

# RECORDS

OF THE

# SURVEY OF INDIA

Volume XVI

(Supplementary to General Report 1920-21)

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## ANNUAL REPORTS OF PARTIES AND OFFICES 1920-21.

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PREPARED UNDER THE DIRECTION OF

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Surveyor General of India.



DEHRA DUN  
PRINTED AT THE OFFICE OF THE TRIGONOMETRICAL SURVEY  
1922

*Price Four Rupees or Eight Shillings.*



Major James Rennell,  
Bengal Engineers,  
Surveyor & Geographer.

Born 3rd December 1742. Buried in Westminster Abbey  
6th April 1830.

Fellow of the Royal Society 1781. Copley medal of the  
Royal Society 1791. Member of the Institute of France; of  
the Imperial Academy of St. Petersburg; and of the Royal  
Society of Gottingen. Instrumental in the forming of the  
African Society, whilst the Royal Geographical Society was  
his "Successor and Executor".

Served in the Royal Navy 1756—1763; as a Surveyor in  
Bengal 1764—1766; and as Surveyor General 1767—1776.



## PART III.—SPECIAL REPORTS.

### HIGH CLIMBS IN THE HIMALAYA PRIOR TO THE EVEREST EXPEDITION.

BY MAJOR KENNETH MASON, M.C., R.E.

(Reprinted by permission of the Proprietors of the "*Pioneer*").

At a time when the Alpine Club, Royal Geographical Society, and Survey of India are combining in an effort to reach the earth's highest summit, it is interesting to review briefly the most prominent mountaineering achievements in the Himalaya. With a northern barrier of stupendous ranges containing the highest peaks of the earth, it is not surprising that for more than eighty years, the mountaineering altitude record has lain in this borderland. It is not proposed to deal with ascents outside this region, nor with expeditions that do not involve high mountain climbs. It may however be mentioned that in other continents, Aconcagua alone attains an altitude of 23,000 feet, and its summit has been reached.

The first recorded ascent to this altitude is typical of the lack of interest in alpine craft, which has almost invariably been exhibited by the vast majority of Englishmen in India; and, incidentally, this climb is one of the very few records, the authority of which has never been assailed. About 1860, an Indian khalasi of the Great Trigonometrical Survey, carried a pole to and fixed it at the summit of Shilla in Spiti. The height was unknown till the observations were made and the results computed; no interest was then aroused, the man's name was forgotten, and the record was buried in a large volume of figures.

It was not till about 1906, nearly fifty years afterwards, that Dr. T. G. Longstaff, on a visit to India, interesting himself in the Survey records, discovered that the Shilla khalasi had held the world's altitude record, 23,050 feet, for some years.

During the surveys of Kāngra, Kumaun, Kashmīr and Ladākh from 1850 to 1865, no less than 37 ascents to over 20,000 feet, including 5 to above 21,000, were made by the Survey of India employés and have been proved by careful trigonometrical observations; if the plane-table fixings of the detailed survey are included, these numbers must be vastly increased. Of all of them, the most interesting which has led to much controversy, was the casual statement by Mr. W.H. Johnson in the report of his journey to Khotan in 1865, that he had climbed the mountain "E61", whose height had previously been determined by triangulation to be 23,890 feet. Mr. Johnson himself laid no claim to an altitude record, probably because no one was particularly interested in such matters in those days. Nevertheless it is now practically certain that owing to the point being incorrectly plotted on his plane-table, it was not "E61" but either Zokputaran, Pk 2/61A, (22,639) or Cholpanglik, Pk 8/52M, (23,309) that was climbed. In any case, either climb, coupled with his other achievements, entitles Johnson to a foremost place among the mountaineers of his day.

In 1883, Mr. W.W. Graham, assisted by Swiss guides, made some notable ascents in Sikkim. He claimed to have reached a point within 50 feet of the summit of Kabru, Pk 16/78A, (24,002) and to have established a world's altitude record. Though supported by Freshfield, doubt has often been thrown on the ascent, and the latest opinion among experts, including the president of the Alpine Club and Harold Raeburn, the leader of Everest's mountaineering party, is that Graham was mistaken and that the peak he climbed was the lower "Porked Peak".

There are no further records or claims to 23,000 feet until Dr. H. Workman reported that he reached a point estimated by him at 23,394 feet on a peak in the Chogo Lungma region in 1903. Later, in 1906, Mrs. Bullock Workman claimed to have reached the summit of "Pinnacle Peak", (Pk 6/52B) in the Nun Kun district. She contended that the height of the peak was 23,300 feet, and that the triangulated survey height, 22,810, was inaccurate. The peak however has been refixed since then, and the old height has been found to be correct within a very few feet. Nevertheless this climb of Mrs. Bullock Workman is, it is believed, an altitude record for ladies.

In 1905, Dr. T. G. Longstaff came to India and we get definite records that are unchallenged. In that year, with the assistance of the two Brocherels from Switzerland, he

attempted the ascent of Gurla Mandhata (Pk 7/62F), 25,355. Of all climbs in the Himālaya, this one of Longstaff stands out as the supreme exhibition of human endurance. From a camp at 20,000 feet, the party reached a height of about 23,000 feet on the western *arête* of the mountain. At this point an avalanche swept them away to a glacier some 1,000 feet below; by keeping their wits they succeeded in extricating themselves from the snow and camped in the shelter of some rocks near the glacier.

This they ascended the following day, and reached a point above 23,000 feet, where they were forced to spend their fourth night in a hole dug in the snow. On the fifth day they made their final effort, and though Longstaff has never claimed to have reached 24,000 feet, most competent critics credit him with having reached this altitude.

In 1907, Longstaff made another expedition to Garhwāl, and with a Swiss guide and Gurkha orderly reached the summit of Trisūl (Pk 117/53N), 23,360 feet. The climbing of nearly 6,000 feet in 10½ hours, on the last day at this altitude, was the notable feature of this climb.

During the same year two Norwegians, Rubensen and Monrad Aas, reached the summit of Kabru, 24,002 (Pk 16/78 A). For twelve days they struggled through ice and snow at altitudes over 20,000 feet, a single icefall, 1,500 feet in height, taking them five days to negotiate.

The present height record\* was attained by the Duke of the Abruzzi in 1909. After setting out with the object of climbing K<sup>2</sup>, the second highest mountain in the world, and after reconnoitring all sides of it in vain for practicable routes to its summit, he decided to attack "Bride Peak" (Pk 25/52A), on the south side of the Baltoro glacier. Nine days were spent over 20,000 feet, and a final altitude of 24,583 (from hypsometric readings) was reached. The party was eventually stopped by foul weather and the summit which had been fixed by the Survey of India at 25,510 was not attained.

Mr. C. F. Meade's expeditions in 1910, 1912 and 1913, with a Swiss guide, are particularly interesting, for they illustrate the results that may be obtained by perseverance in the attempt to conquer a particular peak. Meade selected Kāmet, (Pk 49/53N), the height of which was known to be 25,447 feet. In his last expedition he reached a saddle to its north, pitched his camp there and ascended about 100 feet higher. The height of this camp, estimated by him at 23,000 feet, has since been fixed by the Survey of India as 23,500, and is the record altitude\* at which human beings have passed a night. The actual height reached was about 23,600, but the party was forced back by exhaustion, powdery snow and a powerful sun.

Lieut. Slingsby about the same time, reached a point about 23,350 on the other side of Kāmet, and Dr. Kellas and Major Morshead last year (1920) followed Meade's route and reached his camping ground on the Kāmet saddle, where however their coolies refused to take their camp. Among other climbs of Dr. Kellas, may be mentioned that on Pauhuri in Sikkim, 23,186.

The list above embraces all the recorded climbs over 23,000 feet in the Himālaya, and nothing has been said of the many lesser climbs which have been made and recorded in the annals of the Alpine Club. References to these are often extremely scrappy and difficult to follow, for maps in India have not been made with a view to assist in the identification of minor peaks, the vast majority of which are unnamed and unnumbered. Allusions to "Broad Peaks", "Pointed Peaks", "Snowy Peaks", &c., make the task of investigation an impossible one, as such names are not entered on our maps. Nevertheless there are undoubtedly many ascents of the highest climbing order that have been made in this country by members of the Alpine Club.

This short summary would be incomplete and misleading, unless mentions were made of a few failures. Everest, first and foremost, has never been attempted. But K<sup>2</sup> and Kinchinjunga, the next on the list of high peaks, have both been visited. Several expeditions under competent leadership have visited them, and the conclusion has been reached that neither presents a feasible route sufficiently easy to negotiate at that high altitude.

