THE GEOGRAPHICAL JOURNAL

VOLUME LXXXIII

JANUARY TO JUNE

1934

PUBLISHED UNDER THE AUTHORITY OF THE COUNCIL

EDITED BY THE SECRETARY

THE ROYAL GEOGRAPHICAL SOCIETY
KENSINGTON GORE LONDON S.W.7

EDWARD STANFORD LTD. 12 LONG ACRE W.C.2
AND 43 WHITEHALL S.W.1

ROYAL GEOGRAPHICAL SOCIETY

Patrons

HIS MAJESTY THE KING
HER MAJESTY THE QUEEN

Vice-Patron

H.R.H. THE PRINCE OF WALES, K.G., F.R.S.

Honorary President

H.R.H. THE DUKE OF CONNAUGHT, K.G., G.C.B., G.C.S.I.

THE COUNCIL

(Elected 19 June 1933 for the Session of 1933-34)

President : Major-General Sir Percy Cox, G.C.M.G., G.C.I.E., K.C.S.I.

Vice-Presidents

Sir Harcourt Butler, G.C.S.I., G.C.I.E.
Colonel Sir Charles Close, K.B.E., C.M.G., C.B., SC.D., F.R.S.
Admiral Sir William Goodenough, G.C.B., M.V.O.
Brigadier E. M. Jack, C.B., C.M.G., D.S.O.
The Rt. Hon. Sir Halford Mackinder
Lieut.-Col. Sir Francis Younghusband, K.C.S.I., K.C.I.E.

Treasurer—The Lord Biddulph

Trustees—Douglas W. Freshfield, D.C.L., *decd.*; The Most Hon. the Marquess of Zetland, G.C.S.I., G.C.I.E.

Honorary Secretaries—Dr. T. G. Longstaff; W. L. Sclater

Foreign Secretary—The Right Hon. the Lord Howard of Penrith, G.C.B., G.C.M.G., C.V.O.

Members of the Council

Field-Marshal the Viscount Allenby, G.C.B., G.C.M.G.
Henry Balfour, F.R.S.
Air Vice-Marshal F. W. Bowhill, C.M.G., D.S.O.
Lieut.-Col. Sir John Chancellor, G.C.M.G., D.S.O., R.E.
The Lord Conway of Allington
Augustine Courtauld
Professor F. Debenham, O.B.E.
Vice-Admiral Sir Percy Douglas, K.C.B., C.M.G.
Admiral Sir Cyril Fuller, K.C.B., C.M.G., D.S.O.
Maj.-Gen. Lord Edward Gleichen, K.C.V.O., C.B., C.M.G., D.S.O.
John de Vere Loder, M.P.
Col. M. N. MacLeod, D.S.O., M.C., R.E.
Professor Kenneth Mason, M.C.
Dr. Hugh Robert Mill
Lieut.-Col. the Right Hon. Sir Matthew Nathan, G.C.M.G.
Mrs. Patrick Ness
Brigadier E. F. Norton, D.S.O., M.C.
The Hon. Francis J. R. Rodd
Sir Denison Ross, C.I.E.
Professor E. G. R. Taylor
Bertram Thomas, O.B.E.

Secretary and Editor of Publications—Arthur R. Hinks, C.B.E., F.R.S.

Librarian : Edward Heawood

Map Curator : F. Allen

Bankers—Martin's Bank Ltd. (Cocks, Biddulph Branch), 16 Whitehall, S.W.1

CONTENTS

NO. 1 *JANUARY* 1934

MAPS:

The
GEOGRAPHICAL JOURNAL

Vol LXXXIII No 1 R.G.S. *January 1934*

THE MOUNT EVEREST EXPEDITION, 1933: *A paper read at Afternoon and Evening Meetings of the Society on 6 November 1933 and repeated on the evening of 8 November 1933, by*

HUGH RUTTLEDGE

EIGHT years had elapsed since the last expedition to Mount Everest when the good offices of the Government of India and of Colonel J. L. R. Weir, Political Officer in Sikkim, secured at last the permission of the Tibetan Government for another attempt. The news was received in August 1932, and this gave but little time for preparation in England, if the new expedition was to start early in 1933.

