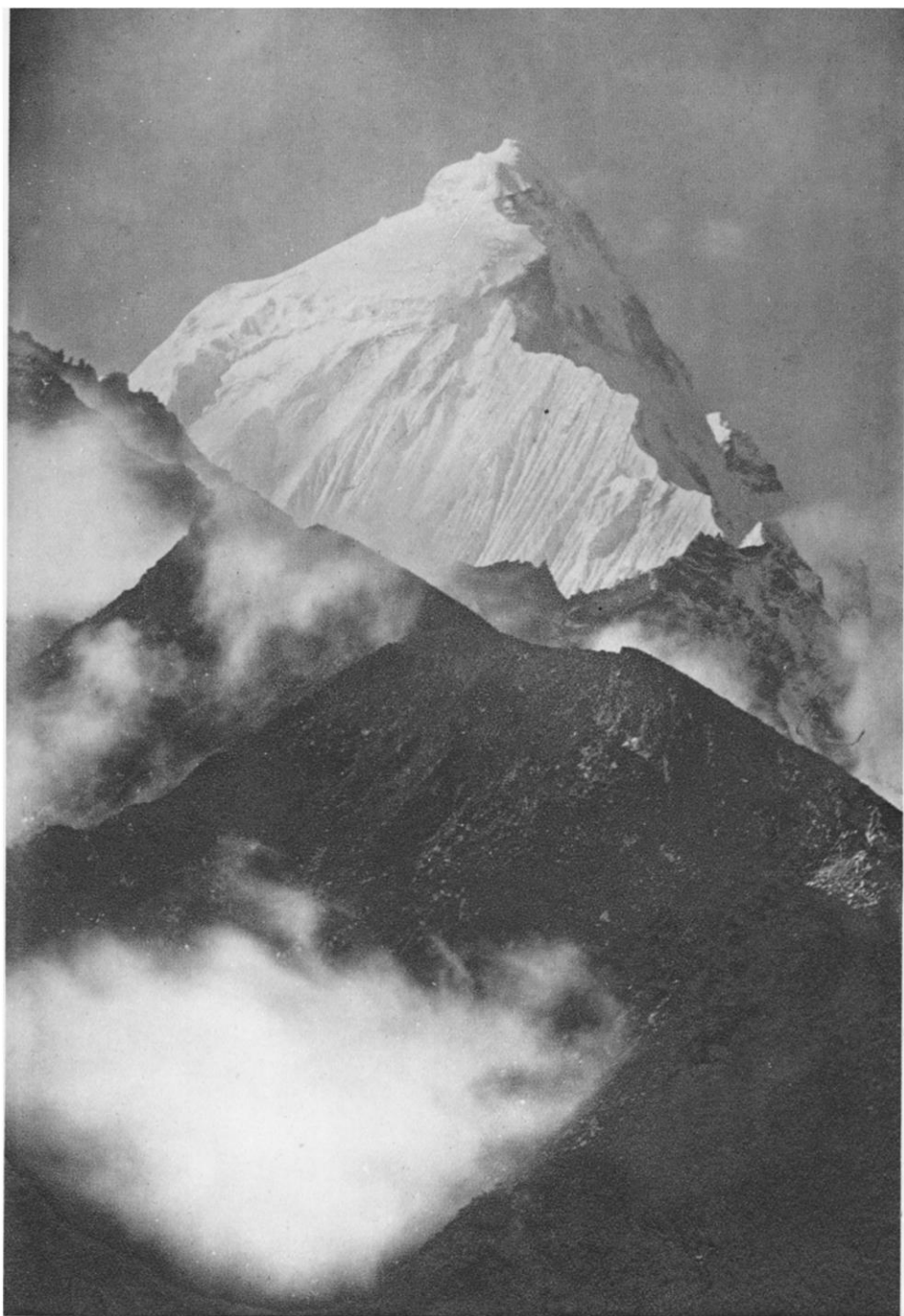
N.E. Shoulder

Chang La



21. DETAIL OF NORTH-EAST ARÊTE AND NORTH FACE FROM THE LHAKPA LA

East Rongbuk Glacier



22. GAURISANKAR FROM THE WEST

Phot. by A. F. R. Wollaston

over 17,000 feet. Wollaston and I arrived there on September 6. Our tents were pitched in some little grassy hollows, which formed a perfect Alpine garden, as they were carpeted with gentians and saxifrages, and all around grew a host of other lovely little Alpine plants. Unfortunately the weather broke again, and until September 19 we had constant falls of snow every day. The time was spent in carrying up fuel and stores to the 20,000-foot camp, so that as soon as the weather improved we might start off at once.

There was a temporary break on the 17th, and with Mallory and Morshead we made one of the most delightful excursions that I have ever taken part in. We started off at 2 a.m. with a full moon shining with the most brilliant light, turning night into day, and we climbed up along the ridge south of the camp which led to a peak 21,300 feet high that overhung the Kama Valley. When we started there were 13 degrees of frost, and, except for the distant roar of the stream far away in the valley, there was no other sound, only an intense stillness. The valleys in Tibet, the great gorges of the Arun, the wooded valleys of Nepal, all lay buried under a white sea of clouds, out of which emerged the summits of the highest mountains, like islands out of a fairy sea. In the bright moonlight mountains like Kangchenjunga, 100 miles away, stood out sharp and distinct, and far away to the south, over the plains of India, was constant lightning. Here on this sharp ridge, at a height of 21,000 feet, with no obstruction to hide the view, sunrise came to us in all its grandeur and beauty. To the west, and close at hand, towered up Mount Everest, still over 8000 feet above us, at first cold and grey, like the dead, and with a sky of the deepest purple behind. Then, all of a sudden, a flash of golden light touched the utmost summit of Mount Everest and spread with a glow of gold all over the highest snows and ridges of this wonderful mountain, while behind the deep purple of the sky changed to orange. Makalu caught next the first rays of the sun and glowed as though alive, and then the white sea of cloud was struck by the rays of the sun and gleamed with colour; then slowly rose and struck against the island peaks in great billows of fleecy white. Such a scene it has seldom been the privilege of man to see, and once seen leaves a memory that the passing of time can never efface.

By September 20 we had all moved up to the 20,000-foot camp, situated on a sunny terrace of stones between two glaciers. Even here a few flowers existed, and every night any food in my tent left unprotected was eaten by some mountain rats, though what they can find ordinarily to eat at these heights I cannot imagine. The nights here were cold, but the days delightfully warm, and the black-bulb thermometer registered sun temperatures of 195° and 197° Fahr. regularly. The sun at these great heights is one of the great foes that we have to contend with. It seemed to exhaust and draw off all one's vitality and leave us limp, and good for no exertion. The whole climate is trying, and the extremes are so great

that your feet can be suffering from frost-bite while you are getting sun-stroke at the same time. It is only the young and thoroughly fit person that can withstand the extraordinary changes of climate and temperature that there are in Tibet, and can acclimatize himself properly to the changed conditions of existence and food.

We had been saddled with a very useless and incompetent sirdar, who was in charge of the coolies; he was a thoroughly untrustworthy man, and was always making mischief; we had sent him away to Kharta to get him out of the way, and once he was gone we never had any trouble with the coolies, who worked most willingly. On September 22 six of us moved up to the Lhakpa La, a col 22,320 feet in height, to which Mallory had been busy carrying up stores; from here the only possible way up to Mount Everest could be seen clearly. It necessitated first a descent of 1200 feet on to a branch of the Rongbuk Valley, and then a steep climb up to the north col, a col that joined Mount Everest with the north peak, a peak some 24,600 feet in height. Mr. Mallory with Mr. Bullock and Major Wheeler went on the next day and reached the col at a height of about 23,000 feet; but the fates were altogether against them, and though the weather remained bright and clear, a north-westerly gale had already set in which made life even at the Lhakpa La camp very unpleasant, and conditions became absolutely impossible for any higher climbing. The whole slopes of Mount Everest seemed to be smoking with the snow being blown about in suffocating whirls and clouds, and with the iciest wind that made breathing almost an impossibility. After the monsoon there seems to set in a strong north-westerly current of air, with the force of a gale at heights over 23,000 feet, and nearly every day afterwards, throughout all our journey back, and right to the end of October, we could see the snow being blown off in great clouds from every peak over 23,000 feet, by a gale from the north-west, which would seem to preclude any higher climbs after the monsoon has ended in this easterly portion of the Himalayas. Tracks of hares, foxes, and wolves were seen in the snow at great heights up to 21,000 feet, and the track of what was probably a large loping grey wolf, which had tracks very like that of a barefooted man, gave rise to the legend of the snow man, which was well known to our coolies. As in many other countries, they have in Tibet a bogey man with which to frighten their children when naughty, and this takes the form of a hairy man that lives in the snow; and when they want to escape from him they must run downhill, as long hair from his head falls over his eyes when he runs downhill, and he is then unable to see, and so they can escape from him. Many such stories they have, and these wolf tracks in the snow, which looked at first sight like human prints, were at once accepted by them as being the tracks of wild men.

Defeated by the continuous gale, Mallory, Bullock, and Morshead, with Raeburn, whom they had picked up at the 20,000-foot camp, returned straight to Kharta, while Wollaston, Wheeler, and I crossed over a pass

opposite the 20,000-foot camp and went round to Kharta after spending a few days in the Kama Valley, where we were lucky in getting some good photographs. It was not until October 5 that we were able finally to get away from Kharta. The autumn colours in the Kama Valley were magnificent, and near Kharta the willows and birches were all brown and gold. The crops of barley and peas had all been garnered, and the people of these villages were very satisfied, as they said that we had brought the rain with us, and that their crops were 50 per cent. better than they were in most years.

We chose another route for the journey back, following up the valley of the Arun or Bhong Chu, as it is called in Tibet. This route was impassable during the summer months, when the rivers were in flood, but now with the snow and ice no longer melting its width was reduced by half, and it was fully 10 feet lower, so that we could make use of the Heath Robinson bridge of twisted hide at Gadompa. Across these ropes each load and person were slowly pulled, and when the Tibetans wished to play a joke on any one they let him slide rapidly down to the centre of the rope, where it sagged just clear of the water; but as a large wave formed in the rapids they had only to pause for a moment to allow the unfortunate passenger, who was helplessly trussed up, to get a ducking in this ice-cold water. At Shilling, near the sand-dunes and the quicksands, we struck our old route and travelled back swiftly along it, as winter in these lofty regions was coming on apace, and between Kampa Dzong and Phari the thermometer fell to zero Fahrenheit, and we had a regular blizzard of snow. This time we came back by the shorter route, so that it only took the caravan three days to get from Kampa Dzong to Phari, but the marches were long, over 20 miles each day, and over 16,000 feet all the time. Darjeeling was reached on October 25, and the expedition of 1921 was over. The expedition had accomplished what it had set out to do. All the approaches to Mount Everest from the north, north-west, north-east, and east had been carefully reconnoitred, and a possible route to the top had been found up the north-east ridge, and it was only climatic conditions that prevented a much greater height being attained this year.

The scientific results have not yet been fully worked out, but in general outline some 13,000 square miles of new country have been surveyed and mapped, part of this by the method of photographic survey and on a large scale; a large number of birds and mammals of all sizes have been collected; the geology of the whole region has been carefully worked out by the indefatigable Dr. Heron, who is at present compiling a geological map of the district, and a series of photographs have been taken of a country quite unknown and containing some of the grandest scenery in the world.

Such, in brief, have been the results of the first year's expedition.

MAP I. PRELIMINARY MAP to illustrate the route of the MOUNT EVEREST EXPEDITION 1921.

Reduced from the map on the scale 1/253440
by Major Morshead and assistants of the Survey of India
accompanying the expedition: the neighbourhood of
the Mountain from Map II.

Scale 1/750,000 or 1 Inch = 11.84 Stat. Miles.

Route of the Expedition ——— Pass =
Heights in feet.



86°

29°

28°



TSANGPO

Seru La x 19644

Pongang

19629

15151

20039

Tsanghla
21169

Tsangla Chu

Khakyu

Pekhu
Tso

Pongrong

19204

Yao La

Men Chu

Menkhap Me

Pyuk

BURTRA

Menkhap To

Drongkar

T

Men Chu

Nebung

17691

Ling

Ling

21952

17656

Tsanda

142

Chu

21870

22220

22380

20770

Liangkor

Tabung

Thong La

17981

Gya Chu

23082

Gosainthan
26291

Tashishong

21153

22410

21680

22876

Nyenyam

21839

19600

LAPCHE YANG

Lapche

Tazang

18590

Kangchen
La

Khumbu La

19005

Choksum

19988

Trintang

Chomo Tsering
(Gaurisankar)

23440

18940

19550

Dram



▲ Tolung 18160

▲ Mok Kyong 18160

Seru La 19644

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Men Chu • Menkham Me

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Kyishong

Thong La

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Liangkor

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Lamar La 18575

Pangla

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PHARRU

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Khang Gya K

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Khuse La

Kyetrak Glacier

Rongbuk

Doya La

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Lang Chu

Kharta Chu

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Cho Uyo 26867

Rongbuk Glacier

▲ Gyachung Kang 25990

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Khartichangri ▲ 23420

Khartaphu ▲ 23800

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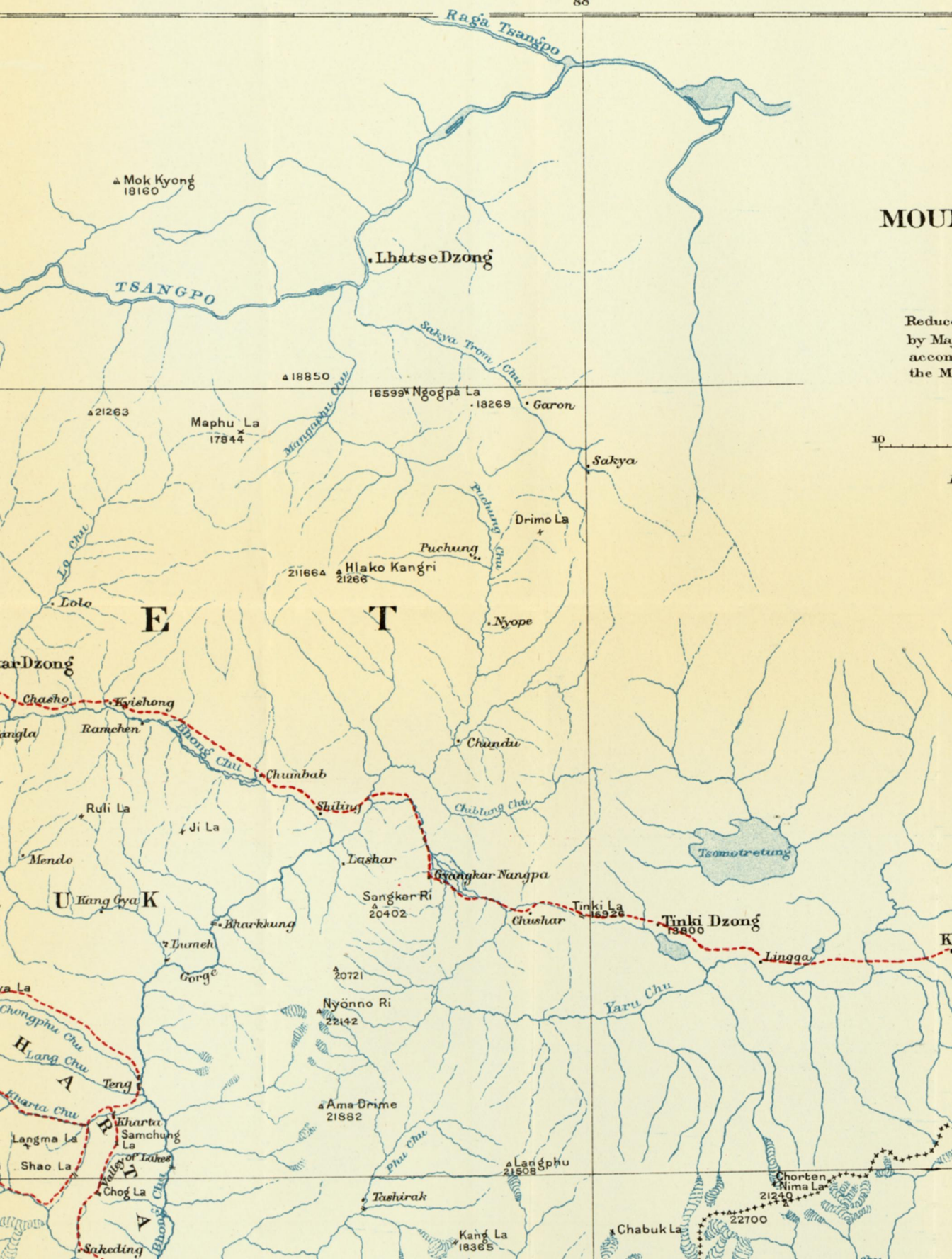
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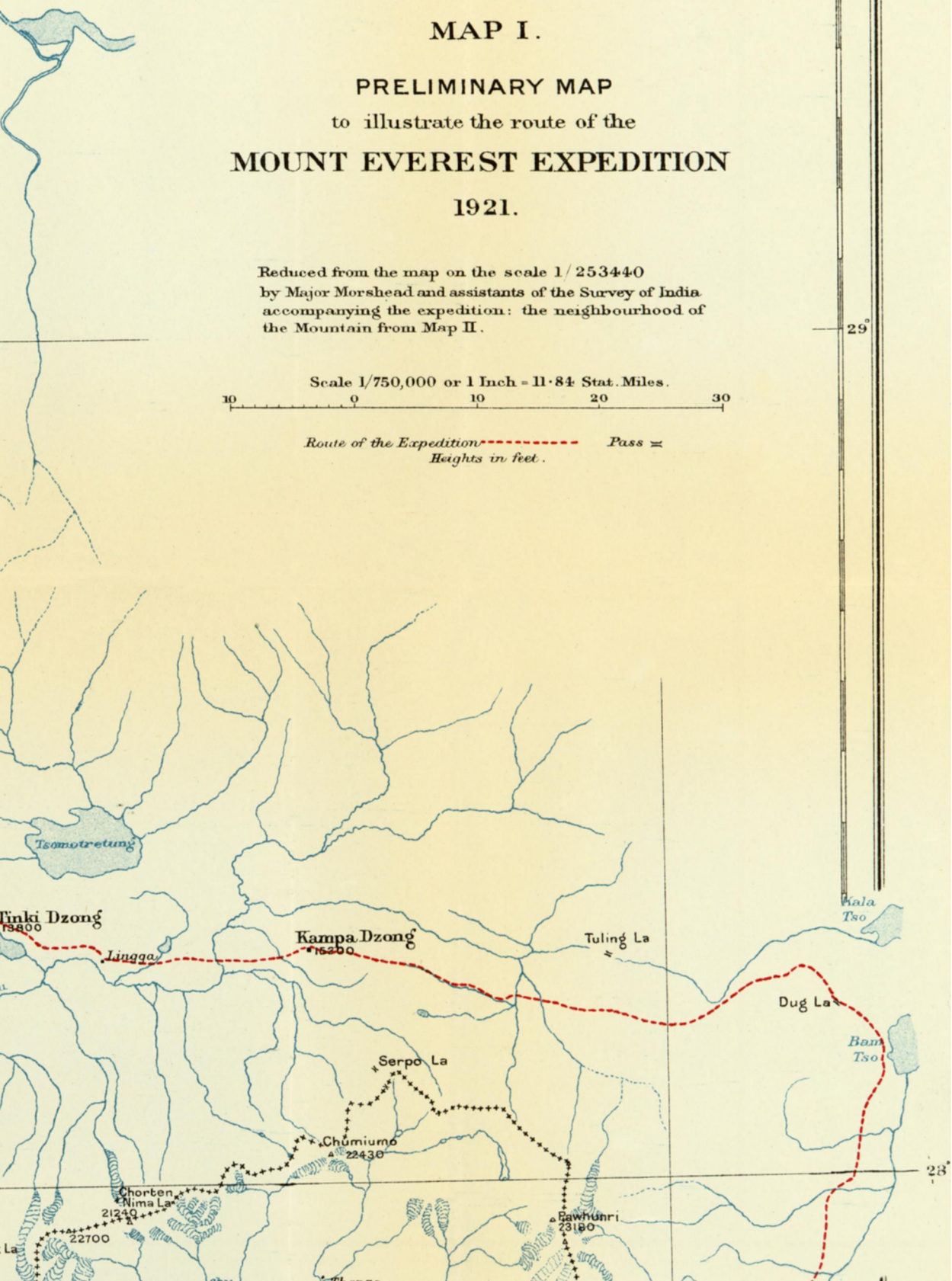
85°

MAP I.
 PRELIMINARY MAP
 to illustrate the route of the
MOUNT EVEREST EXPEDITION
 1921.

Reduced from the map on the scale 1/253440
 by Major Morshead and assistants of the Survey of India
 accompanying the expedition: the neighbourhood of
 the Mountain from Map II.

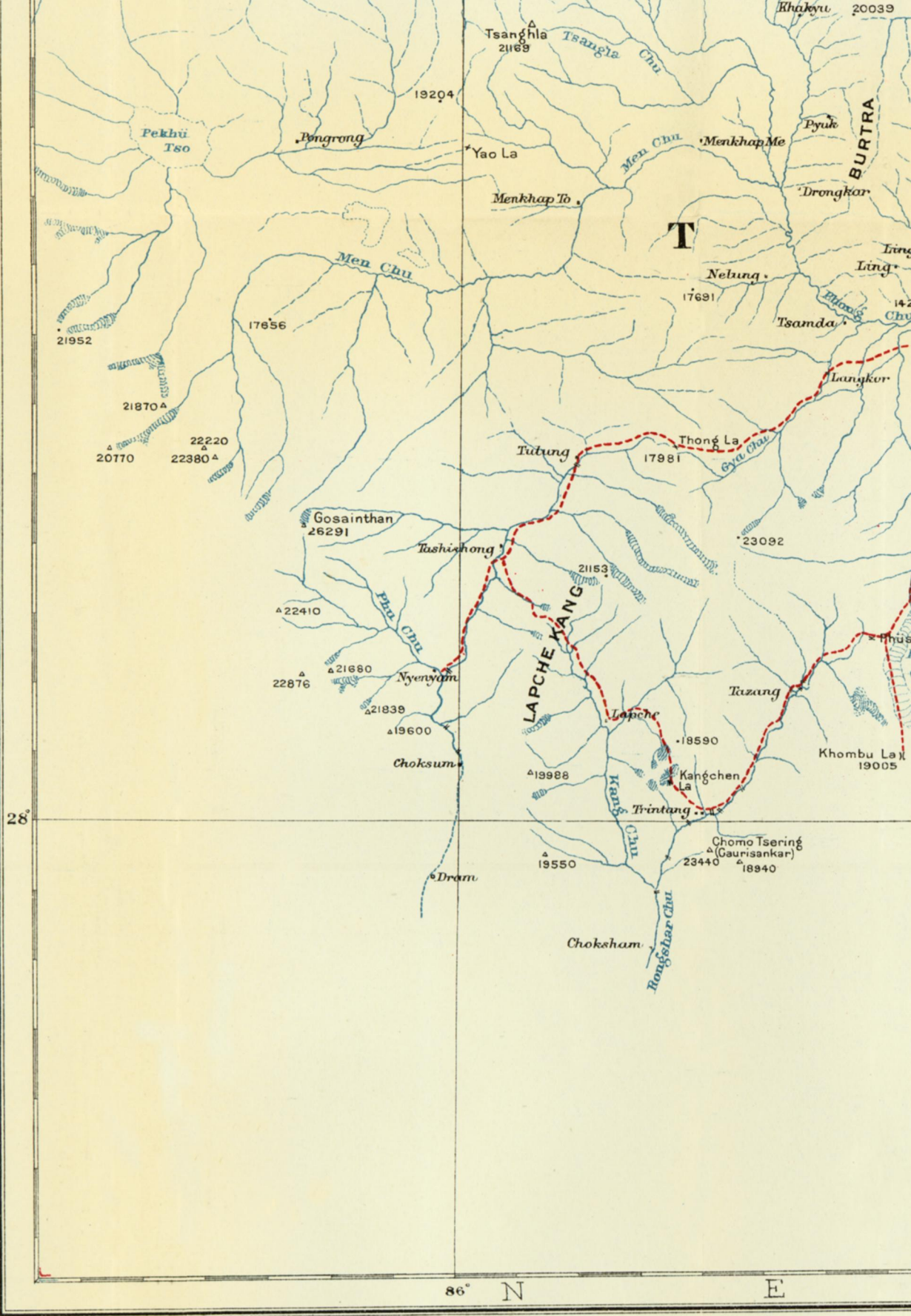
Scale 1/750,000 or 1 Inch = 11.84 Stat. Miles.

Route of the Expedition ----- Pass ≡
 Heights in feet.



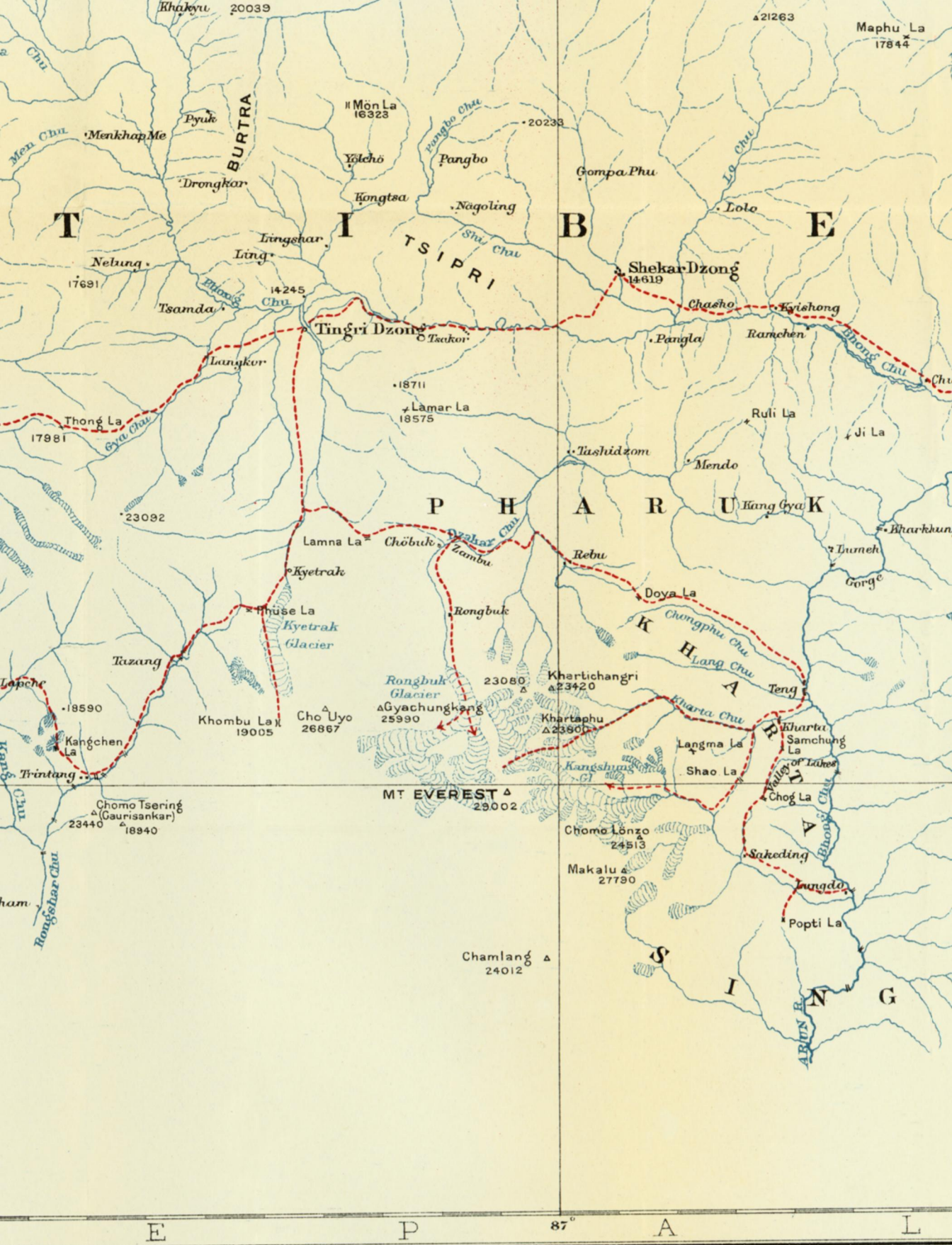
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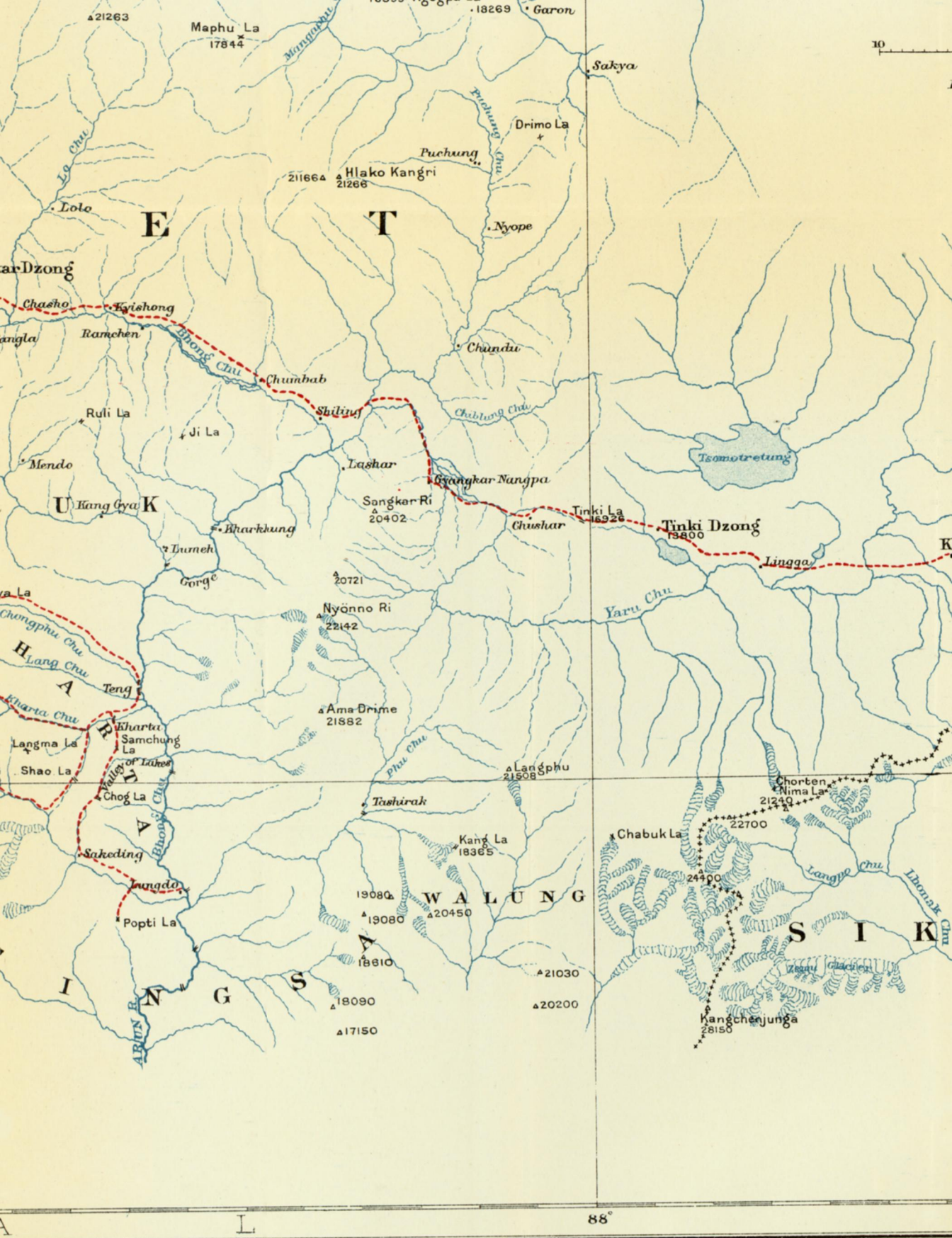
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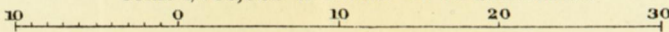
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86° N E

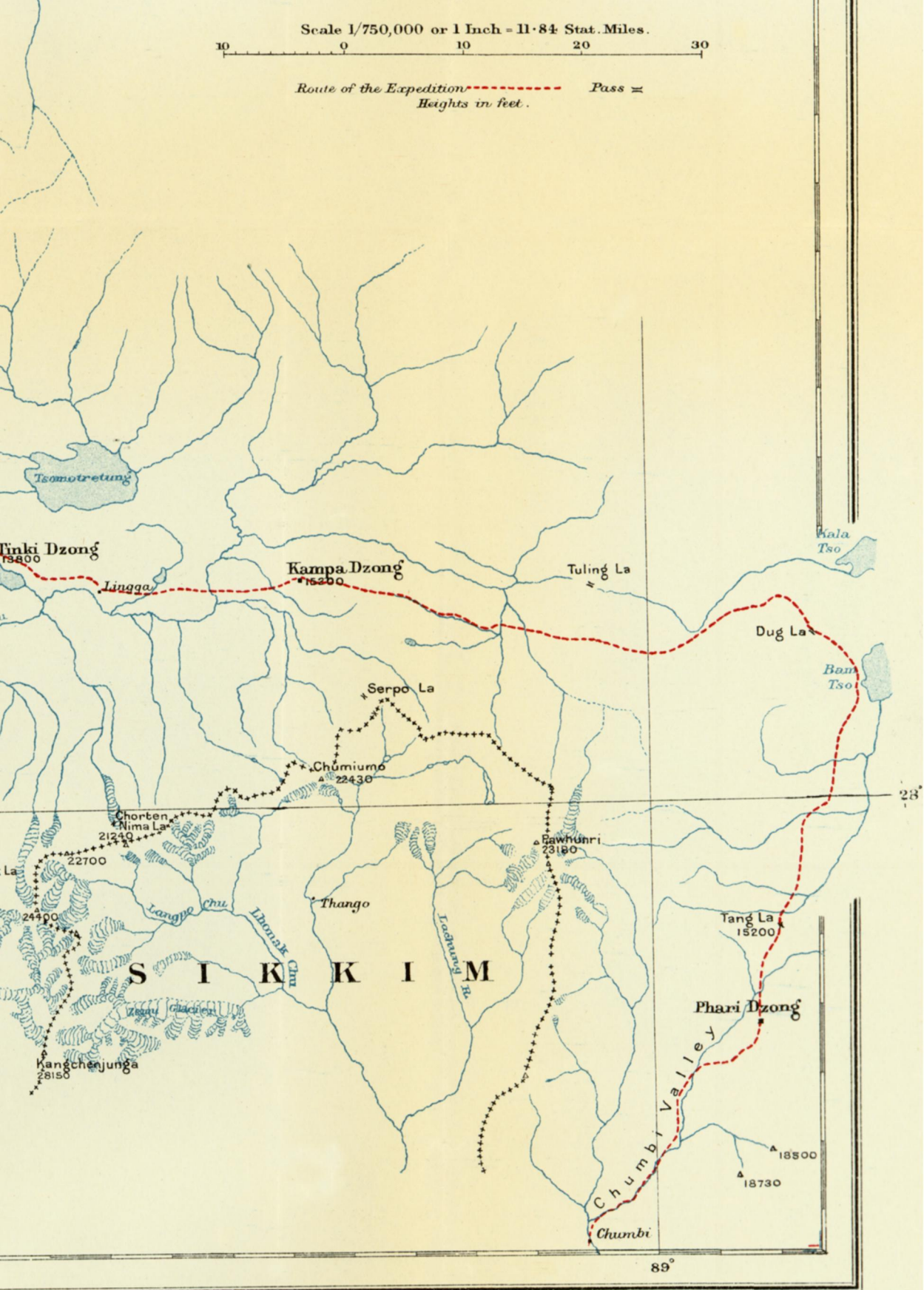




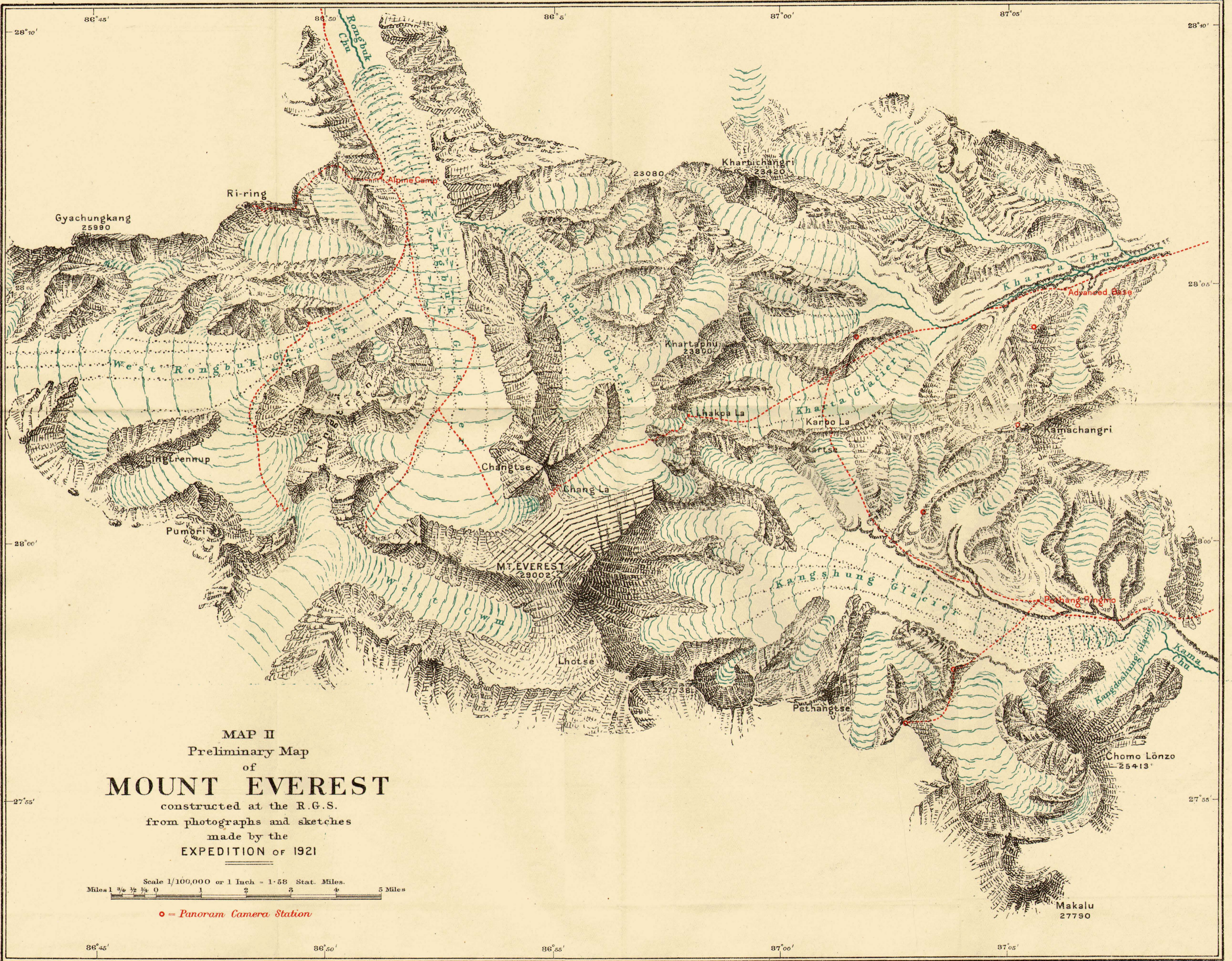
Scale 1/750,000 or 1 Inch = 11.84 Stat. Miles.