Glaciers and mountains have claimed their victims in the Himālaya as in other parts of the world; but with the exception of an insignificant number of accidents due to hidden crevasses, which are always avoidable with proper precautions, and the fatal but unforeseen avalanche on Nanga Parbat, resulting in the death of Mummery, the remaining fatalities have befallen sportsmen generally in search of game. These have either not realized the risks or taken no precautions. In the Himālaya, as in the Alps, far more accidents are caused by ignorance of the art among amateurs than by acts of God.

\* These records have since been beaten by the Everest expedition 1922.





Photo by MAJ. WHEELER.

SHEKAR VILLAGE AND MONASTERY.

Blackburne - History of India, Volume, 1920.





Photo by MAJ. WHEELER.

Photogravure. Survey of India Offices, Calcutta, 1933.

SHEKAR VILLAGE AND MONASTERY.

**REPORT ON THE OPERATIONS OF THE MT. EVEREST SURVEY  
DETACHMENT, 1921.**

**I.—NARRATIVE REPORT.**

BY MAJOR H. T. MORSHEAD, D. S. O., R. E.

Towards the end of December 1920, news was received that Mr. C. A. Bell, C. M. G., C. I. E., I. C. S., then in Lhāsa on a special mission, had succeeded in obtaining the consent of the Tibetan Government to the despatch of an Expedition to Mount Everest. Preparations were at once put in hand in England by a joint committee of the Alpine Club and the Royal Geographical Society, and an expedition was organised under the leadership of Lt.-Col. C. K. Howard Bury, D. S. O., an officer who had only recently returned from India, whither he had gone at his own expense, with the object of investigating the possibilities of such a scheme.

The other members, selected by the Mt. Everest Committee to form the expedition, were:—

H. Raeburn, Esq.	}	Mountaineering
Dr. A. M. Kellas, D. Sc., Ph. D.		Experts.
G. L. Mallory, Esq.	}	Climbers.
G. H. Bullock, Esq.		
Dr. A. F. R. Wollaston, D. S. C., M. A., M. B., Surgeon and Naturalist.		

In addition, the Indian Government agreed to the deputation of a small survey detachment, and of an officer of the Geological Survey (Dr. A. M. Heron, D. Sc., M. A.). The expedition, with a large supply of stores and equipment, assembled in Darjeeling early in May.

The composition of the Survey Detachment selected to accompany the expedition is given below:—

*Class I Officers.*

Major H. T. Morshead, D.S.O., R. E., in charge.

Bt.-Major E. O. Wheeler, M. C., R. E.

*Upper Subordinate Service.*

Mr. Lalbir Singh.

*Lower Subordinate Service.*

1st Class Surveyor Gujjar Singh.

Inter „ „ Torabāz Khan.

3rd Division Photographer Abdul Jalil.

*Menial Establishment.*

16 Khalasis, etc.

The detachment was placed under the administrative control of the Superintendent of the Trigonometrical Survey.

The tasks allotted to the detachment were:—

(1) A general survey of the whole unmapped area covered by the expedition, on the scale of 4 miles = 1 inch.

(2) A detailed survey of the immediate environs of Mt. Everest on the scale of 1 inch to 1 mile.

(3) A complete revision of the existing  $\frac{1}{4}$ -inch map of Sikkim (sheet 75 A).

The survey operations were to be confined as far as possible to the beaten track followed by the expedition. In deference to Tibetan susceptibilities, the survey operations were to be confined as far as possible to the beaten track followed by the expedition. Col. Bury's plans contemplated an outward northerly journey *via* Shekar and Tingri to the western flank of Mt. Everest, whence the reconnaissance of the mountain was to be carried out from west to east, parallel to the northern frontier of Nepāl. This rendered feasible the mapping of the whole unknown area between the southern watershed of the Tsangpo river (the so-called Ladākh Range) on the north, and the main Himālaya Range (the Nepāl-Tibet frontier) on the south, as far west as Long. 85° 30'.

For the purpose of the detailed survey, it was arranged that Major Wheeler should make a thorough test of the Canadian pattern of photo-survey apparatus, of which he had had previous experience in Canada. This method of survey is specially adapted for use in high

mountain regions. Fortunately, the experimental outfit, which had recently been ordered from England, was delivered just in time to accompany the expedition. Major Wheeler's report on his season's work will be found on page 117.

With a view to carrying out the revision survey of Sikkim while awaiting the arrival of the members of the expedition from England, the Survey detachment was authorised to assemble at Darjeeling early in April—six weeks before the date fixed for the start of the expedition. The surveyors were provided with special "combined" blue-prints of the latest (1921) edition of the map; these were pinned to the plane-tables on the top of sheets previously mounted and prepared for use in the Mt. Everest area, so that at any moment when required to advance each surveyor had merely to strip the top sheet of paper from his board.

After completing the necessary arrangements with Col. Bury, I left Darjeeling on 13th May, intending to join the remainder of the expedition at Kampa Dzong, Narrative Report. after inspecting the work of the three surveyors in Sikkim. Continuous rain however, rendered the latter task impossible; the road was moreover blocked in several places by severe landslips, so that I only reached Kampa Dzong on 28th.

The remainder of the expedition, which had left Darjeeling in two parties on 18th and 19th May, had been delayed in the Chumbi Valley owing to the breakdown of the 100 transport mules lent by the Quarter Master General's department, and did not arrive at Kampa Dzong until 5th June. While awaiting their arrival, I filled in the time by occupying and re-observing from Colonel Ryder's old triangulation stations of 1903, overlooking the Kampa plain. The arrival of the expedition at Kampa was saddened by the death of Dr. Kellas from heart failure consequent on severe gastritis. He had been unwell almost from the start, but with characteristic determination had refused to give in or to turn back. He was buried the following day on a spur near the dzong, in sight of the three great peaks of Chomiomo, Kangehenjau and Pauhumi, which he alone had climbed. Mr. Raeburn, who was also unwell, was at this point compelled to return temporarily to Sikkim, under Dr. Wollaston's care. The Sikkim revision-survey having been so much delayed by bad weather, I decided to take only two of the surveyors with the expedition into Tibet, leaving surveyor Torabaz Khan to complete the comparatively dry areas of northern Sikkim before the arrival of the monsoon. This he succeeded in doing at the cost of considerable personal discomfort, returning to Darjeeling in July.

Resuming our march on 8th June, Tengkye Dzong was reached in two stages. Here a day's halt was necessary while fresh transport was being collected. Up to this point, I had managed to carry on a rapid triangulation while keeping pace with the remainder of the expedition. I realised, however, that with daily marches averaging 15 to 20 miles this would no longer be possible, and that it was necessary to decide at once whether to delay the surveyors sufficiently long to enable a triangulation to be carried forward, or, alternatively, to allow them to keep pace with the expedition while merely utilizing the previously existing triangulated points, of which a fair number were visible. In view of the obvious signs of a rapidly approaching monsoon, I decided in favour of the latter alternative.

From Tengkye we marched in 6 stages to the next dzong, Shekar—crossing the broad sandy bed of the Shiling river a mile above its junction with the Phung Chu. Owing to the prevalence of rinderpest in the Phung Valley, the transport yaks and bullocks provided by the dzongpen of Tengkye had to be replaced by donkeys for the two last marches before reaching Shekar.

The Phung river is remarkable for the amount of mud which it carries in suspension; below Shekar it flows through a wide, open valley with occasional stretches of fertile marshland, and scattered clumps of a stunted species of *salix* resembling sea-buckthorn, known in Tibetan as "lamdse." Flowering clematis everywhere abounds, and a sweet-smelling valerian or candytuft—the latter is said by the Tibetans to be very poisonous, and is carefully avoided by cattle.

The town of Shekar is situated five miles north of the Phung Chu, on the edge of a level plain containing numerous irrigated fertile barley-fields, with scattered hamlets and *gumpas*. The large monastery of Shekar Chöte is finely situated on a commanding hill behind the town to which it gives its name—Shekar being an abbreviation of "Shel Karpo" (white glass), in allusion to the numerous windows and conspicuous whitewashed walls of the monastery, which glisten in the morning sun. At Shekar, transport requirements once more necessitated a day's halt, on 17th June; this we utilised in visiting in turn the dzong and monastery, where we were hospitably received. A sharp shower of rain fell in the evening, a forerunner of the coming monsoon.



HIGH CAMP ON KYETBAK GLACIER.

Photo by Major Wheeler.

Photo-engraved & printed at the Offices of the Survey of India, Calcutta, 1928.



Pl. 26,867

KYETRAK GLACIER.