The Mount Everest Committee, consisting of representatives of the Royal Geographical Society and the Alpine Club, under the chairmanship of Admiral Sir William Goodenough, met without delay. Its first task was to select a leader. Unfortunately General Bruce was no longer available in an active capacity, though he was a member of the Committee; and neither Brigadier E. F. Norton nor Major Geoffrey Bruce was able to accept an invitation to lead. It was necessary to find some one with experience of Himalayan peoples as well as with mountaineering knowledge, and eventually the lot fell upon me. I had served for nearly five years in the Himalayan district of Almora, in the Kumaun Himalaya, and had climbed a good deal with Gurkhas and Sherpas. The advice of members of previous expeditions was freely placed at my disposal, and I was given practically *carte blanche* in the selection of the climbing party and of equipment and stores. The party finally selected consisted of: Hugh Ruttledge (Leader), E. O. Shebbeare, Colin G. Crawford, F. S. Smythe, Captain E. StJ. Birnie, Lieut.-Colonel Hugh Boustead, T. A. Brocklebank, Doctor C. R. Greene, P. Wyn Harris, J. L. Longland, Doctor W. McLean, E. E. Shipton, L. R. Wager, G. Wood-Johnson. Of these, Crawford had been with the expedition of 1922, and Shebbeare with that of 1924. Four others were members of the party which climbed Kamet in 1931.

Every effort had been made to secure a party of which every member, with the possible exception of the leader and the chief transport officer, should be capable of taking part in the final assaults on the mountain. The numbers

were slightly increased beyond those of previous expeditions in case it should be found advisable to stay on after the break of the monsoon, in which case a strong reserve would be necessary. The medical examinations were conducted by the R.A.F. Central Medical Board and by Doctor Claude Wilson, and were of great severity. It was realized of course that the tests applied to pilots of the R.A.F. who are carried to high altitudes without exertion and without preliminary acclimatization, and who use oxygen in liberal quantities, could not afford adequate data for determining the qualifications necessary to take a man high on Mount Everest, but it was at least possible to make sure that his heart and lungs were thoroughly sound, that he had powers of resistance to oxygen lack, and that he would be likely to be able to withstand the great strains imposed by such an expedition.

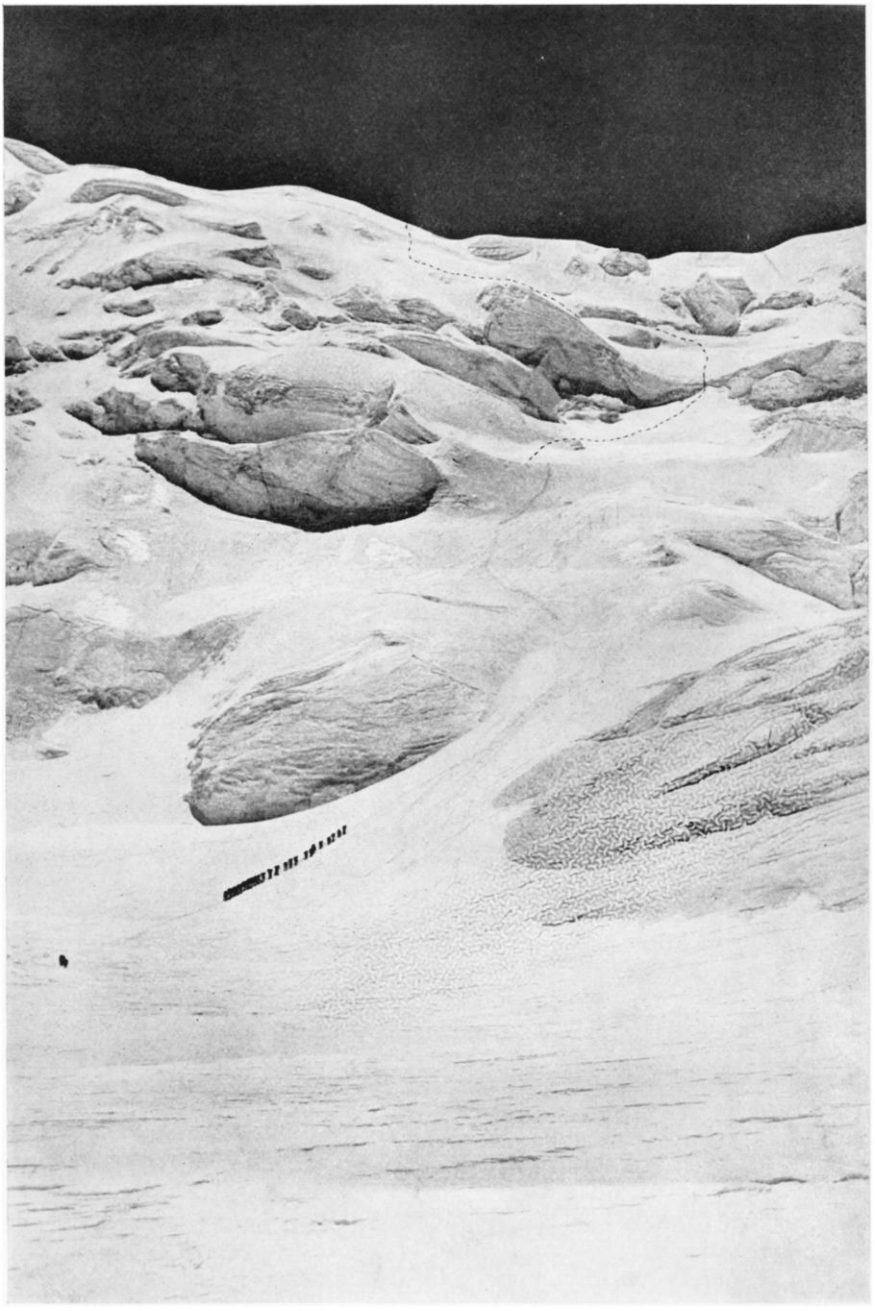
Not many innovations were made in equipment and stores. The principal was perhaps a new kind of tent combining the properties of an Asiatic *yurt* and of the arctic tent used by the late Mr. Watkins in Greenland. This was of octagonal shape and double skinned. It proved of the greatest value in bad weather conditions. Three such tents were taken.