Route of the Expedition - - - - - Pass =
Heights in feet.



MT EVEREST EXPEDITION.



MAP II
 Preliminary Map
 of
MOUNT EVEREST

constructed at the R.G.S.
 from photographs and sketches
 made by the
 EXPEDITION of 1921

Scale 1/100,000 or 1 Inch = 1.58 Stat. Miles.
 Miles 1 1/4 1/2 3/4 0 1 2 3 4 5 Miles

○ = Panoramic Camera Station

86° 45'

86° 50'

28° 10'

Rongbuk
Chin

Alpine Camp

Ri-ring

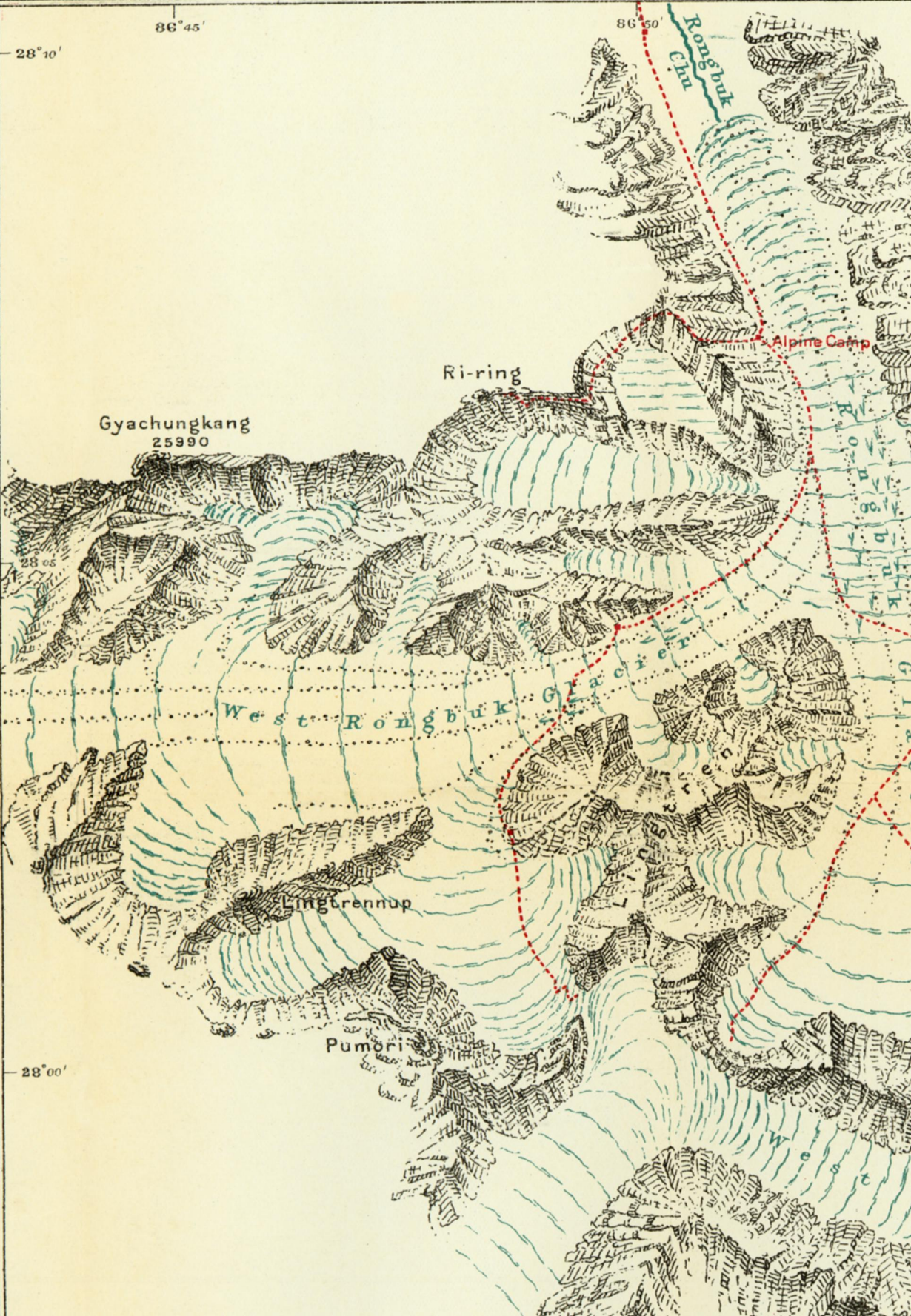
Gyachungkang
25990

West Rongbuk Glacier

Lingrennup

Pumori

28° 00'



86° 55'

87° 00'



Alpine Camp

23080

Kharbichangri
23420

East Rongbuk Glacier

Khartaphu
23800

Khakpa La

Karpo La

Kartse

Changtse

Chang La

MT. EVEREST
29002

Kangshu

Lhotse

87°00'

87°05'

28°10'



hangri
3420

Kharta Chu

Advanced Base

28°05'

Kharta Glacier

Karpo La

Kamachangri

Kartse

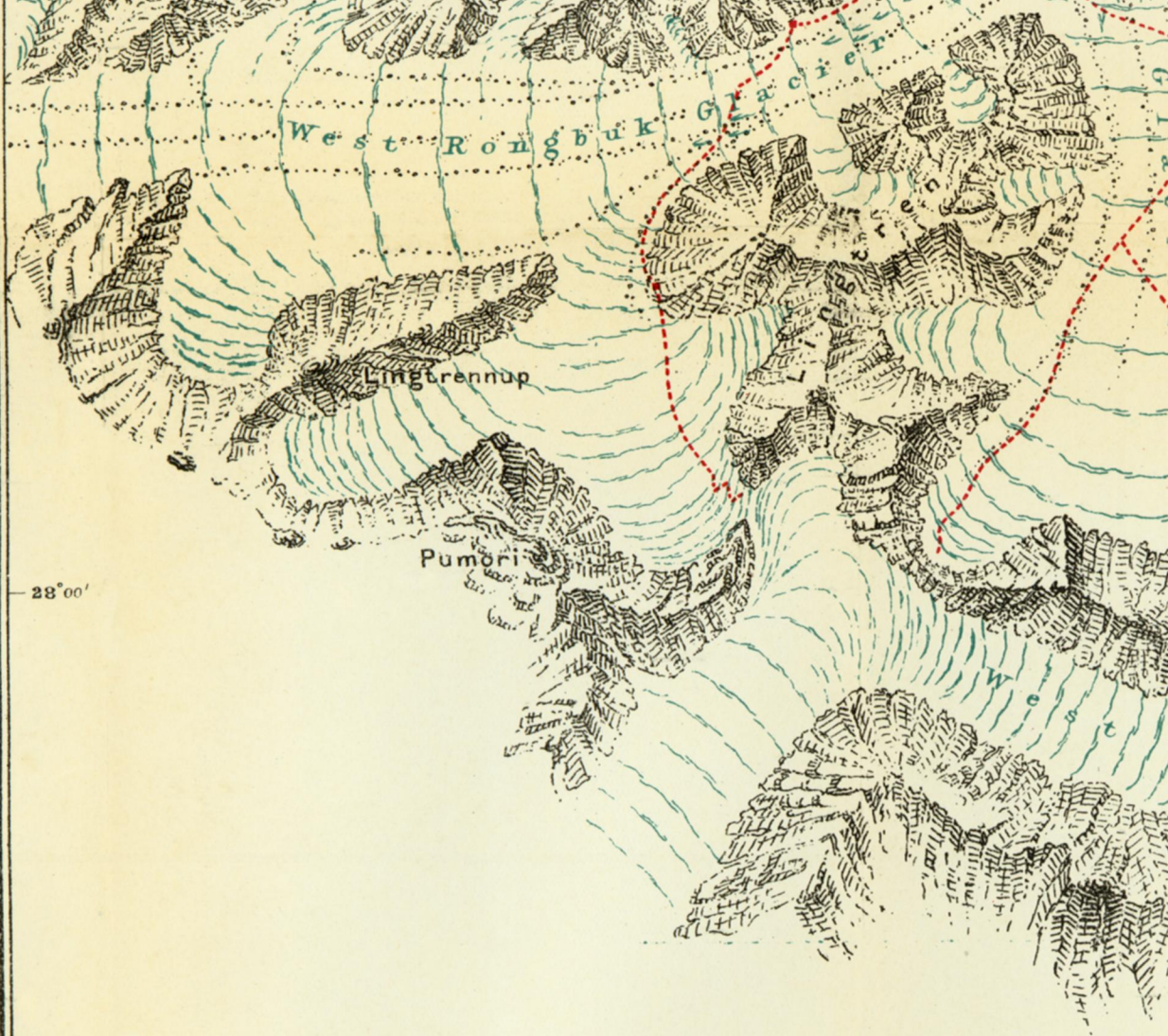
Kangshung Glacier

Parhang Pingmo

28°00'

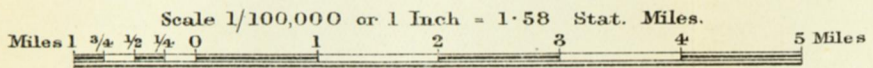
Glacier

Kama
Chu



MAP II
 Preliminary Map
 of
MOUNT EVEREST

constructed at the R.G.S.
 from photographs and sketches
 made by the
EXPEDITION OF 1921



o = Panoram Camera Station

86°45'

86°50'



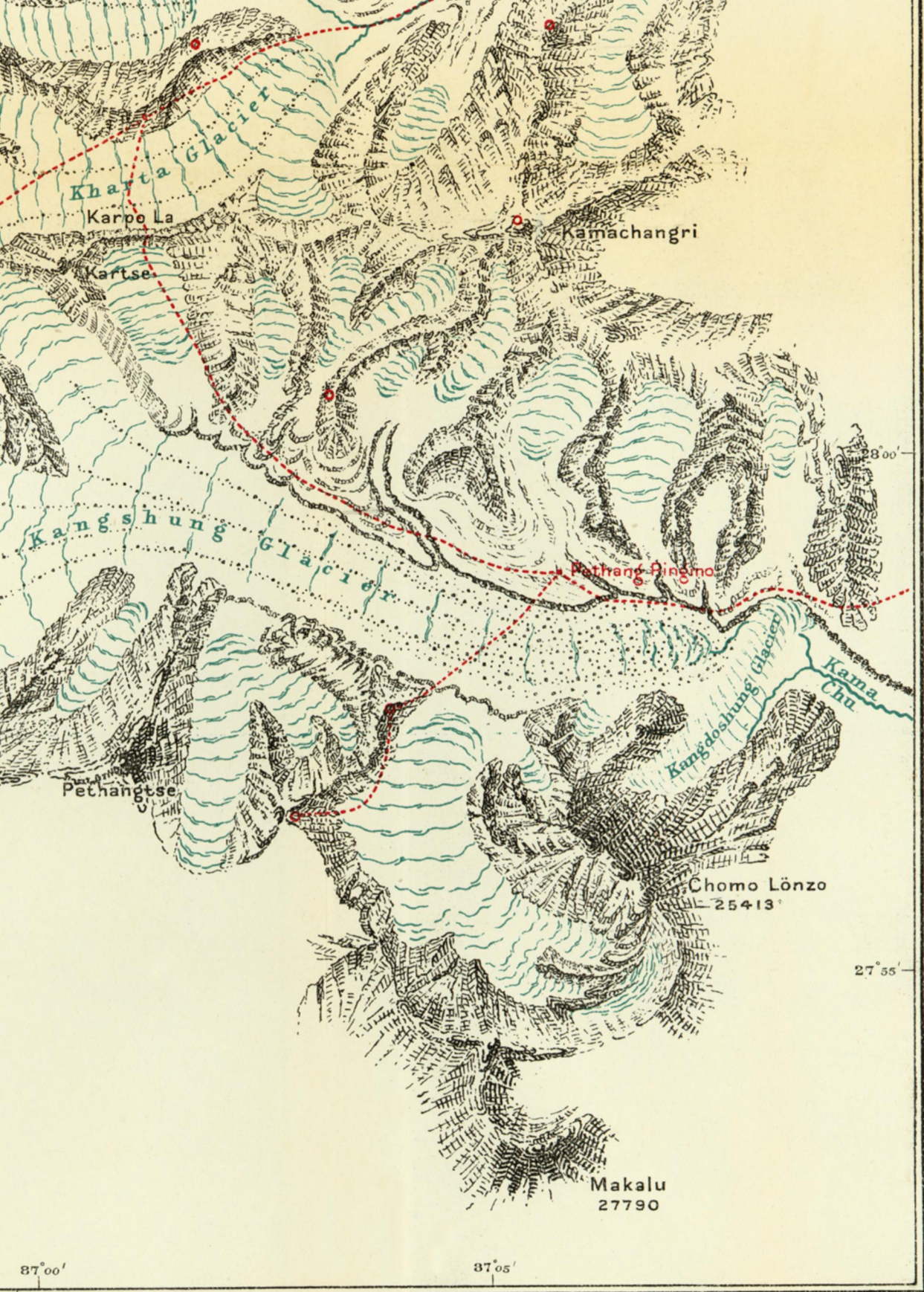
ST

5 Miles

86°55'

87°00'

Published by the Royal Geographical Society.



MOUNT EVEREST: THE RECONNAISSANCE

George Leigh Mallory

Read with the preceding paper at the Joint Meeting of the R.G.S. and A.C. on 20 December 1921.

THE reconnaissance of Mount Everest is a long story, and I do not propose to tell it now. It was necessary for our purpose, firstly, to seek in an unexplored country the most convenient approaches to various parts; secondly, by regarding the mountain from many different points of view to come to a correct understanding of its shape, and distinguish the vulnerable parts of its armour; finally, to pit our skill against the mountain wherever an opportunity of ascent presented itself. In the first two objects our task was largely accomplished between June 23, when we set out from Tingri, and August 18, when we first reached the Lhakpa La and looked over into the snow basin, which is the head of the East Rongbuk glacier. The final phase of the reconnaissance occupied the first three weeks of September, and I call it the "Assault," because we intended to climb as far up the mountain as we were able.

We had discovered before the final phase that the summit of Mount Everest was formed by the convergence of three arêtes. The faces which lay between them were clearly seen to be impracticable. The south arête is blocked by the south peak, a formidable crest about 28,000 feet high. The other two arêtes, west-north-west and north-east, are so steep in their lower parts that access is impossible. The only possible line of ascent is to reach the upper part of the north-east arête from the north. Between Everest and the north peak is a high snow col (about 23,000 feet), and it looks possible to get up from here.

The line of approach chosen to this col had been determined by a variety of circumstances, more particularly by the abundance of fuel in the Kharta Valley which had suggested an advance from the eastern side; but this approach would involve the crossing of another snow col, the Lhakpa La (22,500 feet), which we had already reached. Once the snow was firm the way there would present no difficulties.

It had become evident during our reconnaissance in July and August that any serious climbing on the great mountain itself must wait on the weather—if only for the sufficient reason that the labour of carrying loads over unmelted snow would be an unendurable strain upon our coolies. Our plans were based upon the assumption that what the wise men prophesied about the weather would come true. We were promised a fine September. Some time about the beginning of the month the monsoon would end, and then we should have clear days of glorious sunshine and warmth to melt the snow, and cold nights to freeze it; at worst the calm spell would only be broken by a short anger. And so it was arranged

in hope, if not in confidence, to move up on the first signs of improvement. Already, before we came down to Kharta, our advanced base camp had been moved up. It was now situated at about 17,300 feet on a convenient grassy plateau and only a reasonable stage below our 20,000 feet camp, where some light tents and stores had also been left. At these two camps we had, in fact, left everything which we should not absolutely require at Kharta, so that few mountaineering stores would have to be carried up from the base when we came up again. Our first task would be to supply the advanced base with food and fuel, and a start had already been made by collecting here a pile of wood, nominally thirty loads. Transport in any case was not likely to be a difficulty in the early stages. Local coolies could easily be hired, and Colonel Howard-Bury was to follow us up after a short interval with all available strength to help in every possible way.

The first object which our plans must include was, of course, to reach the north col ; by finding the way to this point we should establish a line of attack and complete a stage of our reconnaissance. Secondly, we must aim at reaching the north-east arête. In so far as it was an object of reconnaissance to determine whether it was possible to climb Mount Everest, our task could never be complete until we had actually climbed it ; but short of that it was important to have a view of the final stage, and could we reach the great shoulder of the arête we should at least be in a better position to estimate what lay between there and the summit. Finally, we saw no reason to exclude the supreme object itself. It would involve no sacrifice of meaner ends ; the best would not interfere with the good. For if it should turn out that the additional supplies required for a larger campaign were more than our coolies could carry, we could simply drop them and aim less high.

In organizing the assault we had to consider how our camp could be established firstly at Lhakpa La, or, perhaps, better beyond it at a lower elevation, secondly at the north col, and finally as high as possible, somewhere under the shoulder, one thought, at about 26,500 feet. From the camp on the north col we should have to carry up ten loads, each of 15 lbs., which would provide tents enough and sleeping-sacks and food for a maximum of four sahibs and four coolies. Sixteen coolies were allowed for this task ; twelve would, therefore, have to return on the day of their ascent and sleep at the north col ; on the assumption that they would require an escort of sahibs, who must also sleep at this camp, four small tents must remain there, making six in all to be carried up to this point.

The lower end of the ladder must be so constructed as to support the weight at the top. It was comparatively a simple matter to provide the earlier camps. The first above the advanced base could be supplied before we moved up to sleep there, the coolies returning on the same day whenever they carried up loads. And the same plan could be adopted for the second at Lhakpa La ; only one journey there, I calculated, would

be required before we started from the 20,000-foot camp, and we could then go straight ahead without delay. The crux would lie in the stage from Lhakpa La to the north col. At the most we should have twenty-three coolies, sixteen who had been all along with the climbing party, three whom Wheeler had partially trained, and four more Sherpas, the maximum number being determined by the supply of boots. But it would not be necessary to carry on all the loads from Lhakpa La; and return journeys could be made from the north col, both by those who were not to stay there and by the twelve already mentioned who might fetch supplies if necessary on the final day of the assault. This plan was never executed in its later stages, and we cannot know for certain whether it would have held good. But it may be conjectured in view of our experience that the weakest link would have broken; either an extra day would have been spent between Lhakpa La and the north col, or, if we reached the north col, according to our programme, with the minimum of supplies, the coolies would not have been brought to this point a second time, and the climbing party would have been cut off from its reserves. And, granted the most favourable conditions for the attempt, in asking the coolies to carry loads of 30 lbs. on two consecutive days at these high altitudes we were probably expecting too much of them. It must be concluded, if this opinion is correct, that we had not sufficient coolies for what we intended.

On the last day of August, Bullock and myself were established once again at our advanced base. The weather had not yet cleared, though it was showing some signs of change. But it had been necessary to move up for the coolies' sake. At Kharta they had little to amuse them, and no work to employ their time; they were badly in need of a routine, which was easily enough provided. Besides, I wanted to be ready, and it seemed not too soon to begin carrying loads up to the next camp. There was no occasion for hurry in the event. We were obliged to wait nearly three weeks, until September 19, before moving forward. The delay served no useful purpose. The work of supplying our present needs and providing for the future was sufficiently spread over the long tale of days, but interspersed with more rest and leisure than any one required. It was a blessing to be comparatively a large party. Howard-Bury and Wollaston and also Raeburn had come up on the 6th, Morshead and Wheeler on the 11th, and for two nights Heron was of our company. We kept ourselves fit. But it amused nobody to watch the procession of clouds which precipitated sleet by day and snow by night, and our appetite for adventure could not be stimulated by the days of waiting in so dreary a scene.

When at last the weather cleared, it was evident that the fate of our enterprise would be decided by the sun's power to melt the snow. Before we left the advanced base I had good reason to expect that we should meet adverse conditions, and was so resolved at the same time

that nothing was to be gained by waiting. The coolies were lightly laden up to the first advanced camp, and sufficiently unfatigued to proceed next day. On the 20th, therefore, leaving Bullock to accompany Wheeler, Morshead and I set forth to get fourteen loads up to Lhakpa La. We had one spare coolie who carried no load, and Sanglu, who was now our acting sirdar, four of us in all to break the trail for the loaded men. Snowshoes were not carried, because there were not enough to go round. Though our prospects of reaching a high point on Everest were already sufficiently dim, I intended to carry out the original plan until obliged by circumstances to modify it ; it might prove necessary to spend an extra day in reaching the north col, and in that case we could perhaps afford to stop short of Lhakpa La and establish our camp below its final slopes. But if the strain on this first day was likely to be severe, I argued that the coolies could rest to-morrow, and that the second journey in frozen tracks would be easy enough. That on the col we should pass the night a few hundred feet higher (22,500 feet) was a relatively unimportant consideration. The great matter was to put heart into the coolies ; it would be infinitely more encouraging to reach the crest with a sense of complete achievement, to see the clear prospect ahead, and to proceed downwards on the other side. Our start at an early hour on the 20th was sufficiently propitious. The night was exceedingly cold, and we walked on hard crisp snow up to the icfall. But the conditions here were no better than expected ; higher they were worse than I had imagined possible. No firm steps could be stamped by the leaders to save the coolies behind, and each in turn had to contend with the shifting substance of fine powder. Three fell out in a state of exhaustion, and made their own way down. Two of the loads were bravely carried on until they had to be abandoned about 800 feet below the pass. The party straggled badly. But time was on our side, and gradually the eleven remaining loads arrived at their destination. The coolies had behaved in the gamest fashion, and no small share in the result was contributed by Morshead, who alternately plodded in front and kept together a party behind. Whatever measure of success we afterwards attained was secured on this day.

Now that we had obtained a clearer view of the north col it was possible to make more exact calculations, and it was evident we must modify our plans. We had seen a wall of formidable dimensions, perhaps 1000 feet high ; the surface was unpleasantly broken by insuperable bergschrunds, and the general angle was undoubtedly steep. The slopes of Everest to the south were out of the question, and if it were possible to avoid a direct assault by the north side the way here would be long, difficult, and exceedingly laborious. The wall itself offered the best chance, and I was in good hopes we could get up. But it would not be work for untrained men, and to have on the rope a number of laden coolies, more or less mountain-sick, conducted by so small a nucleus as three sahibs, who would also presumably be feeling the effects of altitude,

was a proposition not to be contemplated for a moment. We must have as strong a party as possible, in the first place simply to reach the col and afterwards to bring up a camp, if we were able, as a separate operation. With this idea I selected the party. Wollaston could not be one of us as his place of duty was not with the van. Only Wheeler besides had sufficient mountaineering experience, and it was decided that he alone should accompany Bullock and myself on our first attempt to reach the col.

I had hoped we should have a full complement of coolies on the 22nd, but when morning came it was found that three, including two of the best men, were too ill to start, consequently some of the loads were rather heavier than I intended. But all arrived safely at Lakpa La before midday. Visited by malicious gusts from the north-west the pass was cheerless and chilly. However, the rim afforded us some protection, and we decided to pitch our tents there rather than descend on the other side with the whole party, a move which I felt might jeopardize the return. I was not very happy about the prospects for the morrow. For my own part I had been excessively and unaccountably tired in coming up to the col; I observed no great sparkle of energy or enthusiasm among my companions. Sanglu was practically *hors de combat*; some of the coolies had, with difficulty, been brought up to the col and were more or less exhausted, and many complaints of headache, even from the best of them, were a bad sign.

There was no question of bustling off before dawn on the 23rd, but we rose early enough, as I supposed, to push on to the north col if we were sufficiently strong. Morshead and I, in a Mummery tent, had slept well. I congratulated myself on an act of mutilation in cutting two large slits in its roof. The rest had not fared so well, but seemed fit enough, and the wonderful prospect from our camp at sunrise was a cheering sight. With the coolies, however, the case was different. Those who had been unwell overnight had not recovered, and it was evident that only a comparatively small number would be able to come on. Eventually I gathered ten—two men, who both protested they were ill, casting lots for the last place; and of these ten it was evident that none were unaffected by the height, and several were more seriously mountain-sick.* Under these circumstances it was necessary to consider which loads should be carried on. Howard-Bury, Wollaston, and Morshead suggested that they should go back at once so as not to burden the party with the extra weight of their belongings, and it seemed the wisest plan that they should return. Certain stores were left behind at Lhakpa La as reserve supplies for the climbing party. I decided at an early hour that our best chance was to take an easy day, and, after a late start and a very slow march, we pitched our tents on the open snow up towards the col.

* I use this expression to denote, not a state of intermittent vomiting, but simply one in which physical exertion exhausts the body abnormally, and causes a remarkable disinclination to further exertion.

It might have been supposed that in so deep a combe and sheltered on three sides by steep mountain slopes we should find a tranquil air and the soothing though chilly calm of undisturbed frost. Night came clearly indeed, with no gentle attentions. Fierce squalls of wind visited our tents and shook and worried them with the disagreeable threat of tearing them away from their moorings, and then scurried off, leaving us in wonder at the change and asking what next to expect. It was a cold wind at an altitude of over 22,000 feet, and however little one may have suffered the atmosphere discouraged sleep. Again, I believe I was more fortunate than my companions, but Bullock and Wheeler fared badly. Lack of sleep, since it makes one sleepy, always discourages an early start, and hot drinks take time to brew. In any case, it was wise not to start too soon so as to have the benefit of warm sun whenever our feet should be obliged to linger in cold snow or ice steps. It was an hour or so after sunrise when we started, and half an hour later we were breaking the crust on the first slopes under the wall. We had taken three coolies who were sufficiently fit and competent, and now proceeded to use them for the hardest work. Apart from one brief spell of cutting, when we passed the corner of a bergschrund, it was a matter of straightforward plugging, firstly slanting up to the right on partially frozen avalanche snow, and then left in one long upward traverse to the summit. Only one passage, shortly below the col, caused either anxiety or trouble. Here the snow was lying at a very steep angle and was deep enough to be disagreeable. About 500 steps of very hard work covered all the worst of the traverse, and we were on the col shortly before 11.30 a.m. By this time two coolies were distinctly tired, though by no means incapable of coming on; the third was comparatively fresh. Wheeler thought he might be good for another 500 feet, but had lost all feeling in his feet. Bullock was obviously tired, but by sheer will power would evidently come on—how far one could not say. For my part, I had had the wonderful good fortune of sleeping tolerably well at both high camps, and now finding my best form; I supposed I might be capable of another 2000 feet, and there would be no time for more. But what lay ahead of us? My eyes had often strayed as we came up to the rounded edge above the col and the final rocks below the north-east arête. If ever one had doubted whether the arête were accessible, it was impossible to doubt any longer. On those easy rock and snow slopes was neither danger nor difficulty. But at the present time there was wind. Even where we stood under the lee of a little ice cliff, it came in fierce gusts at frequent intervals, blowing up the powdery snow in an evil manner sufficient to take one's breath away. On the col beyond it was blowing a gale. And higher was a more fearful sight. The powdery fresh snow on the great face of Everest was being swept along in unbroken spindrift, and the very ridge where our route lay was marked out to receive the full fury of this onslaught. We could see the blown snow deflected upwards for a moment where the wind met the

ridge only to rush violently down in a veritable blizzard on the leeward side. To see, in fact, was enough; the wind had settled the question; it would have been folly to go on. Nevertheless, we struggled a few steps further to put the matter to the test. For a few moments we exposed ourselves on the col to feel the full blast, and then struggled back to shelter.

It remained to take the final decision on the morning of the 25th. We were evidently too weak a party to play a waiting game at this altitude. We must either take our camp to the col or go back. A serious objection to going forward lay in the shortage of coolies' rations. Had the men been fit, it would not have been too much for them to go back to Lhakpa La unladen and reach the north col the same day. I doubted whether any two could be found to do that now; and to subtract two was to leave only eight, of whom two were unfit to go on, so that six would remain to carry seven loads. However, the distance to the col was so short that I was confident such difficulties could be overcome one way or another. A more unpleasant consideration was the thought of requiring a party which already felt the height too much to sleep at least 1000 feet higher. We might well find it more than we could do to get back over Lhakpa La and be forced to make a hungry descent down the Rongbuk Valley. But there would be no disaster in that event. The crucial matter was the condition of the climbers. It seemed we had not sufficient strength to allow a margin for the unforeseen. And what more were we likely to accomplish from a camp on the north col? The second night had been no less windy than the first. Ever since the weather had cleared the wind had been strong from north-west, and every day we had seen the powdery cloud blown from the mountain crests. The only signs of a change now pointed to no improvement, but rather a fall of snow, by no means an improbable event according to local lore. The arguments, in fact, were all on one side; it would be bad heroics to take wrong risks; and fairly facing the situation one could only admit the necessity of retreat.

It may be added that the real weakness of the party became only too apparent in the course of our return journey over Lhakpa La on this final day; and it must be safe to say that none of the three climbers has ever felt a spasm of regret about the decision to go back or a moment's doubt as to its rightness. It was imposed upon us by circumstances without a reasonable alternative.

No considerations can be more important for future guidance than those affecting the health of the party. But here knowledge will not best be sought from one man's report, even the doctor's. If every member of the expedition were to write a full and frank report of his own health from first to last, with particular reference to the effects of elevation, we might begin to know something about it. I know chiefly in a negative way, and in any case not minutely, how I felt in differing circumstances at various

elevations; I know just a little how Bullock was affected, and still less about the coolies. It may possibly be worth adding a few inferences to what has previously been recorded by other parties in the Himalayas.

It is unfortunate for the present purpose that I enjoyed an almost uniform good health at all elevations from first to last. So far as mere living at high altitudes is concerned I observed almost no effects in my own case. My appetite was never-failing. I ate large quantities of solid food, mutton, potatoes, quaker oats, bread, and biscuits—whatever presented itself—and it was often decidedly unattractive; and after a day's climbing I had the same craving for sweet things which I have often noticed in the Alps, where, at a place like Zermatt, the consumption of a great number of sweet cakes seems only to stimulate my energy. And I almost invariably slept well at almost all our camps, more lightly perhaps at the higher ones, but with sufficiently refreshing unconsciousness. Comfortable ground, sufficient warmth, a pillow rightly adjusted, all the conditions of a contented body, mattered far more to me than the quality of the air I breathed. On one occasion, after sleeping less well than usual at 17,000 feet, I went up to 20,000 feet and slept in divine oblivion, waking only to see the dawn with fresh delight. Not every one was quite so fortunate as myself. Bullock's appetite, though it improved later to admiration, was notably deficient during the first three weeks for one who was working his body so hard; and he was short of sleep at our highest camps. But in general he seemed hardly to suffer from the fact of living for a few days together at elevations above 17,000 and 18,000 feet. Some other members of the expedition seemed not to be quite at their best at 20,000 feet, and at Lhakpa La were imperfectly refreshed by the night's rest. As to the coolies, I fear their discomforts were apt to increase at the higher camps more than ours, and consequently they may have suffered some loss of sleep, but I have not the slightest evidence to show that after spending a night or several nights at a high camp, except at the last two, they were in any way less fit to go on next day as a consequence of the altitude.* It should, perhaps, be added that it seemed in some physical way a relief to come down after staying a long time about 17,000 feet or higher; but on the two occasions when we rested for some days at about 12,000 feet (Kharta), it seemed to me that we were less rather than more fit when we went up again.

Another aspect of this inquiry is the effects of altitude over a longer period. What were the general effects upon health after two or three months? When the party gathered at Kharta, towards the end of August, I observed that most of us seemed remarkably fit; but not so Bullock; he was too thin and appeared to require rest. I dare say he took it with advantage. About myself it is worth remarking that I had completely recovered, with the aid of a tonic, from a nasty visitation of fever and

* Nevertheless, I think it a wise precaution to avoid much sleeping at camps as high as 20,000 feet.

sore throat *without coming down to lower altitudes*. The last few days of our reconnaissance were a strenuous time, but for the expedition, which, far more than any other, demanded endurance, when we first reached Lhakpa La, I was perfectly fit. Nevertheless, when we went up again on August 30 I was mountain-sick, and never afterwards in September regained my earlier strength. Nor I think did Bullock. It is difficult to account for this deterioration, unless we suppose that altitude, though it may have no immediate effect, takes its toll at length. Wheeler, whose experiences of high camps may be compared with ours, may not agree with this conclusion as fitting his own case; but then his case was different.