NANGPA LA

CHO KAPSANG.

PHUSE LA

GAURI SANKAR.

RA CHU AND KYETRAK GLACIER, LOOKING TOWARDS NANGPA LA.

Photo by Major Wheeler.

Photoduplicated & printed at the offices of the Survey of India, Calcutta, India.

Resuming our journey up the Phung Valley, Tingri was reached in two long marches on 19th June. Tingri possesses no dzong, its affairs being managed by a *nyerpa* or steward, subordinate to the dzongpen of Shekar. It is also the peace-time headquarters of a Tibetan general; the present incumbent was however absent on active service in Kham, and his duties, which mainly consist of safeguarding the annual tribute paid to the Nepāl Darbār, were being carried on by a civilian agent and a couple of soldiers. This tribute, amounting to 60 *dots* (Rs. 5,000) annually, has been paid by Tibet every November since the last Gurkha invasion in 1854, when the Gurkha forces reached almost to Shigatse.

The village of Tingri or Gangkar (white spur) is built on the slopes of a low isolated hill in the middle of an extensive alluvial plain. The hill is crowned by the remains of a Chinese fort, now abandoned; just below is the erstwhile residence of the Chinese commandant—a building now used as a "circuit-house" for Tibetan officials when on tour. This was destined to be the headquarters of the expedition for the next six weeks, and formed a convenient centre for various scientific excursions into the surrounding districts; a dark-room was installed in which Abdul Jalil was kept busily employed in developing the photographs taken by the several members of the expedition.

After a few busy days spent in sorting and arranging kit, Col. Bury accompanied by Dr. Heron, started on a hasty reconnaissance of the tracts of country known as Phārūk and Khārta, lying to the north and east of Mt. Everest, with the object of settling on a suitable site for the next headquarters when a further move should become necessary. Bullock and Mallory set off to examine the north-west approaches of Mt. Everest, and to train the coolies in ice, snow and rock technique. Major Wheeler commenced his photo-survey in the neighbourhood of Kyetrak, two marches to the south. Leaving Lalbir Singh at headquarters to complete and ink-up his plane-table, I started with Gujjar Singh to explore the western tributaries of the Phung Chu. The first day's march led us past the hot spring at Tsanda into the broad Sutsu plain. Turning westwards at Gutso, two more marches brought us to Menkhaptō. Eight miles beyond this village, the road crosses a high spur known as the Lungchen La, from which a good view is obtained over the whole Pekhū plain, which extends 20 miles to the west. This plain is almost uninhabited, and its features can be sketched from a couple of fixings on either side of the Lungchen Pass. Bad weather had now set in, and the snowy range forming the western boundary of the plain was hidden in cloud. I therefore left Gujjar Singh camped on the pass to await a favourable opportunity for completing the survey of this area, and myself returned to Tingri at the end of June, rejoining Dr. Wollaston who had been detained by an outbreak of enteric fever among the expedition servants.

The next few days were spent in examining Lalbir Singh's work, and correcting his list of village-names with the assistance of the local Tibetan officials, after which he departed on a lengthy programme of work in Phārūk and Khārta. It was three months before I saw him again.

About this time, a messenger arrived from the dzongpen of Nyenam, inviting us to visit his district which lay four marches to the south-west, in the valley of the Pō Chu, or Bhotia Kosi river. Although Nyenam was not one of the districts specifically mentioned in our passport, we decided, with the concurrence of Col. Bury who had meantime returned to headquarters, to avail ourselves of the opportunity of visiting this little-known area. Leaving Tingri on 13th July, Wollaston and myself, with surveyor Gujjar Singh and interpreter Gyaldzan Kāzi, camped that night at Lungkor, a small village at the western edge of the Tingri plain. There is here an interesting temple, said to be over 1,000 years old, containing a stone which is alleged to have been thrown over the Himālaya Range from India and to have pitched on the Tingri plain, whose name is derived from the noise ("ting") made by the falling stone. The stone is carefully preserved inside a wooden box which is opened with much ceremony on the first day of the Tibetan new year.

Crossing the Thung La (17,980 ft.) in a driving snowstorm, a long march of 22 miles brought us next day to the village of Tulung in the valley of the Pō Chu. Two days later we reached Nyenam (12,500 ft.), a large and very insanitary village which is known under the name of Kūti by the Nepālese who constitute the majority of its inhabitants. These Nepālese traders (Newārs) have their own Hindu temple in the village; there is also a Nepālese *chauki* with a *hākīm* (magistrate) having summary powers of jurisdiction over Nepālese subjects. He is specially charged with the settlement of trade disputes, and the encouragement of Tibeto-Nepālese trade and commerce.

As is customary in all important districts of Tibet, there are here two dzongpens who, by a polite fiction, are known as "eastern" and "western" (*dzongshar* and *dzongnup*) respective-

ly. Actually, the functions of the two dzongpens are identical—the *raison d'être* of the double régime being an attempt to protect the peasants from extortion by the device of providing two administrators who, in theory at least, act as a check upon each other's pecculations. At the time of our arrival, these two worthies were so busy preparing a picnic that we had considerable difficulty in getting their attention.

I spent three days in exploring the neighbourhood of Nyenam, while Wollaston was engaged in his botanical and zoological pursuits. Gujjar Singh with the plane-table being detained by bad weather higher up the valley, I was reduced to rough route-traverses by prismatic compass for this portion of the map. Below Nyenam the river enters a very narrow gorge, while pines and other forest trees begin to appear; the road, which here becomes impassable for animals, crosses the river four times in eight miles before reaching the village of Choksum, but I could find no trace of the portion described by explorer Hari Rām in 1871 as consisting of slabs of stone 9 to 18 inches wide supported on iron pegs let into the vertical face of the rock at a height of 1,500 ft. above the river. At Choksum (10,500 ft.) the river falls at the average rate of 500 ft. per mile. The Nepāl frontier is crossed near Dram village some 10 miles below Choksum, but owing to the vile state of the weather, which rendered even the roughest attempts at surveying impossible, I abandoned my idea of reaching the spot.

On 20th July we returned 9 miles up the valley to Trashigang, where we found Dr. Heron encamped, together with Gujjar Singh whose work had been hung up for a week by continued cloud and rainfall. Heron went northward next day, while we followed a rough easterly track leading over the Lapche Range to the village of the same name in the valley of the Kang Chu. The weather on this day was atrocious and our last pretence of plane-tabling from fixed points broke down, leaving no alternative but a rough traverse by "time and compass" until we joined up with our earlier work at Kyetrak ten days later. We were unable to reach the village by dusk, and spent a somewhat miserable night camping on boulders in drenching rain at 14,600 ft. with no fuel except a few green twigs of dwarf rhododendron.

Lapche (La-rinpoche = "precious hill") is sacred as the home and birth-place of *jetsün* Mila Repa, a wandering lama and saint who lived in southern Tibet in the eleventh century, and whose collections of songs and parables are still among the most popular books in the country. His hermit-cell still remains under a rock on the hillside, and his memory is preserved by an ancient temple, the resort of numerous pilgrims, alongside which we pitched our tents.

The extreme dampness of the Lapche climate is indicated by the trailing streamers of lichen which festoon the trees, and by the pent roofs of the buildings. The village only contains some eight or ten houses, of which half are occupied by Tibetans and half by Nepālese subjects (Sharpas), each community having its own headman. The inhabitants were very friendly and pleasant, and gave us much interesting information. The village is deserted during the winter months, when the whole population migrates across the border into Nepāl. The Tibetans pay no taxes to Nepāl during their half-yearly sojourn in the lower valley, while conversely the Nepālese during their summer residence in Lapche are not subject to Tibetan taxation or to the imposition of "*ulag*" (forced labour, or "*begār*"). Kātmāndu can be reached from Lapche in eight marches, but the track is bad and very little trade passes this way. Gujjar Singh utilised a day's halt in running a traverse down the valley as far as the Nepāl frontier.

From Lapche we proceeded to the Rongshar Valley, crossing the Kangchen and Kangchung passes. Descending the hill to Trintang village where we camped, the clouds lifted momentarily, disclosing an amazing view of the superb peak of Gauri Sankar towering magnificently above us just across the valley. This mountain, which the Tibetans call Chomo Tshering or Trashi Tshering, is the westernmost of five very sacred peaks known collectively as Tshering Tsenga ("Tsering five-peaks"). Unfortunately, owing to constant clouds, I was unable to identify with certainty the remaining four peaks of Thingki Shalzung, Miyo Lobzung, Chopen Drinzang and Tekar Drozung. Owing to the sacred nature of the Rongshar Valley, the slaughtering of animals is forbidden, and the large flocks and herds of the villagers are only kept for sale in Tingri and Nepāl. We were only able to buy a sheep on promising not to kill it until after quitting the valley.