The oxygen question was still open, and we could not afford to dispense with anything which might contribute to success. The apparatus taken by former expeditions had been heavy and cumbrous. Doctor Greene set to work with his fellow members of the British Committee for Oxygen Supply, and produced an improved and simplified apparatus, admirably made by Messrs. Siebe, Gorman & Co. It weighed only $12\frac{3}{4}$ lb.

Experience has shown that parties going to high altitudes suffer from considerable loss of appetite, and have, in fact, to make a duty of eating. It was therefore necessary to devise a high-altitude ration which should include the correct quantity of vitamins and calories. Doctor Zilva of the Lister Institute very kindly came to our help in the matter. In the event, our calculations were somewhat upset by the fact that slow acclimatization enabled the climbers to assimilate the ordinary foods of civilization up to and even beyond a height of 23,000 feet; and we were obliged to draw upon stores intended for the march and for the lower camps. To eliminate the risk of scurvy in a country like Tibet, where fresh vegetables, fruit, and fresh meat are difficult to obtain, we had recourse to a highly concentrated form of lemon juice.

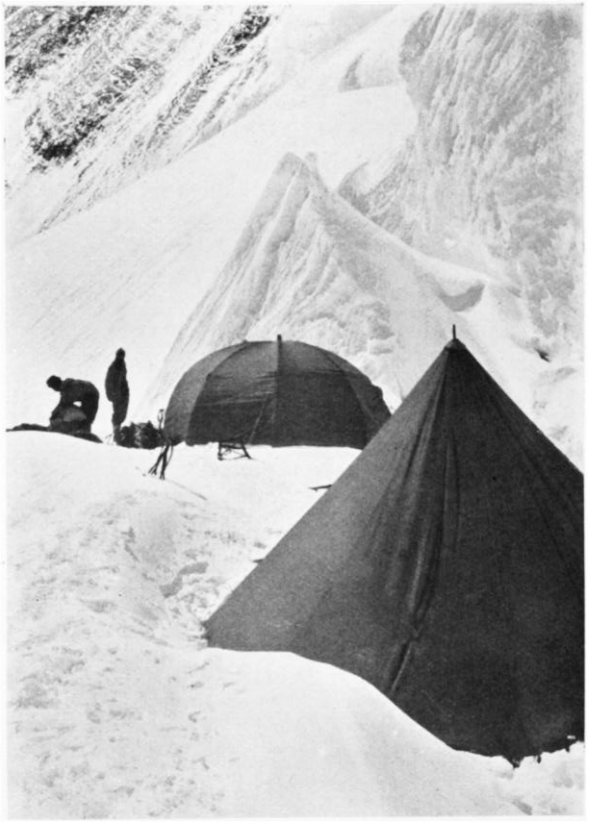
The main body of the expedition left England on 20 January 1933, by which time various climbing plans had been collated, improved upon by Longland, and discussed in detail by all available members. They provided for no less than four assaults on the summit in the course of one week, but could be indefinitely extended in accordance with the vagaries of the weather.

The keynote of this year's strategy was a slow and methodical advance. No two men acclimatize at exactly the same rate, and it was intended to make our speed, so far as possible, that of the slowest member. The expedition moved out of Darjeeling in two parties with a week's interval; the last leaving on March 12. This was thirteen days ahead of our predecessors. We had been fortunate in recruiting about seventy men of the best type of Sherpa and Bhutia porters, several of whom had previous experience. Among them was Lhakpa Chedi, the best of the "tigers" of 1924.