Exertion at great heights is another matter, and less dubious in its results. I suppose them to be sufficiently well known. I observed especially: (1) Rapid acclimatization much as in the Alps, but even more remarkable. (2) Very little relief in coming down; descent was very definitely an exertion, and fatigue continued to increase, especially on gentle slopes; it was necessary to breathe with conscious effort even when descending. (3) The difference between what we could do, say, at 18,000 feet and 20,000 feet was greater in the case of the coolies, whenever they carried loads, than in others. The coolies always appeared to feel the height more quickly. I put this down partly to the fact that few of them really learned either how to breathe or how to husband their strength. Certainly they were much better towards the end, walking rhythmically, but to the last the majority were inclined to hurry. In any case, a small load makes a big difference, but can be compensated largely by reducing pace. (4) Headache was at least as common after descent as before; but personally, so long as I was perfectly fit, and remembered to breathe properly, I did not suffer from headache. (5) A stomach disordered, even in the smallest degree, enormously decreased one's power of endurance. (6) In the last stages, whether as a result of higher altitudes or unfitness I cannot say, a prolonged exertion required more rest—two whole days. This applies to the coolies as well as to myself and others, too, I believe. (7) I was much surprised to find how easily steps might be cut at 21,000 feet. I found myself quite untired after an hour's work in hard ice. (8) We had little experience of rock climbing; but from such as we had (*e.g.* some steep pitches on one of the peaks which we climbed west of the Rongbuk), I am inclined to think that easy rocks, where one is constantly helping oneself up with arms as well as legs, offer the least tiring way of ascent; and that even comparatively difficult rocks might very well be climbed by fit men up to 23,000 feet.

Finally, it may perhaps be worthy of remark that on the very few occasions when my mind was exerted, I found mental exertion to be tiring at high altitudes and tending to sleeplessness. The life of the lotus-eater was best between expeditions—with perhaps a little piquet.

Is it humanly possible to reach the summit of Everest? We have not a single convincing argument to solve that problem. I felt somehow, when we reached the north col, that the task was not impossible; but that may only have been a delusion based on the appearance of the mountain from that point; it looks much smaller than it is. However, one factor, easily forgotten, is in favour of the assault. The higher one goes the less will be the effect of any given rise. To ascend the 3000 feet above 17,000 is notably less laborious than to ascend the next 3000 up to 23,000 feet; but the atmospheric pressure diminishes less rapidly as one goes up; consequently the difference in effort required between one stage and another should be less at each succeeding stage, and least of all between the last stage and the last but one. I believe it to be possible, at all events, for unladen mountaineers to reach 26,000 feet, and if they can go up so far without exhaustion, I fancy the last 3000 feet will not prove so very much more tiring as to exclude the possibility of their reaching the summit.

But in asserting this bare possibility, which, besides, leaves the coolies out of account, I am very far from a sanguine estimate as to the prospects of success. Before we parted, I put this question to Bullock: "What are the chances that a given party will get up in a given year?" After considered reflection, he replied: "Fifty to one against." That answer also expressed my own feelings. Perhaps at a greater distance from the mountain I am now more sanguine. If men could be found to besiege Everest year after year, I believe it would surrender at last. But the chances against any particular expedition are indeed very large. I assume that principles time-honoured in the Alpine Club will be honoured no less on Mount Everest than on other mountains. Climbers, of course, are always taking risks; but there are some which experience and *à priori* reason alike reject. A party of two arriving at the top, each so tired that he is beyond helping the other, might provide good copy for the press, but the performance would provoke the censure of reasonable opinion. If any one falls sick at the last camp, he must be taken down with an adequate escort and as soon as possible; and similarly on the final day. And coolies who become exhausted in carrying up their loads cannot be allowed to make their own way down; exhausted they are incompetent, and must be properly looked after. It is with such difficulties and such necessities that we have to reckon; and any reckoning, I believe, which fairly weighs the conditions and circumstances governing such an enterprise can only come to the conclusion that the chances in favour of success for any particular party are small indeed.

Before Colonel Howard-Bury's paper, Colonel Sir FRANCIS YOUNGHUSBAND, President R.G.S., after thanking His Royal Highness the Duke of York for honouring the Meeting with his presence, and reading telegrams of congratulation from the Alpine Club of Canada and the Société de Géographie of Paris, said: We are here to welcome back Colonel Howard-Bury and the members

of the Mount Everest Expedition, and to congratulate them upon having exactly achieved the object with which they were dispatched, namely, to discover the most practicable way to the summit of the mountain. They were not instructed to attempt to reach the summit, or to break any record. That task was to be reserved for next year's expedition. But they were expected to find out what was without any shadow of doubt the most feasible way to the top, so that next year's expedition might, without any hesitation, go full speed ahead along that route, and that object they have most definitely and unquestionably accomplished. So now we can set about our main effort on the sure foundations which Colonel Howard-Bury and Mr. Mallory have laid, in perfect confidence that we are on the right track.

"Seek ye first the very highest, and all these things shall be added unto you." We sought first the highest mountain in the world, and now we are seeking the very top of that highest mountain. And already a number of most delightful things have been added unto us. First, we have Colonel Howard-Bury's graphic telegrams and the magnificent photographs which he and Mr. Wollaston sent back, revealing to us mountain scenery of a grandeur not to be surpassed, and the enjoyment of which can now be shared by men in every country and for all time—enjoyment which will be greatly increased when we have the paintings of the artist whom we shall be sending with the expedition next year. Then came Mr. Wollaston's natural history collections, telling us of the height to which life ascends on these highest mountains, and including seeds—already planted at Kew and Edinburgh, and in the Royal Horticultural Society Gardens—of new or rare primulas, gentians, and rhododendrons and other plants which will add to the beauty of our gardens. After this came a map by Major Morshead, of the whole region ; and another by Major Wheeler, of the mountain itself and its immediate neighbourhood, is expected daily. An account of the geology of the region by Dr. Heron is on its way. Lastly has come the bill. We had expected it to be £5000. Actually it is only £4000—that is, excluding the expenses incurred by the Government of India on the survey.

These results were rendered possible in the first instance by the generosity of our Patron, His Majesty the King, and our Vice-Patron, H.R.H. the Prince of Wales, and other liberal donors to the funds of the expedition, especially the members of the Alpine Club, who, urged on by the persuasiveness of their President and the coerciveness of Captain Farrar, contributed more than £3000. But the chief credit for the satisfactory result is, of course, due to those who worked so arduously on the spot—to Colonel Howard-Bury, who with such skill and address conducted the expedition as a whole, overcame all initial difficulties, and brought the climbers up to the mountain ; to Messrs. Mallory and Bullock for their resolute persistence in ferreting out a way, when they were deprived of the guidance of that experienced Himalaya climber, Dr. Kellas, whose death we so deeply deplore, and of their mountain leader Mr. Raeburn ; to Mr. Wollaston for the thoroughness with which he carried out his scientific duties and looked after the health of the party ; to Major Morshead and Major Wheeler for their untiring energy in mapping so lofty a mountain region, and for the rapidity with which they have furnished us with maps ; and lastly to Dr. Heron, whose energy seems to have been remarkable even among such energetic men.

With this necessarily brief but most sincere acknowledgment of their services, I now invite the chief of the expedition to give us an account of his charge.

Colonel Howard-Bury then read the paper printed above.

Before Mr. Mallory's paper, Prof. J. NORMAN COLLIE, President of the Alpine Club, said : From a mountaineering point of view the Expedition to Mount Everest has been most successful ; an easy route has been discovered, free from any prolonged difficult climbing, by which it is hoped that next year the ascent of Mount Everest may be made. The ascent, however, could only be attempted in the very finest weather, and we are yet ignorant whether much climbing can be done as high as 28,000 to 29,000 feet. The Expedition was sent out this year primarily to make a complete reconnaissance of Mount Everest. This has been done thoroughly. On every side, except on the south, which is in Nepal, all the valleys leading to the great peak have been explored. The climbers, Messrs. Mallory and Bullock, with untiring energy, have been more than once to over 23,000 feet, visited many passes, and explored a large number of glaciers. A magnificent series of mountain photographs have been secured. Taking into consideration the difficulties of climbing at such altitudes, the mountaineers are to be congratulated warmly on their success.

Mr. Mallory then read the paper printed above.

The President expressed his great regret that the lateness of the hour made it impossible to call on Mr. A. F. R. Wollaston, the Surgeon and Naturalist of the expedition, for his account of the very interesting work on the flora and fauna of the region. All present would be anxious to hear him on another occasion.

Monsieur A. GATINE (Vice-Président du C.A.F.) : Mes premières paroles seront pour vous dire avec quelle gratitude le Comité de Direction du Club Alpin Français a reçu la cordiale invitation qui lui a été adressée pour cette réception magnifique des courageux explorateurs de l'Himalaya. Nous vous prions d'agréer les excuses et les regrets de notre Président, M. le Baron Gabet, que des nécessités impérieuses ont empêché d'être ici ce soir, comme c'était sa formelle intention. Nous sommes heureux, M. Henry Bregault, Secrétaire-Général, M. Richard-Berenger, Membre du Comité de Direction, et moi, d'avoir en cette mémorable circonstance la bonne fortune d'être les porte-paroles du Club Alpin Français auprès des Membres de l'Alpine Club et de la Royal Geographical Society. Nous saluons dans ces deux Sociétés deux des Associations les plus anciennes et les plus actives du Monde, justement renommées pour leurs travaux et leurs publications. Elles ont su ne pas se reposer sur leurs lauriers, comme nous disons en France, et voici que, une fois de plus, nous les trouvons à la tête du mouvement et du progrès, à l'occasion de l'étude et de l'exploration du massif montagneux le plus haut du Globe. Nous ne saurions oublier que les Membres de l'Alpine Club ont toujours été parmi les plus actifs et les plus hardis des Alpinistes qui se sont attaqués aux cimes vierges de la Savoie et du Dauphiné. Les noms de beaucoup d'entre eux brillent au premier rang dans ce qu'on a appelé "la période héroïque de l'Alpinisme."

Cette période sera-t-elle couronnée, en quelque sorte, dès l'année prochaine par la conquête de la plus haute cime du Monde ? Nous le souhaitons de tout cœur. Nous désirons en tout cas apporter dès à présent les félicitations du Club Alpin Français aux organisateurs que la confiance des deux puissantes associations a chargés de la préparation méthodique d'une expédition aussi hardie que l'assaut du Mont-Everest, et nous exprimons notre admiration aux Savants, aux Alpinistes, aux Topographes dont les travaux et l'endurance ont déjà obtenu ce superbe résultat de découvrir, dès cette première campagne,

au cours d'une ascension bravement poussée jusqu'à plus de 2000 mètres au-dessus de l'altitude du Mont-Blanc, une voie d'accès, qui paraît praticable, vers le sommet du Géant des Montagnes. Nous déplorons que de pareilles expéditions ne puissent se faire sans de très grandes risques, et nous souhaitons aux explorateurs de 1922 de revenir tous en parfaite santé, après que les Alpinistes de l'expédition auront eu l'honneur d'atteindre le plus haut sommet qui dans le Monde reçoive le baiser du soleil.

Mes collègues et moi, nous vous félicitons infiniment de la fraternité cordiale des Alpinistes Britanniques et Français, semblable à celle des combattants de nos deux Nations, qui ont souffert et lutté côte à côte pendant la Grande Guerre, et dans un sentiment de gratitude pour l'amiable accueil fait aux représentants du Club Alpin Français, nous souhaitons tous les bonheurs, tous les succès à votre Altesse Royale, à Monsieur le Président de l'Alpine Club, à Monsieur le Président de la Royal Geographical Society.

The President, in conclusion, offered the congratulations and thanks of the Meeting to the speakers, Colonel Howard-Bury and Mr. Mallory, and to all the members of the expedition; and in the name of the R.G.S. and the Alpine Club thanked the French Alpine Club for their signal proof of friendship in sending a distinguished delegation from France to attend the Meeting.

A CHINESE EXPEDITION ACROSS THE PAMIRS AND HINDUKUSH, A.D. 747

Sir Aurel Stein, K.C.I.E.

AT the beginning of my second Central Asian journey (1906-08), and again at that of the third (1913-16), I had the good fortune to visit ground in the high snowy range of the Hindukush which, however inaccessible and remote it may seem from the scenes of the great historical dramas of Asia, was yet in the eighth century A.D. destined to witness events closely bound up with a struggle of momentous bearing for vast areas of the continent. I mean the glacier pass of the Darkot (15,400 feet above sea-level) and the high valleys to the north and south of it through which leads an ancient route connecting the Pamirs and the uppermost headwaters of the Oxus with the Dard territories on the Indus, and thus with the north-west marches of India.*

The events referred to arose from the prolonged conflict with the Arabs in the west and the rising power of the Tibetans in the south

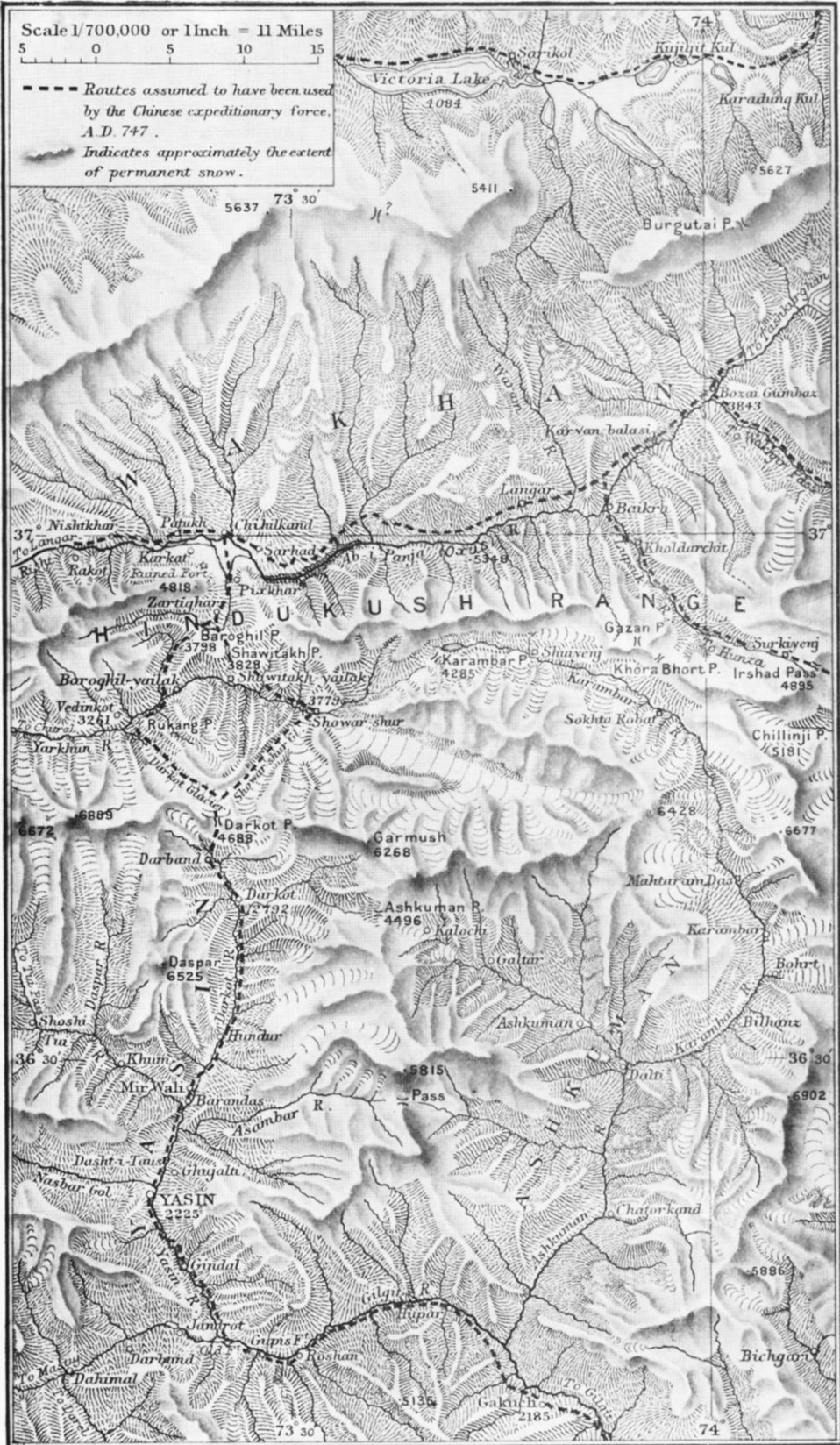
* The accompanying sketch-map 1 is intended to illustrate the general features of the mountain territories between the western T'ien-shan and the Indus which were affected by the political developments and military operations discussed in this paper.

Sketch-map 2 reproduces essential topographical details of that portion of the ground between the uppermost Oxus and Gilgit river valleys which witnessed the chief exploits of the Chinese expedition of A.D. 747 into the Hindukush region. It has been prepared from Northern Transfrontier Sheet No. 2 S.W. of the Survey of India, scale 4 miles to 1 inch.

For convenient reference regarding the general topography of this mountain region may be recommended also sheet No. 42 of the 1 : 1,000,000 map of Asia published by the Survey of India (Calcutta, 1919).



1. SKETCH-MAP OF MOUNTAIN COUNTRY BETWEEN THE WESTERN T'IENTHAN AND THE INDUS



2. SKETCH-MAP OF THE COUNTRY BETWEEN THE HEAD OF THE OXUS AND THE GILGIT RIVER. Heights in metres

into which the Chinese empire under the T'ang dynasty was brought by its policy of Central Asian expansion. Our knowledge of the memorable expedition of which I propose to treat here, and of the historical developments leading up to it, is derived wholly from the official Chinese records contained in the Annals of the T'ang dynasty. They were first rendered generally accessible by the extracts which M. Chavannes, the lamented great Sinologue, published in his invaluable 'Documents sur les Turcs occidentaux.' *

In order to understand fully the details of the remarkable exploit which brought a Chinese army right across the high inhospitable plateaus of the Pamirs to the uppermost Oxus valley, and thence across the ice-covered Darkot down to the valleys of Yasin and Gilgit draining into the Indus, it is necessary to pay the closest regard to the topography of that difficult ground. Modern developments arising from the Central Asian interests of two great Asiatic powers, the British and Russian empires, have since the eighties of the last century helped greatly to add to our knowledge of the regions comprised in, or adjacent to, the great mountain massif in the centre of Asia which classical geography designated by the vague but convenient name of *Imaos*. But much of the detailed topographical information is not as yet generally accessible to students. Even more than elsewhere personal familiarity with the ground in its topographical and antiquarian aspects seems here needed for a full comprehension of historical details.

This local knowledge I was privileged to acquire in the course of the two Central Asian expeditions already referred to, and accordingly I have taken occasion to elucidate the facts connected with that memorable Chinese exploit in *Serindia*, the detailed report on my second journey, soon to be issued from the Oxford University Press.† The bulk and largely archæological contents of this work may prevent that account from attracting the attention of the geographical student. Hence, with the kind permission of the Delegates of the Oxford University Press, I avail myself of the opportunity to present here the main results of my researches.

Some preliminary remarks seem needed to make clear the political and military situation which prevailed in Central Asia during the first half of the eighth century A.D., and which accounted for the enterprise to be discussed here.‡ After a long and difficult struggle the Chinese under the great T'ang emperors T'ai-tsung (A.D. 627-650) and Kao-tsung (A.D. 650-684) succeeded in vanquishing, first the Northern Turks (A.D. 630), and after a short interval also the Western Turks. They were the

* 'Documents sur les Tou-kiue (Turcs) occidentaux recueillis et commentés par Édouard Chavannes, Membre de l'Institut,' etc., published by the Imperial Academy of Sciences of St. Petersburg, 1903; see in particular pp. 149-154.

† The work has appeared since the above was written [ED. G. J.]

‡ For a masterly exposition from Chinese and Western sources of all historical facts here briefly summed up, see M. Chavannes' 'Essai sur l'histoire des Tou-kiue occidentaux,' forming the concluding portion of his 'Documents sur les Turcs occidentaux,' pp. 217-303.

principal branches of that great Turkish nation which since its victory over the Juan-juan (Avars) and the Hoa, or Hephthalites, about the middle of the seventh century, had made itself master of inner Asia. By A.D. 659 the Chinese had regained political predominance, and for the most part also military control, over the great Central Asian territories roughly corresponding to what is now known as Chinese Turkestan, after having lost them for about four centuries.*

This renewed effort at Central Asian expansion, like that first made by the great Han emperor Wu-ti (140-86 B.C.), had for its object partly the protection of north-western China from nomadic inroads and partly the control of the great Central Asian trade route passing through the Tarim basin. Stretching from east to west between the great mountain ranges of the T'ien-shan in the north and the K'un-lun in the south, the Tarim basin is filled for the most part by huge drift-sand deserts. Yet it was destined by nature to serve as the main overland line for the trade intercourse between the Far East and Western Asia, and recent archaeological explorations have abundantly proved its great importance generally for the interchange of civilizations between China, India, Iran, and the classical West.

During Han times, when China's great export trade of silk had first begun about 110 B.C. to find its way westwards through the strings of oases scattered along the foot of the T'ien-shan and K'un-lun, the Chinese hold upon the "Western Kingdoms" with their settled and highly civilized populations had been threatened mainly by inroads of the Huns and other nomadic tribes from the north. After the reconquest under the Emperor Kao-tung the situation was essentially different. The danger from the nomadic north had lessened. Troubles with the medley of Turkish tribes left in possession of the wide grazing areas beyond the T'ien-shan never ceased. Yet the Chinese administration by a well-organized system of garrisons, and still more by diplomatic skill, was well able to hold them in check. But additional and greater dangers had soon to be faced from other sides. The claim to the succession of the whole vast dominion of the Western Turks was drawing the administration of the Chinese protectorate, established in the Tarim basin and known as the "Four Garrisons," into constant attempts to assert effective authority also to the west of the great meridional range, the ancient *Imaos*, in the regions comprising what is now Russian and Afghan Turkestan.†

Considering the vast distances separating these regions from China proper and the formidable difficulties offered by the intervening great deserts and mountain ranges, Chinese control over them was from the outset bound to be far more precarious than that over the Tarim basin.

* Cf. Chavannes, 'Turcs occidentaux,' pp. 266 *sqq.*

† For very interesting notices of the administrative organization which the Chinese attempted soon after A.D. 659 to impose upon the territories from the Yaxartes to the Oxus and even south of the Hindukush, see Chavannes, 'Turcs occidentaux,' pp. 268 *sqq.*

But the dangers besetting Chinese dominion in Central Asia increased greatly with the appearance of two new forces upon the scene. Already in the last quarter of the seventh century the newly rising power of the Tibetans seriously threatened and for a time effaced the Chinese hold upon the Tarim basin.* Even after its recovery by the Chinese in A.D. 692 the struggle never quite ceased.

Another and almost equally great threat to China's Central Asian dominion arose in the west through the advance of Arab conquest to the Oxus and beyond. About A.D. 670 it had already made itself felt in Tokharistan, the important territory on the middle Oxus comprising the greater part of the present Afghan Turkestan. Between A.D. 705 and 715 the campaigns of the famous Arab general Qotaïba had carried the Muhammadan arms triumphantly into Sogdiana, between Oxus and Yaxartes, and even further.† By taking advantage of internal troubles among the Arabs and by giving support to all the principalities between the Yaxartes and the Hindukush which the Arabs threatened with extinction, the Chinese managed for a time to stem this wave of Muhammadan aggression. But the danger continued from this side, and the Chinese position in Central Asia became even more seriously jeopardized when the Tibetans soon after A.D. 741 advanced to the Oxus valley and succeeded in joining hands with the Arabs, their natural allies.

Balked for the time in their attempts to secure the Tarim basin, the Tibetans had only one line open to effect this junction. It led first down the Indus from Ladak through Baltistan (the "Great P'o-lü" of the Chinese Annals) to the Hindukush territories of Gilgit and Yasin, both comprised in the "Little P'o-lü" of the Chinese records.‡ Thence the passes of the Darkot and the Baroghil—the latter a saddle in the range separating the Oxus from the Chitral river headwaters—would give the Tibetans access to Wakhan; through this open portion of the upper Oxus valley and through fertile Badakhshan the Arabs established on the middle Oxus might be reached with comparative ease. But an advance along the previous portions of this route was beset with very serious difficulties, not merely on account of the great height of the passes to be traversed and of the extremely confined nature of the gorges met with on the Indus and the Gilgit river, but quite as much through the practical absence of local resources sufficient to feed an invading force anywhere between Ladak and Badakhshan.

Nevertheless the persistent advance of the Tibetans along this most difficult line is clearly traceable in the Chinese records. "Great P'o-lü," *i.e.* Baltistan, had already become subject to them before A.D. 722. About that time they attacked "Little P'o-lü," declaring, as the T'ang Annals

* Cf. Chavannes, 'Turcs occidentaux,' pp. 280 *sqq.*

† See Chavannes, *ibid.*, pp. 288 *sqq.*

‡ Cf. for this identification Chavannes, *ibid.*, p. 150, and 'Notes supplémentaires'; also my 'Ancient Khotan,' i. pp. 6 *sqq.*

tell us, to Mo-chin-mang its king: "It is not your kingdom which we covet, but we wish to use your route in order to attack the Four Garrisons (*i.e.* the Chinese in the Tarim basin)." * In A.D. 722 timely military aid rendered by the Chinese enabled this king to defeat the Tibetan design. But after three changes of reign the Tibetans won over his successor Su-shih-li-chih, and inducing him to marry a Tibetan princess secured a footing in "Little P'o-lü." "Thereupon," in the words of the *T'ang shu*, "more than twenty kingdoms to the north-west became all subject to the Tibetans." † These events occurred shortly after A.D. 741. ‡

The danger thus created by the junction between Tibetans and Arabs forced the Chinese to special efforts to recover their hold upon Yasin and Gilgit. Three successive expeditions despatched by the "Protector of the Four Garrisons," the Chinese Governor-General, had failed, when a special decree of the Emperor Hsüan-tsang in A.D. 747 entrusted the Deputy Protector Kao Hsien-chih, a general of Korean extraction commanding the military forces in the Tarim basin, with the enterprise to be traced here. We owe our detailed knowledge of it to the official biography of Kao Hsien-chih preserved in the *T'ang Annals* and translated by M. Chavannes. To that truly great scholar, through whose premature death in 1918 all branches of historical research concerning the Far East and Central Asia have suffered an irreparable loss, belongs full credit for having recognized that Kao Hsien-chih's remarkable expedition led him and his force across the Pamirs and over the Baroghil and Darkot passes. But he did not attempt to trace in detail the actual routes followed by Kao Hsien-chih on this hazardous enterprise or to localize the scenes of all its striking events. To do this in the light of personal acquaintance with the topography of these regions, their physical conditions, and their scanty ancient remains, is my object in the following pages.

With a force of 10,000 cavalry and infantry Kao Hsien-chih started in the spring of A.D. 747 from *An-hsi*, then the headquarters of the Chinese administration in the Tarim basin and corresponding to the present town and oasis of Kucha. § In thirty-five days he reached *Su-lü*, or Kashgar, through Ak-su and by the great caravan road leading along the foot of the T'ien-shan. Twenty days more brought his force to the military post of the Ts'ung-ling mountains, established in the position of the present Tashkurgan in Sarikol. || Thence by a march of twenty days the "valley of

* See Chavannes, 'Turcs occidentaux,' p. 150.

† Cf. Chavannes, *ibid.*, p. 151. By the twenty kingdoms are obviously meant petty hill principalities on the Upper Oxus from Wakhan downwards, and probably also others in the valleys south of Hindukush, such as Mastuj and Chitral.

‡ Cf. Stein, 'Ancient Khotan,' i. p. 7. A.D. 741 is the date borne by the Imperial edict investing Su-shih-li-chih's immediate predecessor; its text is still extant in the records extracted by M. Chavannes, 'Turcs occidentaux,' pp. 211 *sqq.*

§ For these and all other details taken from M. Chavannes' translation of Kao Hsien-chih's biography in the *T'ang shu*, see 'Turcs occidentaux,' pp. 152 *sqq.*

|| *Ts'ung-ling*, or "the Onion Mountains," is the ancient Chinese designation for the great snowy range which connects the T'ien-shan in the north with the K'un-lun and

Po-mi," or the Pamirs, was gained, and after another twenty days Kao Hsien-chih arrived in "the kingdom of the five Shih-ni," *i.e.* the present Shighnan on the Oxus.

The marching distance here indicated agrees well with the time which large caravans of men and transport animals would at present need to cover the same ground. But how the Chinese general managed to feed so large a force after once it had entered the tortuous gorges and barren high valleys beyond the outlying oases of the present Kashgar and Yangi-hissar districts is a problem which might look formidable, indeed, to any modern commander. The biography in the Annals particularly notes that "at that time the foot soldiers all kept horses (*i.e.* ponies) on their own account." Such a provision of transport must have considerably increased the mobility of the Chinese troops. But it also implied greatly increased difficulties on the passage through ranges which, with the exception of certain portions of the Pamirs, do not afford sufficient grazing to keep animals alive without liberal provision of fodder.

It was probably as a strategic measure meant to reduce the difficulties of supply in this inhospitable Pamir region that Kao Hsien-chih divided his forces into three columns before starting his attack upon the position held by the Tibetans at *Lien-yün*. M. Chavannes has shown good reason for assuming that by the river *P'o-lé* (or *So-lé*), which is described as flowing in front of *Lien-yün*, is meant the Ab-i-Panja branch of the Oxus, and that *Lien-yün* itself occupied a position corresponding to the present village of Sarhad, but on the opposite, or southern, side of the river, where the route from the Baroghil pass debouches on the Ab-i-Panja. We shall return to this identification in detail hereafter. Here it will suffice to show that this location is also clearly indicated by the details recorded of the concentration of Kao Hsien-chih's forces upon *Lien-yün*.

Of the three columns which were to operate from different directions and to effect a simultaneous junction before *Lien-yün* on the thirteenth day of the seventh month (about the middle of August), the main force, under Kao Hsien-chih himself and the Imperial Commissioner Pien Ling-ch'êng, passed through the kingdom of Hu-mi, or Wakhan, ascending the main Oxus valley from the west. Another column which is said to have

Hindukush in the south, and forms the mighty eastern rim of the Pamirs. The Chinese term is sometimes extended to the high valleys and plateaus of the latter also. The range culminates near its centre in the great ice-clad peak of Muztagh-ata and those to the north of it, rising to over 25,000 feet above sea-level. It is to this great mountain chain, through which all routes from the Oxus to the Tarim basin pass, that the term *Imaos* is clearly applied in Ptolemy's 'Geography.'

The great valley of Sarikol, situated over 10,000 feet above sea-level, yet largely cultivated in ancient times, forms the natural base for any military operations across the Pamirs; for early accounts of it in Chinese historical texts and in the records of old travellers from the East and West, cf. my 'Ancient Khotan,' i. pp. 27 *sqq.* Descriptions of the present Sarikol and of the two main routes which connect it with Kashgar, through the Gez valley to the north of Muztagh-ata and across the Chichiklik pass in the south, are given in my 'Ruins of Khotan,' pp. 67 *sqq.*, and 'Desert Cathay,' i. pp. 89 *sqq.*

moved upon Lien-yün by the route of *Ch'ih-fo-t'ang*, "the shrine of the red Buddha,"* may be assumed, in view of a subsequent mention of this route below, to have operated from the opposite direction down the headwaters of the Ab-i-Panja. These could be reached without serious difficulty from the Sarikol base either over the Tagh-dumbash Pamir and the Wakh-jir pass (16,200 feet),† or by way of the Naiza-tash pass and the Little Pamir. Finally, a third column, composed of 3000 horsemen, which was to make its way to Lien-yün by *Pei-ku*, or "the northern gorge," may be supposed to have descended from the side of the Great Pamir. For such a move from the north either one of the several passes could be used which lead across the Nicholas range, south-east of Victoria lake, or possibly a glacier track, as yet unexplored, leading from the latter into one of the gorges which debouch east of Sarhad.‡ In any case it is clear that by thus bringing up his forces on convergent but wholly distinct lines, and by securing for himself a fresh base in distant Shighnan, the Chinese general effectively guarded against those difficulties of supplies and transport which, then as now, would make the united move of so large a body of men across the Pamirs a physical impossibility.

The crossing of the Pamirs by a force which in its total strength amounted to ten thousand men is so remarkable a military achievement that the measures which alone probably made it possible deserve some closer examination, however succinct the Chinese record is upon which we have to base it. So much appears to me clear, that the march was not effected in one body, but in three columns moving up from Kashgar in successive stages by routes of which Tash-kurghan, "the post of the Ts'ung-ling mountains," was the advanced base or *point d'appui*. If Kao Hsien-chih moved ahead with the first column or detachment to Shighnan and was followed at intervals by the other two detachments, the advantage gained as regards supplies and transport must have been very great. His own column would have reached a fresh base of supplies in Shighnan while the second was moving across the main Pamirs and the third arriving in Sarikol from the plains. Thus the great strain of having to feed simultaneously the whole force on ground absolutely without local resources was avoided. It must be remembered that, once established on the Oxus, the Chinese Commissariat could easily draw upon the abundant produce of Badakhshan, and that for the column left on the Pamirs the comparatively easy route across the Alai would be available for drawing supplies from the rich plains of Farghana, then still under Chinese control.

* The term *fo-t'ang*, which M. Chavannes translates "la salle du Bouddha . . .," designates, according to Dr. Giles's Chinese-English Dictionary, p. 1330, "a family shrine or oratory for the worship of Buddha." Considering the location, the rendering of *t'ang* by "shrine" seems here appropriate.

† For descriptions of this route, cf. my 'Ruins of Khotan,' pp. 60 *sqq.*, and 'Desert Cathay,' i. pp. 83 *sqq.*

‡ Regarding the existence of this track, cf. the information obtained in the course of my third Central Asian journey, *Geographical Journal*, 48 (1916), p. 216.

By disposing his force *en échelon* from Shighnan to Sarikol, Kao Hsien-chih obtained also a strategically advantageous position. He was thus able to concert the simultaneous convergent movement of his columns upon the Tibetans at Sarhad without unduly exposing any of his detachments to separate attack and defeat by a superior Tibetan force; for the Tibetans could not leave their position at Sarhad without imminent risk of being cut off from the Baroghil, their only line of communication. At the same time the disposition of the Chinese forces effectively precluded any Tibetan advance either upon Sarikol or Badakhshan. Difficult as Kao Hsien-chih's operations must have been across the Pamirs, yet he had the great advantage of commanding two, if not three, independent lines of supplies (from Kashgar-Yarkand; Badakhshan; eventually Farghana), whereas the Tibetan force of about equal strength, cooped up at the debouchure of the Baroghil, had only a single line, and one of exceptional natural difficulty, to fall back upon. Of the territories of Yasin, Gilgit, Baltistan, through which this line led, we know that they could not provide any surplus supplies for an army.*

The problem, as it seems to me, is not so much how the Chinese general succeeded in overcoming the difficulties of his operations across the Pamirs, but how the Tibetans ever managed to bring a force of nine or ten thousand men across the Darkot to Sarhad and to maintain it there in the almost total absence of local resources. It is certainly significant that neither before nor after these events do we hear of any other attempt of the Tibetans to attack the Chinese power in the Tarim basin by way of the uppermost Oxus, constant, and in the end successful, as their aggression was during the eighth century A.D.

The boldness of the plan which made Kao Hsien-chih's offensive possible and crowned it with deserved success must, I think, command admiration quite as much as the actual crossing of the Darkot. The student of military history has, indeed, reason to regret that the Chinese record does not furnish us with any details about the organization which rendered this first and, as far as we know, last crossing of the Pamirs by a large regular force possible. But whatever our opinion may be about the fighting qualities of the Chinese soldier as judged by our standards—and there is significant evidence of their probably not having been much more serious in T'ang times than they are now—it is certain that those who know the formidable obstacles of deserts and mountains which Chinese troops have successfully faced and overcome during modern times will not feel altogether surprised at the power of resource and painstaking organization which the success of Kao Hsien-chih's operations indisputably attests in that long-forgotten Chinese leader and those who shared his efforts.