Trintang village occupies a plateau 1,750 ft. above the level of the Rongshar river; 1,400 ft. below is the village of Tropde, to which the Trintang residents all descend in winter. Rongshar Dzong, which is situated in the lower village, has no importance; at the time of our visit the dzongpen had gone on a holiday, leaving his affairs in the hands of a steward. A day's halt being necessary in order to collect transport, I took the opportunity of descending the



TIBETAN DANCERS AT LINGGA.



BREAKING CAMP AT GYANGKAR NANGPA.

Photo. by Major Wheeler.





FOOT-BRIDGE OVER RONGBEK R. AT CHÖBU.



ROPE-BRIDGE OVER PHUNG CHU AT GARTHONG.



FOOT-BRIDGE AT GORGE 6 MILES ABOVE CHÖBU.

Photos by Major Wheeler.  
Photo-secured & printed at the offices of the Survey of India, Calcutta, 1924.

Rongshar Valley as far as the Nepā frontier, while Gujjar Singh endeavoured, without much success, to pick up the threads of his survey by identifying the snow peaks which occasionally afforded us brief glimpses through rifts in the clouds. The Rongshar Chu falls 1,400 ft. in the seven miles between Trojde and the Nepāl frontier, which it crosses at an altitude of roughly 9,000 ft.

On 27th July we marched 20 miles up the Rongshar Valley to the village of Tāsam (Takpa-santsam = "limit of birch-trees") which, as its name implies, is situated at the extreme upper limit of the forest zone. On the way we passed the village and monastery of Chuphar, whence a track leads southwards over the difficult snow-pass of Menlung ("valley of medicinal herbs") to the villages of Rowaling and Tangpa in the Kangphu Valley of Nepāl. The headman of Tāsam was too drunk, on the evening of our arrival, to send out the necessary messages summoning yaks from the grazing grounds. In consequence, our baggage next day only got started at 11 a.m., and we were compelled to pitch our tents at a grazing camp after covering only nine miles. The weather showed signs of improvement in proportion as we receded from the Himalayan gorges, but dense banks of cloud still obscured all the hill-tops. An easy march over the Phūse La brought us on 29th, to the bleak village of Kyetrak at the extreme southern edge of the Tingri plain, an area which had already been surveyed from Tingri.

Four days later we rejoined the expedition headquarters which Col. Bury had just transferred to Khārta, in the lower valley of the Phung Chu. Khārta is a scattered district, administered by a steward who is directly under the Lhāsa government and independent of the Shekar dzongpen. The valleys are dotted with picturesque hamlets and scattered farmsteads surrounded by irrigated fields of barley, mustard and dwarf pea. Numerous tall poplar trees give a distinctive and unusual appearance to the landscape, and form the nesting-places of countless magpies.

The weather during the whole of August rendered out-of-door work almost impossible. Gujjar Singh was occupied during the month in adjusting his traverse, while I endeavoured to fill in the time by making progress-traces of all work so far completed. I also spent ten days with the mountaineers, Mallory and Bullock, on a reconnaissance at the head of the Khārta Valley, when the route was decided on for the season's final high climb, after the monsoon should have abated.

Major Wheeler returned to headquarters on 27th August, having had a very rough and unpleasant time in the Rongbuk Valley, almost due north of Mt. Everest. It is difficult for those who have not actually had the experience, to conceive the degree of mental and physical discomfort which results from prolonged camping during the monsoon at heights of 19,000 ft. or more, waiting for the fine day which never comes. Such had been Wheeler's fate ever since leaving Tingri three months previously.

On 1st September we were surprised by the unexpected return of Mr. Raeburn, who had completely recovered from his indisposition, and who brought with him a welcome gift of apples and corn-cobs from the kind-hearted ladies of the Scandinavian Mission at Lachen.

As the weather now showed slight signs of improvement, it was decided to move to an advanced base-camp 20 miles up the Khārta Valley at a spot known as Khārtaphu (17,500 ft.), whence further preparations could be put in hand for the final high climb. Mallory and Bullock had already left on 31st August, and were followed on 5th September by Col. Bury, Raeburn and Wollaston. After starting Gujjar Singh on an area of 1-inch plane-tabling north of the Khārta Chu, I joined Wheeler during his photographic survey of the Khārta Valley; the weather, as usual, greatly delayed his work, so that we only reached Khārtaphu on 12th. Here there was yet another week of tedious waiting before the weather improved sufficiently to warrant a further move to No. 1 advanced camp, where fuel, stores and mountain tents had already been dumped in advance. The camp was pitched at 20,000 ft. on a stony ledge overlooking the Khārta glacier 500 ft. below. From here, a further consignment of tents and stores was carried to the site of No. 2 advanced camp, on the summit of the col (22,200 ft.) at the head of the Khārta glacier.

After resting the coolies for a day, we all moved up to No. 2 advanced camp on 22nd September. The track led over the Khārta glacier, the surface of which was in good condition, so that the last coolie had arrived by 11 a.m. The wind on the summit of the col was terrific, but unfortunately no other sufficiently level stretch of snow was available on which to pitch the tents. We named the spot Hlakpa La ("windy-gap"). Wheeler's camera and theodolite station on the col is probably the highest station of observation which has

ever been made. His instrument was supported by ration-bags of *tsampa* (parched barley flour) on the snow. The night temperature fell to zero F.

One or two of the coolies collapsed with mountain-sickness after reaching the col; but apart from this, few of us suffered any worse effects from the height than a general feeling of lassitude, and considerable insomnia at night. Our party, consisting of 6 Europeans and 18 coolies, was, however, obviously too large and unwieldy for work at high altitudes. It was therefore decided that only the three experts,—Mallory, Bullock and Wheeler—with 10 coolies and three days' supplies, should go forward to the third advanced camp; the remainder of the party descended again on 23rd September to No. 1 camp to await their return. The mountaineers returned to No. 1 camp two days later, having reached a height of approximately 23,000 feet on the col due north of Mt. Everest, from which point they were compelled to turn back by the terrific gales of wind, which lifted dense clouds of snow into the air and threatened them with suffocation.

The following day, Bury, Wollaston and Wheeler departed southwards for a five-days' tour of the upper Kārma Valley, while the remainder of the party returned by easy stages to Khārta, bringing all the tents and equipment.

The return journey to Darjeeling was made by the various members of the expedition in several different detachments. Accompanied by Gujjar Singh, I left Khārta on 2nd October and ascended the Phung Valley for three marches, rejoining the outward route of the expedition at Shiling. From Gyangkar Nangpa I despatched Gujjar Singh to complete the remaining portions of the Sikkim revision; at the same spot I picked up Lalbir Singh, who, after completing the Phārūk and Khārta areas, had crossed the Phung Chu below Lungtö and worked his way back *via* Tāshirāk and Sār. Travelling *via* Kampa and the Lachen Valley, we reached Darjeeling on 16th October. By 25th October the whole expedition had returned except Gujjar Singh, whose work in Sikkim detained him until early December.

Fair-traces of the whole original  $\frac{1}{4}$ -inch survey had been kept up as far as possible during the expedition; these were completed in Darjeeling and despatched to the Photo-Litho. Office for vandyking, so that a preliminary map printed in six colours was available before the last members of the expedition had sailed from Bombay.

The earliest recorded European travellers in the area, are the German Jesuit Johannes

Grueber and his Belgian companion Albert de Dorville in 1661-62.

**Previous Travellers.** Grueber, who occupied the position of mathematician to the Court of Peking, received a summons to Rome early in 1661. The sea-route being closed owing to war with Holland, Grueber was instructed to discover a route to Europe overland. Travelling by way of Sining Fu and Lhāsa, he thence proceeded south-west to Kātmāndu and India *via* Kūti (Nyenam) and the valley of the Bhotia Kosi river,—finally reaching Italy through Makrān, Persia and Asia Minor. Grueber made sketches of his route, and also carried an astrolabe with which he took occasional observations for latitude. His results exhibit a general mean error of about half a degree.

During the first half of the eighteenth century there appears to have been frequent traffic across the Himālayan passes between the Capuchin mission then existing at Kātmāndu and the various branch establishments in southern Tibet. The only journey, however, of which a record exists is that of Cassiano Beligatti de Macerata, one of a party of ten Capuchin brethren returning from Europe to re-establish the mission at Lhāsa. Leaving Patna in December 1739, the party remained at Kātmāndu (then only a provincial town) until after the rainy season of 1740. Their route led through Kūti and the Tingri plain to Sakya and Gyāntse; Beligatti's description of the country and people might well have been written today.