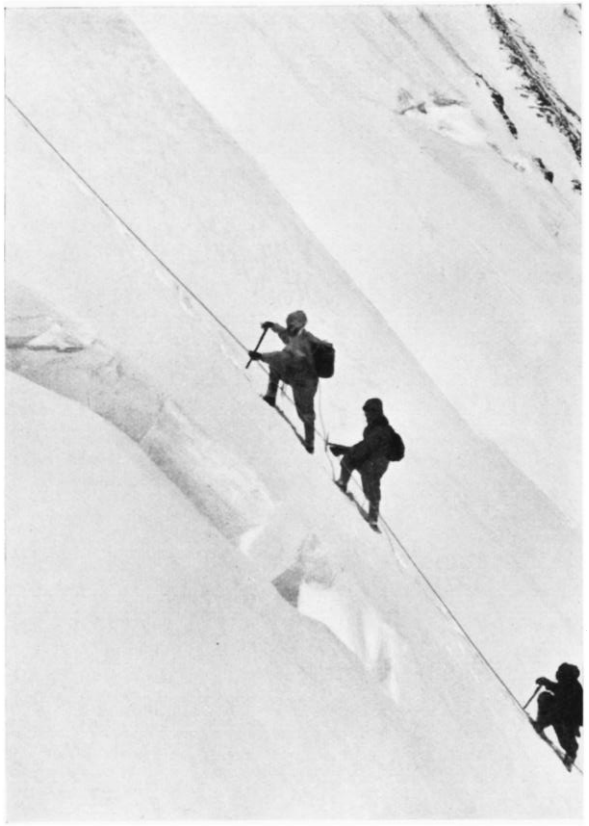
Phot. H. R.

Slopes of the North Col from Camp IIIa, showing track of ascent (continued by pecked line)



Phot. F. S. S.

Camp IV



Phot. E. E. S.

Climbing the ice slope below the great crevasse on the North Col

We had hoped to proceed to Kampa Dzong by the Lachen Valley and over the Sebu La, which is, in good conditions, much the best and shortest way. Unfortunately the Sebu La was closed to traffic early in March by a sudden heavy fall of snow, so we were obliged to proceed *via* Gangtok and the Natu La, over into the Chumbi Valley and on to Phari. The two parties reunited at Gautsa, where a little preliminary acclimatization was secured at a height of over 12,000 feet.

The Phari authorities have sometimes given a good deal of trouble in the matter of transport. We were spared this by having secured the services of Pangda Tshang, the Tibetan Government trader, who undertook to move our thirty odd tons of equipment and stores right through from Kalimpong to Kampa Dzong.

The Tibetan plateau can be terribly bleak and cold in the early spring. At Shabra Shubra, under the shadow of the great peak Chomolhari, we had 36° F. of frost, followed by a long march through a blizzard which took considerable toll of the party, though no one actually fell out. After this rough introduction, the crossing of the high Donka La and Chago La was unexpectedly easy; after which no serious inconvenience was encountered anywhere except from the strong westerly winds and the dust which blew into our food and into our eyes and throats, causing some trouble from laryngitis and pharyngitis. The porters suffered as much as we in this respect.

On the march from Tatsang to Kampa Dzong we took the opportunity of climbing a hill about 18,000 feet high, both for the purpose of testing our condition and obtaining a view. It was a perfect day. We climbed slowly without distress, and at the summit were rewarded by the most glorious panorama which most of us have ever seen. To the south were the great Sikkim peaks which Doctor Kellas climbed: Pau Hunri, Kangchenjau, and Chomiomo; to the south-west, Kangchenjunga, with the Bavarians' ridge in full view; Jongsong and innumerable unnamed peaks. Nearly 100 miles away to the west was a great triangular snow peak which could only be Mount Everest. The snow had that yellow look which only distance can give.

We descended to the pass on which Kellas died in 1921 and continued down a long narrow valley at the end of which, with tremendous suddenness, appeared the soaring battlements of Kampa Dzong. Here our sirdar Nursang was awaiting us with the advance baggage, guarded by a one-eyed Tibetan mastiff to which he had given the extraordinary name of Policie. This dog faithfully carried out her charge. She was apt to resent a sudden and informal approach, but soon got to know, with unerring accuracy, the members of the expedition, and confined her attacks to her own countrymen, of whom she spared neither sex nor age.