The location of *Lien-yün* near Sarhad, as originally proposed by M. Chavannes, is confirmed by the description of the battle by which the

* Cf. 'Ancient Khotan,' i. pp. 11 sqq.

Chinese general rendered himself master of the Tibetan position and of the route it was intended to guard. The three Chinese columns operating, as I have shown, from the west, east, and north, "had agreed to effect their junction on the thirteenth day of the seventh month (August) between seven and nine o'clock in the morning at the Tibetan stronghold of Lien-yün. In that stronghold there were a thousand soldiers; moreover, at a distance of 15 *li* (about 3 miles) to the south of the rampart, advantage had been taken of the mountains to erect palisades, behind which there were eight to nine thousand troops. At the foot of the rampart there flowed the river of the valley of *P'o-lü*, which was in flood and could not be crossed.* Kao Hsien-chih made an offering of three victims to the river; he directed his captains to select their best soldiers and their best horses; each man carried rations of dry food for three days. In the morning they assembled by the river-bank. As the waters were difficult to cross, officers and soldiers all thought the enterprise senseless. But when the other river-bank was reached, neither had the men wetted their standards nor the horses their saddle-cloths.

"After the troops had crossed and formed their ranks, Kao Hsien-chih, overjoyed, said to Pien Ling-ch'êng (the Imperial Commissioner): 'For a moment, while we were in the midst of the passage, our force was beaten if the enemy had come. Now that we have crossed and formed ranks, it is proof that Heaven delivers our enemies into our hands.' He at once ascended the mountain and engaged in a battle which lasted from the *ch'ên* period (7-9 a.m.) to the *ssü* period (9-11 a.m.). He inflicted a great defeat upon the barbarians, who fled when the night came. He pursued them, killed 5000 men, and made 1000 prisoners; all the rest dispersed. He took more than 1000 horses, and warlike stores and arms beyond counting."

The analysis given above of the routes followed by the Chinese columns, and what we shall show below of Kao Hsien-chih's three days' march to Mount *T'an-chü*, or the Darkot, confirm M. Chavannes in locating the Tibetan stronghold of Lien-yün near the present Sarhad, the last permanent settlement on the uppermost Oxus. It is equally clear from the description of the river crossing that the Chinese concentration must have taken place on the right or northern bank of the Ab-i-Panja, where the hamlets constituting the present Sarhad are situated, while the stronghold of Lien-yün lay on the opposite left bank.

Before I was able to visit the ground in May 1906, I had already expressed the belief that the position taken up by the Tibetan main force, 15 *li* (*circ.* 3 miles) to the south of Lien-yün, must be looked for in the valley which debouches on the Ab-i-Panja opposite to Sarhad.† It is

* M. Chavannes has shown ('*Turcs occidentaux*,' p. 154) that this name *P'o-lü* is a misreading easily explained in Chinese writing for *So-lü* mentioned elsewhere as a town in Hu-mi or Wakhan.

† See 'Ancient Khotan,' i. p. 7.

through this open valley that the remarkable depression in the main Hindu-kush range, represented by the Baroghil and Shawitakh saddles (12,460 and 12,560 feet respectively), is gained. I also surmised that the Chinese general, apart from the confidence aroused by the successful river crossing, owed his victory mainly to a flanking movement by which his troops gained the heights, and thus successfully turned the fortified line behind which the Tibetans were awaiting them.

The opinion was confirmed by what I saw of the valley leading to the Oxus on my descent from the Baroghil on 19 May 1906, and by the examination I was able to make two days later of the mountain-side flanking its debouchure from the west. The valley into which the route leads down from the Baroghil is quite open and easy about Zartighar, the southernmost hamlet. There a ruined watch-tower shows that defence of the route had been a concern also in modern times. Further down the valley-bottom gradually contracts, though still offering easy going, until, from a point about 2 miles below Zartighar to beyond the scattered homesteads of Pitkhar,* its width is reduced to between one-half and one-third of a mile. On both sides this defile is flanked by high and very precipitous rocky ridges, the last offshoots of spurs which descend from the main Hindukush watershed.

These natural defences seemed to provide just the kind of position which would recommend itself to the Tibetans wishing to bar approach to the Baroghil, and thus to safeguard their sole line of communication with the Indus valley. The width of the defile would account for the comparatively large number of defenders recorded by the Chinese Annals for the enemy's main line; the softness of the ground at its bottom, which is almost perfectly level, covered with fine grass in the summer, and distinctly swampy in the spring owing to imperfect drainage, would explain the use of palisades, at first sight a rather strange method of fortification in these barren mountains.† Finally, the position seemed to agree curiously well with what two historical instances of modern times, the fights in 1904 at Guru and on the Karo-la, had revealed as the typical and time-honoured Tibetan scheme of defence—to await attack behind a wall erected across the open ground of a valley or saddle.

* The *Pitkhar* of sketch-map 2 is a misprint.

† In my note in 'Ancient Khotan,' p. 9, I had ventured to suggest that, considering how scanty timber must at all times have been about Sarhad, there was some probability that walls or "Sangars" constructed of loose stones were really meant by the "palisades" mentioned in the translation of the passage from the T'ang Annals.

This suggestion illustrates afresh the risk run in doubting the accuracy of Chinese records on quasi-topographical points without adequate local knowledge. On the one hand, I found that the peculiar nature of the soil in the defile would make the construction of heavy stone walls inadvisable, if not distinctly difficult. On the other, my subsequent march up the Ab-i-Panja showed that, though timber was as scarce about Sarhad itself as I had been led to assume, yet there was abundance of willow and other jungle in parts of the narrow river gorge one march higher up near the debouchure of the Shaor and Baharak streams. This could well have been used for palisades after being floated down by the river.

There remained the question whether the defile of Pitkhar was capable of being turned by an attack on the flanking heights such as the Chinese record seemed plainly to indicate. The possibility of such a movement on the east was clearly precluded by the extremely precipitous character of the flanking spur, and still more by the fact that the summer flood of the Ab-i-Panja in the very confined gorge above Sarhad would have rendered that spur inaccessible to the Chinese operating from the northern bank of the river. All the greater was my satisfaction when I heard from my Wakhi informants of ruins of an ancient fort, known as *Kansir*, situated on the precipitous crest of the flanking spur westwards, almost opposite to Pitkhar. During the single day's halt, which to my regret was all that circumstances would allow me at Sarhad, I was kept too busy otherwise to make a close inspection of the ground where the Tibetan post of Lien-yün might possibly have been situated. Nothing was known locally of old remains on the open alluvial plain which adjoins the river at the mouth of the valley coming from the Baroghil; nor were such likely to survive long on ground liable to inundation from the Oxus, flowing here in numerous shifting channels with a total width of over a mile.

Even if the exact position of Lien-yün thus remained undetermined, my short stay at Sarhad sufficed to convince me how closely local conditions agreed with the details of Kao Hsien-chih's exploit in crossing the Oxus. The river at the time of the summer flood must, indeed, present a very imposing appearance as it spreads out its waters over the wide valley-bottom at Sarhad. But the very separation of the waters makes fording always possible even at that season, provided the passage takes place in the early morning, when the flood due to the melting snow and ice is temporarily reduced by the effect of the night's frost on the glaciers and snow-beds at the head of the Ab-i-Panja. The account in the *Annals* distinctly shows that the river passage must have been carried out at an early hour of the morning, and thus explains the complete success of an otherwise difficult operation.

I was able to trace the scene of the remaining portion of the Chinese general's exploit when, on May 21, I visited the ruined fortifications reported on the steep spur overlooking the debouchure of the Baroghil stream from the west and known as *Kansir*. After riding across the level plain of sand and marsh, and then along the flat bottom of the Pitkhar defile for a total distance of about 3 miles, we left our ponies at a point a little to the south of some absolutely impracticable rock faces which overlook Pitkhar from the west. Then, guided by a few Wakhis, I climbed to the crest of the western spur, reaching it only after an hour's hard scramble over steep slopes of rock and shingle. There, beyond a stretch of easily sloping ground and about 300 feet higher, rose the old fort of *Kansir* at the extreme north end of the crest. Between the narrow ridge occupied by the walls and bastions and the continuation of the spur

south-westwards a broad dip seemed to offer an easy descent towards the hamlet of Karkat on the Oxus.

It was clearly for the purpose of guarding this approach that the little fort had been erected on this exposed height. On the north and east, where the end of the spur falls away in unscalable cliffs to the main valley of the Oxus and towards the mouth of the Pitkhar defile, some 1600 to 1700 feet below, structural defences were needless. But the slope of the ridge facing westwards and the narrow neck to the south had been protected on the crest by a bastioned wall for a distance of about 400 feet. Three bastions facing west and south-west, and one at the extreme southern point, still rose, in fair preservation in parts, to a height of over 30 feet. The connecting wall-curtains had suffered more, through the foundations giving way on the steep incline. Of structures inside the little fort there remained no trace.

Definite archæological evidence as to the antiquity of the little fortification was supplied by the construction of the walls. Outside a core of closely packed rough stones they show throughout a solid brick facing up to 6 feet in thickness with regular thin layers of brushwood separating the courses of large sun-dried bricks. Now this systematic use of brushwood layers is a characteristic peculiarity of ancient Chinese construction in Central Asia, intended to assure greater consistency under climatic conditions of particular dryness in regions where ground and structures alike are liable to constant wind erosion. My explorations around Lop-nor and on the ancient Chinese *Limes* of Tun-huang have conclusively proved that it dates from the very commencement of Chinese expansion into Central Asia.* At the same time my explorations in the Tarim basin have shown also that the Tibetan invaders of the T'ang period, when building their forts, did not neglect to copy this constructive expedient of their Chinese predecessors and opponents in these regions.† On various grounds which cannot be discussed here in detail it appears to me very probable that the construction of the Kansir walls was due to the Tibetan invaders of Wakhan. But whether the fortification existed already when Kao Hsien-chih carried the Tibetan main position by an attack on its mountain flank, or whether it was erected by the Tibetans when they returned after the retirement of the Chinese some years later, and were, perhaps, anxious to guard against any repetition of this move outflanking a favourite defensive position, I am unable to say.

The victory thus gained by Kao Hsien-chih on the Oxus had been signal, and it was followed up by him with the boldness of a truly great commander. The Imperial Commissioner and certain other high officers feared the risks of a further advance. So Kao Hsien-chih decided to leave them behind together with over 3000 men who were sick or worn out by

* Cf., e.g., 'Desert Cathay,' i. pp. 387 *sqq.*, 540 *sqq.*; ii. pp. 44, 50, etc.

† This was distinctly observed by me in the Tibetan forts at Miran and Mazar-tagh, built and occupied in the 8th century A.D.; cf. 'Serindia,' pp. 457, 1285 *sqq.*

the previous hardships, and to let them guard Lien-yün. With the rest of his troops he "pushed on, and after three days arrived at Mount *T'an-chü*; from that point downwards there were precipices for over 40 *li* (circ. 8 miles) in a straight line. Kao Hsien-chih surmised: 'If the barbarians of *A-nu-yüeh* were to come to meet us promptly, this would be the proof of their being well-disposed.' Fearing besides that his soldiers would not care to face the descent [from Mount *T'an-chü*], he employed the stratagem of sending twenty horsemen ahead with orders to disguise themselves in dress as if they were barbarians of the town of *A-nu-yüeh*, and to meet his troops on the summit of the mountain. When the troops had got up Mount *T'an-chü* they, in fact, refused to make the descent, saying, 'To what sort of places would the Commissioner-in-Chief have us go?' Before they had finished speaking, the twenty men who had been sent ahead came to meet them with the report: 'The barbarians of the town of *A-nu-yüeh* are all well-disposed and eager to welcome you; the destruction of the bridge over the *So-yi* river is completed.' Kao Hsien-chih pretended to rejoice, and on his giving the order all the troops effected their descent."

After three more marches the Chinese force was in reality met by "the barbarians of the town of *A-nu-yüeh*" offering their submission. The same day Kao Hsien-chih sent ahead an advance guard of a thousand horsemen, charging its leader to secure the persons of the chiefs of "Little *P'o-lü*" through a ruse. This order having been carried out, on the following day Kao Hsien-chih himself occupied *A-nu-yüeh*, and had the five or six dignitaries who were supporting the Tibetans executed. He then hastened to have the bridge broken which spanned the *So-yi* river at a distance of 60 *li*, or about 12 miles, from *A-nu-yüeh*. "Scarcely had the bridge been destroyed in the evening when the Tibetans, mounted and on foot, arrived in great numbers, but it was then too late for them to attain their object. The bridge was the length of an arrow-shot; it had taken a whole year to construct it. It had been built at the time when the Tibetans, under the pretext of using its route, had by deceit possessed themselves of Little *P'o-lü*." Thus secured from a Tibetan counter-attack on *Yasin*, Kao Hsien-chih prevailed upon the king of Little *P'o-lü* to give himself up from his hiding-place, and completely pacified the territory.

The personal acquaintance with the ground which I gained in 1906 on my journey up the *Yarkhun*, or *Mastuj*, valley and across to *Sarhad*, and again on my move up *Yasin* and across the *Darkot* in 1913, has rendered it easy to trace the successive stages here recorded of Kao Hsien-chih's great exploit. All the details furnished by the Chinese record agree accurately with the important route that leads across the depression in the *Hindukush* range, formed by the adjacent *Baroghil* and *Shawitakh* Passes, to the sources of the *Mastuj* river, and then, surmounting southwards the ice-covered *Darkot* Pass (circ. 15,400 feet),

descends the valley of Yasin to its debouchure on the main river of Gilgit. The only serious natural obstacle on this route, but that a formidable one, is presented by the glacier pass of the Darkot. I first ascended it on 17 May 1906, from the Mastuj side, under considerable difficulties, and to a description of that visit and the photographic illustrations which accompany it I may here refer for all details.*

Owing to a curious orographic configuration two great ice-streams descend from the northern face of the Darkot pass. One, the Darkot glacier properly so called, slopes down to the north-west with an easy fall for a distance of nearly 8 miles, pushing its snout to the foot of the Rukang spur, where it meets the far steeper Chatiboi glacier. The other ice-stream, which on the map is shown quite as long but which reliable information represents as somewhat shorter, descends towards the north-east and ends some miles above the summer grazing ground of Showarshur on the uppermost Yarkhun river. Thus two divergent routes offer themselves to the traveller who reaches the Darkot pass from the south and wishes to proceed to the Oxus.

The one, keeping to the Darkot glacier, which I followed myself on my visit to the Darkot pass, has its continuation in the easy track which crosses the Rukang spur, and then the Yarkhun river below it to the open valley known as Baroghil-yailak. Thence it ascends over a very gentle grassy slope to the Baroghil saddle, characteristically called *Dash-i-Baroghil*, "the plain of Baroghil." From this point it leads down over equally easy ground, past the hamlet of Zartighar, to the Ab-i-Panja opposite Sarhad. The other route, after descending the glacier to the north-east of the Darkot Pass, passes down the Yarkhun river past the meadows of Showarshur to the grazing ground of Shawitakh-yailak; thence it reaches the Hindukush watershed by an easy gradient near the lake of Shawitakh or Sarkhin-zhoe. The saddles of Baroghil and Shawitakh are separated only by about 2 miles of low gently sloping hills, and at Zartighar both routes join.

The distances to be covered between the Darkot pass and Sarhad are practically the same by both these routes, so far as the map and other available information allow me to judge. My original intention in 1906 was to examine personally those portions of both routes which lie over the *névé*-beds and glaciers of the Darkot. But the uncertain weather conditions prevailing at the time of my ascent, and the exceptional difficulties then encountered owing to the early season and the heavy snowfall of that spring, effectively prevented my plan of ascending from the foot

* See 'Desert Cathay,' i. pp. 52 *sqq.* In 1913 I crossed the Darkot from the Yasin side towards the close of August, *i.e.* at the very season when Kao Hsien-chih effected his passage. The difficulties then encountered in the deep snow of the *névé* beds on the top of the pass, on the great and much-crevassed glacier to the north, and on the huge side moraines along which the descent leads, impressed me as much as before with the greatness of Kao Hsien-chih's alpine feat in taking a military force across the Darkot.

of the Rukang spur and descending to Showar-shur. In 1913 I was anxious to complete my examination of the Darkot by a descent on the latter route. But my intention was unfortunately frustrated by the fact that the passage of the glacier on the Showar-shur side had been blocked for several years past by an impracticable ice-fall which had formed at its end.

Having thus personal experience only of the north-west route, I am unable to judge to what extent present conditions justify the report which represents the glacier part of the north-eastern route as somewhat easier. It is, however, a fact that the Pamir Boundary Commission of 1895, with its heavy transport of some six hundred ponies, used the latter route both coming from and returning to Gilgit. The numerous losses reported of animals and loads show that here, too, the passage of the much-crevassed glacier and the treacherous snow-covered moraines proved a very serious difficulty for the transport. Nevertheless, inasmuch as for a force coming from the Wakhan side the ascent to the Darkot pass from the nearest practicable camping ground would be about 1300 feet less by the Showar-shur route than by that passing the Rukang spur, I consider it probable that the former was used.

Kao Hsien-chih's biography states that it took the Chinese general three days to reach "Mount T'an-chü," *i.e.* the Darkot, but does not make it quite clear whether thereby the arrival at the north foot of the range or on its crest is meant. If the latter interpretation is assumed, with the more rapid advance it implies, it is easy to account for the time taken by a reference to the ground; for, although the Shawitakh-Baroghil saddle is crossed without any difficulty in the summer after the snow has melted, no military force accompanied by baggage animals could accomplish the march from Sarhad across the Darkot in less than three days, the total marching distance being about 30 miles. Even a four days' march to the crest, as implied in the first interpretation, would not be too large an allowance, considering the high elevations and the exceptional difficulties offered by the glacier ascent at the end.

The most striking evidence of the identity of "Mount T'an-chü" with the Darkot is supplied by the description given in the record of "the precipices for over 40 *li* in a straight line" which dismayed the Chinese soldiers on looking down from the heights of Mount T'an-chü; for the slope on the southern face of the Darkot is extremely steep, as I found on my ascent in 1913, and as all previous descriptions have duly emphasized. The track, mostly over moraines and bare rock, with a crossing of a much-crevassed glacier *en route*, descends close on 5000 feet in a distance of little more than 5 miles before reaching, near a ruined "Darband," or *Chiusa*, the nearest practicable camping ground above the small village of Darkot.

Well could I understand the reluctance shown to further advance by Kao Hsien-chih's cautious "braves," as from the top of the pass I looked

down on 17 May 1906 through temporary rifts in the brooding vapour into the seeming abyss of the valley. The effect was still further heightened by the wall of ice-clad mountains rising to over 20,000 feet which showed across the head of the Yasin valley south-eastwards, and by the contrast which the depths before me presented to the broad snowy expanse of the glacier *firm* sloping gently away on the north. Taking into account the close agreement between the Chinese record and the topography of the Darkot, we need not hesitate to recognize in *T'an-chü* an endeavour to give a phonetic rendering of some earlier form of the name *Darkot*, as accurate as the imperfections of the Chinese transcriptional devices would permit.

The stratagem by which Kao Hsien-chih met and overcame the reluctance of his troops, which threatened failure when success seemed assured, looks characteristically Chinese. The forethought shown in preparing this ruse is a proof alike of Kao Hsien-chih's judgment of men and of the extreme care with which every step of his great enterprise must have been planned. But such a ruse, to prove effective, must have remained unsuspected. I believe that in planning it full advantage was taken of the peculiar configuration of the Darkot, which provides, as seen, a double route of access to the pass. If the party of men sent ahead to play the rôle of the "barbarians of Little P'o-lü" offering their submission was despatched by the Baroghil and Rukang route while the troops marched by the Showitakh-Showar-shur route, all chance of discovery while on the move would be safely guarded against. As I had often occasion to note in the course of my explorations, Chinese military activity from antiquity down to modern times has always taken advantage of the keen sense of topography widely spread in the race. So Kao Hsien-chih was likely to take full account of the alternative routes. Nor could it have been particularly difficult for him to find suitable actors, in view of the generous admixture of local auxiliaries which the Chinese forces in Central Asia have at all times comprised.*

The remaining stages of Kao Hsien-chih's advance can be traced with equal ease. The three marches which brought him from the southern foot of the pass to "the town of A-nu-yüeh" obviously correspond to the distance, close on 30 miles, reckoned between the first camping ground below the Darkot to the large village of Yasin. The latter, by its position and the abundance of cultivable ground near by, must always have been the political centre of the Yasin valley. Hence it is reasonable to assume that we have in *A-nu-yüeh* a fairly accurate reproduction of the name *Arniya* or *Arniah* by which the Dards of the Gilgit valley know Yasin.

The best confirmation of this identification is furnished by the state-

* The T'ang Annals specifically mention in the account of Shih-ni, or Shighnan, on the Oxus that its chief in A.D. 747 followed the Imperial troops in their attack on Little P'o-liü, and was killed in the fighting; cf. Chavannes, 'Tures occidentaux,' p. 163.

ment of the Chinese record that the bridge across the River So-yi was situated 60 *li* from A-nu-yüeh. Since the notice of Little P'ö-lü contained in the T'ang Annals names the River So-yi as the one on which Yeh-to, the capital of the kingdom, stood, it is clear that the Gilgit river must be meant. Now, a reference to the map shows that, in a descent of the valley from Yasin, the Gilgit river is reached at a distance of about 12 miles, which exactly agrees with the 60 *li* of the Chinese account. It is evident also that, since the only practicable route towards Gilgit proper and the Indus valley leads along the right, or southern, bank of the Gilgit river, the Tibetan reinforcements hurrying up from that direction could not reach Yasin without first crossing the river. This explains the importance attaching to the bridge and the prompt steps taken by the Chinese leader to have it broken. As the Gilgit river is quite unfordable in the summer the destruction of the bridge sufficed to assure safe possession of Yasin.*

It still remains for us to consider briefly what the biography in the T'ang Annals tells us of Kao Hsien-chih's return from Little P'ö-lü. After having secured the king and his consort and pacified the whole territory, he is said to have retired by the route of "the shrine of the red Buddha" in the eighth (Chinese) month of A.D. 747. In the ninth month (October) he rejoined the troops he had left behind at Lien-yüan, *i.e.* Sarhad, and by the end of the same month regained "the valley of Po-mi," or the Pamirs.

Reference to the map shows that there are only two direct routes, apart from that over the Darkot and Baroghil, by which the upper Ab-i-Panja valley can be gained from Gilgit-Yasin. One leads up the extremely difficult gorge of the Karambar or Ashkuman river to its headwaters east of the Yarkhun river sources, and thence by the Khora-bhort Pass over the main Hindukush range and down the Lupsuk valley to the Ab-i-Panja. This it strikes at a point close to Karwan-balasi, half a march below the debouchure of the Little Pamir and two and a half marches above Sarhad.† The other, a longer but distinctly easier route, leads up from Gilgit through the Hunza valley to Guhyal, whence the Ab-i-Panja headwaters can be gained either *viâ* the Kilik and Wakhjir passes or by the Chapursan valley. At the head of the latter the Irshad pass gives access to the Lupsuk valley already mentioned, and down this Karwan-balasi is gained on the Ab-i-Panja.‡ All three passes are high, close on

* The biography of Kao Hsien-chih calls this bridge "pont de rotin" in M. Chavannes' translation, 'Turcs occidentaux,' p. 153. But there can be no doubt that what is meant is a "rope bridge," or *jhula*, made of twigs twisted into ropes, a mode of construction still regularly used in all the valleys between Kashmir and the Hindukush. Rope bridges of this kind across the Gilgit river near the debouchure of the Yasin valley were the only permanent means of access to the latter from the south until the wire suspension bridge near the present fort of Gupis was built in recent years.

† Regarding Karwan-balasi and the route along the Oxus connecting Sarhad with the Little Pamir, cf. 'Desert Cathay,' i. pp. 72 *seq.*

‡ The Hunza valley route was followed by me in 1900. For a description of it and

or over 16,000 feet, but clear of ice and comparatively easy to cross in the summer or early autumn.

Taking into account the distinct statement that Kao Hsien-chih left after the whole "kingdom" had been pacified, it is difficult to believe he should not have visited Gilgit, the most important portion of Little P'o-lü. In this case the return through Hunza would have offered manifest advantages, including the passage through a tract comparatively fertile in places and not yet touched by invasion. This assumption receives support also from the long time, one month, indicated between the start on the return march and the arrival at Lien-yün. Whereas the distance from Gilgit to Sarhad *via* Hunza and the Irshad pass is now counted at twenty-two marches, that from Gilgit to the same place by the Karambar river and across the Khora-bhort is reckoned at only thirteen. But the latter route is very difficult at all times and quite impracticable for load-carrying men in the summer and early autumn, when the Karambar river completely fills its narrow rock-bound gorge.

The important point is that both routes would have brought Kao Hsien-chih to the same place on the uppermost Ab-i-Panja, near Karwan-balasi, which must be passed by all wishing to gain Sarhad from the east, whether starting from Hunza, Sarikol, or the Little Pamir. This leads me to believe that the "shrine of the red Buddha," already mentioned above as on the route which Kao Hsien-chih's eastern column followed on its advance to Sarhad, must be looked for in this vicinity. Now it is just here that we find the small ruin known as *Karwan-balasi*, which has all the structural features of a Buddhist shrine though now revered as a Muhammadan tomb.* We have here probably another instance of that continuity of local cult which has so often converted places of ancient Buddhist worship in Central Asia and elsewhere into shrines of supposed Muhammadan saints.†

According to the Annals the victorious general repaired to the Imperial capital, taking with him in triumph the captured king Su-shih-li-chih and his consort. The Emperor pardoned the captive chief and enrolled him in the Imperial guards, *i.e.* kept him in honourable exile,

of the Kilik and Wakhjir passes by which it connects with the Ab-i-Panja-valley close to the true glacier source of the Oxus, see my 'Ruins of Khotan,' pp. 29 *sqq.*

The branch of this route leading up the Chapursan valley and across the Irshad pass, was for the most part seen by me in 1913. The Chapursan valley is open and easy almost throughout and shows evidence of having contained a good deal of cultivation in older times; see my note in *Geographical Journal*, 48, p. 109. On this account, and in view of the fact that this route is some 18 miles shorter than that over the Wakhjir and crosses only one watershed, it offers a distinctly more convenient line of access to the Oxus headwaters from Gilgit than the former branch.

* Regarding the ruin of Karwan-balasi, cf. 'Desert Cathay,' i. pp. 76 *sqq.*; 'Serindia,' i. pp. 70 *sq.*

† For references, see 'Ancient Khotan,' i. p. 611, *sv.* "local worship"; also my "Note on Buddhist Local Worship in Muhammadan Central Asia," *Journal of the Royal Asiatic Society*, 1910, pp. 839 *sqq.*

safely away from his territory. This was turned into a Chinese military district under the designation of *Kuei-jên*, and a garrison of a thousand men established there. The deep impression which Kao Hsien-chih's remarkable expedition must have produced in all neighbouring regions is duly reflected in the closing remarks of the *T'ang-shu*: "Then the Fu-lin (Syria), the Ta-shih (*i.e.* the Tazi or Arabs), and seventy-two kingdoms of divers barbarian peoples were all seized with fear and made their submission."

It was the greatness of the natural obstacles overcome on Kao Hsien-chih's victorious march across the inhospitable Pamirs and the icy Hindukush which made the fame of this last Central Asian success of the T'ang arms spread so far. If judged by the physical difficulties encountered and vanquished, the achievement of the able Korean general deserves fully to rank by the side of the great alpine feats of commanders famous in European history. He, for the first, and perhaps the last, time led an organized army right across the Pamirs and successfully pierced the great mountain rampart that defends Yasin-Gilgit and with it the Indus valley against invasion from the north. Respect for the energy and skill of the leader must increase with the recognition of traditional weakness which the Annals' ungarished account reveals in his troops.

Diplomatic documents reproduced from the Imperial archives give us an interesting glimpse of the difficult conditions under which the Chinese garrison placed in Little P'o-lü was maintained for some years after Kao Hsien-chih's great exploit. As I have had occasion to discuss this curious record fully elsewhere, it will suffice to note that the small Chinese force was dependent wholly upon supplies obtained from Kashmir,* exactly as the present garrison of Indian Imperial Service troops has been ever since it was placed in Gilgit some thirty years ago.

In view of such natural difficulties as even the present Kashmir-Gilgit road, an achievement of modern engineering, has not succeeded in removing, it is not surprising to find that before long resumed Tibetan aggression threatened the Chinese hold, not merely upon Gilgit-Yasin, but upon Chitral and distant Tokharistan too. A victorious expedition undertaken by Kao Hsien-chih in A.D. 750 to Chitral succeeded in averting this danger.† But the fresh triumph of the Chinese arms in these distant regions was destined to be short. Early in the following year Kao Hsien-chih's high-handed intervention in the affairs of Tashkend, far away to

* Cf. 'Ancient Khotan,' i. pp. 11 *sqq.*; for the official documents embodied in the 'Tsê fu yuan kuei' (published A.D. 1013), see Chavannes, 'Turcs occidentaux,' pp. 214 *sqq.*

In the former place I have pointed out the exact parallel which the difficulties experienced since 1890 about the maintenance of an Indian Imperial garrison in Gilgit present to the conditions indicated by the Chinese record of A.D. 749. The troubles attending the transport of supplies from Kashmir necessitated the construction of the present Gilgit Road, a difficult piece of engineering.

† Cf. Chavannes, 'Turcs occidentaux,' pp. 158, 214 *sqq.*, 296.

the north, brought about a great rising of the populations beyond the Yaxartes, who received aid from the Arabs. In a great battle fought in July 751, in the plains near Talas, Kao Hsien-chih was completely defeated by the Arabs and their local allies, and in the ensuing *débâcle* barely escaped with a small remnant of his troops.*

This disaster marked the end of all Chinese enterprise beyond the *Imaos*. In Eastern Turkestan Chinese domination succeeded in maintaining itself for some time amidst constant struggles until by A.D. 791 the last of its administrators and garrisons, completely cut off long before from contact with the Empire, finally succumbed to Tibetan invasion. Close on a thousand years were to pass after Kao Hsien-chih's downfall before Chinese control was established once again over the Tarim basin and north of the T'ien-shan under the great emperor Ch'ien-lung.

THE MOUNT EVEREST MAPS AND PHOTOGRAPHS

TWO maps are published with the present number of the *Journal* to illustrate the papers by Colonel Howard-Bury and Mr. Mallory, read at the joint meeting of the Society and the Alpine Club held at the Queen's Hall on December 20. Since both are preliminary and rather hastily made maps of hitherto unmapped country, it is necessary to explain, more fully than could be done on the face of the maps, the origin of each.

The survey party which, at the request of the Government of India, accompanied the expedition, consisted of Majors Morshead and Wheeler, two Indian plane-tablers, an Indian photographic assistant, and the necessary subordinates. Major Morshead and his plane-tablers mapped the whole country traversed by the expedition on the scale of 4 miles to 1 inch, with the exception of the area within about 10 miles of Mount Everest, which was reserved for photographic survey by Major Wheeler. A rapid triangulation was carried from the existing triangulation at Kampa Dzong (made by Col. Ryder on the Tibet Mission of 1903-04) as far west only as Tinki; from that place the plane-table sheets are based on intersected points determined by Col. Ryder. In the valleys to the extreme west of the area mapped, bad weather obscured all the summits and made plane-tabling impossible; the map in these districts depends on a rough time- and compass-traverse by Major Morshead.

Fair tracings of the plane-table sheets were kept up as far as possible during the progress of the work in the field, and were rapidly completed on the return to Darjeeling, so that within three weeks copies reproduced by the Vandyke process in six colours were available in Calcutta, and a

* Cf. Chavannes, 'Turcs occidentaux,' p. 142, note 2. M. Chavannes, p. 297, quotes the closely concordant account of these events from Muhammadan historical records.

large number have been received in England for the use of the 1922 expedition. The area reserved for photographic survey is marked by a red line, but within this line there is shown a great deal of detail which seems to have been sketched in by the plane-tables from without. A note states that this detail is shown only "with approximate accuracy." The photographs brought back by the expedition prove clearly, however, that this estimate is too high: the detail within the boundary should be neglected. In particular, the East Rongbuk glacier, which is the key to the position, is omitted; the main glacier is named the East Rongbuk glacier; and the name "West Rongbuk glacier" is in the wrong place.

The tracing of his first sketch-map from the photographic survey, which was covered by a letter received from Major Wheeler on December 12, was not itself received until December 28, having apparently missed a mail, and then gone all the way round by sea. For the meeting on December 20 it was necessary to produce some kind of map of the mountain area. Experiments made by Mr. Hinks showed that it was possible to measure approximately rounds of angles on the panoramas made by Colonel Howard-Bury with a 5-inch Panoram Kodak from a number of well-chosen stations east and north of the mountain. The positions of the stations could be re-sected from the few peaks whose places had been triangulated from the plains of India. When the stations were fixed, other points could be intersected, and a framework thus constructed. A careful repetition and extension of this process by Mr. Batchelor fixed the principal points east and north of the mountain. Mr. Frank Debenham, University Lecturer in Cartography at Cambridge, then kindly gave a few days' hard work to sketching the topography from the photographs; and Mr. Milne, from all this material, made the drawing which was shown on the screen at the meeting of December 20. The topography west of the mountain, for which there were no panoramas, was very doubtful.

When on December 28 Major Wheeler's preliminary map from the photographic survey came to hand, it was seen at once that it could not be reproduced as it stood, and that there was no time to do it justice by completely redrawing it for reproduction in this number of the *Journal*. It was therefore put aside for the moment, and Map II. now published has been completed by Mr. Milne from the drawing made for December 20, with further study of the photographs, helpful criticism and explanations by several members of the expedition, and the use of a compass sketch of the Rongbuk district produced by Mr. Bullock. Nothing has been taken from Major Wheeler's map, and no comparison with it has been made up to the present, in order that Map II. should be available as an eventual test of what may be done from the rapid study of panoramic photographs.

Meanwhile Map I. on the scale 1/750,000, has been reduced from Major Morshead's map, extended east of Tinki from existing Survey of India maps, and completed in the reserved area by a reduction from

Map II. There has been no time to prepare a hill-shaded or hachured plate from Major Morshead's map; but this will now be taken in hand by Mr. Batchelor, and a fully hill-shaded map should be ready for the book on the Expedition of 1921, which will be published by Mr. Edward Arnold in the spring.

Within the last few days we have received, by the courtesy of the Surveyor-General of India, typed copies of the reports made to him by his two officers, and we hope to give some account of these reports in a future number of the *Journal*. To have surveyed 12,000 square miles of new country on the 1/4 inch scale in a single season, and published a map in six colours three weeks after the return to civilization, is no mean achievement. To what, asks M. Rabot, in *L'Illustration*, is this excellent result due? To the admirable invention of a French officer: photographic survey! The claim is characteristic, but ill-founded. The late Colonel Laussedat certainly wrote books about photographic survey many years ago, but he never persuaded his own countrymen there was much in it. The Canadian methods employed by Major Wheeler were developed by Mr. Deville, the Surveyor-General of Canada. Whatever merit they have, when applied to Mount Everest, remains to be proved, and will not be known for several months yet; there are those who think that only stereographic survey can be of much effect in such wonderful country. In any case, the 12,000 square miles of survey to which M. Rabot referred owed nothing to any photographic method, French or otherwise. They were done with the plane-table, whose proper use was discovered by the Survey of India.

In discussing the photographs published in former numbers of the *Journal*, we were compelled to use the unsatisfactory method of assigning arbitrary letters for reference, or of using English descriptive names, as the North Peak. It is now time to make suggestions for a more convenient nomenclature.