It was while the Capuchin missions were still in existence, between the years 1723 and 1736, that the adventurous Dutchman Samuel Van de Putte visited Tibet in the course of his remarkable 20-years tour from Aleppo to Peking. He appears to have been an excellent Tibetan scholar as well as a skilled and competent observer, but on his death (in Batavia on his way home in 1745) his papers were all burnt under the terms of his will. His sketch map of southern Tibet, which is however still extant, gives the positions of Kūti, Tingri and the Phung Chu.

From the final closing of the missions in 1745, there is no further record of travel in this portion of southern Tibet until the period of the Survey of India trained native explorers, a century and a quarter later. Explorer "m.H." (Hari Rām) in the course of his first journey in 1871-72 entered Tibet *via* Wālung, Tāshirāk and the Nye La, whence he proceeded over the Tengkye Pass to Shigātse. Turning westwards from here, he followed the Chiblung

MAIN RONGBUK GLACIER.

EVEREST N. PEAK.

MT. EVEREST.



PANORAMA OF MT. EVEREST, WITH ITS N & W RIDGES, FROM W. RONGBUK GLACIER.

Photo. by Major Wheeler.

Photo-engraved & printed at the Office of the Survey of India, Calcutta, 1925.



KARMA VALLEY.

EVEREST S. E. PEAK.

MT. EVEREST, (ACTUAL  
SUMMIT INVISIBLE).

NORTH COL.

NORTH PEAK.

MOUNT EVEREST, NORTH COL AND NORTH PEAK, FROM HILAKPA LA.

Photo. by Major Wheeler.

Photographed & printed at the Offices of the Survey of India, Calcutta, India.

stream to its junction at Shiling with the Phung Chu, which latter valley he ascended as far as Tingri. Crossing the Thung La he returned to India by way of Nyenam (Küti) and Kätmädu.

On his second journey in 1885, accompanied by his son, "m.H." again visited Tingri—travelling on this occasion *via* Nepäl, the Nangpa (or Kangphu) Pass and Kyetrak. From Tingri he ascended the upper valley of the Phung Chu, thence continuing past the Pekhu (Palgu) lake and plain to Dzongka and Kirang. His work is very accurate and reliable.

Another explorer, "G.S.S.", in 1886 ascended the Arun valley as far as Kharta district, the whole of which he places 15 miles too far to the north. His work was regarded with suspicion at the time, and his report was not thought sufficiently reliable for publication.

Babu Sarat Chandra Dass and his companion, lama Ugyen Gyatsho, on their second expedition in 1882, entered Tibet *via* Tashiräk, the Langphu La and Sar. They traversed the Chiblung Valley twice during the course of their journey, but undertook no surveying.

The first rigorous survey, based on triangulated points, undertaken in this area, was that carried out under Capt. Ryder, R.E. (now Colonel C.H.D. Ryder, C.B., C.I.E., D.S.O., Surveyor General of India) during the Tibet Mission of 1903-04. During the stay of the Mission at Kampa, the  $\frac{1}{4}$ -inch survey was carried as far west as longitude  $88^{\circ}$  approximately. On the return-march up the Tsangpo Valley, accurate  $\frac{1}{4}$ -inch surveys were extended as far as the southern watershed of the great river, in latitude  $29^{\circ}$  approximately (the so-called Ladakh Range).

There thus remained a stretch of unsurveyed country, some 65 miles wide by 225 miles long, between the Ladakh and the Great Himalaya Ranges—the latter forming the northern frontier of Nepäl. The Mt. Everest Expedition provided an opportunity of surveying the whole of this area,—with the exception of some 2,000 square miles at the extreme western end, comprising the districts of Kirang and Dzongka, into which, in view of restrictions imposed by the Foreign Department, I did not feel justified in penetrating.

The northern portion of the area, which we passed on the outward journey, consists essentially of flat alluvial plains and wide valleys 13,000 to 15,000 ft. in altitude, bounded by bare rolling hills of Jurassic shale and sandstone, rising to 18,000 and 19,000 ft. Occasional granite peaks of 21,000 ft. outcrop along the axes of the Ladakh Range and of the meridional range of Nyönno Ri ("madman's hill") on the eastern bank of the Phung Chu. The permanent snow-line is about 20,000 ft. As one goes southward the valleys become narrower; the sandstones are metamorphosed into quartzite, and crystalline schists become more and more common. Finally, for a zone of perhaps 30 miles in width in the central belt of the Great Himalaya Range, the rocks consist entirely of crystalline granite, gneiss and schist.

A short description of the Nepäl-Tibet frontier may be of interest. Commencing from the western edge of the map, the frontier is represented by the sharp range of peaks running south-eastwards from Gosainthän. Crossing the Pö Chu (Bhotia Kosi) above the village of Chenegang (some 20 miles below Nyenam), where a Nepälese guard is stationed, it maintains a general easterly direction, crossing the Kang and Rongshar rivers a few miles above their junction. Thence, passing through the summit of Gauri Sankar, it runs in a north-easterly direction to the Nangpa (Kangphu) Pass. From here, after following the chain of high snow-peaks known as Cho Oyu and Gyächung Kang, it turns south-eastwards along the Mt. Everest-Makalu ridge, past the Popte La, where a masonry pillar indicates the frontier. Crossing the Phung Chu (Arun river) two miles below Kyimatang, at a height of roughly 7,500 ft., it follows a spur leading north-eastwards past Ritak (where a masonry pillar again marks the frontier) to the Rakha La (16,250 ft.), whence it turns sharply south, following the main range to the Tipta La (17,400 ft.). After running eastwards for 7 miles, it again turns north-east for 16 miles to the snow peak of Langphu (21,500 ft.), whence it proceeds due east to the trijunction of Tibet, Nepäl and Sikkim at the Jongsong Peak (24,350 ft.).

The place-names occurring on the map have in nearly every instance been spelled in the vernacular by local officials, whom I found very ready to assist in the matter. In the case of rivers which rise in Tibet, such as the Pö Chu (Bhotia Kosi) and Phung Chu (Arun), the Tibetan name has been used for the portion north of the frontier. In the case of the latter river, I have adopted the name "Phung Chu" in preference to that of "Yaru Tsangpo" by which the lower portion of its Tibetan course has sometimes been shown on old maps. The former name is used by 9 out of every 10 Tibetans; in fact I only once heard the name "Yaru Tsangpo" used, and then it was applied merely to the Kampa branch of the river, by the villagers of Rongkong.

Brief Description  
of country.

Summary and  
Conclusion.

Actually, "Yaru" is an adjectival form of the word *Yarka* (summer), and is applicable to any river which overflows its banks during the summer months. If "Yaru" is to be accepted as the proper-name for any individual river, it would appear preferable to reserve it for the big Tsangpo (Brahmaputra) river of Tibet, as was done by Hooker and the earlier writers.

In the case of snow peaks on the main Himālaya Range, both the Tibetan and the Nepālese names have in most instances been given. The local Tibetan name for Mt. Everest, "Chomo Longma", is an abbreviation for "Chomo Lo-Zangma" ("liberal-minded fairy"). We were unsuccessful in obtaining any corroboration of the name "Makalu", either from Tibetan or Nepālese sources; the mountain is known locally in Tibet as Chomo Löntso or Cho Lōndo.\*

In regard to special equipment, little need be said. Khalasis were of course clothed on the "arctic" scale. For levelling tent-sites etc., each squad was equipped with an infantry-pattern entrenching tool obtained from the Quartermaster's Store at Jalāpahār. Special tents were made to my design by the Muir Mills Co., Ltd., of Cawnpore, as follows:—

For officers and surveyors—5 single-fly tents of green rot-proof canvas 6 feet × 6 feet, walls 2 ft. high, with floor of the same material sewn on to the side walls as a protection against wind and drifting sand, weight 50 lbs. each.

For khalasis and coolies—5 single-pole circular tents of green rot-proof canvas 14 ft. in diameter, with side-walls 1 ft. high, the side walls continued inwards for 2 ft. all round, weight 50 lbs. each.

These 10 tents, which were supplied by the Company at the very nominal cost of Rs. 100 each, proved generally very satisfactory, although not thoroughly water-proof in wet weather. For his high camps, Major Wheeler and his coolies used a couple of the expedition light Whymper tents which were kindly lent by Colonel Bury.

The detachment was inspected by the Surveyor General after its return to Darjeeling on 9th-11th November, when it was decided that the fair-mapping should be carried out as follows:—

$\frac{1}{4}$ -inch degree sheet 78 A.—No. 1 Drawing Office, Calcutta.