Our passport, and the innate friendliness of the people, smoothed over all transport difficulties; no simple matter when it is understood that transport has to be changed at the headquarters of each successive Tibetan district; no less than four such changes had to be made on the 350-mile march to Mount Everest.

At Tinkye Dzong, the Dzongpen was a native of Lhasa, very sociable and extremely bored by his relegation to an outlying district. He welcomed us with open arms. We organized a sports meeting. The football, begun by the

porters, was soon joined in by the entire Tibetan population, and the ball was soon lost to sight as the multitude surged madly across the ground to the grievous detriment of tent ropes. Boustead gave some boxing lessons which were heartily taken up by some Tibetan children, whom it was impossible to separate once they had joined battle. Then Longland gave an exhibition of pole jumping, which was a great success. All this was followed by a banquet at the Dzongpen's house, where his wife, with her wonderful hoop-like head-dress and a black patch on her nose, did the honours with great dignity.

It is one thing to secure an adequate number of transport animals but quite another to get them laden in good time at the beginning of a march. The drivers all struggle to secure the lightest loads and pandemonium rages. The Dzongpen took an active part in the conflict and got us off in fairly good time for the long march over the Bahman Dopte pass. This northerly route was adopted partly because the inhabitants of Gyanka Nampa to the south had an unenviable reputation as thieves.

We got something of a fright at Dochen, where our postal agent, Lobsang Tsering, had a fall from his horse and broke his collar-bone. The administration of anaesthetics at an altitude of over 14,000 feet is evidently a risky business. Lobsang Tsering did not come round for some time, and Greene and McLean had to work very hard on him before he came to life again.

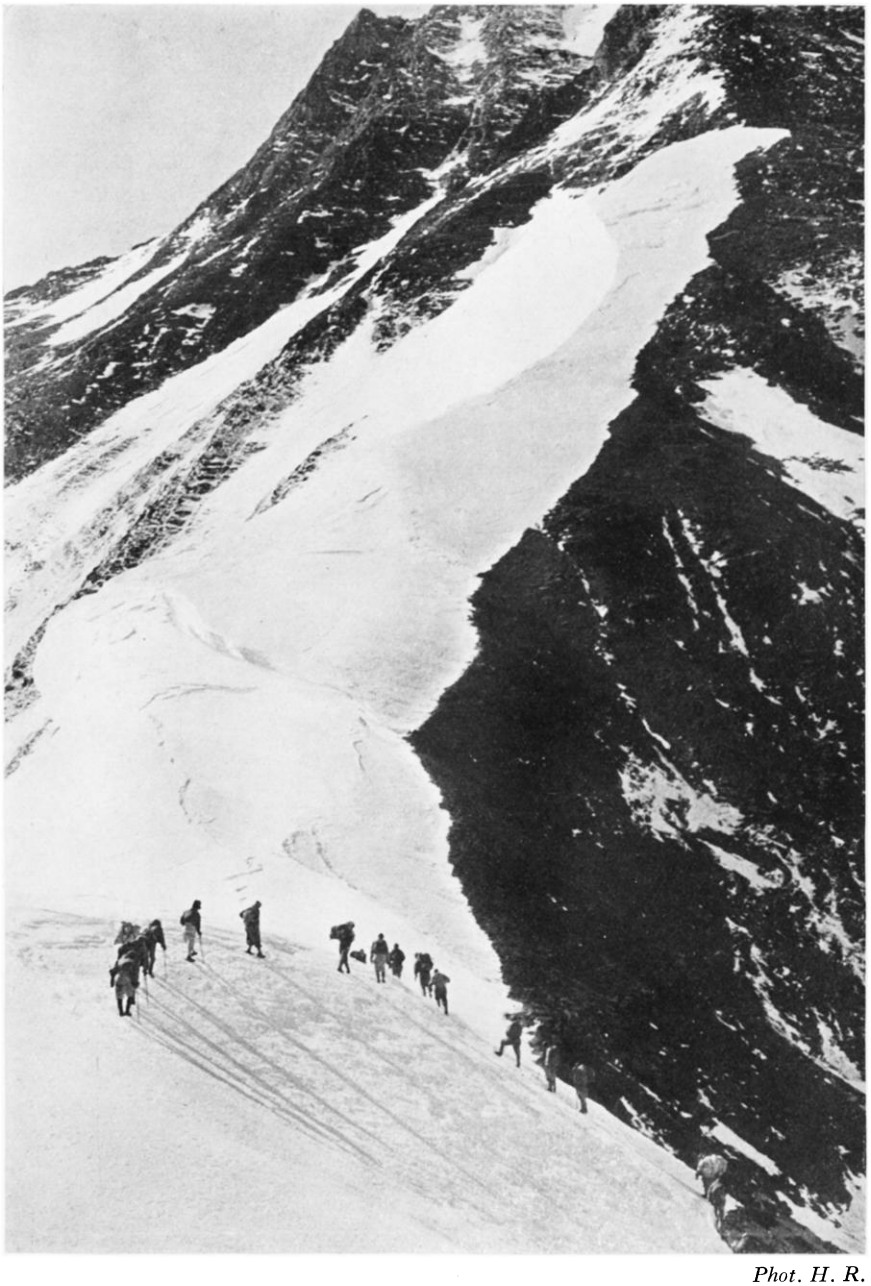
At Shekar Dzong we made the unpleasant discovery that a good deal of our equipment had been pilfered during the march. Grave suspicion attached to the transport drivers whom we had taken on at Dochen. The Shekar Dzongpen, always anxious to oblige, flogged several of them according to Tibetan (and our own mediaeval) practice, but no confessions resulted and nothing was ever recovered.