Mount Everest must, as an exceptional case, retain the European name by which it has long been known to us, though we are now sure that the Tibetan name is Chomo Lungma: the mountain is so named in the passport for the expedition issued by the Prime Minister of the Dalai Lama. But successive Surveyor-Generals have resolved, in full agreement with this Society, that no more European names shall appear on Himalayan maps. Last year's expedition has discovered a certain number of Tibetan names, Chomo Lönzo for peak N 53 of the Survey—not for Makalu, which is not conspicuous from the camping-grounds in the Kama valley—Cho Uyo for Pk. 5/71L (26,867), and Gyachung Kang for Pk. 3/71L (25,990); but no names are discoverable for most of the features which figure prominently in the narrative. Our best course is then to take convenient descriptive names and turn them into Tibetan. Colonel Howard-Bury and Major Morshead had already agreed that Pk. 8/71L (23,800)

at the head of the Kharta valley should be called Khartaphu; that the isolated peak in the gap between Mount Everest and Makalu should be called Pethang peak, from the camping-ground of Pethang Ringmo opposite; and the windy pass at the head of the Kharta glacier Lhakpa La. After consultation with Colonel Howard-Bury and Mr. Mallory, Tibetan equivalents for other peaks were suggested and submitted for criticism to Sir Charles Bell on his recent return to England from Lhasa, with the following results:

The south peak of Mount Everest (28,100)	Lhotse.
The north peak	Changtse.
The north col	Chang La.
Pk. 6/71L	Khartichangri.
The group of mountains at the head of the Rongbuk valley lying like an island between the Rongbuk and West Rongbuk glaciers in front of the north-west ridge	Lingtren.
The small peak west of this in the West Rongbuk glacier, referred to as the Island peak	Lingtrennup.
The white snow-peak climbed by Mallory on August 7, at head of Kama valley	Kartse.
The peak with the long ridge climbed on July 5 near the head of the Rongbuk valley	Ri-ring.
The peak north of the Kama valley and south of the advanced base in the Kharta valley	Kamachangri.
The fine isolated rock peak west of Mount Everest and south of the West Rongbuk glacier	Pumori.
The Pethang peak	Pethangtse.

One considerable advantage of these names is that they will mean something to the Tibetan coolies, and will be convenient in giving instructions.

It is not proposed for the present to give special names to the various features of the mountain: we shall speak of the summit, the north-east shoulder, the north-eastern and northern arêtes which meet at the north-east shoulder, the summit ridge from the north-east shoulder to the summit, the north-western and western ridges enclosing the western cwm. The northern arête, which is the chosen route for the assault, is very obtuse, hardly more than a slight bend in the northern face, and for the time being it seems convenient to speak of the whole, nearly flat face between the north-eastern and north-western arêtes as the north face, although the northern arête divides it into two parts slightly inclined one to the other. The triangular face below the north-eastern arête will be called the north-east facet.

From the admirable collection of photographs brought home by the

expedition we have chosen for reproduction this month a series that illustrates pretty completely the topography of the mountain; they have, in fact, formed the principal material for the construction of Map II.

The Lingtren group (Plate 1) stand at the head of the Rongbuk valley in front of Mount Everest, but quite detached from it. Between this group and the end of the north-west ridge just appearing over the crest is a glacier pass reached by Mr. Bullock, connecting the south-western head of the Rongbuk glacier with a southern branch of the west Rongbuk, seen on the right in Plate 3.

The northern ridge (Plate 2) descends sharply to the eastern bank of the Rongbuk glacier, straight and nearly unbroken from the Changtse to the exit of the East Rongbuk glacier (Plate 9). But behind it lies the long unsuspected East Rongbuk glacier, the key to the whole problem, shown in Major Wheeler's photographs (Plates 10 and 11). This East Rongbuk glacier must have a larger basin than the main Rongbuk: many tributary glaciers descend to it from the high plateau eastward (Plate 11); it drains a large basin north of Changtse and east of the north ridge (Plate 10); and it has a broad head between the Lhakpa and the Chang La under the northern face of Mount Everest (Plates 18 and 21). Yet its glacier torrent, which runs for a mile or so under the lower end of the main Rongbuk glacier, was relatively small at the end of June, and did not in the least suggest an important glacier just out of sight round the corner.

The very interesting photograph No. 3 was taken from somewhere on the peak in the left foreground of No. 4, and is the only picture we have showing nearly the full extent of the north-west ridge, that here forms the watershed. The long narrow glacier in front of it is an affluent of the West Rongbuk: beyond it lies the deep and sombre western cwm, whose glacier drains into Nepal. Mr. Mallory reached the glacier pass looking into this cwm (beyond the end of the north-west ridge in Plate 4) and took the photograph No. 6, which shows the glacier after its exit from the cwm flowing away south into Nepal. The photograph from the same point looking up the dark western cwm at sunrise is hardly strong enough for reproduction.

The watershed crosses the pass and rises to the beautiful Pumori (the Daughter peak), whence it evidently runs along the range shown in Plate 5. But its further course is at present quite uncertain. Major Morshead in his report to the Surveyor-General makes it run through Gyachung Kang. This is difficult to reconcile with the panorama No. 10 of the December *Journal* and with other photographs more directly looking up the West Rongbuk glacier, which seems to lie south of Gyachung Kang and Cho Uyo. The glacier is described as coming from a pass leading into Nepal, but this does not help to determine the question. On discussing the matter with Mr. Bullock, it was agreed that there is nothing at present to exclude the possibility that the head of the

West Rongbuk is not far from the Khombu pass, in which case Gyachung Kang and Cho Uyo would seem to lie altogether in Tibet.

To return eastward, the approach to the Chang La from the eastern head of the Rongbuk glacier (Plate 7) looks steep and difficult: there is every reason to prefer the East Rongbuk route, which has, according to Major Wheeler, an easy medial moraine, perhaps as far as the glacier junction shown in Plate 11. The ridge to the left of Changtse in Plate 10 is the same as that seen on the right of Changtse in No. 14. The three photographs, Nos. 10, 11, 14, show between them the whole extent of the glacier, and no clear evidence of any serious icefall. The glacier seems steepest in the centre of No. 10, not far from its snout. Just above the snout, to the north, is a fine rock peak (Plate 9) which is almost certainly the "light rock peak flecked with snow" shown in Dr. Kellas' now famous photograph from the Kang La (see *Geog. Journ.*, April 1921).

The panoramas Nos. 13 to 16 were the foundation of Map II. Chomo Lönzo, Makalu, the point to the right of the big cirque south-east of Mount Everest, the summit, Khartaphu (No. 13), and Khartichangri (No. 15) were all fixed many years ago from the south. A few trials verified the identifications, and the camera stations were resected. They are shown in red on the map. Pethangtse, Changtse, Lhotse, and the unnamed peak beyond the camp on the Lhakpa La (No. 14) were then fixed by intersection, and the rest followed. It would have been easier if the panoramas had included the whole 360° instead of falling generally a little short, and this will be rectified in the next season. It would not have been difficult to determine approximate heights from these panoramas if one were certain that the camera was carefully levelled; but time has not allowed any experiments in this direction.

Plates 12 and 20 were taken from nearly the same point, just above the 20,000-foot camp on the stony terrace above the left bank of the Kharta glacier. The first is a tele-photograph, with all the curious want of perspective that is inherent in such pictures. If it were not for the cloud that has happily filled the cirque one would scarcely realize that the knife-edges, with their magnificent snow fluting, are far in front of the mountain. They are actually the rims of the great cirque at the head of the Kama valley (EL and EM of Plate 12, December *Journal*). The peak away to the right in Plate 20 is not Changtse, but the sharp peak beyond the camp in No. 14.

Plate 21 shows in profile the north arête which is seen much foreshortened in No. 19—a combination of two photographs taken with a V.P. Kodak looking right up the northern face, with the north arête to the left. It joins the north-east arête just above the pinnacles of the north-east shoulder, at about 28,000 feet. The slope from the Chang La to this shoulder is a little more than 30° ; from the shoulder to the summit a good deal less until near the end, which is steep. The arête is broad, with room to circumvent obstacles. It happily avoids the nasty-looking

horizontal band of steep rock on the north face ; and one could hardly expect to find a better way. But the gales of September 1921, whose effect is seen in plate 20, absolutely forbade any further progress beyond the end of the footprints seen in No. 19 in the left-hand corner.

On the way home to Kharta Colonel Howard-Bury, Mr. Wollaston, and Major Wheeler made a *détour* through the Kama valley, descending by the snow pass north of Kartse : the peak climbed by Mr. Mallory on August 7. Plate 8 shows that he was fortunate in approaching this peak from the east. Colonel Howard-Bury crossed the horribly ugly Kangshung glacier early one morning and climbed to a point on the snowy ridge immediately to the right of Makalu in No. 13, from which he took the most instructive panorama No. 20 and other excellent pictures of the inside of the Makalu and Chomo Lünzo group. Comparison with No. 3 of the December *Journal* will show how unexpectedly thin is the mass that looks so imposing from below the Langma La.

The panorama No. 17, showing the whole extent of the upper Kama valley from the south, was taken lower down on the way back to the camp at Pethang Ringmo, from which Mr. Wollaston obtained two photographs of Chomo Lönzo that are technically the finest of all the pictures taken this year. Enlargements from these plates were shown at the Alpine Club Hall exhibition, and are in the photograph room of the Society : it is not possible to do justice to them in the small page of the *Journal*.

In choosing the photographs here reproduced we have kept close to Mount Everest : the many beautiful pictures taken further afield and on the way back down the Chumbi valley have been set aside for the moment, with one exception. It is necessary to close this series with a mountain 35 miles west of Mount Everest, much inferior in height, much superior in beauty : Gaurisankar. Many years ago two Germans mistook it for Mount Everest ; and though the error was soon detected, and the Survey of India took special pains to dispose of it, the name Gaurisankar appears as alternative to Mount Everest in one of the best and most recent atlases, and is still frequently used in certain countries of Europe. There have even been applications from persons abroad to join the Gaurisankar Expedition !

REVIEWS

EUROPE

Catalogue des Guides-Routiers et des Itinéraires Français, 1552-1850.— Sir

H. George Fordham. Paris : 1920. Pp. 47. *Maps*.

Ditto : *Illustrations Supplémentaires*.— Cambridge. 1921.

The Earliest French Itineraries, 1552 and 1591.— The Same. Oxford University Press. 1921. *Facsimiles*.

THE catalogue of Road-books and Itineraries of France is a valuable addition to the author's publications in carto-bibliography. The period covered commences with the work of Estienne, 1552, and closes with the change in

THE MOUNT EVEREST EXPEDITION

THE preparations for this year's expedition are now complete, and the nine members going from England have left for India. They are :

- Brig.-Gen. the Hon. C. G. Bruce, C.B., Chief of the Expedition.
- Lt.-Col. E. L. Strutt, C.B.E., D.S.O., Second-in-Command.
- Mr. G. L. Mallory, who led the climbing party in 1921.
- Mr. George Finch, of the Imperial College of Science.
- Major E. F. Norton, D.S.O., R.F.A.
- Mr. T. Howard Somervell, F.R.C.S., of University College Hospital.
- Dr. A. M. Wakefield, of Megantic, Quebec Province.
- Dr. T. G. Longstaff, Surgeon and Naturalist.
- Capt. J. B. L. Noel, M.G.C., Photographic Officer.

The party will be joined in India by Capt. Geoffrey Bruce, 5th Gurkhas, and by Captain C. J. Morris, 3rd Q.A.O. Gurkhas. The twelfth place was to have been filled by an artist ; but to the great disappointment of the Committee it was not possible to find one, among those whose methods seemed appropriate, that could undertake the journey.

Of the eleven members of the expedition named above six are soldiers : three of the Gurkhas, one of the Royal Scots, one Royal Field Artillery, and one Machine Gun Corps, formerly of the East Yorkshire Regiment.

Three members of the party are of Cambridge University : Mr. Mallory of Magdalene, Mr. Somervell of Caius, and Dr. Wakefield of Trinity. Two are of Oxford University : Colonel Strutt and Dr. Longstaff, both of Christ Church. Three are surgeons ; two are naturalists ; several are expert photographers ; one at least is a painter ; and all are distinguished mountaineers. It is, in fact, a very strong party, of which much is expected.

We hope to publish in a future number of the *Journal* an account of the climbing equipment, which includes an oxygen apparatus specially devised for the occasion.

The photographic outfit is very complete, including three cinematograph cameras, of which one is equipped with a battery of lenses up to 20 inches focal length ; two panoramic cameras, of which one rotates through the complete circle ; four cameras for glass plates, including one $7\frac{1}{2}$ by 5 inches, all fitted with telephoto lenses ; one stereoscopic camera ; and five Kodaks ; besides a variety of private cameras belonging to different members of the party. The dark-room equipment includes all that is required for developing cinematograph films in the field.

Herre Knudsen's work contains a biography, an account of Sørensen's hydrographic work, etc., and is illustrated with reproductions of some of his chief charts with the true outlines indicated for comparison, and two or three other contemporary charts.

W. A. T.

ASIA

The Angami Nagas, with some Notes on Neighbouring Tribes.— J. H. Hutton, C.I.E., M.A. (I.C.S.). London: Macmillan & Co. 1921. 40s. *net*.

This is a good specimen of the modern method of anthropological research by monograph, or the intensive study of a single community. In this case moreover, the subject appears to be one to which this mode of treatment is specially appropriate, in that the rugged hill tract occupied by the tribes-known collectively as Naga has had an unusually separative influence upon immigrant communities of undoubtedly identical origin. To this may be added the continuous intertribal warfare which subsisted up to the present generation, and necessitated the segregation of the inhabitants on the best fortifiable hilltops. Thus, while the seven main divisions of the Naga dwelling in the tract under British administration probably started from some common region far to the south, they now present a very marked diversity of physique, dress, customs, and language. On the other hand, there seems some reason to expect that under the influence of settled government, increased material prosperity, missionary enterprise, and closer intercourse with the Brahmanized population of the plains, much of the above diversity will in no long time be levelled into comparative uniformity. This, however, is a prospect which lends point to the plea urged by the author, in common with most administrators of similar tracts, for the speedy investigation and record of a social life the traditions and practices of which are fading into oblivion. Students of anthropology, therefore, and others interested in descriptions of the less developed communities on the fringe of British Dependencies, will be glad to learn that this monograph is to be followed by similar studies by the same author and his colleagues, dealing with other important branches of the Naga, such as the Sema and Lhota.*

Mr. Hutton disclaims the title of trained anthropologist, but his notes show that he has read widely and well on the subject, and knows what material to collect and how best to arrange it so as to help on the work of those who have not his own advantage of intimate personal acquaintance with the people he describes. Furthermore, the results of his experience are classified under well-chosen general heads, which are to be adopted in the forthcoming monographs mentioned above. In this way comparison with other communities is facilitated—an essential point, only ranking below accurate original inquiry. As to this last, the general tone of the book inspires confidence. The author is in complete sympathy with those about whom he writes, and they with him. Had it not been so, the remarkably intimate and interesting details he sets forth would not have been divulged to alien ears.

J. A. B.

AFRICA

Studies in North Africa.— Cyril Fletcher Grant. London: Simpkin. 1921. *Illustrations*. Pp. 256. 8s. 6d. *net*.

This is a new edition, revised, of the first part of a volume, 'Twixt Sand and Sea,' published in 1911 and reviewed in the *Journal* for August 1912 (vol. 40, p. 206). As was then said, Mr. Grant gives a most attractive account of the vary-

* Mr. Hutton's work on the Sema Nagas has since appeared.—Ed. *G. J.*

Note.—There can be little doubt that another eruption is imminent in the Kivu volcanic region, for both the great volcanoes of Namlagira and Ninagongo are showing unwonted activity. During my stay at Kissenyies the other white inhabitants as well as myself suffered inconvenience from headaches several days when the fumes drifted in our direction.

THE GLACIATION OF CHINESE TIBET

F. Kingdon Ward

IN a paper read before this Society I pointed out that there are records of extensive glaciation on the high ranges which enclose the Yangtze, Mekong, and Salween rivers, in the neighbourhood of lat. 28° N. (*Geog. Journ.*, September 1920, 63, 186). Further, that the retreat of these glaciers is more pronounced on the eastern than on the western ranges, close as these are to one another; on the former indeed they are generally extinct. There was thus reason to believe that deglaciation had proceeded gradually, and might still be proceeding, from east to west. Partly in the hope of throwing more light on this interesting question, I selected Muli, on the Litang river, and well to the east of the Yangtze, as a base for plant collecting in the summer and autumn of 1921.

The ranges in that neighbourhood are composed almost entirely of limestone, but occasionally of slate and other metamorphic rocks, which latter reappear in the river-bed. The strata dip east or west at high angles, the strike being nearly always due north and south, except in the gorges, where the rocks are crumpled; overthrusts also occur.

The main ranges, which clearly are folded, trend north and south, exactly as they do west of the Yangtze, and this apparently determines the course of the rivers, which flow from north to south. The tributary streams also tend to flow along the strike of the rocks, so that the rivers may be younger than the synclines along which they flow.

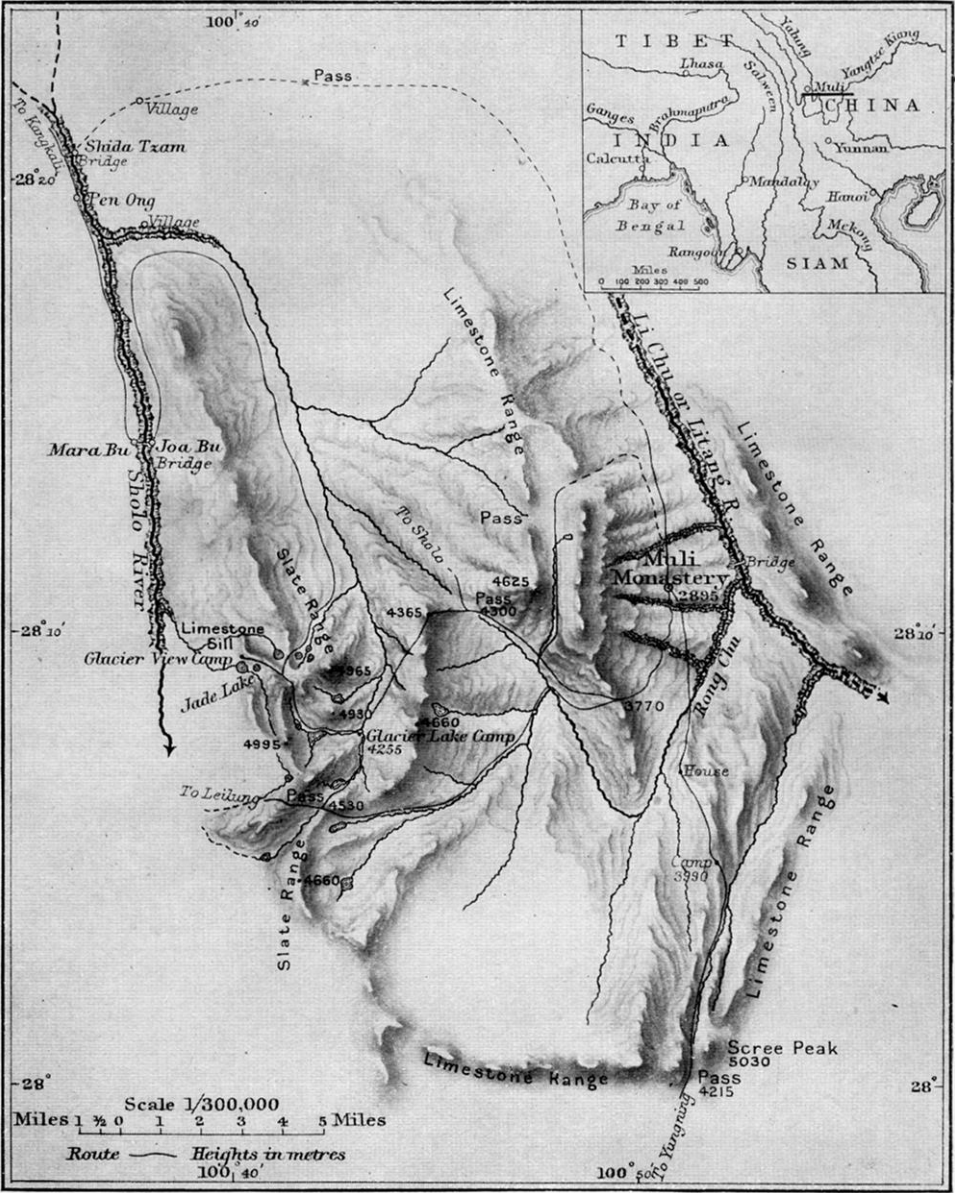
Approaching Muli from the south one crosses a high limestone range, an offshoot of the Litang river divide to the west. Though even here there is unmistakable evidence of former glaciation, so feebly does limestone retain the impression of ice that it becomes a difficult matter to trace its effects. In the first place, owing to the violent weathering this rock undergoes, no moraines are to be seen. Instead, at the foot of each tower are piled up huge screes, which must long ago have buried any moraines. In the second place, owing to the porous nature of limestone, the glacier lakes have long since been drained, though I came across silted-up basins exactly resembling the lakelets to be described presently. The valleys, however, are of typical ice-worn form, being U-shaped in section, with the spurs smoothed off and many of the rock surfaces rounded.

From the summit of this range, which rises to peaks of about 15,000 feet, I ascertained the direction of the nearest permanent snow. There were isolated snow peaks far to the north, and also in the south, where the vast bulk of a great snowy range was visible. This is not the Likiang snow peak, but a massif west of Yungning. Westwards at no great distance towered three snow pyramids, close together. Arrived at Muli, therefore, it was in this direction I now proceeded.

Muli itself lies far down in the valley between two mountain ranges, that to the west forming the watershed between the Litang and Sholo rivers; the latter flows direct to the Yangtze. To the east is the Yalung divide. Although I crossed the Litang river, and proceeded several days' journey over the mountains in the direction of the Yalung, finding always the same evidence of previous glaciation, in what follows I shall confine my remarks to the mountain range lying due west of Muli, for it was there that my chief observations were made.

Immediately west of the Sholo gorge, in about lat. 28° , rises the group of snowy peaks already referred to. The Sholo river itself divides into two streams a little to the north of Muli, one branch flowing from Kangkali, behind the snow peaks, the other from a plateau called Döpa, further north. The divide between the Sholo and the Litang river nowhere reaches the snow line, though one limestone peak near Muli attains over 16,000 feet; it is necessary to cross the profound gorge of the Sholo before permanent snow is found, on the divide between that river and some unknown stream to the west.

The first day's ascent of the range took us round the huge limestone cliff overlooking the monastery of Muli; and on the second day we crossed the divide by a pass 14,110 feet above the sea, and descended into a broad alpine valley. This valley trended from north to south before the stream turned west to join the Sholo river, a range of lofty crags, separated by deep ravines, forming the western boundary. The basin form of this valley, its level boggy floor, the absence of lateral spurs, and a number of smoothed rock hummocks which ended abruptly in scarps facing down valley, at once suggested the work of ice; a suspicion abundantly confirmed when, ascending the valley, we presently crossed a well-preserved medial moraine. This moraine, beginning at the foot of a high cliff where the valley forked, had been cut through by the stream below, but could be traced for a distance of about 2 miles; and on its flank I picked up ice-scratched stones. Caught up amongst the fragments of this moraine were several marshes occupying depressions now silted up. I next turned my attention to the western boundary range, three peaks of which rose about 16,000 feet above the sea. Behind this range—which it may be noted was not the main divide—lay the gorge of the Sholo river itself. Here the rock was slate and schist dipping west at angles which approached the vertical; but a belt of limestone carrying the highest peak of all cropped out west of the two



SKETCH-MAP OF THE MOUNTAINS WEST OF MULI, FROM SURVEYS BY MR. F. KINGDON WARD

nearer peaks. These metâomorphic sedimentaries were of the utmost value, because they retained the records engraved on them by ice as though they were scored but yesterday. Here were all the familiar signs. The whole region was pitted with deep lakelets, the water from which cascaded over cliffs. One valley contained five such basins one above the other.

The cliffs separating basin from basin might represent successive stages in the retreat of the ice. If the glacier foot were to remain stationary for a time, the issuing stream, charged with rock splinters, would soon grind down the valley level below, leaving a cliff protected by ice above. As the cliff grew, a basin would be dug out at its foot. Thus lakelet and cliff are formed together and are always associated. Such cliffs once formed tend to persist, the glacier stream merely cutting a groove for itself.

I may here digress for a moment to point out the significant part played by these lakelets; for apart from their direct effect on the scenery, they play an important rôle indirectly. In the first place they act as reservoirs, so controlling the water supply to the lower valleys that even during the heaviest rains, or the most rapid melting of the snow in spring, floods are unknown. In short, they help to promote a constant and steady flow of water.

In the second place they are filters which so effectually draw the sting from the water during the most active stage of its descent, that for a long time after issuing from the last lake its corrosive power is almost *nil*. The deep gorges which the tributary streams, after turning east or west, have cut through the divide, doubtless date from the time when, laden with sharp glacier grit, the water was able to saw straight down through the rock with rapidity and ease. They must have been formed before the lakes. All the tributary valleys, terraced as described, and thus generally "hanging" valleys, open into the main valley by bottle-necked mouths, forming with it an acute angle; but this is due rather to the tendency of the streams to follow the strike of the rocks than to ice action.

Under the watershed, however, these valleys widen out into circular basins, sometimes containing several lakelets. Such a "circus" at the valley head, surrounded by a sierra-like wall, is typical of ice action. It appears to be caused by equal erosion on all sides while the head of the valley is filled with snow and ice. Water-eroded valley heads are always V-shaped in section, due to greater erosion in the centre than on the flanks. Along the shores of the lakelets, and on the slopes separating one lake terrace from another, the rocks are planed and carefully rounded off at the summit though their down-valley faces may be scarped. Occasionally a perched boulder is seen, balanced on one of these smoothed inclines.

I have said that the record left by the ice on a limestone foundation is almost entirely effaced. A good example of this occurs on the west flank

of the slate range, where a big limestone sill crops out. In the schists above is a jade-green lake. Formerly the ice must have flowed over the limestone cliff, in which it has cut a deep notch; for the schists which appear again immediately below the cliff are ice-worn. But the stream from the lake above, instead of flowing down the groove already prepared for it, prefers to burrow beneath the sill, gushing from its foot. Had the jade lake itself been scooped out in the limestone probably no vestige of it would now remain. This limestone band, its strata standing on edge, runs for several miles in a north-and-south direction, occupying a syncline in the metamorphic rocks, and is one of the most remarkable features in the country. The slate range in fact is flanked by parallel limestone ranges.

How far the ice has retreated on this range cannot be determined off-hand; possibly in the lower reaches its record has been obliterated. But in the main valley described, the last fragment of moraine is about 4 miles from the valley head, measured in a straight line.

So much for the facts, interesting enough in themselves, of deglaciation in this locality. It is, however, when we came to inquire into the reasons of such retreat, and its possible bearing on recent changes in the topography of the country, that the main interest lies. Bound up with this again are many puzzling features in the distribution of the flora on which it may be possible to shed some light.

Scattered over the whole of Chinese Tibet, a region comprising the entire south-west corner of Szechwan between 27° and 30° north latitude and 99° and 102° east longitude, are a number of snow peaks more or less isolated from one another; and it would appear certain that at one period, not very remote, the whole of this region was glaciated. Baber, Johnston, and other travellers have remarked ancient moraines in various parts of western Szechwan.

As we travel westwards we find these isolated peaks gathered into definite ranges of snow-clad mountains, where deglaciation, though evident, is less pronounced; until after crossing the Mekong river, the glaciers show little more symptoms of retreat than could be accounted for by periodic fluctuation, common to all glaciers. This progressive diminution of glaciation from west to east suggests that deglaciation has crept westwards from the interior, whatever the ultimate cause may be. It is clear we cannot dissociate deglaciation west of the Yangtze from the same phenomenon east of that river; geographically the region is one.

Now there are three possible causes which might bring about deglaciation on a large scale: a general rise in the mean annual temperature, a change in the seasonal distribution of precipitation, and a general decrease in the amount of that precipitation.

The first possibility may be dismissed. It would require a considerable and long-sustained rise in temperature to abolish glaciers of the size indicated, and we have no evidence for any such climatic change. We

have reason to believe that deglaciation is still proceeding throughout this region; hence the cause which has operated in the past must still be in operation. A general rise in temperature, however, could hardly be confined to this comparatively insignificant corner of Asia; it could be brought about only by fundamental causes, and would affect a wide area. We must therefore seek some more local cause.

In considering the second we must bear in mind that the area over which deglaciation has taken place is, compared with the great bulk of Asia, very small. A change in the seasonal distribution of rainfall is not a factor which alters locally or rapidly. Long periods of time are required to bring about climatic changes, which likewise affect wide areas; and again, there is no evidence for such a change. On the contrary, there is every reason to suppose that the monsoon, which brings the summer rain to this part of China, prevailed before these changes took place.

We must therefore fall back on the third explanation—a general decrease in precipitation over this region. Here we have a cause which might operate locally. Moreover, to a certain extent this condition includes the second, for if the rainy season is curtailed, or begins later, the dry season is correspondingly prolonged.

Deglaciation might by this means be brought about rapidly, and judging from the state of preservation of the moraines they cannot be very old. This then appears to be the only reasonable explanation of deglaciation in far western Szechwan.

It receives some support from the distribution of floras in that part of Asia, for we find in the valleys a few plants of Indo-Malayan affinity; indeed some of the species are identical with those found in Burma. Such genera as *Hedychium* (1 sp.), *Strobilanthes* (3 spp.), *Chirita* (2 spp.), *Impatiens* (5 spp.), *Ficus* (1 sp.), *Begonia* (2 spp.), *Leptocodon* (1 sp.), *Ceratostigma* (1 sp.), etc., betray their origin. They are aliens. They must either be survivals of a previous flora which was in direct communication with the Indo-Malayan region to the west or south, or they must have arrived here by chance from that region.

With the possible exception of *Ficus* none of the plants mentioned above possess seeds provided with special means for transportation, and it is difficult to see how, under present circumstances, they could have arrived here from outside. Moreover, Indo-Malayan species whose seeds are better adapted to long journeys—for example, *Æschynanthus*—are lacking. All the plants mentioned belong to orders and genera whose representatives increase in numbers as we go westwards. Hence we conclude that these Indo-Malayan plants of Muli are remnants, not waifs; and that an originally more extensive Indo-Malayan element has dwindled to its present proportions. At present the summer temperature in the valleys is quite sufficient to maintain a monsoon flora such as is found on the north-east frontier of Burma; nor are the winters too cold. Only sufficient moisture is lacking. Were the rainfall greater, and more

equally distributed throughout the year, there can be no doubt that we should find a more pronounced Indo-Malayan element in the flora. No peak on the range with which we are dealing much exceeds 16,000 feet. Allowing 2000 feet of permanent snow to give rise to glaciers of the size indicated—no excessive estimate—the snow line must have lain at about 14,000 feet, and the alpine belt would then lie between 12,000 and 14,000 feet. This corresponds to the present alpine belt on the north-east frontier of Burma, where an Indo-Malayan flora flourishes in the valleys. It would require a much heavier rainfall and a more curtailed dry season than prevails to-day to support glaciers as low as 14,000 or 13,000 feet.

Turning to the alpine region we find, it is true, a flora very similar to that of the snowy ranges further west; indeed, many Himalayan alpinists such as *Myosotis Hookeri*, *Isopyrum grandiflorum*, *Diapensia himalaica* occur; perhaps 70 per cent. of the alpine flora is found at least as far west as the Mekong-Salween divide. This however need not surprise us. Conditions in the high alpine region towards the limit of plant life are very much the same everywhere. Given some former bridge connecting these ranges, many plants would tend to spread over the entire mountain system, and would be little affected by subsequent changes of climate.

On the other hand, it is in the high alpine belt on these several ranges that the majority of endemic species are found, a fact which is in accordance with the disappearance of permanent snow and ice over a large area.

Thus the fact of deglaciation, while being fully in harmony with the appearance of new alpine species, is not hostile to the survival of old. So long as the permanent summer mist bath in which many of these plants dwell prevails, there is no reason why they should vary or disappear though long isolated on their respective ranges. The presence of identical alpine species as far apart as Muli and Sikkim merely serves to emphasize the fact that these regions were formerly in direct communication; that such communication has subsequently broken down scarcely affects the plants in question. Moreover, many of these alpinists, living at 15,000 or 16,000 feet in western Szechwan, are found in the corresponding alpine belt at 13,000 feet on the north-east frontier of Burma. Mere altitude is of no great significance; it is altitude in relation to the snow line that counts.

There is another circumstance which suggests a gradual desiccation of the region as responsible for the disappearance of these glaciers. On the limestone cliffs of Muli are found a few plants which appear to be doomed to die out altogether in this region—species of *Primula*, *Campanula*, *Delphinium*, *Didissandra*, and perhaps also *Pinguicula*, *Rhododendron*, *Gentiana*, and a few others. They are found for the most part lurking in crevices and niches, forming a thin network of vegetation on a vast continent of naked rock. All are more or less rare, and set scarcely any seed. Though the autumn of 1920 was unusually wet, I found most of these plants shrivelling up in the bright November

sunshine. Scorched by day and frozen by night, life for them was brief. Their empty capsules, stunted and barren, told a tale of suffering and struggle, all in vain. Not one or two only, but the great majority set no seed. The inference is, that these plants are not at home under present conditions. Once upon a time no doubt they were common on these stark cliffs; now they are rare, and year by year are growing rarer. Finally they will disappear altogether. Incidentally, some light is thrown on the production of rare plants.

We have, then, good reason to believe that decreasing precipitation has brought about the changes noted in this region; and lastly, I must briefly refer to the problem of *how* this decreasing precipitation has come about. Here we are on much more controversial ground. There are, however, certain significant facts. East of the Yangtze we find these north and south ranges of uniform elevation persisting over great distances, till a solitary snow peak, far outstripping its neighbours in altitude, breaks the comparative uniformity. Here it may be remarked that the high peaks of Chinese Tibet appear to be composed, not of granite as in the Himalaya, but of limestone. These snow peaks, regarded by themselves, seem to lack any definite arrangement; they are as it were scattered fortuitously over the country, though were the entire region from the Yangtze to the Yalung glaciated as formerly, we would surely perceive some more regular arrangement than is now visible.

It would be premature to attempt an explanation of this phenomenon until the positions of all these snow peaks—there are scores of them—have been fixed on the map, and their alignment scrutinized. But I cannot refrain from suggesting that, though they at present dominate north and south axes, they may eventually prove to be but the surviving stumps of shattered ranges which trended in quite a different direction, serving as nuclei round which the newer uplifts oriented themselves. The change of front thus effected, by frustrating the west winds, may have brought about the deglaciation observed. That there has been such recent uplift is, I think, indicated by this progressive deglaciation and elevation of the snow line from west to east, which must be attributed to a gradual decrease of precipitation in the same direction; and we may suspect that the period of deglaciation throughout Chinese Tibet corresponds with the uplift of the high ranges on either side of the Yangtze, cutting off the moisture-bearing winds from the south-west. Whatever the age of these latter ranges may be, all the evidence goes to show that they are distinctly post-Himalayan.

It will be seen that the glacier-filled depression which we traversed on our journey has its main direction at right angles to the general direction of Novaya Zemlya in that latitude, and at right angles to the direction of the strata. We have here one of the many instances of the predominance on the north island of Novaya Zemlya of transverse and not longitudinal valleys. This condition is of course already indicated by the numerous and sometimes long fjords in the southern half of north island. In the northern half the relief of the solid rock is hidden by huge masses of inland ice. Therefore, in reality, the narrow Matochkin Strait, which cuts transversely through the land-mass, can (as has been pointed out by Chernyshev) not be regarded as the isolated cleft in the country which it appears to be when seen on the map of Novaya Zemlya, and which naturally gives rise to the thought that there exists there a fault fissure, a zone of dislocation, which is not the case. In reality there are a number of similar cuttings, only the others do not extend quite so deeply, or else they are covered by a glacial mass.