$\frac{1}{4}$ -inch degree sheets 71 H, L, and P, and 72 M—No. 2 Drawing Office, Dehra Dun.

With the exception of an outbreak of enteric fever among the domestic staff, one of whom—Major Wheeler's private servant—died at Tingri, the health of the detachment was excellent throughout the season.

The out-turn of work during the seven months' field season is as under:—

$\frac{1}{4}$ -inch Revision survey (sheet 78 A, Sikkim, etc.), 4,000 square miles.

$\frac{1}{4}$ -inch Original survey (sheets 71 H, L and P), 12,000 square miles.

Detail Photo survey (environs of Mt. Everest), 600 square miles.

The cost of the Survey Detachment up to 30th November amounts to Rs. 65,282, giving an average over-all cost-rate of Rs. 3·9 per square mile.

The surveyors all worked splendidly under difficult and trying conditions. Major Wheeler had probably the hardest time of any member of the expedition, and the fact that he has succeeded in the face of such appalling conditions of wind and weather, in bringing back photographic material for the fair-mapping of 600 square miles of some of the most mountainous country in the world, is sufficient proof of his determination and endurance.

I cannot conclude without a tribute to the very liberal and efficient manner in which the expedition was organised. Everything was provided which experience could suggest as likely to ensure the comfort or enhance the success of the enterprise; while the cordial relations which were everywhere established with the Tibetans, and the happy atmosphere which prevailed among the individual members of the expedition, are eloquent testimony to the tact and ability of our genial leader, Colonel Howard Bury.

\* It is very probable that other Tibetan and Nepālese names for the same peaks are current locally.

The names, Mount Everest and Makalu, are already well known throughout the world and, after much discussion and consideration, it has been decided to retain them on Survey of India maps.







Photo by MAU WHEELEN.

Thangpooson, Survey of India, Chitro, Calcutta, 1922.

MOUNT EVEREST AND SOUTH PEAK FROM NEAR N°1 ADVANCED CAMP.

## II.—REPORT ON THE TRIAL OF THE CANADIAN PHOTO-TOPOGRAPHICAL METHOD OF SURVEY.

By BT.-MAJOR E. O. WHEELER, M. C., R. E.

A trial of this method was carried out with the Mt. Everest Expedition from May to October 1921; a camera and 3-inch theodolite, similar to those in use in Canada, having been obtained from England early in the year. Although the method has been extensively applied elsewhere with marked success, particularly in Canada, it was doubtful whether it could be successfully employed in the deep narrow Himālayan valleys, and whether it could compete with the plane-table on the smaller ( $\frac{1}{4}$ -inch and  $\frac{1}{2}$ -inch) scales.

The instruments were received from England early in April. Considerable adjustment and alteration were found to be necessary, particularly in the case of the camera; and the usual tests for the horizon and principal lines, focal length, bubble readings, etc., had to be made. These preliminaries were carried out in Dehra Dūn before starting for Darjeeling.

I reached Darjeeling on April 30th and proceeded with the expedition on May 18th *via* the Dzalep La, Phāri and Kampa Dzong to Tingri, which we reached on June 19th.

Altogether, some five months were spent in the field, of which three were employed on the site of the work and two in marching to and from the work and in developing and printing photographs, of which some 240 were taken in all. It seemed wise to develop in the field to ascertain that exposures were correct, and to guard against possible deterioration of plates on the return march through the damp climate of Sikkim. Prints of some of the negatives were made to assist in the identification of peaks when seen from new angles.

Mt. Everest lies in latitude N.  $27^{\circ} 59' 16'' \cdot 2$  and longitude E.  $86^{\circ} 55' 39'' \cdot 9$  on the backbone of the main chain of the Himālaya and on the Nepāl-Tibet boundary. It is flanked on the west by a high group reaching to 26,867 ft.; to the north by a group reaching to 23,800 ft.; to the east by the Makalu group (27,790 ft.); and to the south by many high peaks. Permission to enter Nepāl not being granted, only the area north of the boundary could be considered. A map which will explain Mt. Everest clearly and will show its connection with neighbouring mountains and with the drainage of its vicinity must include the mountain groups mentioned above. In fact, they, with Mt. Everest itself form one great mountain mass, the whole of which may best be described as the "Everest Group". This classification is borne out by the general topography of the area.

About 20 miles west of Everest and immediately west of Pk. 26,867 (called locally Cho Oyu), the Rā Chu flows north from the Kangphu or Nangba La (on the Nepāl-Tibet boundary) to Tingri where it joins the Phung Chu flowing east; the Phung Chu after following an easterly course for some 65 miles turns south to flow through the main chain about 30 miles east of Everest and close east of Makalu. About 20 miles north of the Nepāl boundary, a tributary of the Rā Chu from the east gives a low pass to the Dzākar Chu, flowing down from Everest, first north and then north-east to join the Phung Chu about 30 miles north of the frontier. These two streams practically form the dividing line between the real mountains on the south and the high rolling hills of Tibet on the north. The area south of these two streams and bounded east and west by the Phung Chu and Rā Chu respectively thus contains a mass of great peaks, including the groups referred to above, which culminate in Mt. Everest in the centre and which all drain eventually *via* the Phung Chu through the Arun gorge into Nepāl.

This area seemed suitable for the experiment. It contained some 1,200 square miles of country—about a season's work, given fine weather—and gave opportunities for photographing all types of country from rolling hills with villages and cultivation, through steep gorges, to glaciers and tremendous snow and ice clad mountains. With Major Morshead's approval, I therefore decided to tackle this area with a view to fair-mapping both on 1-inch and  $\frac{1}{4}$ -inch scale: the former is the most suitable scale for this method and for the detailed map asked for by the Royal Geographical Society. But it seemed desirable to plot also on the  $\frac{1}{4}$ -inch scale to ascertain how far the method was suitable for ordinary small scale work and to enable "single ray" work over a larger area to be tested.

My equipment was divided into four parts :

(1). *Surveying equipment*, consisting of :

Equipment. *3-inch theodolite* and stand, in canvas case, weight 27 lbs.  
*Camera* in leather case, also containing 11 filled plate-holders, angle and exposure note books, pencils, waterproof cover for camera and theodolite etc., weight 30 lbs.  
 18-inch square collapsible *plane-table* to fit on theodolite stand,  
 and 12-inch sight-rule.

With this was carried a Web Equipment pack containing 13 spare filled plate-holders, a measuring tape and a medical box containing bandages, etc., total weight about 30 lbs.

All the above loads were arranged to be carried on the shoulders like a rucksack, leaving the hands free for serious climbing. They were carried by three selected coolies who were fitted out with warm clothes, boots, blankets, snow glasses, ice axes, etc. A climbing rope was added when necessary. The plane-table, which was plotted on  $\frac{1}{8}$ -inch scale, was used only for picking up triangulated points; a matter of some difficulty in high mountains where it is very easy to mistake one peak for another. After the first few days, the plane-table was not required, and only two coolies climbed with me, the third acting as spare man. At first I used "Pahāris" from southern Nepal: but they were very unsatisfactory at high altitudes. I therefore substituted Bhotias, who proved to be much better both as regards altitude and picking up climbing wrinkles.

(2). *High Camp Equipment*, consisting of :

1 "Meade" tent for myself.  
 1 "Whymper" for the three "high coolies" who remained with me.  
 1 Dark tent, for changing plates (not necessary on dark nights).  
 1 Primus stove for my personal cooking. This was a two-burner "roarer" type which I found to work very satisfactorily up to 19,500 feet. Above that height, spirit stoves or a specially adapted Primus must be used.  
 1 Petrol tin, filled kerosene oil.  
 1 or more small tins methylated spirit.  
 1 or more of the Expedition "high climbing boxes" of food, each calculated to last one man for ten days, and weighing about 30 lbs.  
 A small supply of aluminium cooking pots and plates etc.  
 Bedding, consisting mainly of down sleeping bags, a change of clothes etc.  
 Spare photographic plates.  
 Coolies' rations, cow-dung fuel and blankets.

With this equipment I slept 11 nights on moraines and glaciers at altitudes between 18,000 and 22,000 feet. It was carried by 10 permanent coolies, who also acted as dāk runners and fuel gatherers, etc. They were not fitted out with warm clothes or light tents, and therefore had always to sleep at the main camp, only coming up to me as required; this considerably restricted my radius of action, but on the other hand reduced the number of coolies I had to maintain. To penetrate to the heads of glaciers of the size here met with however, it is essential to be able to camp at least 12 coolies on ice, and therefore to fit them with boots, warm clothes and mountaineering equipment.