We climbed the "hill of shining glass," which is what Shekar means, because it was known that Mount Everest, 50 miles away, can be well seen from there in fine weather. With the telescope we could see something of the northern arête, but not enough to judge it in any detail, for there was much cloud about.

From Shekar Dzong, one of the senior porters was despatched over the Khombu La to make some direct recruitment at Sola Khombu, the home of the Sherpas. He was held up by heavy snow and we did not see him again till operations were well forward on the mountain. But when he did come he brought forty-six of the finest porters I have ever seen, among them the famous Narbu Yishé, the *purana miles* (Urdu-Latin for old soldier) of 1924.

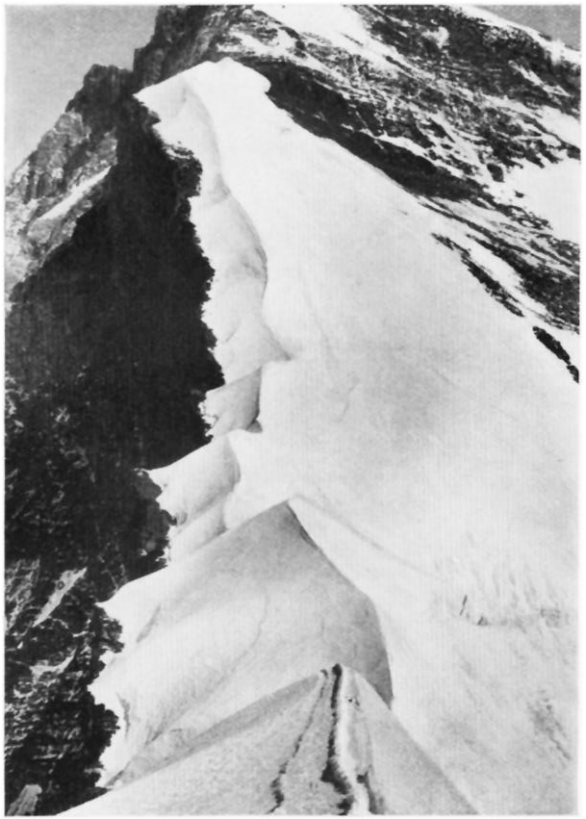
We were now marching southwards direct for Mount Everest. The weather was somewhat unsettled: we found heavy winds and a good deal of snow in crossing the Pang La, and got no view of the mountain before dropping down into the valley of the Dzakar Chu. One march short of Rongbuk, at Chödzong, some of us climbed the hill behind the camp in the evening and were lucky enough to get a magnificent view of the north face less than 20 miles away. From this distance it was seen in true perspective, and we realized how much steeper the north-east arête is than it seems to be when viewed from Rongbuk.

On April 16, after marching for hours up a stony and desolate valley which appeared to lead nowhere, we suddenly turned a corner and found the great Rongbuk Monastery outlined against a grim background of wind-torn mists