From a purely geographical point of view it may be of interest that the crossing from Mashigin to Zivolka fjord has been made, for hitherto the north island had only been crossed at two places. One of these was between Krestovii fjord and Rosmyslov fjord (which is the shortest possible passage across Novaya Zemlya); the other is far north, from Pankratyev peninsula (slightly north of 76°) and across the country towards the south-east. The crossing at the former place was made by the Russian Arctic explorer Russanov and the Italian Candiotti in the summer of 1908, and at the latter by the Russians Pavlov and Wiese in the winter of 1912-13, during the wintering of the Sedov Expedition at Pankratyev peninsula.

THE EXPLORATION OF THE UPPER YARKAND VALLEY IN 1914 BY THE DE FILIPPI EXPEDITION

Lieut.-Colonel H. Wood, R.E., Survey of India

IN the paper read before the Royal Geographical Society by Sir Filippo De Filippi, K.C.I.E., in June 1915 (*Geog. Journ.*, 46, pp. 85 *et seq.*), the general results of the work of this expedition were dealt with; this note is intended to amplify in some particulars the account of the survey and exploration of the Upper Yarkand valley by one of the parties of that expedition.

Previous to 1914, our knowledge of this neighbourhood was based on the sketches and reports of Johnson of the Survey of India in 1864-65, and of the explorer Hayward in 1868. But even so far back as 1876 Shaw had expressed doubts as to the accuracy of the mapping of this region, and Dr. Longstaff in 1910 had independently come to the same conclusions about it.

In July 1914 one of the survey parties of the De Filippi expedition proceeded to the Daulat-beg-öldi or Pulo stream, which leads from the Depsang plateau to the Karakoram pass, and crossing the col at its head, a little north-west of the pass, entered the valley to the north. About 12 miles further down the stream, which trended in a north-westerly direction, they reached a large amphitheatre or basin, into which several streams flowed. This amphitheatre is at the place where, on Atlas sheet No. 44A, the stream is shown making a sharp bend to the west, eventually to join the Shyok river. This valley runs N.E.—S.W., and the stream, instead of flowing from east to west, actually flows in the reverse direction.

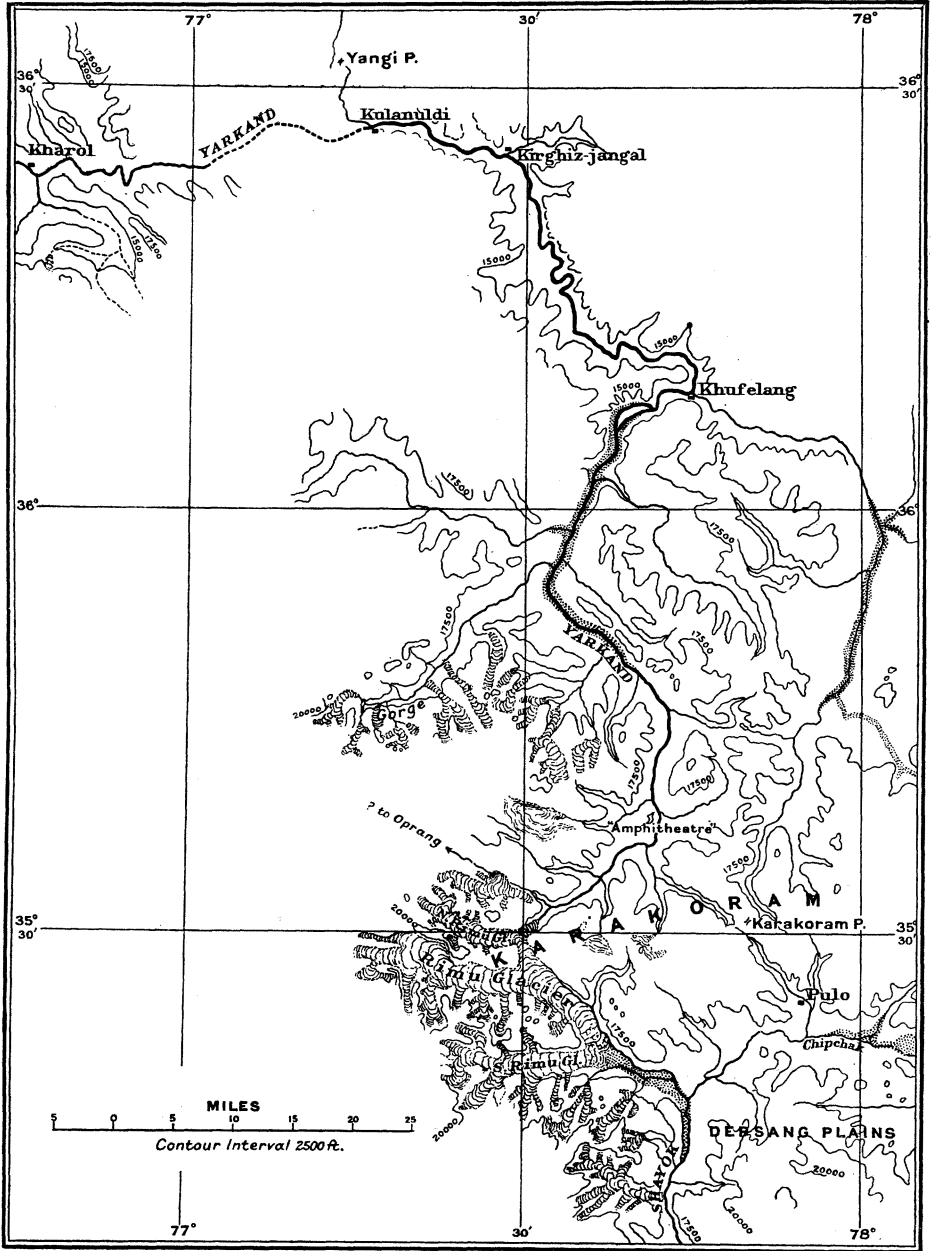
It was surveyed to its source. Investigation showed that this was the snout of a large glacier, an arm of the Remo, and led to the interesting discovery that the Shyok and Yarkand rivers have a joint origin in one glacier. About half a mile below the source of this stream a tributary joins from the west; this also rises from a glacier, resting, like its neighbour the Remo, on a pass and thrusting branches into opposite valleys. Its north-western snout is probably one, and possibly the most distant, of the sources of the Oprang river.

At the northern end of the amphitheatre before mentioned another tributary joins the Yarkand river from the west, presumably explored by Hayward, and considered by him the source of the river. He reached this place in December, when the whole country was deep in snow, and his description therefore is somewhat misleading in places. No glaciers extend into the basin, nor are there any on the adjoining slopes. His visit was very hasty, and it is certain that he could not have seen the large western valley at the south end of the amphitheatre, for he was a careful and accurate recorder of everything that he saw. Nor is the basin a lake, as he surmised, though a small tarn, entirely disconnected from the river system, actually exists in it.

Below the amphitheatre no large stream joins the river for about 30 miles, but here two tributaries, both carrying a considerable flow of water, effect a junction on the left bank within 3 miles of each other. It is the northern of these two streams which Hayward mentions in his narrative as being two marches from Khufelang, and leading to a pass across the Karakoram range to Nuba and Chorbut. Both were explored in September 1914, when the flow of water down them had decreased, and permitted an easier passage than was feasible in July, when their outlets were first reached.

The valley of the southern stream is open, contains a fair amount of grass, and has a general trend to the south-west. About 15 miles from its junction with the Yarkand river, two long but comparatively narrow glaciers, parallel to each other but about 3 miles apart, descend from the snow-covered range to the east which separates the valley from the river. Both reach the stream bed and block it, but the western slopes of the

valley being gentle, an easy passage exists past their snouts. Some 5



The Upper Yarkand Valley, from the Surveys of the De Filippi Expedition.

miles further on the stream issues from a narrow gorge, cut through the moraine of an old but now non-existent glacier ; beyond, the upper course

bends almost due west. It has a double source on the northern slopes of a snow-covered mass, apparently part of the range before mentioned. This mountain group lies about 15 miles to the north of the Karakoram and appears to be entirely disconnected from it. The glaciers giving rise to both sources of the stream, like many others in this region, project their snouts into two river systems. In this case the south-western outlets probably drain into the Oprang.

The valley of the northern stream is the exact antithesis of its southern neighbour. It flows throughout its entire length in a deep narrow gorge, the upper slopes of which are entirely bare of all vegetation. Its course is almost from due west, and its source is on the northern slopes of a snow-covered range, believed to be a continuation or part of the same snowy mass at the head of the southern stream. Exceptionally severe weather prevented the actual source of this stream being reached, but the range from which it rose was only a few miles from the point to which the survey was carried.

A route to Nubra was supposed to follow this stream, and during its exploration a sharp look-out was kept for relics of previous travellers. A few miles from its junction with the river we found the abandoned baggage of an Indian, containing some books and letters. From these it would appear that the traveller was returning from Mecca to Yarkand about 1904. Attempts to trace the owner, made by the British Consul-General's staff at Kashgar, were fruitless. This find certainly points to the correctness of the rumour mentioned by Hayward and other travellers; but the valley is exceptionally difficult to traverse, and the route, if such existed, can have been very seldom used.

Between these two streams and Kulanuldi, at the entrance to the valley leading to the Yangi-dawan, no stream of any size joins on the left bank, so most of the drainage from the hills on this side must flow towards the Oprang. The Yarkand river, from its source to Khufelang, flows in a wide and fairly open valley, with moderate slopes on either bank; between Khufelang and Kirghiz-jangal the hills begin to close in and the valley becomes more confined, these features being more accentuated between the latter place and Kulanuldi. Still lower down and below Kharol, opposite the entrance to the valley leading to the Aghil pass, gorges are very frequent and the enclosing walls precipitous.

From south of the Depsang plateau to Kirghiz-jangal in the north the only formations are limestone, in which fossils are numerous, and sandstone. Granite rocks were found in the river-bed north of Kirghiz-jangal, but the crest of the K'un-lun at the Yangi-dawan is limestone. Granite boulders were also noticed, embedded in a fine clay, in the tongue of land between the junctions of the two large streams, which were explored in September; this tongue appeared to be the remains of an ancient and large glacial moraine.

The Oprang valley was not explored, but its source is probably some

30 or 40 miles further east than Sir Francis Younghusband suspected, when he travelled in these regions in 1889.

A detailed account of all the work of the expedition will be published in Italy in due course, with an abridged English edition; a narrative report of the explorations of the Survey of India detachment, which formed part of the expedition, will also be published in the Annual Report of the Survey of India for 1921-22 (Record volume).

Note: The topographical results of the work which Colonel Wood thus briefly describes have been shown on a special sheet (scale 1/500,000) prepared by the Survey of India, which is however rather difficult to follow in detail, since the drawing is not quite up to standard: it was done during the war, with little or no supervision. The same results have been incorporated in sheets 51 and 52 of the 1/M series of India and Adjacent Countries, published in 1916 and 1917: but here the draughtsman has made the grave fault of representing as lakes what are really broad gravel beds of rivers, nearly dry, and has failed to realize the size and importance of the Yarkand. These sheets require revision.

A much more elaborate representation of the same material has been drawn at the Istituto Geografico Militare on the scale 1/250,000 for inclusion in Cav. De Filippi's volumes of scientific results. This sheet is in well-executed hachures, and the glaciers are carefully sketched: but there are no contours.

The sketch-map to illustrate this note by Colonel Ward has been made by reduction of detail from the Italian map, with a few contours reduced and adjusted from the Survey of India sheet.

Cav. De Filippi very kindly offered to arrange for printing an edition of his map for the *Journal* from the plates at Florence: but the need for strict economy has limited us to the simple sketch-map, which will however serve—perhaps as well as the more elaborate—to illustrate the most striking of his important geographical results. The names on the Italian map look strange, because the cartographers (against the inclination of their chief) insist on spelling Indian frontier names phonetically in Italian. The British long ago resolved to adopt the system of "vowels as in Italian." May we hope that some day the Italians will return the compliment with "consonants as in English"? We cannot admire the spelling Sciaiok, which is not even phonetically correct if Dr. De Filippi is right in preferring Shayok to the Survey of India's Shyok, that ought to be pronounced as one syllable. (But is the real name Sha-yok or Shai-ok?) In two names, Shayok and Rimu, for Shyok and Remo, we have in the sketch-map ventured to disagree with the Survey of India and to agree with Dr. De Filippi.

THE MOUNT EVEREST EXPEDITION

ON the recommendation of Colonel Howard-Bury it was decided by the Mount Everest Committee last October that this year's expedition should leave Darjeeling by the end of March, expecting the grand assault on the mountain at the end of May or in the first half of June. In accordance with this plan General Bruce took the road with the first detachment of the main party on March 26, and a telegram from

Phari dated April 6 announced the arrival of the expedition on the plateau of Tibet in excellent health, after a pleasant and easy journey up the Chumbi valley, with little trouble from snow on the passes, though it was so early in the season.

The party had been strengthened by the inclusion of Major Morshead (who goes this year as a climber) and of Mr. Crawford, I.C.S., who was happily able at the last minute to get leave from the Government of Assam. No Survey of India party is to go this year, and Dr. Heron of the Geological Survey has not been allowed by the political authorities to continue his geological work. There was some little difficulty last year about the disturbance of the dragons that live under the sacred mountains, and every one is anxious that this year there shall be no cause whatever for complaint, however fantastic.

The transport of this year's expedition has required a more elaborate organization, for it is estimated that there are at least 500 mule-loads to be carried to the base camp, besides a great deal of apparatus too delicate for mule-back, that must be taken all the way by special coolies. But the expedition has been most fortunate in its agents: Mr. Weatherall at Darjeeling and Mr. Brown of the Army and Navy Stores at Calcutta. Without their excellent arrangements in advance it would have been impossible, says General Bruce, to get the stores and equipment ready for a punctual start. Railhead has been established at Kalimpong Road, where Captain Morris as transport officer has dealt with all the supplies coming up from Calcutta. By March 24, two days before General Bruce left Darjeeling, 250 loads were already at Phari, the end of the first stage, where the route diverges from the high-road to Lhasa, and transport by contract with the regular mule caravans comes to an end. At this point Captain Morris will organize a supply train *viâ* Kampa Dzong to the Rongbuk valley.

It must, we think, be untrue that Captain Noel was arriving at Darjeeling with a box 40 feet long, and that General Bruce was "scouring the country for an adequate mule." But the photographic equipment of this expedition, and still more the oxygen gear, will require much transport—out of all proportion to that required last year for the scientific equipment. An unofficial estimate puts the cost of carrying the oxygen outfit from Calcutta to the Chang La at £600; and expenditure on this scale differentiates the present attempt from what was done last year and from what may be counted in the future as legitimate mountaineering.

The party was equipped this year with oxygen at the strong desire of a section of the climbers who had convinced themselves, or had been convinced, that they would never reach the summit without it. The Committee, feeling bound to supply whatever in reason might be demanded, cheerfully faced the large expenditure required, and gave the oxygen sub-committee—Captain Farrar, Mr. Finch, Mr. Somervell, and

Mr. Unna—a pretty free hand. With the enthusiastic help of Prof. Dreyer of Oxford, Major C. J. Stewart and Mr. Eagar of the Air Ministry, and Messrs. R. H. Davis and C. Rosling of Siebe Gorman & Co., who made the gear, the sub-committee in about five weeks produced the remarkable outfit which was loaded on the P. and O. special that left Victoria on March 2. It is described at length by Mr. Unna in a very interesting paper that will be published in the *Alpine Journal*. By the courtesy of Captain Farrar an advance proof has been sent us, with permission to use the whole in the *Geographical Journal* if we so desired.

There are, however, several sides to the question; and it may, we think, be said that though the Mount Everest Committee were all willing and anxious that full use should be made of oxygen if it proved to be essential to success, they were not as a whole convinced that it is in all ways a desirable adjunct to mountaineering, and especially they were not prepared to admit that it is essential to any advance beyond the Chang La. The Duke of the Abruzzi reached 24,600 feet without it; Dr. Longstaff 24,000: while Dr. Kellas and Major Morshead on Kamet in 1920 found themselves at 23,500 feet so fit that they were convinced they could have gone much higher if their party had been strong enough to bring up the camp. The Mount Everest Expedition of 1922 is by far the strongest and best-equipped party that has ever been in the Himalaya. The experience of last year seems to show that this year there should be no very great difficulty in establishing a well-found camp on the Chang La at 23,000 feet; and it is absurd to suppose, in the face of past experience, that a strong climbing party, starting fresh and fit from this camp, cannot go 2000 or 3000 feet higher. Whether they could go to the top is quite another matter.

In the pressure chamber at Oxford two of the climbing party were "taken to 23,000 feet" and exercised in stepping on and off a chair with a 30-lb. load. One succeeded without apparent difficulty: the other was stopped by the observers after his fifth step because he seemed uncertain, and oxygen was forcibly administered, "though he vigorously denied that he felt any ill effects, thus exhibiting the symptoms previously described": mental confusion and a tendency to quarrel, with a disposition, after he has been brought round, to deny that anything abnormal has taken place!

Opinions on the value of such experiments will always differ: the want of acclimatization, the depressing effect of being shut in, the presence of medical observers (themselves breathing oxygen) ready to interfere at any moment, the absence of any direct objective, and the self-consciousness of the victim under observation, must have a disturbing effect difficult to assess. In the pressure chamber the subject is liable to become unconscious suddenly, without any warning symptoms he can detect, and the belief that this might happen to one or more of a climbing party is the principal argument for oxygen equipment. One may say in

reply that sudden unconsciousness never has afflicted a climber at the most extreme heights yet attained in the open air, and that the symptoms may belong to the peculiar conditions of the pressure chamber.

Prof. Dreyer insists that when the supply of oxygen has been started, it must never be interrupted, and this has ruled the construction of the gear, which has four cylinders, charged with 240 litres of oxygen each, carried in a frame on the back, from which a steel arm passes over the left shoulder, carrying two copper supply tubes to a base plate fitted with regulating valves, pressure gauges, and flow meter. From this point a flexible pipe is led to the mask, of which there are two distinct patterns. A full and very interesting account of the technical details is given by Mr. Unna in his paper for the *Alpine Journal*.

The apparatus complete with four full bottles of oxygen weighs 32 lbs., and it is estimated that each bottle will serve for 100 to 120 minutes' climbing: or we should say, exercise, for Prof. Dreyer stipulates for as generous a supply of oxygen (2.0 to 2.4 litres per minute) in descending as in ascending, and 1 litre per minute while at rest, even while asleep. The oxygen sub-committee consider that compliance with these requirements makes the establishment of a camp above the Chang La practically impossible, but that it may be possible to reach the last 6000 feet of the mountain in one day, if dumps of oxygen can be laid out ahead by other parties themselves consuming oxygen.

A beautiful diagram in Mr. Unna's paper shows the solution of the "four-bottle problem," due to Mr. Couper, and the following paragraphs give a clear account of the programme for an ascent in four stages, each stage requiring one bottle on the ascent and half a bottle on the descent:

"One man starts with four bottles, climbs one stage using one bottle in the process, dumps two bottles, and returns using the fourth, having some oxygen still left in the bottle when he finishes.

"One man starts with four bottles, ascends one stage using one bottle in the process, throws that bottle away at the top of the first stage, picks up one bottle from the dump; climbs another stage using one bottle in the process, dumps two bottles at the top of the second stage, and descends using the fourth bottle.

"One man with four bottles uses one bottle at the first stage, throws it away at the top of that stage and picks up the remaining bottle from the dump; climbs the second stage using another bottle, throws it away at the top of the second stage, and picks up one of the bottles dumped there; climbs the third stage and throws away the bottle he has used in doing so; uses one bottle in getting from the top of the fourth stage to the summit and descending again to the top of that stage: uses his last bottle in descending stages four and three, picks up a bottle from the dump, and uses that for the remainder of the descent."

In short, a man starting with four bottles can get up and down with something to spare if he can find one bottle a quarter of the way up,

and two more halfway up. If three men are to go to the top, the whole programme is multiplied by three.

The scheme thus neatly laid out on paper will be subject to the accidents of experience, and it is easy to speculate how differently it is likely to work out. In particular, not every one will accept Prof. Dreyer's dictum that oxygen should be taken at all times above 23,000 feet. There seems to be no real reason why the first dump of oxygen cylinders should not be made at about 24,500 feet by trips from the camp at the Chang La without using any oxygen at all; nor why the second dump should not be made by climbers using the auxiliary of Prof. Leonard Hill's bags supplied with oxygen from cakes of sodium peroxide (oxylith) acted on by water, and used as a restorative at halts. If this can be done, it may equally be possible to make the high camp at 25,000 or 26,000 feet that was discussed as an essential before ever the oxygen outfit was seriously considered.

In any case, we anticipate that no cut-and-dried scheme based on experiments in the laboratory is likely to survive the criticism of knowledge gained in the field, and that the programme carried out on Mount Everest in June will not closely resemble the mechanical performance outlined above. It is more than likely that some of the climbers will find it impossible to tolerate the restraint of all this apparatus, and will develop new and interesting varieties of the "claustrophobia" that afflicts men shut up in the pressure chamber or the diving dress. And this would be a good thing, because it seems to us quite as important to discover how high a man can climb without oxygen as to get to a specified point, even the highest summit of the world, in conditions so artificial that they can never become "legitimate" mountaineering. Therefore we shall all look forward with the keenest interest to the cablegrams of the next few weeks, feeling sure that the varied talent under the command of General Bruce will give us something of real value for future mountaineering, whether climbing with the use of oxygen, or without any such artificial aid.

REVIEWS

EUROPE

Géologie de la France.— L. de Launay. Paris: Armand Colin. 1921.

Pp. xi., 501. 64 *Photographs* and 43 *Text-figures*; 8 *Coloured Maps*. 40 fr.

PROF. de Launay has planned this work on bold and novel lines, which should be particularly appreciated by geographers, for whom and the general reader, rather than for the professional geologist, it may be considered to be written. He deals essentially with geological history and tectonics, and expects his readers to take the age of geological formations as settled, without asking for evidence. This enables him to dispense almost completely with any reference to fossils, an omission for which many readers will doubtless be grateful. He recognizes sixty divisions of geological time and numbers them consecutively, and as he never mentions any one of them without adding its

Mémoire sur les Dunes de Gascogne.— Edouard Harlé et Jacques Harlé.
Paris: Imprimerie National. 1920. Pp. 145, 10 *Photographic Plates*,
51 *Text-figures*.

This interesting monograph deals very fully with the sand-dunes of the Landes. They fall into two categories: *continental* (i.e. inland) and *maritime*, the latter being again divided into *ancient* and *modern*. The inland dunes are scattered hills, lying principally to the south of a line from Arcachon to Casteljaloux. They are considered to date from the Quaternary Steppe period, and were fixed in prehistoric times by dense vegetation, which produced a ferruginous sub-surface layer known as *allios*. Later climatic changes led to incipient destruction by the wind, with formation of hollows called *caoudeyres* (caldrons) and the production of a parabolic form. During the last sixty years they have been planted with pine trees. The ancient maritime dunes have been covered with vegetation since time immemorial; they are so closely crowded that groups of parabolic dunes are combined into a rake-like form (*en rateau*). The modern maritime dunes, on the other hand, were bare until Brémontier and his successors planted them with pines from 1787 onwards; an accepted view that their bareness resulted from fires during the barbarian invasions is controverted. There are discussions of the mechanics of dune-formation, and many other matters of interest in this valuable memoir.

A. M. D.

ASIA

Serindia: Detailed Report of Explorations in Central Asia and Westernmost China. Carried out and described under the orders of H.M. Indian Government by Aurel Stein. 5 volumes. Vols. 1 to 3, text (pp. 1580); vol. 4, 175 Plates; vol. 5, 94 Maps. Oxford: Clarendon Press. 1921. Size 13½ × 10. Price £12 12s. net.

It is impossible to do more in a short notice than to indicate briefly some of the main features of the monumental work by Sir Aurel Stein which has been issued by the Clarendon Press, Oxford, under the title 'Serindia.' Serindia (a designation which appears to be of French origin) is the regional name adopted for that much of Asia which lies between the Pamirs and the Pacific watershed, and it includes most of the scenes of Sir Aurel's unwearied researches during his three journeys extending over intermittent periods between 1900 and 1915. It is the results of these three journeys undertaken in geographical, archaeological, and historical interests which are now given to the world in due scientific form, and which, supported by the collaboration of many of the leading scientists of the day, form a brilliant and lasting record of achievement.

Commencing with an exhaustive study of the routes between Buddhist Asia centering in Kashgar and the ancient Gandhara (Swat) which were followed by Chinese pilgrims as they journeyed India-wards in search of "the law," the author identifies each step from Turkestan to northern India with such convincing evidence as to leave nothing to be desired except that either he or some other equally gifted explorer should hereafter investigate those other pilgrim routes which touch Balkh, Haibak, Bamian, and Kabul, and which are at present barred to the explorer by Afghan prejudice. But the chief interest of this great work does not lie amidst the spurs of the Hindu Kush or even in the marvellous recovery of Buddhist records innumerable from the long-buried shrines and temples of the Takla Makan, deeply interesting as these undoubtedly are, but in the researches farther east. We may note, however, that as regards this region of Chinese Turkestan Sir Aurel does not fully agree

with Prof. Huntington in his views that desiccation has been the cause of the desertion and ruin of the once populous Buddhist centres of the Tarim basin. There have been many causes, political as well as climatic, and amongst them desiccation is not always in evidence. The crowning glory of Sir Aurel's discoveries lies in that long geographical "corridor" which passes north of the Nan Shan mountains, linking Kansu with the ancient sites of Lop Nor and Lou Lan. This outlet for China westwards has always embraced the great trade routes of Asia, and it is here (as might have been expected) that the greatest discoveries were made. The extension of the great wall of China westwards to the borders of Turkestan, and the valuable evidence collected of its extreme antiquity (which was chiefly unearthed from the filthy débris of ancient military occupation) has thrown quite a new light on certain dark pages of Asiatic history about the period when Christ was teaching in Galilee and for some centuries later. Situated centrally in this comparatively narrow geographical avenue between mountains and deserts is the Chinese town hitherto known in our maps as Sha-chau (but hereafter as Tun Huang), and it is near this place that the extraordinary wealth of literature in many languages, pictures on paper, silk, or linen, representing Buddhist divinities and scenes of Buddhist mythology were unearthed (or, rather, unwall'd) from the caves of the thousand Buddhas. Persian (Sassanian) and Chinese art seem to have met at this halfway museum. Vol. 4 of *Serindia* is full of most excellent coloured reproductions of these works of art, not one of which is without its own instructive story. This volume of illustrations is beyond all praise.

The geographical results of these remarkable journeys have already been given to the Society and embodied in maps; the artistic results will offer as great opportunity for years of careful study, as will the historical records and mass of ancient literature. Sir Aurel Stein makes no claim to be an original discoverer. The existence of the caves of the thousand Buddhas was well known before his time; but it is entirely due to his personality, his unwearied activity, his patient insistence, and, above all, to his admirable tact that the rewards of discovery have fallen to him. Were I to search for the key of his extraordinary success I think I should find it embedded in the principle of sympathetic co-operation. To the stiff-necked curator of the Buddhist archives he was the earnest disciple of the great Chinese pilgrim and saint Hsuang Tsang, as careful for the sanctity of the Buddhist records as the curator himself. To his native surveyors (to whom he accords unstinted praise) and to all his native assistants and subordinates, he is not merely the director of works but one who is ever prepared to work with them—or even for them if necessary. To all who helped him he is most careful to record his gratitude. As for those distinguished names which appear outside the covers of his great work, the very list itself breathes the spirit of loyal and hearty scientific co-operation. Such methods are bound to succeed.

T. H. H.

The Civilian's South India : Some Places and People in Madras.— "Civilian."

London : John Lane. 1921. 12s. 6d. net.

Thinking that "it was high time people at home realized that there are other parts of India besides the Panjab," the author here gives some experiences of life in parts of the Madras Presidency, not by way of description, but merely showing how things there appear to him personally. It is the seamy side, apparently, of those things which he considers will best appeal to the people he addresses, and material of this sort, especially when expressed in a style monotonously and elaborately artificial, is too thin for a volume of

badly lame, and that if we stayed where we were discovery would be certain. The only course left us was to "cast" part of the loads and to trust to luck. We left behind all we could dispense with, redistributed the loads, and stumbled on into the night. The rest was a nightmare of confusion, of tumble and scramble, of bruised feet, and of falling about for want of sleep, until we got down into the Wadi Araba just as the moon rose behind us over the hills which we had been clambering down for the last five hours." After getting across the Araba depression (here 12 miles wide) they experienced the same difficulty in the hills opposite; the guide came to the end of his knowledge and was sent back. But eventually they struck a well-marked track which was supposed to be the Ma'an-Kuntilla route; then they camped after "completing over twenty hours on end, with only two halts." The next morning "a search with the glasses revealed three white objects like buildings to the north; we bore down on them, and found them to be the police post of Kuntilla."

Shakespear passed on to Suez, Port Said, and Europe a contented man, having achieved his ambition, and having added his jot (no small one) to the sum-total of human knowledge.

GEOLOGICAL RESULTS OF THE MOUNT EVEREST EXPEDITION, 1921

A. M. Heron, D.Sc., F.G.S., Geological Survey of India

*Read at the Afternoon Meeting of the Society, 10 April 1922. Map
follows p. 480.*

THE area geologically examined consists of over 8000 square miles, included within a rectangle some 120 miles from east to west and 70 miles from north to south. This corresponds with the Tibetan portion of the drainage area of the Arun river, a complicated system of valleys which unite to form the Arun before it breaks through the main Himalayan range in the impressive gorge below Kharta. The headwaters of the Rongshar Chu and the Bhutia Kosi (Pö Chu) above Nyenyam were also examined.

The southern watershed is the line of great snowy peaks running from the Khombu pass south-eastwards through Everest and Makalu to the Arun, and to the east of the Arun is the continuation of the range which divides Sikkim from Tibet; a range which lies considerably to the north of the great Kangchenjunga group of peaks.

The northern watershed is the extension of what has been termed the Ladak or northern range of the Central Himalaya; there this is hardly a definite range but rather a broad belt of high and much-dissected country, with a few peaks of over 20,000 feet distributed without linear arrange-

ment. To the north of this watershed short tributaries drain to the Brahmaputra (Tsangpo).

I am greatly indebted to the promoters of the Expedition for the privilege of accompanying it, and in particular to Colonel C. K. Howard-Bury, D.S.O., the leader, for much assistance and practical interest in my work, which is virtually a continuation, to the westward, of Sir Henry Hayden's pioneer investigations during the Tibet Expedition of 1903-4. With the exception of Sir Henry Hayden no geologist had visited this part of Tibet.

The geological mapping was done on a scale of $\frac{1}{4}$ inch to 1 mile, on skeleton maps furnished by the topographical surveyors as their plan-tabling proceeded. My very cordial thanks are due to Major H. T. Morshead, R.E., D.S.O., in charge of the Survey of India detachment, for many such facilities given and for valuable information, accompanied by specimens, from localities which I could not visit. Over a considerable portion of the area, however, my work had to proceed in advance of the surveys; geological boundaries in such cases were drawn on the maps subsequently from memory, supplemented by sketch-maps and notes. It was not considered advisable to arouse the suspicions of the Tibetans by too close and prolonged examination of any particular area, and the general conditions of the Expedition's movements were unfavourable to detailed work, so I endeavoured to traverse as large an area of Tibet as possible, and to lay down on the map with fair accuracy the boundaries of the different formations where they were accessible. A considerable amount of interpolation was however, necessary, and my work must be considered as a reconnaissance and nothing more.

If I have the good fortune to accompany the second expedition I hope to examine more carefully the crystalline area in the neighbourhood of Mount Everest, with the assistance of Major Wheeler's map, constructed from photographic surveys on a scale of 1 inch to 1 mile, and to cast some light on such problems as the origin and constitution of the banded biotite gneiss and its relationships with the metamorphosed sedimentaries. The quarter-inch map was on too small a scale to be of use in the mapping of a crystalline complex.

Geologically the area is divided into two divisions: Tibetan and sedimentary to the north, and Himalayan and crystalline to the south. This distinction is clearly displayed in the topography resulting from the underlying geological structure, for to the north we have the somewhat tame rounded and lumpy mountain ranges of Tibet, with their broad and flat-bottomed valleys, contrasting with the higher, steeper, and more rugged Himalayas on the south.

The Expedition found nothing of economic interest. Stones showing the green staining of copper compounds were now and again seen on moraines, but beyond that I saw no signs of mineralization. A few clear fragments of pink tourmaline and garnet were picked up by the coolies,

but none were sufficiently free from flaws to be worth cutting. I panned the gravels in several places for gold, but without getting a colour.

The River Systems.

The two main branches of the Arun river, the Bhong Chu (or Men Chu, as it is called in its upper portion) and the Yaru Chu (Ko Chu) flow from the west and the east respectively, in a general east-and-west direction, uniting near the village of Lashar and then flowing south-westwards and southwards through the main Himalayan range. The Yaru Chu rises in the hills to the north of Kampa Dzong and meanders through the broad plain which here lies at the northern foot of the snowy range, until at Sar it meets a high spur of crystalline rocks projecting northwards. This deflects it in a great sweep to the north-east and it finally cuts through the toe of this spur in the Rongme gorge instead of flowing round its end.

The Men Chu rises on the northern slopes of Gosainthan, above the Pekhü Tang, a great plain which contains a basin of enclosed drainage, the Pekhü Tso. On leaving the plain it finds its way along a valley excavated in a syncline of Cretaceous limestones, leaves that and cuts across the intervening Jurassic shales in a fine gorge to another parallel limestone syncline, and after some 16 miles along it is deflected back again to the original syncline by a north-south barrier of pegmatite veins and hard slates. Along this it then flows as the Bhong Chu for between 50 and 60 miles to near its junction with the Yaru. Two of its more important northern tributaries, the Shi Chu and the Lo Chu, also have their courses largely determined by the presence of softer bands of Cretaceous limestones. Parallel to the Bhong Chu and joining the Arun 20 miles below the confluence at Lashar is the Dzakar Chu, which, with its tributaries the Ding Chu and the Neo Chu, drains the mountainous district of Pharuk. In these also the synclinal origin of the valleys is distinct. The main drainage lines are therefore parallel to and dependent on the folding to which the region has been subjected; the general strike of the folds is W.N.W.—E.S.E.

At approximately right angles to the longitudinal drainage system are a number of transverse tributaries. Those from the northern slopes of the Great Himalaya are turbulent glacial torrents, with straighter courses and greater discharge than those from the Ladak range. Of the latter the more important occupy valleys intervening between tracts of high land which owe their prominence to their being composed of hardened and partly metamorphosed shales with clusters of intrusive granite veins. Except for glacial tarns held up by moraine dams, the Arun region is devoid of lakes; at either end, however, are basins of enclosed drainage, that of the Tsometretung to the east, and to the west that containing the Pekhü Tso, the Kharru Ochen Tso, and the Khumen Tso. All these are very shallow and vary greatly in extent according to the season of the year. In the broader valleys are extensive swamps



ENTRANCE TO THE YÖ RI GORGE OF THE ARUN RIVER

Phot. A. F. R. Wollaston.



EXIT OF THE ARUN FROM THE YÔ RI GORGE

and tracts temporarily flooded during the rains, and the so-called lakes are in fact little more.

Changes in drainage lines.

There is little doubt that the Arun has cut back through the Great Himalaya range and has captured a river which possibly flowed east from the vicinity of Gosainthan more or less along the present courses of the Men Chu and the Bhong Chu and then through the Jikkyop gap and over the plain to the south of Kampa Dzong; this river may even, as Hayden (*Mem. Geol. Surv. Ind.*, 36, pt. 2, p. 8) suggests, have flowed northward to join the Tsangpo, perhaps on the line of the Nyang Chu, the river which passes Gyantse and Shigatse. The Dzakar Chu, now also captured by the Arun, probably joined the above conjectural river flowing north-eastwards on a course approximately from the Küyok La, above Lungme, along the present valley of the Arun between Kharkhung and Lashar.