(3). *Main Camp Equipment*, consisting of :

1 Forty pound tent (single fly green canvas, with floor sewn in) for myself.  
 1 Bell tent for 10 coolies.  
 1 Kitchen and servant's tent.  
 Spare Photographic plates, clothes, food, mending gear etc.  
 This was in charge of one khalāsi. My cook-servant remained here and sent up cooked food as opportunity offered. Main camp was usually at the glacier snout at an altitude of 16,500 to 17,500 feet. Local transport was used as required for moving this camp.

4. *Base Equipment*, consisting of :

Spare photo plates, developing apparatus and chemicals, spare clothing, etc.  
 Plates were packed in 1-inch deal boxes (tin lined) to contain 9 dozen plates each. The plates (in dozens) were wrapped in thoroughly dried botanical paper, and the boxes soldered up before leaving Dehra Dūn. Each box weighed about 32 lbs. filled.

The above arrangements were on the whole satisfactory. More mountaineering equipment and warm clothes for coolies for use if and when necessary, would however have been an advantage.

On June 24th I moved up the Rā Chu from Tingri, and on the 26th, established my base camp in Kyetrak village 20 miles south of Tingri, and one mile below the snout of the Rā glacier, at an altitude of 16,500 feet.

Narrative.

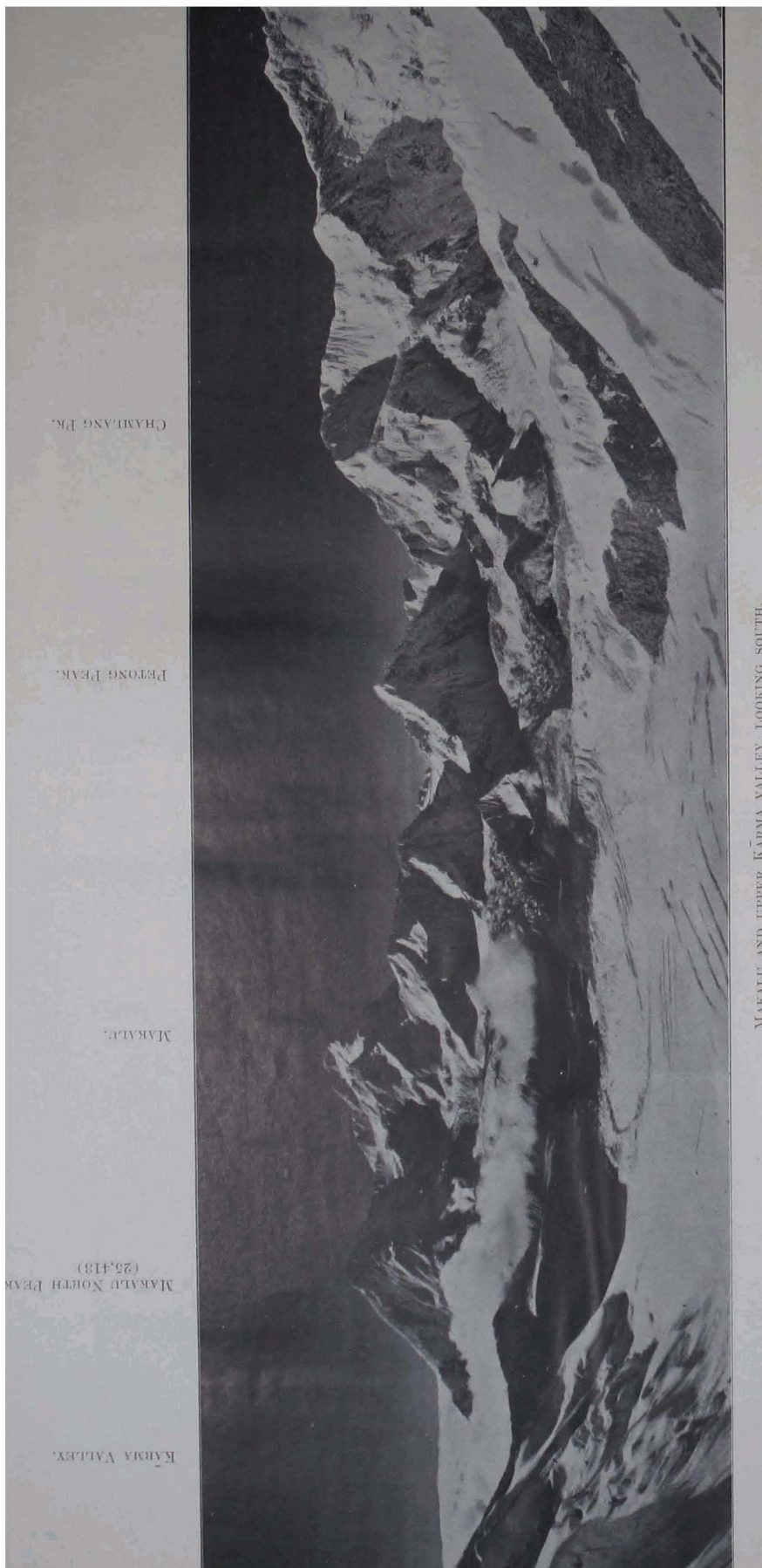
MAKALU.



MAKALU, AND MAKALU NORTH PEAK.

Photo by Major Wheeler.

Photocopy and printed in the offices of the Survey of India, Calcutta, 1938.



KARMA VALLEY.

MARKATU NORTH PEAK  
(25,413)

MARKATU.

PETONG PEAK.

CHAMLANG PEAK.

MARKATU AND UPPER KARMA VALLEY. LOOKING SOUTH.

Two fine days at the outset enabled me to identify 26,867 (Cho Oyu), 25,990 (Gyächung Kang) and 23,440 (Gauri Sankar), and to photograph the lower glacier and upper valley. But for the succeeding three weeks the weather was bad and I was only able to take 2 more stations on the west side of the valley, and 3 on the east. I waited some days in a light camp high up the glacier in the hope of getting a station to overlook the Nepäl side of the Kangphu La, but eventually was forced to abandon it, owing to shortage of time.

On July 18th, after a fruitless attempt to establish a station on the peak overlooking the junction of the Rā Chu with its eastern tributary referred to above, I moved into head-quarters, leaving my main camp at the bridge over the Rā Chu 6 miles below Kyetrak.

On July 24th and 25th, after completing developing and printing to date, I moved back to the bridge and on to Chöbu on the Dzäkar Chu, with Expedition head-quarters. I had intended to try again for the station above the Rā Chu bridge, but as the weather still remained bad and seemed likely to continue so, I decided to push on up the Dzäkar Chu towards Everest, to make certain of the more important portions of the work, returning afterwards to the bridge station if time allowed.

Again fine weather on the first day enabled me to obtain a good idea of the country from an 18,000-foot hill 3 miles south of Chöbu and about 25 from Everest in an air line.

The Dzäkar Chu, up which there is a good track on the right bank as far as the snout of the glacier, (about 15 miles from Chöbu) is a large unfordable stream, bridged only at Chöbu and at a very narrow gorge about 6 miles above. 10 miles from Chöbu is Chöling monastery, and above that only a few hermits' cells. 3 miles above Chöbu, a large stream from the Gyächung glacier and Gyächung Kang (25,990 ft.) joins the main stream on the left bank. My intention was to work up the right bank, cross on the glacier, work down the left bank to the Gyächung Valley, up the latter to the Gyächung glacier, again cross the ice and down to Chöbu. Accordingly, I moved my main camp first to the monastery, and then to the glacier snout, (17,500 feet) taking 2 stations on the right bank en route. But the weather went from bad to worse; I was never able to complete a station without sitting through one or more snow storms, and on one occasion, went up a 20,500-foot station three days running only to get some very indifferent photographs late on the third day. Great glaciers join the main Rongbuk glacier from the east and west about 3-4 miles above its snout. I was unable to penetrate to their heads; but secured sufficient photographs to map them fairly accurately. The east branch flows down from a col between the N.E. ridge of Everest and Pk. 23,800, and the west branch from an ice pass to Nepäl south of Gyächung Kang (25,990 ft.) past the end of the N.W. ridge of Everest. One station on either side of each glacier was taken, and one on each bank of the main glacier; and on the way down, one near the mouth of the Gyächung Chu, on the left bank of the main river. I was forced to abandon the Gyächung Chu altogether, except for views obtained at my first 18,000-foot station, and returning to my old station near the bridge over the Rā Chu was out of the question. On August 23rd I returned to Chöbu, having had only one really clear morning in a month, and having occupied only 10 stations in that time. I had hoped while en route to Khärta, the new Expedition head-quarters, to take stations giving views up the Hielung and various other valleys flowing north from the 23,000-foot group to join the Dzäkar Chu; but the weather again prevented me, and I saw little but clouds all the way.