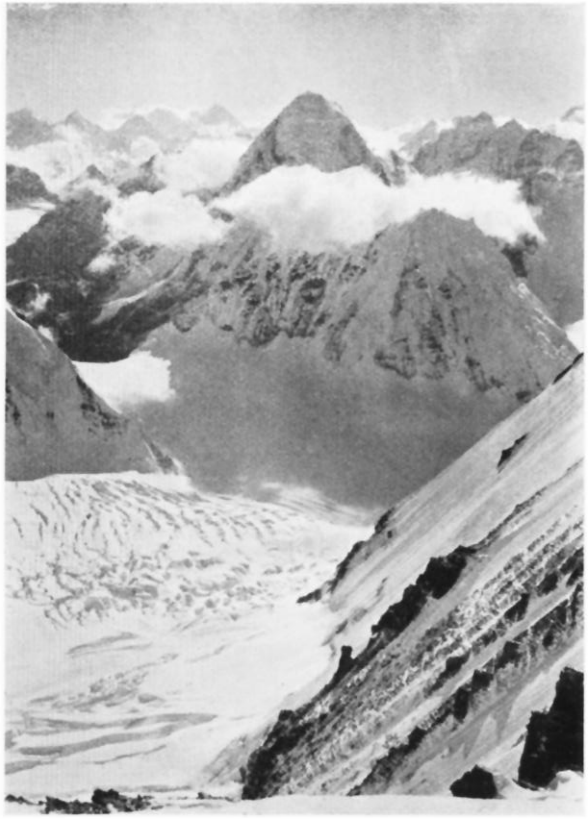
Phot. H. R.

Looking up the North Ridge from the top of the North Col



Phot. H. R.

Changtse from the crest of the North Col



Phot. F. S. S.

Pumori from the North Col

behind which, we knew, was Mount Everest. A bitter wind was blowing off the mountain, and we lost no time in pitching camp. Fortunately for us the head Lama had recently come out of retreat and was willing, as on previous occasions, to bless the expedition. He did so next morning with full ceremony, to the infinite satisfaction of the porters.

The expedition had reached this point in good health save for sore throats, but the bitter cold of the Rongbuk valley soon led to complications. Wyn Harris developed influenza, and Crawford chest trouble. On the morning of April 17 we covered the 4 miles of rough going to Base Camp at 16,800 feet and put the invalids to bed. We were twelve days ahead of our predecessors. Shortly afterwards one of our strongest porters, Ondi, went down with double pneumonia, and to save his life he was packed off under Crawford's care to the Kharta valley, five marches away.

Our plan this year provided for a slow advance up the East Rongbuk glacier. It was laid down that each successive camp should be thoroughly stocked and held for at least four days previous to a further advance. Camp I was duly established on April 21. A considerable amount of snow about this time hindered progress, but there were nine members of the expedition at Camp II by April 26, where a temperature of 50° F. of frost was experienced at night.

The glacier above Camp II is somewhat intricate, and no time was lost in climbing up the mountain behind it from which the best route could be observed. It would be almost impossible to force a way upwards through the séracs but for the existence of two troughs which descend from the upper reaches of the glacier. The problem is to find a way into the left-hand trough, then out of it on to the open glacier, and down into the medial trough. A way was soon found by Smythe, Boustead, and Wood-Johnson, and red flags were placed to indicate the position of dangerous crevasses. After this the porters could always be allowed to move up without escort.

Wind and snow turned back no less than three reconnaissances towards Camp III, but this was eventually established on May 2. The advance party experienced blizzards similar to that which drove out the party of 1924, but the arctic tents were so efficient that in this case no retreat was necessary, and by May 6 twelve members of the expedition were in full occupation.

We had felt considerable anxiety as to changes that might have taken place in the condition of the North Col slopes. It was soon evident that the 1924 route was out of commission. There was now a tremendous ice slope which would have taken weeks to cut up, and at its foot was the debris of many ice avalanches. The only practicable route was that adopted in 1922; this would require considerable care in view of the fatal avalanche which occurred there in 1922, when seven porters were overwhelmed and killed.

It was arranged that parties should work on the wall in shifts, each man cutting steps for about twenty minutes at a time, while his companions drove in pitons and fixed ropes for the safeguarding of porters. To save time and energy a subsidiary Camp IIIa was pitched close to the foot of the wall just out of reach of possible avalanches. The brunt of the work fell upon Shipton, Smythe, Wyn Harris, Wager, Greene, and Boustead. Bad weather persisted throughout this period, with the result that it took from May 6 to May 15 to

make the route up to the North Col. The general angle of the slopes was very steep, and at one point Smythe had to cut steps up a vertical ice wall some 40 feet high. The old ledge near the crest of the col which was used by the 1922 and 1924 expeditions was no longer in existence, but a ledge was found, in reality the lower lip of a crevasse, about 250 feet below the crest, and Camp IV was established here on the morning of May 15.

Meanwhile two causes for anxiety had appeared. Firstly, Wood-Johnson developed a gastric ulcer which necessitated his descent to the Base Camp. He had shown great strength and staying power, and his loss was severely felt. Secondly, news was received by wireless from Calcutta that the monsoon had appeared off the east coast of Ceylon on May 12. It was evident therefore that no time must be lost.