The Arun has two gorges. The lower, in which the river falls 3000 feet in the 18 miles, measured in a straight line, between Kharta and Kyimateng, is fairly straight, with walls rising 5000 feet and more in uninterrupted slopes so steep as to prevent human passage but allowing bushes and trees precarious roothold. The upper gorge is an extraordinary one, and so far I am unable to give an explanation of its origin. Where it enters the gorge the river is flowing through a fairly open valley with immense terraces of boulders and gravel, in the direction of the Küyok La, a low pass over comparatively soft schists. Abruptly the river turns upon itself and then plunges at a right angle into the heart of a high mountain (Yö Ri) of hard gneiss, in a gloomy cañon with almost vertical walls. Through this gorge the river flows south for 3 miles, then swings again and flows west for 4 miles, finally emerging from the gorge on the other side of the Küyok La, into an open valley, which has exactly the same line and character as the original valley. Thus it cuts along two sides of a triangle in hard gneiss, in preference to along the hypotenuse in soft schists. The Rongme gorge on the Yaru Chu is somewhat similar, as the stream now cuts through the end of a northward-trending spur of gneiss and adjacent hard phyllites. It seems probable from the configuration of the country that the Yaru once flowed through the Jikkyop gap 4 miles to the north, the present course of the Chiblung Chu, and has been captured by a tributary from the east.

I was able this year to devote only an occasional day or two to the vicinity of glaciers, but it is hoped that next year, with the advantage of a large-scale map on which glaciers will be shown with particular accuracy, I may be able to carry on glacial observations concurrently with the investigation of the crystalline area, to which

they are confined. I am able to add my testimony to that of Hooker, Blanford, Hayden, Garwood, and others, as to the former much greater extension of glaciation. The present glaciers are but puny representatives of their former selves, as shown by the huge moraines which encumber all the northern valleys. Two at least of the main glaciers of Makalu, flowing to the Kama valley, show evidences of recent advance.

The Himalayan Zone.

The Himalayan and crystalline zone is essentially composed of a foliated and banded biotite gneiss, usually garnetiferous, intimately injected with dykes and sills of all sizes of a schorl-muscovite granite or pegmatite. The latter is often present to such an extent that it is the predominant rock. Forming an intermediate zone between the gneiss and the Tibetan sedimentaries is a band of metamorphic rocks, altered representatives of the latter: these are also penetrated by the schorl-granite in great profusion. They appear to lie upon the gneiss, which is probably intrusive in them; but this point is one which I hope to settle definitely if I accompany the second expedition. Other questions which arise are, to what extent the gneiss represents very highly metamorphosed sedimentaries, and to what extent it is an injection gneiss formed by the intrusion and rolling out of granite veins along the foliation of mica-schists.

Although much the same in mineral constituents, the biotite gneiss varies so greatly in proportion, in structure, and in texture that it is difficult to believe that it all has the same origin. Much of it is undoubtedly derived from granite, as, for example, the porphyritic "augen gneiss" type, and a less common variety, found in large amount near Kharta, showing thin and rather sparse foliæ of biotite with abundant felspar, forms lenticles twisted and contorted. In the Kharta and Dzakar valleys the gneiss resembles that around Darjeeling, in which dark and light bands, biotitic and feldspathic respectively, alternate, and form a rock which from a little distance has the appearance of a bedded sedimentary series. As near Darjeeling, the planes of foliation or banding have usually low dips, and this variety is notably garnetiferous. Low down in some of the valleys towards the Nepal frontier, as for instance below Nyenyam and Tazang, and also probably near Kyimatang, large bodies of mica-schist are found, analogous to the schist occurring in the bottom of the Teesta valley near Darjeeling and in other localities found underlying the gneiss of Sikkim.* The latter have been mapped by Bose as the Daling Series; it is however quite uncertain whether the schist near the Nepal frontier is an altered sedimentary series or is a modification of the gneiss.

* Garwood, in Freshfield's 'Round Kangchenjunga,' p. 275; Mallet, *Mem. Geol. Surv. India*, II, pt. 1; Bose, *Rec. Geol. Surv. India*, 24, pt. 1, p. 46; pt. 2, p. 217.

The schorl granite varies in texture from a fine homogeneous granite to a coarse porphyritic pegmatite, sometimes with graphic intergrowths of quartz and felspar. It is the latest in age of the igneous rocks, and occurs practically everywhere in the crystalline area, penetrating both gneiss and metamorphics in veins and sills of all sizes. The sill habit is especially characteristic, concordant with the foliation of the rocks intruded. Intrusion has taken place to such an extent that schorl granite is often seen to be the predominating rock, and not only so, but its toughness and lack of joints and foliation cause it to resist weathering and abrasion in moraines and streams, so that it nearly always is the main constituent of detrital accumulations. It has as accessory minerals quartz, plagioclase, black tourmaline (schorl) and muscovite, garnet, yellow and pink tourmaline, and beryl.

The metamorphics comprise a considerable variety of rocks, all of which, except certain quartzites, are distinctly banded or foliated in layers of differing mineral composition, with directions determined by the original stratification. As I proceeded on tour shortly after the return of the Expedition I have not had an opportunity of examining fully microscopic sections of these rocks. They range from quartzites and micaceous quartzites to mica-schists and tourmaline mica-schists, representing the arenaceous and argillaceous sedimentaries, with crystalline marbles and actinolite, tremolite, and epidote schists from the calcareous rocks.

Graphitic schists have also been noted, but are rare. They are dislocated by profuse intrusion of vein granite, and their planes of foliation lie as a rule at comparatively low angles; this is striking in the field, especially in comparison with the intense crumpling which the same rocks have undergone in the Tibetan Zone. As one ascends any of the headwaters of the Dzakar Chu towards the Mount Everest group, one leaves the twisted and crumpled Jurassic shales and passes downwards in the section, as the general dip is northwards, though actually rising in elevation to the gently rolling limestones underlying them, which flatten out as they become more altered and the snowy range is neared. In the Rongbuk valley, for instance, above the Chöbu monastery, are limestones much fissured and veined with crystalline calcite, underlain by a thick sill of schorl granite and pervaded by innumerable smaller sills and streaks. Some 60 feet of the limestone immediately above the main sill has been converted into amphibole schist, and below the sill is a band of mica-schists thickly streaked and knotted with granite in lit-par-lit injection, to such an extent that the result has a very strong resemblance to the banded variety of the biotite gneiss. In the gorge of the Dzakar Chu between Kal and Tsa is exposed a great thickness of flaggy limestones with clayey partings. At the base of the section there are great masses of schorl granite with amphibole and epidote calc-schists; upwards

the former become more definitely sill-like, insetbedded with calc-schists and finely crystalline and mottled limestones. The limestones remain crystalline for a considerable distance above the horizon of the topmost sill, and then pass upwards into black limestones, non-crystalline and calcite veined, finally succeeded by Jurassic shales and quartzites. In the valleys above Raphu and Chödzung alteration takes place independent of granite intrusions, calcite-veined, knotted and brecciated limestones passing downwards into tremolite, actinolite, and epidote schists. In the above described sections the change from sedimentary to metamorphic rock is very clearly seen, taking place gradually in magnificent cliff-faces with no break nor discordance in the stratification; from a short distance away it is indeed often impossible to say whether one is looking at limestone or calc-schist.

Speaking generally, the valleys to the north-west and north of Everest, *i.e.* valleys above about 15,000 feet, are excavated in metamorphic rocks, whereas those to the north-east and east, for the most part below about 15,000 feet, are in gneiss. It was impossible, in the time at my disposal and with a small-scale skeleton map, to attempt to lay down a boundary between metamorphics and gneiss, but it would appear possible that the metamorphics form a gently northward dipping sheet underlain by the gneiss. The gneiss is probably intrusive in the metamorphics, judging from evidences of its age elsewhere in the Himalayas, and it may be possible to ascertain this definitely if I am allowed to accompany the second expedition.

The group of high peaks between the Nangba La and the Rongbuk glacier and the north-western side of Everest itself up to the summit are of metamorphics, with of course much schorl granite, to the resistant power of which, and not the easily eroded metamorphics, is due the eminence of these peaks. When I visited the Kharta and Kama valleys on the east side of Everest before the end of the monsoon, the mountain was too much covered with fresh snow to show any geological structure. The base of Chomo Lönzo in the Kama valley is gneiss, but Col. Howard-Bury states that its upper portion is pale granite.

Amphibolites.

In the neighbourhood of Dak, in the Arun valley, numerous fragments of amphibolites, both foliated and granitoid, were observed, but the parent mass was not found. Their nature is therefore uncertain, but they are probably altered igneous rocks of intermediate or basic composition.

The Tibetan Zone.

The Tibetan Zone consists in the main of a great thickness of intensely folded Jurassic shales, the folds in general striking east and west, and repeated many times in complicated fashion. Pinched up in these, in several very elongated and narrow synclines, are limestones belonging to the Kampa System of Hayden, of Cretaceous and Eocene

age. These synclines are closely compressed and overfolded, their axial planes dipping to the north, showing that the compressive force which produced them acted from the north.

Along the southern border of the Tibetan Zone, below the base of the Jurassic shales, is a great thickness of flaggy limestones, in which the fossils have been destroyed and the rocks themselves converted in part into crystalline limestones and calc-schists. The age of these cannot be determined with certainty, but their character and position in the sequence indicate that they are possibly Trias or Permian.

I am much indebted to my colleague, Mr. G. H. Tipper, for identifying for me the small collection of fossils which I made. From a palæontologist's standpoint the country which I covered was very disappointing. The Jurassic shales are almost unfossiliferous, and yielded only a few ammonites, belemnites, and crinoid stems of little interest. The thick limestones bordering the crystalline zone show, near their top, abundant signs of organisms in the form of curved layers of crystalline calcite, which in all probability are the remains of large lamellibranchs or brachiopods, but several days' search in favourable localities failed to discover a single specimen of which one could say anything more definite. This is particularly unfortunate in view of the interest attaching to these rocks and their age.

The Eocene and Cretaceous limestones, the zones of which have been worked out in great detail by Sir Henry Hayden in the magnificent and less disturbed sections of the Kampa ridge, here occur in much compressed synclines, in which fossils have been destroyed or damaged by the shearing which they have undergone, and in which zones are almost impossible to work out owing to faulting and interruption by stretches of alluvium. It is only in the Tsipri ridge that a satisfactory detailed study of the Eocene and Cretaceous rocks can be made, and this I was unable to give time for, as when I passed it I had been separated from the Expedition by floods and had exhausted all my money and nearly all my food. It is, however, unlikely that I could have added anything of value to Sir Henry Hayden's description of these rocks.

The Kampa System.

The Kampa System is developed in two main synclines, the northern of which may be called the Tsipri syncline, from the picturesque and sacred ridge on it, and the southern the Bhong Chu, from the chief river of this area, which has excavated its valley along it; there are besides a number of small synclines. The Eocene beds above the "ferruginous sandstone" of Hayden (*Mem. Geol. Surv. India*, 36, Pt. 2, pp. 44, 48-51) are found only in the northern syncline.

In the exposures between the Yao La and Gutso this is a massive pink and white quartzite, about 100-150 feet thick, weathering into large blocks. In its degree of metamorphism it is a typical Pre-Cambrian

quartzite, although the brown shales below it and the blackish grits above are almost unaltered ; the latter contain fossil wood, dicotyledonous, and is the highest formation present in the section. The Tsipri ridge gives the only fair sections of the combined Eocene and Tertiary of the Kampa System.

I was unable to examine in detail, but the general section is as below :

Bold scarp : Massive thick-bedded grey limestones, with abundant *Alveolina* and *Operculina*, alternating with massive, white, very fine-grained and unfossiliferous limestones and thin-bedded limestones.

Minor scarp : A series of limestone in regular beds of medium thickness ; about the middle of this series comes the "ferruginous sandstone."

Undercliff of above : Grey flaggy limestones.

Lower scarp rising from plain : Brown argillaceous limestones, in thin regular beds.

Usually covered, but exposed at east end of ridge : Great thickness of grey unfossiliferous calcareous shales.

East end of ridge : Black and brown splintery shales with large septarian nodules.

North side of Shi Chu Valley : Grey limestone, massive quartzite, the "wall" quartzite.

The upper limestones on the south side of the ridge are corrugated, and as they pass to the northern side dip steeply up to the vertical ; further north, on the northern side of the Shi Chu valley, the limestones and quartzite at the base of the syncline are inverted, with the Jurassic shales overlying them and dipping to north at 30° to 80° . The Shekar hill shows a subordinate anticline formed to the north of the main syncline. At the western end the topmost limestones come down to plain-level by a downward pitching of the syncline, and are seen in the short ridge to the west of Temi with undulating dips and a great overfold.

In the Tsipri ridge the ferruginous sandstone is not so highly indurated in the Yeo La sections ; it has abundant spherical concretions of iron oxide and is in certain layers finely conglomeratic, the little pebbles, of the size of buckshot, consisting of transparent quartz, quartzite of various colours, and white chert.

At the western end of the northern syncline, where it emerges from the alluvium of the Pekhu plain, the Cretaceous limestones in their upper portion have numerous intercalated thin bands of sandstone and are themselves distinctly arenaceous, indicating, with the occurrence of fossil wood in the Eocene grits above the ferruginous sandstone, the prevalence of shallower water conditions than obtain as one passes to the east.

The structure is that of a recumbent isocline, of which both limbs dip north at 20° to 40° , affected however by minor rollings and corrugations, and the northern margin is considerably altered by metamorphic agencies connected with the granite intrusions of the Northern Range.

Locally the prominent sandstone quartzite band which is found elsewhere in the shales a little distance below the base of the limestones is wanting. This I call the "wall" quartzite. Here there is a passage into the Jurassic shales through shaly limestones. Just below these passage beds, at Menkhap Me and on the Lungchen La, fragments of ammonites of Upper Jurassic type, but not determinable with certainty, were found.

East of Gutse and Menkhap Me a broad alluvium-filled river valley and a southward-trending spur of semi-metamorphic rocks and granite veins (the Burtra ridge) cut off this syncline, but there is little doubt that it is structurally continuous with that of Tsipri. This has been described above. It also is overfolded by pressure from the north.

To the east of Shekar the outcrop of the syncline narrows, through the beds becoming more vertical, and as it swings to the north-east in the valley of the Lo Chu it flattens out again to a very recumbent isocline.

A day's search in the Cretaceous beds round Shekar failed to yield a fossil; the beds appear to have been sheared to some extent, and are shattered and veined with calcite but not rendered crystalline. In the Lo Chu valley the shaly partings between the limestones are silvery from the production of sericite mica.

The Bhong Chu syncline is also overfolded, but not to quite the same extent as the last. Like it, it extends to an unknown distance through the Pekhu plain to the westward. Where first encountered, where the Men Chu flows along a valley excavated in it, a wide plateau of undulating Jurassic shales lies to its south, on which is a shallow saucer-like syncline, containing the "wall" quartzite and a trifling thickness of limestone above it. At the edge of this plateau the shales and the "wall" quartzite roll steeply over into the Men Chu valley.

On the northern bank of the stream is a fine scarp of regularly bedded limestone, in places crowded with small lamellibranchs (unidentifiable) and what appear to be casts of brachiopods in crystalline calcite. To the north of this a double fault is well seen, bringing this limestone against the "wall" quartzite and the Jurassic shales, these dipping vertically where they meet.

Between Nelung and Tinkri, where the Bhong Chu again returns into and excavates a valley along the syncline, both limbs dip northward at about 60° . From Tingri eastwards to where it disappears near Tsonga, its southern limb is fairly regular and the "wall" quartzite stands up conspicuously along the valley, dipping at angles of 45° to 80° . Its boldness and continuity along this valley led me to give to this distinctive bed the field name which I have used here. It is about 120 feet thick; next above it is a thin but massive limestone, and then 300-400 feet of shales, passing into the slabby limestones which form the bulk of the visible section.

The northern edge is not so regular; usually it is overfolded, but in places the dip is high but normal, and south of Shekar runs a strike fault,

cutting out the "wall" quartzite. South of the Tsipri ridge the two synclines approach closely, with an intervening anticline of Jurassic shales separating them. All along the Bhong Chu valley exposures of the Cretaceous limestones are much disconnected by detrital deposits, and usually occur as isolated hills of bizarre form in which the beds are seen to be intensely crumpled and sheared, and fossils are represented by streaks of calcite. At Kyishong, near where it disappears, the syncline widens out owing to a subsidiary anticline rising up along its centre.

The group of synclines to the south, in the Pharuk district, display great irregularities and complexity of structure, so much so that I found it impossible to map them in detail on a $\frac{1}{4}$ -inch scale, and have had to show them in a general and diagrammatic way. That which forms the valley of the Neo Chu and passes eastwards to near Aya is very elongated and narrow; the strata in it stand vertically or lie slightly overfolded in the usual direction, with the "wall" quartzite standing up on either side of the valley. Midway along its length a strike fault repeats it, bringing in a wedge of Jurassic shales between. At its western end it is continued by another similar syncline, not quite in line with it but parallel and a short distance to one side. In the 2 miles south of this, between Namda and Tashidzom, the "wall" quartzite and the basal beds of the Cretaceous limestones are repeated again and again by sharp folds and faults of small throw. Needless to say they are veined with calcite and in places brecciated. South of this again, from Tashidzom to Kuyul, besides the major double syncline shown on the map, small sections of the Cretaceous limestones are pinched up and faulted into the Jurassic shales. In the double syncline there is no inversion, the northern lobe being shallow, saucer-like and fairly symmetrical, while in the southern the beds are undulating and almost horizontal.

The only remaining outcrop of Cretaceous rocks lies far to the north-east, a shallow syncline similar to the last, with the quartzite dipping gently inwards round the periphery and the centre occupied by horizontal and undulating sericitic limestones.

The Jurassic shales.

The most striking features, in fact the only striking features, of the Jurassic beds are the extent and the monotony of their outcrops. They consist for the most part of dark brown and black shales and argillaceous sandstones, with subordinate quartzites, representing the purer type of sandstone, and limestones which are usually darker and more argillaceous than those of the overlying Cretaceous System.

In the tract of country between the crystalline zone and the Northern Range of the Central Himalaya, the Jurassic strata are thrown into great folds and corrugated in the most fantastic fashion, and even where the general dip approaches horizontality the beds roll about irregularly.

In such highly compressed country faulting, especially thrust-faulting, must be very prevalent, but where strata are so uniform in appearance it is extremely difficult to detect. The general strike of these folds is that of the "grain" of the country, *i.e.* in an east-west or E.S.E.-W.N.W. direction, but they are subject to far more irregularities than in the more persistent synclines of the Kampa System limestones.

In the Northern Range, and also where they pass downwards into the thick limestones along the boundary of the crystallines, the shales dip less variably and at lower angles. A certain amount of injection by granite veins has taken place in the Northern Range, along with a widespread regional induration of the rocks, attaining however only a low degree of metamorphism. The intermediate belt, where the Cretaceous and Eocene limestones have been compressed into overfolded synclines and the Jurassic shales have been so intensely folded, has been a region of weakness between two more resistant blocks. The alteration of the rocks in the Northern Range extends considerably further outwards from the areas of granite intrusion than in the opposite section of the Great Himalaya, but is of less degree. Pebbles of garnetiferous mica-schist and hornblende schist (of the "feather amphibolite type") were found in gravels below the Mön La, but the parent rock was not found *in situ*, nor were such highly metamorphosed types met with elsewhere.

Igneous Rocks in the Tibetan Zone.

The intrusive granite of the Northern Range is very similar in appearance to the schorl granite of the Himalayas, but is uniformly fine-grained instead of showing the great variation in texture of the latter rock. Like it, it is a white rock and is very tough and resistant to weathering. Mineralogically it differs from the schorl granite in that it contains biotite (with muscovite as well), instead of schorl.

Near Nelung, Khakyu, and between Namda and Aya, small dykes of dark rock were seen, in the last case strung out along a line running east and west, appearing at intervals over a length of $2\frac{1}{2}$ miles. The dykes individually run only 100 feet, less or more, and are up to 3 feet wide. The rock is too thoroughly decomposed for determination, but is probably basic. Judging from the crushing and dislocation which the dykes have undergone, they are probably antecedent in age to the folding of the rocks.

For the most part the shales have been hardened and have acquired the beginning of slaty structure, being knotted and breaking into prisms, or have developed in them a certain amount of secondary sericite mica and aluminous silicates such as staurolite, and have in certain cases become phyllites. Often they have a baked appearance, being whitish or red, contrasting with the black or rusty brown tints of the unaltered shales. The quartzites show no more alteration than they do amongst the unaltered strata, but then in this area the usual Jurassic sandstone quartzite, fairly free from impurities, is just as hard and vitreous as any typical Pre-Cambrian quartzite.

Permo-Trias Limestones.

Between the crystalline and the sedimentary zones is the outcrop of a thick series of limestones, of which 2000 or 3000 feet are exposed in a very uniform assemblage of rather thin beds of 1 to 3 feet in thickness, with shaly partings. The overlying shales, of which the major portion has been shown by Hayden to be Jurassic, pass down without any visible discordance into the limestones. As has been stated, the limestones as a whole are considerably altered, all fossils having been destroyed and now appearing as streaks of crystalline calcite. More than this, they have been extensively invaded by granite veins, converted into crystalline limestones and calc-schists, and involved in the crystalline complex in such fashion that to lay down a true boundary on the map is impossible. The line which I have drawn between limestones and crystallines is arbitrary, and represents generally the upper and outer limit of granite intrusions: to the south of this line there is much of the limestone in the form of calc-schists, but intimately associated with the schorl granite. The lowest portions of the limestones are thus obliterated and their relation with the biotite gneiss is obscure, but it is probable that the latter is intrusive in them. The limestones were probably continuous right along the southern margin of the Jurassic exposures, but from point to point the zone of metamorphism and granite veining has encroached on them to a varying extent, in some places affecting them throughout and transgressing upwards as far as the Jurassic shales, and in others leaving a great thickness unaltered, so that their outcrop has now the irregular breadth shown upon the map. Their general dip is northward at low angles; at Yalep on the Pö Chu and at Kal are anticlinal flexures, and south of Raphu and Hlelung dips undulate somewhat. The bifurcation of the outcrop north of Tulung is, so far as I was able to ascertain, due to the limestones emerging again to the north of the main exposures along an anticlinal axis. The structure is, however, doubtful, and may be due to faulting. My examination of this portion of the area was much hindered by repeated snowfalls and heavy mist.

The age of these rocks is very doubtful, but may be put down provisionally as Permo-Trias. Sir Henry Hayden (*Mem. Geol. Surv. Ind.*, 36, pt. 2, p. 21) has described, under the name of the Dothak Series, an assemblage of limestones and other sedimentary rocks between the Chumbi valley and Bhutan, which in his opinion may include part or all of the Trias and possibly one or more of the Palæozoic systems.

He also suggests that Triassic rocks occur along the northern slopes of the Lhonak range between Tibet and Sikkim (*Loc. cit.*, pp. 23 and 24), and fossils typical of the Productus Shales (Upper Permian) are known to have been collected from near the Kongra La, the pass which crosses the Lhonak range south of Kampa Dzong. The situation of these exposures with regard to the crystalline zone is very similar to that of the limestones in the present area.

Direct evidence of their age, though not very definite, is given by two sections in the ridges to east and west of Hlelung. At the base of the great series of shales which overlies the limestone, just as they pass downwards into the latter, is a thin ferruginous bed crowded with *Spirifer* and *Productus*, not however specifically determinable. These would indicate that the top of the limestones is about Upper Permian in age, if the section is a straightforward one, which there is no reason to doubt. The bulk of the limestones would then represent the Permian of the European scale, with perhaps a portion of the Carboniferous. Judging from field relationships and lithological characters, I had in my own mind considered these limestones as approximately equivalent to the Kioto Limestone of the Zangskar range in Spiti (Lower Jurassic and Upper Trias), which in that country underlies the Spiti shales (Upper Jurassic), but the fossil evidence puts them much lower in the geological scale, and indicates that the Trias is represented by the lower portion of the great succession of shales; it is unfortunate that the absence of recognizable fossils from the limestones themselves leaves the question so indefinite.

Before the paper the PRESIDENT said: The paper this afternoon is one by Dr. Heron, of the Geological Survey of India. He accompanied the Mount Everest Expedition last year on the reconnaissance of the mountain, and has given us the result of that reconnaissance from the geological point of view. He is very energetic, and managed to cover a great deal of country in the region of Mount Everest. Though I do not believe he actually got to the top of the mountain, he did, however, what is from a geological point of view much more interesting—he explored all the region north of Mount Everest towards the Brahmaputra, and also to the east of it. Dr. Heron, unfortunately for us, is not able to be present as he is still out in India. He was hoping to rejoin the Mount Everest Expedition this year also, but I am not sure that he has been able to do so. We are, however, fortunate in having with us Mr. Fox, who also belongs to the Geological Survey of India, and has worked for the Survey in the Himalayas.

Mr. C. S. FOX, of the Geological Survey of India, gave an account of the above paper by Dr. Heron, and added:

The remarkable parallelism between the trough of the Tsangpo and the axis of the main Himalayan range has always been taken to indicate a common origin for both, that is, crust squeeze or pressure at right angles to these features. The same forces would account for the closely corrugated and crumpled sedimentary beds, and for the great double synclinal sag of the Cretaceous and Tertiary strata. It is, however, difficult to explain the tectonics concerning the metamorphism of the sedimentary rocks at the junction of the Tibetan and Himalayan zones.

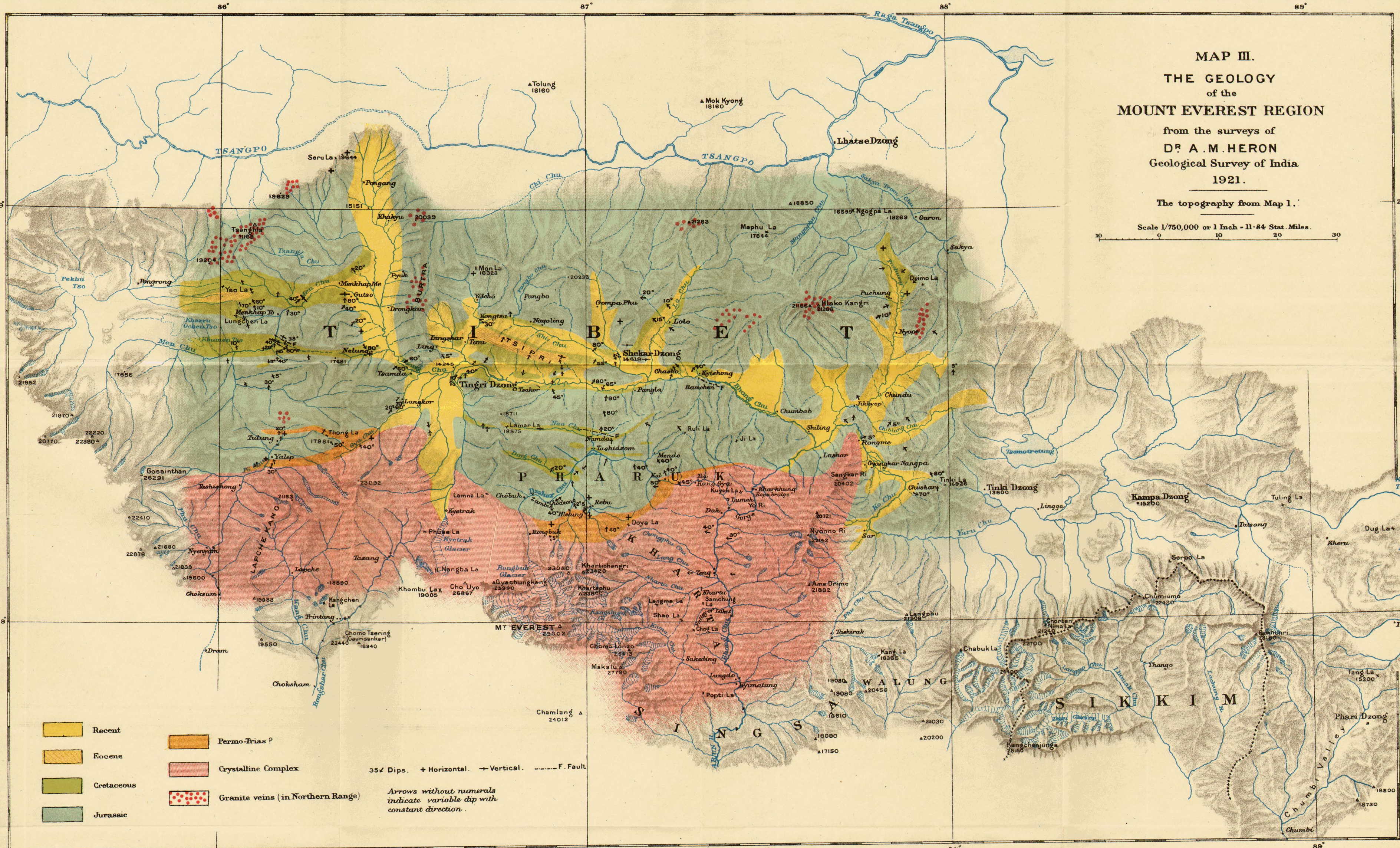
There are certain peculiarities in the valleys of the Men Chu, Bhong Chu, and Dzakar Chu which require comment. These streams occupy synclinals or structural troughs of Cretaceous strata for part of their courses. Such structural courses are as a rule uncommon. Most streams in mountainous country occupy valleys carved along anticlinal folds. It is therefore thought that these above streams began their courses along anticlinal folds, but owing

MAP III. THE GEOLOGY of the MOUNT EVEREST REGION

from the surveys of
DR A. M. HERON
Geological Survey of India
1921.

The topography from Map 1.

Scale 1/750,000 or 1 Inch = 11.84 Stat. Miles.



- Recent
- Eocene
- Cretaceous
- Jurassic
- Permo-Trias ?
- Crystalline Complex
- Granite veins (in Northern Range)

35° Dips. + Horizontal. + Vertical. - - - F. Fault.

Arrows without numerals indicate variable dip with constant direction.

86° N E P A L 87° 88° 89°



Seru La 18644

Tolung 18160

Mok Kyong 18160

Pangang

TSANGPO

15151

Khakru 20039

42263

Mapu La 17844

Menkhang Me

Pyuk

Mön La 16323

Yöleho

Pangbo

Gompa Phu

Gutso

Drongkar

Kongtsa

Nagoling

Loto

T

I

B

E

Nelung

Tsanda

Ling

Temu

Shai Chu

Shekar Dzong

Chasko

Kyishong

Langkor

Tingri Dzong

Tsakor

Neo Chu

Pangla

Ramchen

Chong Chu

Thong La

Lamar La

18711

18575

Namdag

Tashidzom

Mendo

Kal

Ruli La

Ji La

23032

Lamna La

Chöbuk

Rebu

Doye La

Khang Gya

Kuyok La

Lumeh

YG Ri

Phuse La

Kyetrak Glacier

Rongbuk Glacier

Gyachungtang

25990

Khartichangri

23420

Khartaphu

223800

Tazang

Nangba La

Khumbu La

Cho Uyo

26867

Langma La

Shao La

Kharta

Samchung

La

Kangchen La

Trintang

Chomo Tsering

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18940

Chomo Lonzo

25413

Choy La

Sakhedina

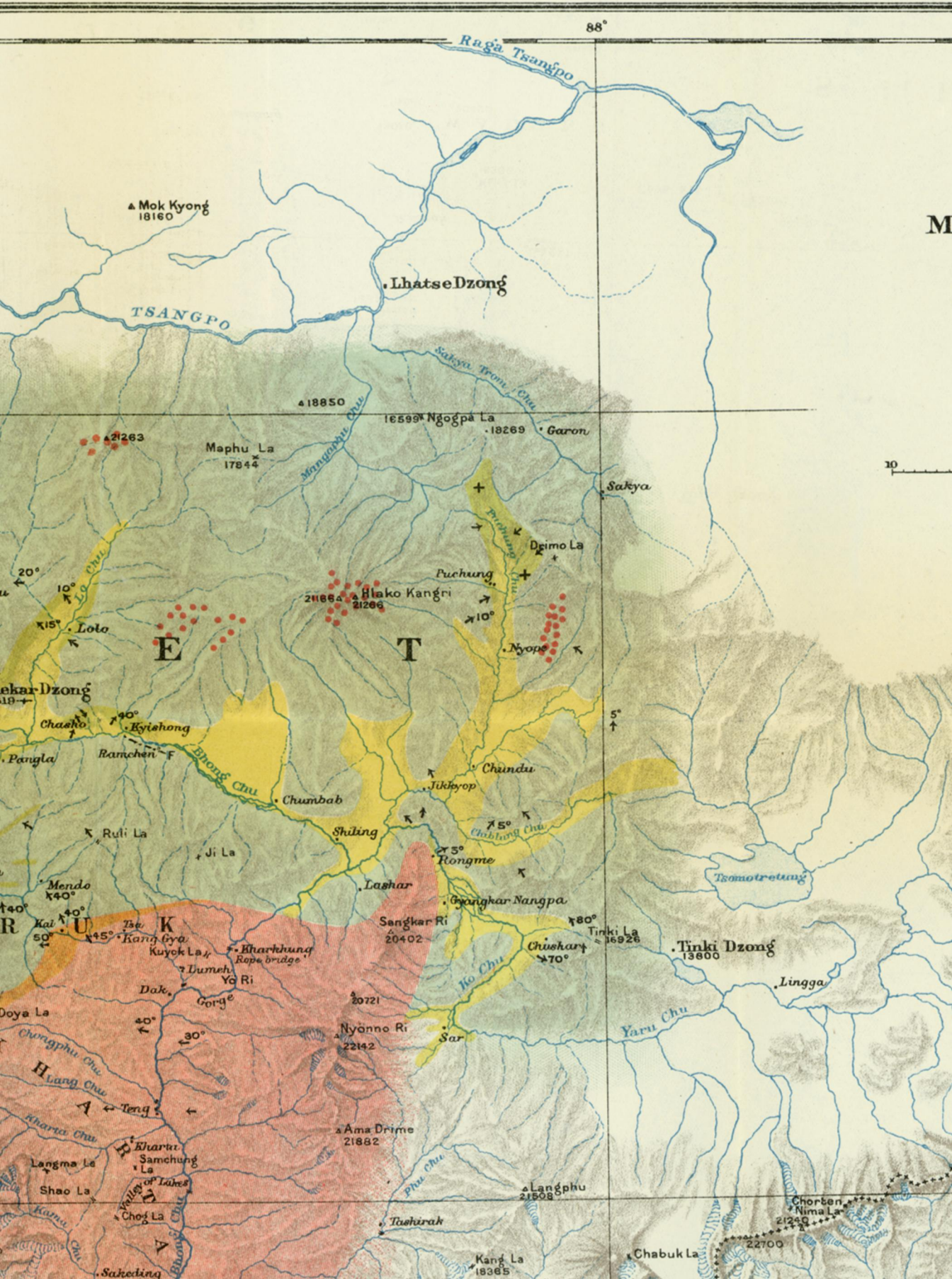
MT EVEREST 29002

Chomo Tsering (Gaurisankar) 23440 18940

Chomo Lonzo 25413

Choy La

Sakhedina



88°

Raga Tsangpo

TSANGPO

▲ Mok Kyong
18160

Lhatse Dzong

▲ 18850

16599 Ngogpa La
18289 Garon

Mapu La
17844

Sakya

10

▲ 21263

▲ Hako Kangri
21866
21206

Puchung

Dgimo La

Nyong

E

T

Lhatse Dzong

Chasho
Ramchen F
Pangla

Chunbab

Ruli La

Ji La

Mendo
Kai

Kang Gya
Kuyok La

Dak
Gorge

Doya La

Chongphu Chu

Hlang Chu

Kharta Chu

Langma La
Shao La

Chor La

Sakteding

Shiling

Lashar

Rongme

Sangkar Ri
20402

Nyanro Ri
22142

Ama Drieme
21882

Sar

Tashirah

Kang La
18365

Chundu

Tukhyop

Chushang

Chushang
70°

Sar

Langphu
21508

Kang La
18365

Tashirah

Kang La
18365

Chabuk La

Chorten
22700

Nimala
21249

Chorten

Nimala
21249

Chorten

Nimala
21249

Chorten

Nimala
21249

Chorten

Nimala
21249

Tinki Dzong
13800

Lingga

Yaru Chu

Chabuk La

Chorten
22700

Nimala
21249

Chorten

Nimala
21249

Chorten

Nimala
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Chorten

Nimala
21249

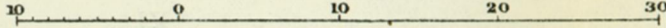
89°

MAP III. THE GEOLOGY of the MOUNT EVEREST REGION

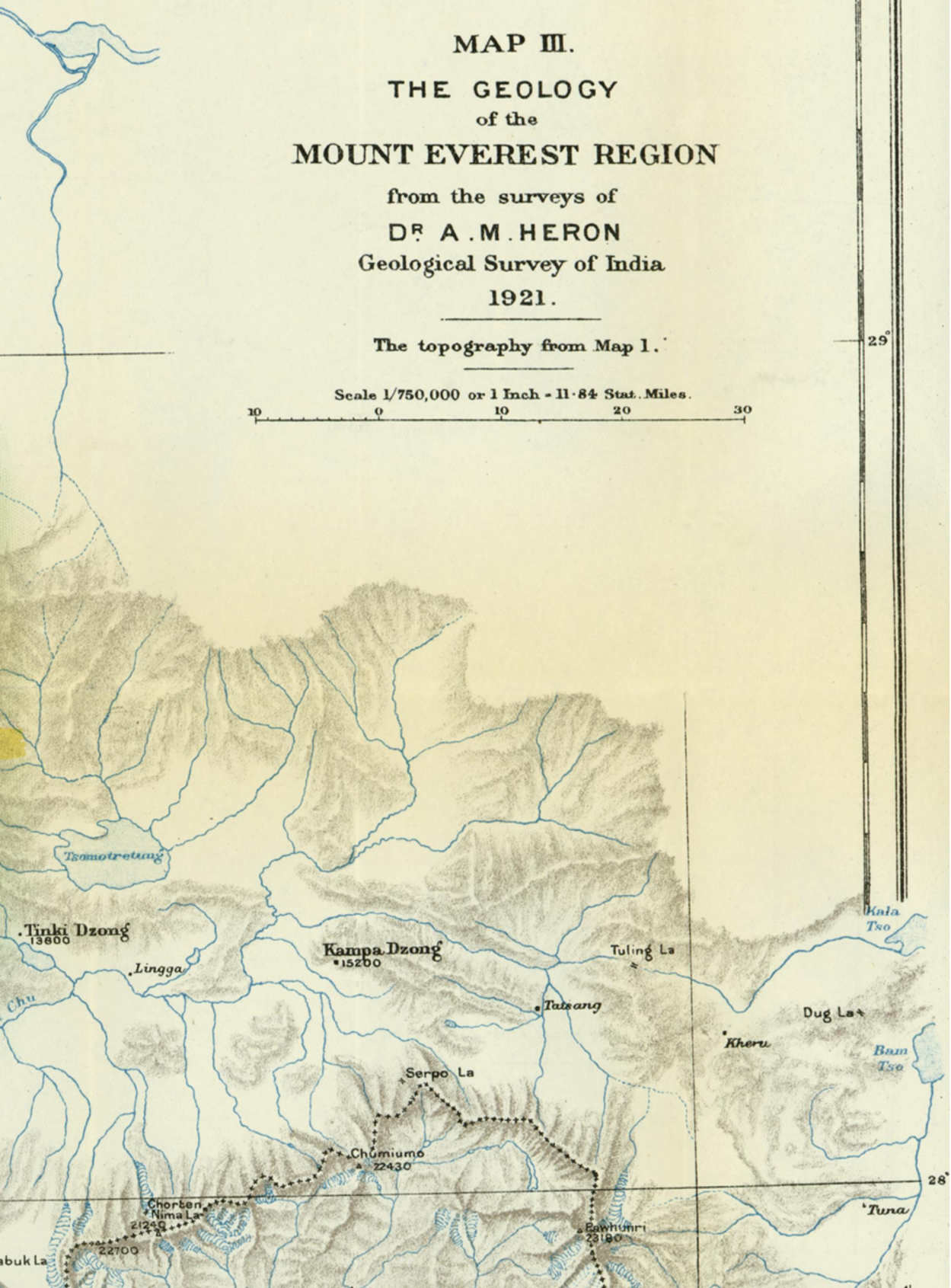
from the surveys of
DR. A. M. HERON
Geological Survey of India
1921.