I reached Khärta on August 27th, and spent 6 days there developing and printing.

On September 3rd, I started with Morshead up the Khärta Chu towards the base camp at 17,500 feet, which had been established in preparation for the final attempt on Mt. Everest. On the 4th, we occupied a useful 16,600-foot station 5 miles up the river, and on the 5th, moved 7 miles to a camp in which we were held up for 6 days with bad weather, and which we finally had to leave without being able to occupy more than a very indifferent station, so as to reach the base camp in time to move on with the Expedition.

Our hurry was unnecessary, for another 8 days were spent here, mostly in snow and cloud; two fine mornings however, enabled me to take useful stations on either side of the valley, and on September 19th, I moved up to "No. 1 Camp" (about 20,000 feet) with Morshead, Mallory and Bullock, taking a station en route. The weather was now greatly improved, except for high winds, and I was able to get two stations done, one on either side of the valley before moving with the Expedition to "Hlakpa La" Camp (22,200 feet) on September 22nd. It was too windy for work on the 22nd, but on the 23rd morning the wind died down somewhat and we occupied an excellent station, connecting up with my previous work in the east branch of the Rongbuk glacier. I found that both theodolite and

camera would remain steady with the tripod resting either on ice axes or bags of grain, although the snow was so soft that one sunk in half way to the knees.

On the 23rd, I left my instruments at the 22,200-foot camp and went on with Mallory and Bullock to the foot of the North Col (between the Main and North Peaks of Everest) where we camped on the glacier at about 21,500 feet. We had first to descend some 1,500 feet of snow to the East Rongbuk glacier, and crossing the latter, ascend its tributary flowing down from between Everest and its North Peak.

The morning of the 24th was bitterly cold, but we made a start about 7-30 a.m., with three coolies, and in 2½ hours reached the north col (about 23,000 ft.) after a grind up steep soft snow. From the col we had an excellent view of the north ridge of Everest, but were unable to stay long or go further on account of the very strong wind blowing.

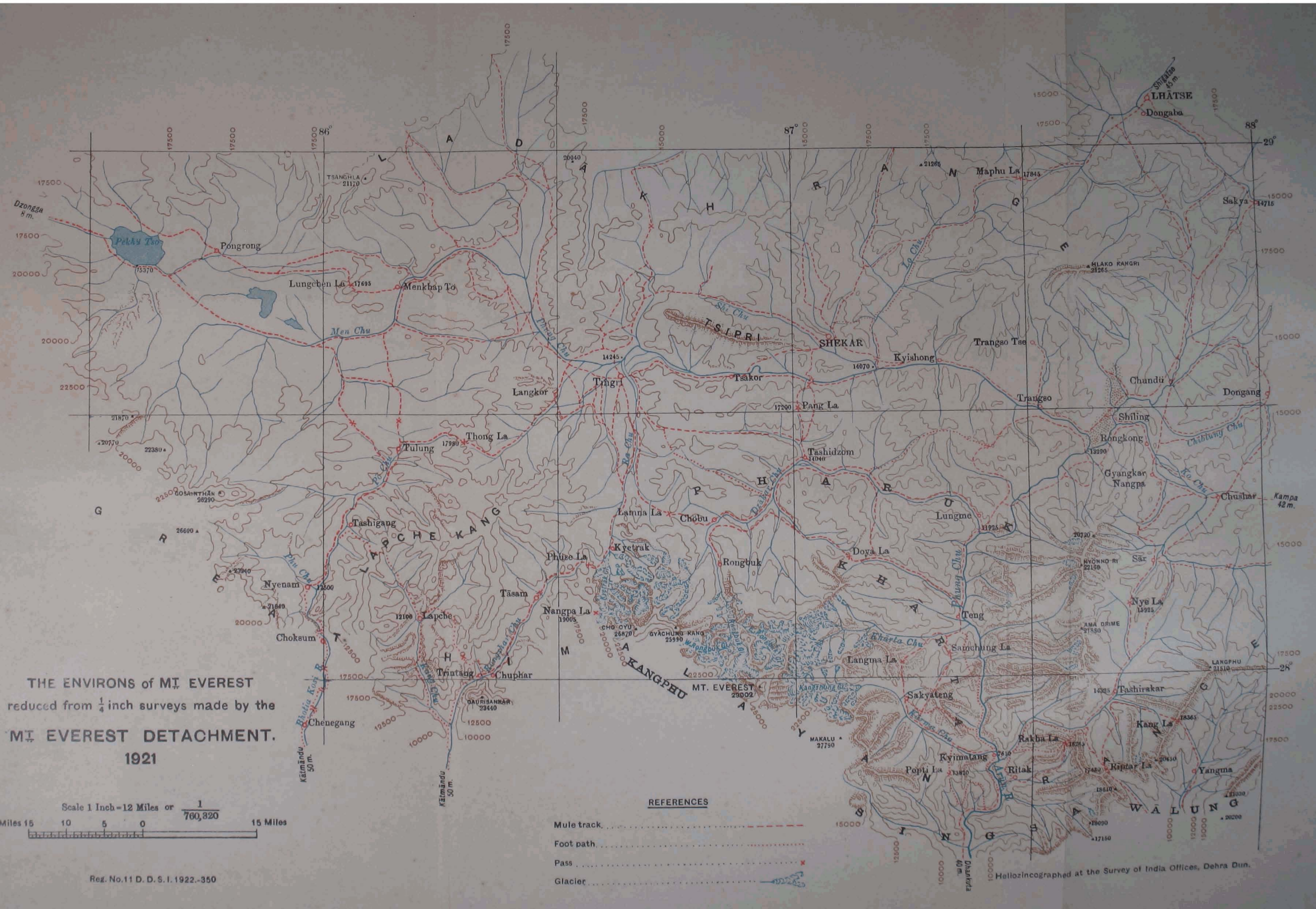
The next day, we rejoined the remainder of the expedition at No. 1 Camp, picking up the instruments, etc., left on Hlakpa La en route. The high wind persisted, making any further attempt on Mt. Everest quite out of the question.

Next day, the 26th, Bury, Wollaston and I crossed a snow pass to the Kärma Valley and camped at 16,500 feet at a grazing camp known as Petäng Ringmo. I established a station en route, and another on the south side of the valley the following day. But the weather on the next few days was very bad and I could do no further work, though I spent the days on the tops of hills, hoping for the clouds to lift. The Kärma Valley is by far the most beautiful I have been in, and it was with great regret that I left it on September 30th to return to Khārta *via* the Shāok La, without having seen more than its upper reaches.

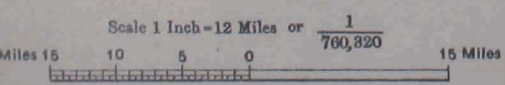
4 days were spent in Khārta completing final development of plates; on October 5th I left with Bury and Wollaston, and arrived in Darjeeling *via* Lachen and the Tista Valley on October 20th.

3 weeks were spent in Darjeeling printing photographs and making a rough ¼-inch sketch map of Everest and its environs, which was completed before the end of November. Until the final map on the 1-inch scale is completed, it is difficult to say whether the method under trial will be suitable for this country or not; it is undoubtedly more suited to a country like Canada with broad open valleys and comparatively low peaks, but at the same time has many advantages over the plane-table in intricate country. Its greatest advantage is probably that of being able to compare at leisure several photographs from different points of view, instead of having to sketch on the spot, in all weathers, and often largely from memory, the complicated jumble of peaks and glaciers and valleys which comprise the greater part of the Himālayas.

The area attempted had to be very greatly curtailed owing to the continuous bad weather experienced, data being collected for the mapping of some 600 square miles only. There is no doubt that the monsoon, as far as clouds are concerned, affects the northern as much as the southern slopes in this part of the range, though the actual precipitation on the north side would appear to be much less.



THE ENVIRONS of MT. EVEREST  
 reduced from  $\frac{1}{4}$  inch surveys made by the  
 MT. EVEREST DETACHMENT.  
 1921



Reg. No. 11 D. D. S. I. 1922-350

- REFERENCES
- Mule track ..... - - - - -
  - Foot path ..... - - - - -
  - Pass ..... x
  - Glacier ..... - - - - -

Heliotincographed at the Survey of India Offices, Dehra Dun.