The topography from Map 1.

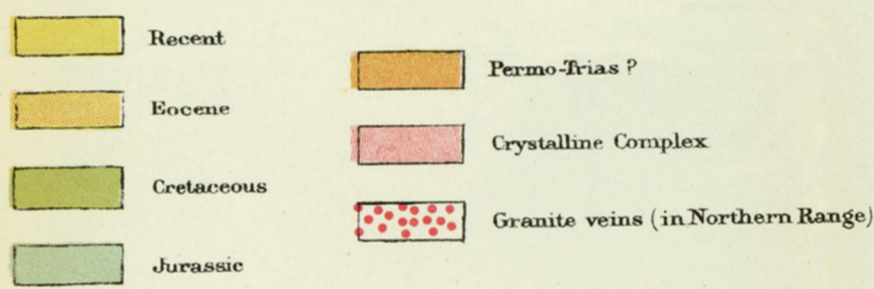
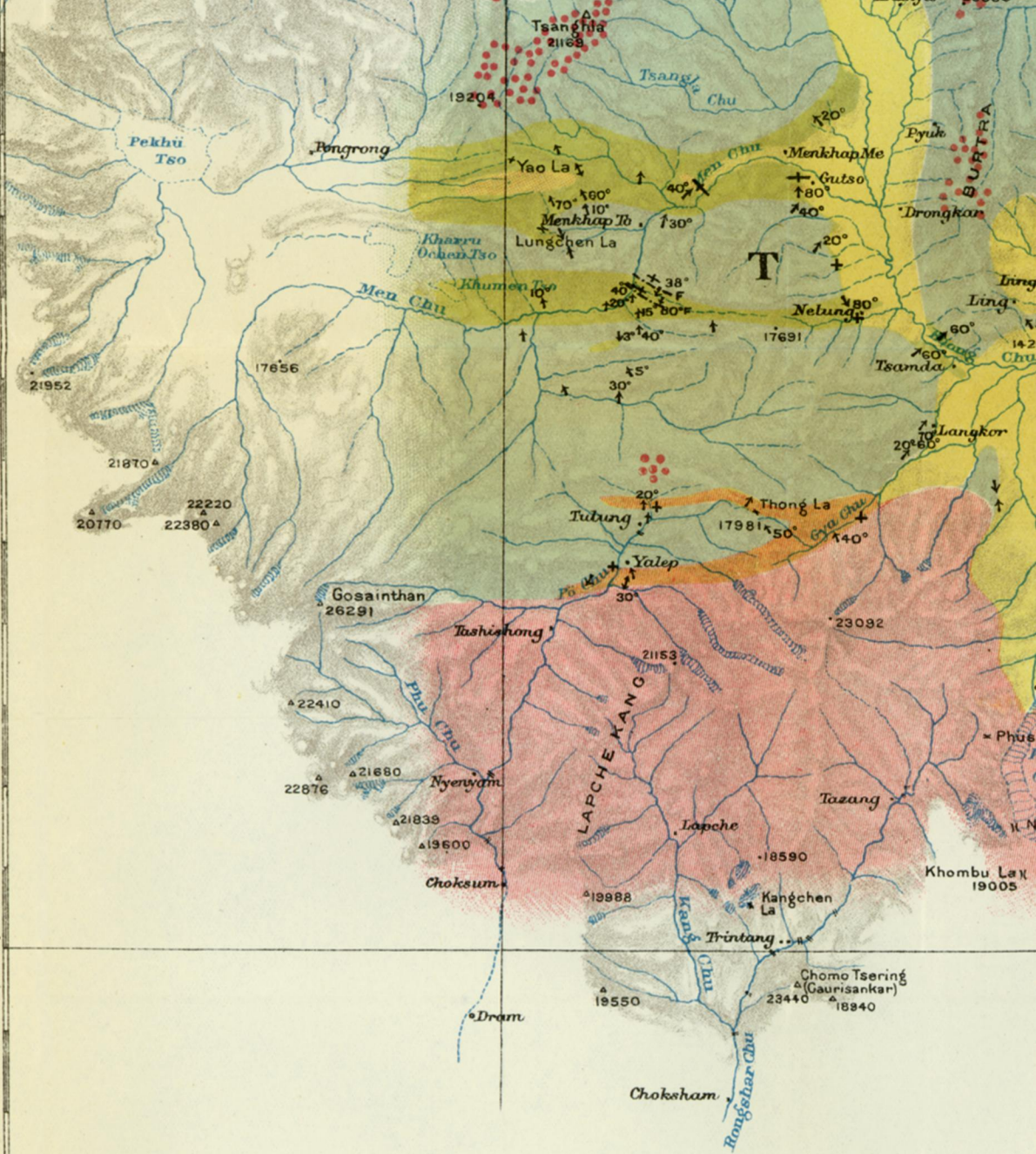
Scale 1/750,000 or 1 Inch = 11.84 Stat. Miles.



29°



28°



35° Dips. + Horiz.
 Arrows without
 indicate various
 constant direc



(Northern Range)

Arrows without numerals indicate variable dip with constant direction.

E P 87° A L



A L 88°

Scale 1/750,000 or 1 Inch = 11.84 Stat. Miles.

10 0 10 20 30



MT EVEREST EXPEDITION.
Map III, Geology.

to the overfolded condition of the strata they have cut their beds down to the underlying synclinal.

There are strange deflections of these rivers which, with the location of certain gorges and also the position of the groups of high peaks, point to the presence of a regional warping of the area in a direction transverse to the folding. Alternate zones of sag and arching of the corrugated sedimentary beds, and of uplift and depression of the crystalline zone, would account for (1) the presence of basins of enclosed drainage, *i.e.* if the uplift was faster than the stream erosion; (2) the occurrences of gorges, if the rate of uplift was slower than the rate of stream erosion; and (3) the high peaks would most likely occur in the sag of the transverse warps: the rocks in such troughs would be in compression and tightly held, whereas the rocks in the arches would be weak and more easily weathered.

However, the most interesting problem of Himalayan geology is the contrast of the two areas which are separated by the granitic core of the range of snowy peaks. The Tibetan Zone comprises fossiliferous rocks including, in one section or another, the succession from Cambrian to Eocene. On the southern side of the range the sedimentary rocks are generally of pre-Cambrian age. The two areas have an entirely different history, and yet the strata of both regions have been hopelessly involved in the crystalline complex of the range. The problem of the granitic core of the main range has not been satisfactorily solved.

The questions which confront us are: What proportion of true igneous rocks occur in the crystalline complex? Are there any intrusive granitic rocks of igneous origin? Do the gneisses and schists not represent sedimentary rocks which have been altered by intense shear stresses? And are not the granitic and granitoid gneisses representatives of those same sedimentary beds which have been subjected to enormous static pressures? These are problems that await Dr. Heron on the slopes of Mount Everest.

In reply to a question by Mr. Edwards on the formation of the gorges, Mr. FOX said: The question of the formation of the gorges in this region is usually dependent on the relative rates of stream cutting or tectonic uplifting. If an area which has been slightly elevated contains a pre-existing stream, and this stream can keep its channel open by cutting its bed deeper at a faster rate than the local rise takes place, a gorge will naturally result. As for the Tsangpo or Brahmaputra coming through, there is an example in the stream of the Assam Brahmaputra, because that river did cut across the Himalaya just as the Arun has, only more successfully. The Tsangpo, or whatever its Eastern Chinese name, very likely originally flowed straight on eastwards. It has been cut off by the Assam Brahmaputra and deflected through Assam. The Arun river will probably deflect the Tsangpo through the Nepal Himalaya in the same way.

Mr. HINKS: There is one spot in particular that has always struck those of us who have been examining the photographs from the Mount Everest Expedition, where the river Arun, having apparently a possible way of going more or less through unobstructed country, suddenly drives right into a hill. Mr. Fox put on a picture of the place just now, but he did not call particular attention to it; and not every one who saw the slide on the screen recognized the extraordinary nature of that gorge. The Arun drives straight into an almost perpendicular hill by an excessively narrow gorge, very much as if a railway engineer had taken a cutting straight through. I remember that Dr. Heron mentioned this in his original report, but gave very little explanation of it, and

I do not know whether Mr. Fox has been able to read into Dr. Heron's paper what is not visible to the ordinary uninstructed person like myself, and, if so, whether he can give us any further explanation of it.

I would like to take this opportunity of asking Mr. Fox if any estimate has been formed as to the rate at which the processes of denudation go on. It will be remembered that in February we had a discussion here on photographic survey with special reference to stereographic survey, particularly of such country as we are now discussing. The point was then raised as to whether it was not highly desirable to survey as accurately as possible some of these areas in order to be able to make a firm base now for fixing the changes that may have taken place in a hundred years' time. Having in mind an arête outlining a cirque, I was wondering if Mr. Fox has, from his work in the Himalaya, formed any idea of the rate at which the edges are degrading. I am anxious to find out what sort of prospect there is of obtaining, in a reasonable time, measurable changes in the visible geology of this splendid mountain mass.

Mr. C. C. FOX: There are two gorges to which Dr. Heron particularly refers. In the Rongme gorge I think the explanation is fairly simple because the rocks dip away from the main mass of the spur. Although Dr. Heron says the stream goes through the spur, it is still following the strike of the bedding or foliation planes of the rocks, and I think the explanation of the cutting action of the stream being greater than the rate of the regional rise fully explains that case. I think Mr. Hinks refers to the gorge south-east of the Küyok La, in which there is an old stream course. An ancient river originally flowed northward into another old river tributary of the Tsangpo. The drainage is now in the opposite direction, *i.e.* south-west. The present river approaches the Küyok La, a low pass over soft rocks, suddenly changes its mind, plunges through a gorge in a hill of hard rock, runs south for about 3 miles and turns away westwards for 4 miles, coming out behind the Küyok La saddle exactly in the same old river valley, in the same direction as it had originally been making for. An explanation of the origin of this gorge is certainly very difficult. The only thing I can suggest is that, if the arrows shown on Dr. Heron's map indicate that the gneisses are foliated on a north-and-south line, this direction is parallel to the southern deflection of the river; although the river had an opportunity of cutting across the low saddle of the Küyok La, it failed to cut across the banding of the rocks. It is far more natural for a stream to turn and follow between two beds than to try and cut across them, however soft they may be. I think in this case the river had taken advantage of a junction between the bedding of the rocks, probably between a soft and a hard bed, and followed this junction. However, in breaking across further south it did cut across the rocks which it had previously avoided. Why it did so it is difficult to say until one has the reduced levels of the saddle and the neighbourhood. It is quite likely that a lake formed, and the saddle was not as high as the point which overlooks the present gorge. I should think there was lower ground here, possibly a tributary of the Arun before the Arun robbed the north-east flowing Dzakar Chu, so that when the river was deflected it broke through a lower point than the saddle. However, it is a point I can say nothing more about, because it is necessary to have particulars of the heights and details of the geological structure.

With regard to the rate of denudation of these high peaks and great ridges and the obtaining of some measurement of the geological erosion of the high peaks, I should think the time required would be very great, though there is certainly a point in favour of making such measurements. It would be necessary

to fix a datum level on some hard basic rock pretty low down and not so exposed to frost. From this point, which can be fixed by an instrument, determinations of the height of points and ridges would be made, together with photographic records. The rocks concerned are granites or granitoid gneisses, which have for many years been considered as very resistant rocks. Granites are resistant rocks, but not resistant to great or rapid changes of temperature; they are rocks which are most easily damaged by changes of temperature in a region where they would be subjected to frost and the baking action of the sun. I remember Colonel Howard-Bury in his lecture spoke of the members of the Expedition having to wear helmets because the sun was so hot, although their feet were frozen.

You have an excellent instance in Trafalgar Square of the poor resistance of granite to changes of temperature. You will remember the base of Nelson's Column is made of granite. On Armistice night people lighted fires, and you will see the scaling action on the plinth facing Whitehall and on the steps facing Cockspur Street. Granite is composed of two minerals, quartz and feldspar, which have very different rates of expansion, with the result that when these minerals are subjected to heat and cooled, or cooled and subjected to heat, the rock disintegrates, and as you have in Nelson's Column through the action of the fire, so in the Himalayan peaks I expect the erosion is very rapid indeed. Judging by the screes we saw in the views of Chomolhari and the photograph looking east over Phari, the granite rocks have been wearing away very rapidly because of the changes of temperature. Therefore, if any experiments are carried out regarding the rate of erosion, they would have to be carried out from some place or rock, particularly dark basic rock, which was not so liable to erosion. I think definite figures for the rate of erosion could be obtained.

Dr. FORBES: It is known that there are marine rocks to the north of the Tsangpo. If so, how far north do these sedimentary marine beds occur? Is it still farther north of the Tibetan area?

Mr. FOX: The highest point at which sedimentary rocks have been found in that part of the Himalaya is 20,000 feet.

Dr. FORBES: To the north of the Tsangpo are there also marine beds?

Mr. FOX: It is suspected that the Jurassic rocks go a long way further north, even to Lhasa. Fossils were found a considerable distance out. There is supposed to be an immense area of marine Jurassic beds. That is what makes the geology of the district so monotonous; you go for hundreds of square miles, and the area is full of these marine sedimentary beds.

The PRESIDENT: We are very much indebted to Mr. Fox for having taken all this trouble as regards Dr. Heron's paper. To one who has been up in these regions there is a very remarkable difference, as Mr. Fox has pointed out, between the line of the great peaks of the Himalaya—Mount Everest, Makalu, and the others further east—and the Tibetan area proper, where you get into those rounded hills and trough-like valleys. But I think the most striking point of the lecture was the expectation that the Arun would one day capture the Brahmaputra itself, and that we should have the Brahmaputra eventually coming down through that Arun gorge and joining the Ganges considerably further west than it does now. What will happen to the rest of the Tsangpo river or the Brahmaputra, one does not like to prognosticate.

I was also rather surprised to hear that Dr. Heron did regard Mount Everest itself and those lines of the great peaks as more interesting than Tibet. I thought really that the geology of the Tibetan plateau was the more interest-

ing of the two, because on the geological map you had a great broad band coloured pink, which is the line of crystalline rock, and that looked very monotonous in comparison with the beautiful blues, yellows, greens, and browns of the Tibetan marine sedimentary rocks. Apparently that area of the crystalline rocks does differ very considerably in different parts, and Dr. Heron, as Mr. Fox has said, did not go to Everest itself last year, because there was no map then of the region, and he had reserved that for this year. However, we are not quite certain whether Dr. Heron will personally go there this year ; but at any rate amongst the members of the expedition there is at least one who is quite a good amateur geologist, and that is Dr. Somervell, who before he left England went particularly into the question of the geology of that region, and knew exactly what it was hoped to find out there. He will, I am sure, do his very best to bring back for geologists the information that they would like, and we also hope that he will bring back a piece of the top of Mount Everest itself.

As regards the denudation of these granite peaks, I must say the idea I had in my mind was that granite, as most people think, is a hard rock which stands weathering better than most. But I can quite bear out what Mr. Fox said, that these peaks do weather away to a most extraordinary extent. Whether Mount Everest is getting lower and lower every year, or whether there is an upward thrust which is compensating for this denudation, we have not any means at present of determining. But it is well worth following up Mr. Hinks' suggestion that as accurate observations as possible should be taken from some reliable base of the summits of these peaks and the prominent points along them, in order that we may get some idea of the rate of denudation.

I am sure you would like me to thank Mr. Fox, on your behalf, for the great trouble he has taken with this lecture, and, as I say, we hope we shall have another lecture from perhaps Dr. Heron, or at any rate some geologist with the Expedition, giving the fuller results of the examination of the Mount Everest region.

Mr. E. H. Pascoe (Director of the Geological Survey of India), sends the following note on Dr. Heron's report :

Before making any comments upon Dr. Heron's interesting paper, I should like to take this opportunity of expressing the Geological Survey's deep appreciation of the courtesy of the Mount Everest Committee in allowing one of us to accompany the Expedition. No one realizes better than we do the grim necessity of cutting down transport and commissariat requirements to a minimum in an expedition of this nature, and we can only hope that the unselfish acquiescence of the Expeditionary leaders in this respect will result in additional public interest and support.

With regard to Dr. Heron's paper, I should like to express my opinion that he has more than justified his selection for the task he has so thoroughly performed. Any one who has ever undertaken such pioneer work in such a rugged country and has had to make his efforts conform to the collective exigencies of a party, has only to look carefully into the geological map submitted, to visualize the heavy going, the arduous and often disappointing climbs, the cold nights, the sore feet, and the frequently empty inside! One might aptly parody the old proverb and say "an ounce of map is worth a pound of text." The primary achievement of Dr. Heron is undoubtedly the prosaic record of the boundary-lines between the Jurassic shales and the Crystalline complex, and similar lines delimiting the outcrops of Cretaceous and Tertiary beds and

indicating, however approximately, the extent of the interesting granite-invaded limestones presumed to be of Permian and Triassic age. We could ill spare the carefully worded remarks and conclusions, but our loss would be profoundly greater if we were deprived of the map. I am constrained to dwell emphatically on this point, as the value and importance of a geological reconnaissance are too often estimated by the number of unusual or unique features and occurrences found therein. The ultimate importance of a map like that before us can only be appreciated when it can take its place as part of a complete geological picture of Central Asia. If it had consisted of one monotonous outcrop of Jurassic shales with no boundary-lines drawn, it would still have been work of prime necessity and importance, without which our endeavour to reconstruct the history of the Earth's crust would have lacked valuable and perhaps critical facts.

The Men Chu, Bhong Chu, and a few other east-west portions of the river system occupy synclines of Cretaceous limestone. It would be unwise, I think, to classify these valleys as synclinal valleys without a word of modification. In the early stages of folding these synclines may have been structurally responsible for the valleys, but that the two features—valley and syncline—still coincide in parts of a system of tightly packed isoclines, seems attributable more to the accidental inferiority in erosion resistance of the Cretaceous beds themselves. That the latter are softer than the immediately surrounding rocks, I gather from Dr. Heron's remark that the Shi Chu and the Lo Chu "also have their courses largely determined by the presence of softer bands of Cretaceous limestones." Possibly Dr. Heron has other confirmatory grounds for speaking of the distinct synclinal origin of the Dzakar Chu, Ding Chu, Neo Chu, and other streams.

One of the most interesting series found seems to be the band of metamorphosed limestones occurring not far from Mount Everest itself, between the gneisses and the Jurassic shales, and attributed with some degree of probability to the Permian and Lower Trias, corresponding to Hayden's Dothak series. A good many points remain to be cleared up regarding their relationship to the gneiss and its intrusive granite, but Dr. Heron seems to have had good reason for his conviction that they include metamorphosed sedimentary deposits. It is to be hoped that he may this year be fortunate enough to discover identifiable fossils.

To some the most interesting find is, perhaps, that of Hayden's Kampa system, and especially of the Eocene members thereof. The occurrence of our old friend the *Alveolina* limestone in the Tsipri ridge illustrates the extension of marine Eocene conditions along the north of the Himalaya chain, and it will be of the greatest interest, from a structural as well as from a palæo-geographical point of view, to trace, as we shall when this part of Asia has been more completely worked over, any correspondence between the Tibetan Eocene waters and the Indian Eocene gulf which stretched from the Punjab south-eastwards along the southern foot of the Himalaya at least as far as the vicinity of Naini Tal. I am convinced that there is a close and interesting analogy between the Tsangpo valley and this old Punjab gulf, which there is good reason for believing gave place to a large north-westerly flowing river. Dr. Heron's description of the ferruginous sandstone of the Tsipri ridge, with its "spherical concretions of iron oxide," is very suggestive of the ferruginous pisolitic band so characteristic of the base of the Indian Eocene or Nummulitic series.

THE MOUNT EVEREST BOOK

Mount Everest : The Reconnaissance, 1921.— Lieut.-Colonel Howard-Bury, D.S.O., and other Members of the Mount Everest Expedition. London : Edward Arnold & Co. 1922. Pp. x. and 356. *Maps and Illustrations.* 25s. net.

THE Reconnaissance Expedition of 1921 to Mount Everest meets with a worthy record in this handsome, well-printed, and finely illustrated volume. Both the authors and the publishers are to be congratulated on having been able to put the work in the hands of the public with such promptitude and at a moderate price. It is also fortunate that the writers who chiefly contribute to the text prove themselves able not only to travel and to climb, but also to observe and to describe so well that every reader who cares for mountains and sublime scenery can follow in their footsteps with unflagging interest.

The volume opens with an emphatic assertion by Sir Francis Younghusband of the claim of mountaineering to a front place among the outlets for the physical energy which is characteristic of the British race and has incidentally helped to create the British Empire. He goes further and looks on it as an incident in that struggle of the human spirit against material obstacles which has marked the progress of mankind. He is content to say to the utilitarian who asks, "Of what use is it?" "None at all from your point of view," rather than to refer him to the practical and commercial results that have in many cases followed on mountain exploration.

The story of the expedition, treated as a whole, is admirably told by its leader. The Society and the Alpine Club were fortunate in having at hand in Colonel Howard-Bury one who was not only from his previous Himalayan and Tibetan experiences exceptionally competent to deal with the local difficulties, but was also as a skilled describer and photographer of mountains, a sportsman and a great lover of flowers, singularly well qualified to observe and depict the natural features of the region to be explored. His chapters are consequently far more than a tale of mountaineering; they will furnish geographers with a living picture of a portion of the Earth's surface which has hitherto been not only unknown but misdescribed! About the date of the march to Lhasa it was the fashion to portray Tibet as a whole as a howling wilderness. Bleak and bare in parts it doubtless is; and the contrast found in the sudden transition from the lavish profusion of Sikkim forests to its chilly uplands makes the impression on the traveller's mind and memory the more vivid. But the party had made but a few marches beyond Kampa Dzong before we find ourselves overlooking one side valley in which fifteen villages are in sight at once, or another pictured as a mass of wild rosebushes covered with hundreds of sweet-scented blossoms 3 inches in diameter. And when we reach later in the journey the Arun Valley and Kharta, we read of hillsides covered with barley-fields, "country houses" surrounded by groves of poplars and willows, watercourses outlined by banks of tall primulas.

From the Tibetan authorities, and in the convent-fortresses visited, the expedition met with consistent friendliness and help in the form of supplies, and a venerable abbot, the doyen of living saints, proved willing, by consenting to be photographed, to add an object of devotion for the shrines of his worshippers. In the more secluded valleys under the great peaks the explorers found beves of anchorites of both sexes, spending years of seclusion in holes of the rocks, engrossed in meditation and cut off from human society, but

making friends, like St. Francis, with the birds and wild animals, whose slaughter was strictly forbidden. The villagers and country proprietors were uniformly well disposed. Even the coolies, generally hired from village to village, proved fairly effective, though the statement that they reckon distances by the cups of tea consumed, on an average three cups to 5 miles, suggests that their halts may have been inconveniently frequent. But the little band, selected and trained for high ascents by the mountaineers of the party, earned praise for the endurance and spirit shown by them in difficult climbs and moments.

Not the least attractive from a literary point of view of the contributions that follow is that of the climber, Mr. Mallory. By the unfortunate death of Dr. Kellas and the subsequent illness of Mr. Raeburn, both of whom brought Himalayan experience to the common stock, he and his colleague Mr. Bullock were left in a position of exceptional difficulty and responsibility. Mr. Mallory gives a singularly clear, modest, yet vivid description of the difficulties that had to be met and surmounted in reconnoitring the approaches to the great mountain, of the solemn splendour of its northern glaciers, the woodland charm of its eastward glens, overhung by the icy precipices of Makalu, a peak which is likely to become a rival for the prize of beauty to the Sikkim Siniolchum. We may also note that Mr. Mallory has set a good example to the Alpine Club by discarding for the most part the foreign technical terms (*Bergschrund*, *couloir*, *arête*, and the like) which have been far too frequent in our climbers' books of recent years. It may however be suggested that the old English "gap" is better than "col" for an impracticable saddle. Col, whatever its Latin derivation, has come to connote a pass.

Dr. Wollaston, an explorer hardened in Central Africa and New Guinea, adds the notes of a naturalist and recounts the obstacles a collector meets with in districts where all animal life is held sacred, and the birds and small animals live in relations of mutual confidence with mankind. A botanical list shows that if novelties, after the researches of Sir J. Hooker and others in corresponding regions of Sikkim, were few, the flora is rich in exquisite varieties. Primulas are found in special abundance, there is a lovely blue poppy, and several fascinating varieties of large and small starry gentians. In a concluding chapter, Prof. Collie, writing from the point of view of a president of the Alpine Club and a Himalayan traveller, gives a summary of the work done by the Reconnaissance. In so doing he has in some degree anticipated and rendered superfluous the task of the expert reviewer. But it may perhaps be permissible and useful to emphasize here the main orographical results recorded in the volume before us, and to indicate a few points on which further information may be looked for next year.

The work of the Mount Everest party sent out from England seems to resolve itself into two sections; the first in importance, as connected with its main object, was the search for a practicable approach to the summit ridge of Mount Everest; the second was the investigation of the peaks and passes in the stretch of some 90 miles between Makalu and Gosainthan. The former again may be divided into the story of the northern approach from the basin of the Rongbuk glacier, and the eastern from the head of the Kharta valley. The Rongbuk valley below the snow-level is a bleak and monotonous glen, a long straight corridor redeemed only by the great Colossus that looms at its head. Its glaciers so far as they were examined appear to afford no practicable passage southward, while the ridges that fall westward from the cliffs of Mount Everest are, to put it mildly, uninviting to a climber's eye. No ready access to

them from the snowy reservoirs that fill the deep hollows at their base revealed itself to the explorers. The north-east crest, the upper portion of which had suggested itself to distant observers as a possible path to the final peak, appeared equally unapproachable from the Rongbuk snowfields. Accordingly at the end of July the climbing party moved their camp by a considerable detour to the Kharta valley on the east side of the mountain. They had by a singular mischance just missed the key of the problem. Hidden away behind the ridge on the east of the Rongbuk glacier lay another large ice-stream which flowed straight from the base of the desired north-east crest. The stream issuing from it was relatively small, and thus failed to attract notice. A few days later, however, the officers of the Indian Survey, who were more or less attached to the party, but had been prospecting farther west, began to attend to the Rongbuk and discovered this hidden glacier, which they named the East Rongbuk. They pronounced it to be practicable throughout; this news reached the climbers at Kharta in the middle of August. For them and still more for the world this delay had its compensations. But for it the glories of the Kharta and Kama valleys might have remained undiscovered, we might have lost the pictures of their magnificent forests of gigantic junipers and silver firs, of the fields of mountain flowers, of the tumbling torrents that fall precipitously from the stupendous precipices and glaciers of Makalu and its rocky satellites. After the story of arduous struggle and endurance among the treasure-houses of the snow the reader turns with delighted surprise to the pages that record the explorers' arrival in this fairyland, nurtured by the perpetual showers that swim up the great ravine of the Arun river.

Nor was their excursion into a more hospitable region without a direct practical result. Among the glaciers at the head of the Kharta valley they found a camping-ground on stones at 20,000 feet, and a gap of 22,230 feet which led by a descent of 1200 feet to the head of the East Rongbuk glacier. From this pass the view of the upper part of the mountain satisfied them that, apart from elevation, the climb might prove practicable. How an attempt was gallantly made and failed is told by Mr. Mallory. He furnishes some interesting figures. The point reached, called the Changla, 23,000 feet, is $2\frac{1}{2}$ miles from the summit; the part of the final crest to be traversed is about half a mile, in which the rise is only 1000 feet. The climb up the face of the buttress cannot therefore be less than 5000 feet in 2 miles, and a camp on it must be regarded as probably essential to complete victory.

For the rest, the exploration of the chain to the west of Mount Everest was greatly hindered by bad weather. In this respect the expedition met with ill luck throughout. There is good reason to believe that in most years September at least is fair. The Kyetrak glacier which leads to two passes practicable at all seasons, the Khombu La and Pusi La, was first visited. The latter, which is under 18,000 feet and free from snow, was traversed by members of the party who penetrated as far as Nyenyam, near the base of the great peak of Gosainthan. On their return they visited the sacred vale of Lapchekang, overhung by Gaurisankar, a magnificent mountain visible from Katmandu. This part of the narrative might well have been more fully illustrated. We offer the hint to the editor of next year's volume. We may point out another matter on which more precise information will be welcome. In the General Map neither the Nepalese-Tibetan frontier nor the approximate line of the watershed are laid down. We write *approximate* because in a preliminary survey accuracy in precise detail among the masses of a chain can hardly be everywhere attained. It is however obvious that here, as formerly on the Sikkim frontier, it is not

the crest of the range but its southern gorges that constitute the political barrier. Several of the heads of the valleys on the southern slope were made accessible to the expedition by the fact of their being politically Tibetan. It would be interesting to know if this is also the case in the valleys east of and accessible from the Khombu La that lie immediately under Mount Everest. The great southern precipice of the mountain so conspicuous from Sikkim must be a prodigious feature.

The survey party, who were acting under the instructions of the Surveyor-General of India, did not join the mountaineers for some time, but worked separately till the end of August. They report that the outturn of work during the expedition was as follows :

$\frac{1}{4}$ -inch revision survey (Sikkim)	1000 square miles.
$\frac{1}{4}$ -inch original survey	12,000 ,,
Detail photo survey (environs of Mount Everest) 600 ..	,,

The last has only just been issued, and not yet in final shape, and the map in this volume is a provisional sketch from photographs, made at Lowther Lodge. Whenever the official map is forthcoming we shall hope to find the name Chomolungma attached to the group of which Mount Everest is the crown, and the official Tibetan name inserted in brackets under the European words Mount Everest. It is clear that it is now too late to call the highest mountain in the world by any other name than that it has borne for more than half a century. But the picturesque title it bears in its own country (by-the-bye, three differing translations of Chomolungma, all more or less poetical, are offered in this volume) should be preserved. And there is evidence here (p. 225) that the name is applied to the whole group just as Monts Roeses (Monte Rosa) was in the sixteenth century made to include all the summits between the St. Théodul and the Weissthör. How loud would have been the protest had the Swiss Survey not been content with naming the Höchste Spitze the Dufour Spitze after their head, but attempted to suppress the traditional Monte Rosa! We would not impute the intention to commit a similar indiscretion to the authorities at Calcutta.

D. W. FRESHFIELD.

REVIEWS

EUROPE

History of the Port of London.— Sir J. G. Broodbank. London: Daniel O'Connor. 1921. 2 vols. Pp. xx. + 532. 63s. *net*.

THIS is likely to be for a long time the standard work on its subject. It records the growth of the port and its organization from the earliest times; but the author naturally devotes most of his space to the harbour and dock developments of the last fifty years. From 1871 to 1920 he was himself an active worker in the port, first as an officer of two of the Dock Companies, and later, since 1909, as Chairman of the Docks and Warehouses Committee of the Port of London Authority. This long experience, and his facilities for access to the Port records, give the author unique qualifications for a task which has evidently been a labour of love. It may also account for the most obvious weakness of the work, a general limitation to an inside view and a lack of comparisons with other ports which might have added to its value. A study of these volumes tempts one to misquote a well-known line and say

“What can they know of London who only London know?”