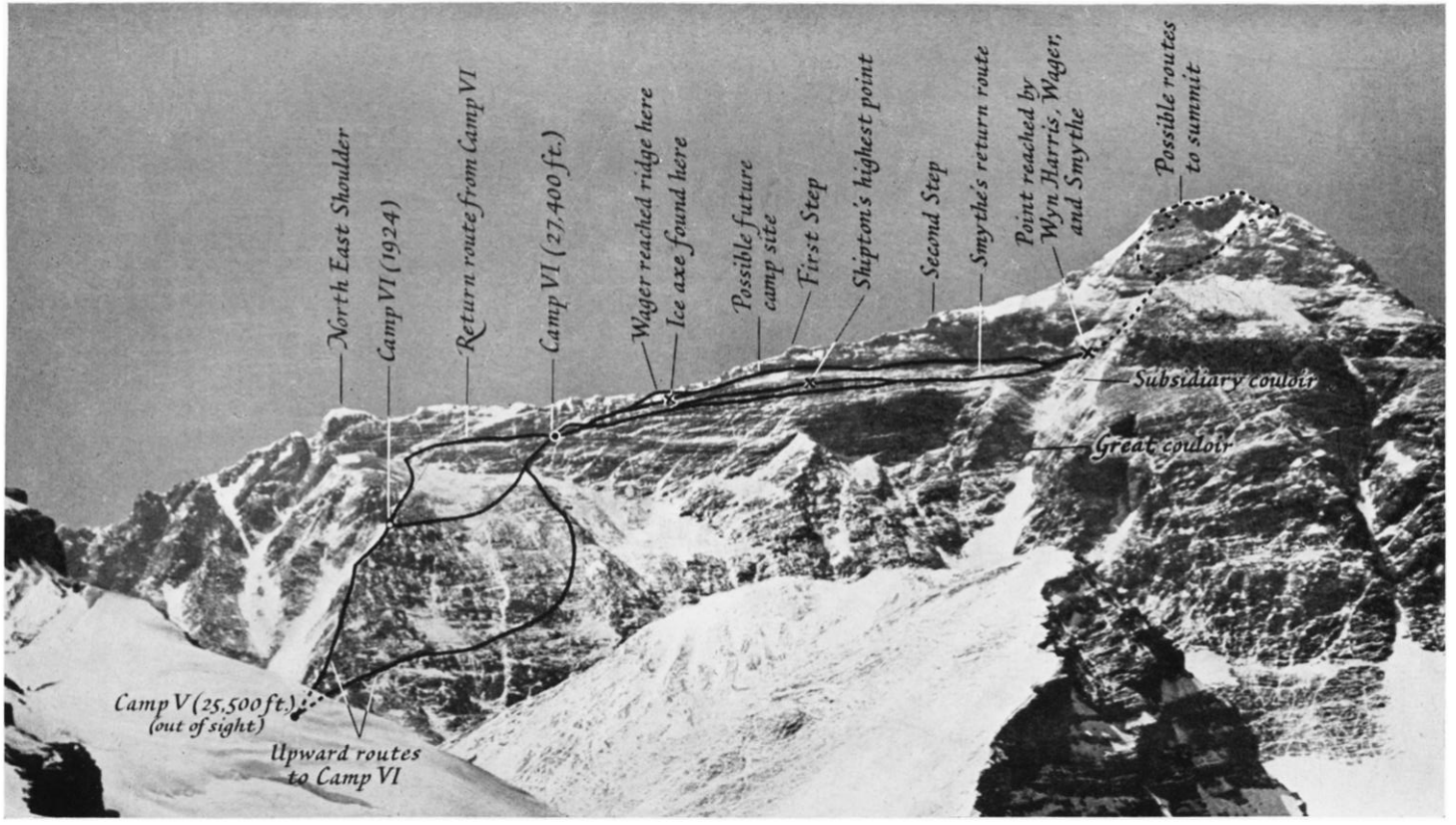
According to our tactical plan, the leading party would not spend more than five days at Camp IV lest deterioration should set in. During temporary lulls in the storms, three attempts were made to reach the site of Camp V, but all were abortive. Finally however a splendid carry was made on May 22. Wyn Harris, Greene, Birnie, and Boustead with twenty-one porters were to establish Camp V, and Wyn Harris and Greene would go on next day to establish Camp VI. Longland and Wager accompanied them for training purposes. Owing to the distance of Camp IV below the crest, this involved a long day's work with an ascent of 2,900 feet. Only one porter broke down, and he was escorted down to Camp IV by Longland. Greene, who had had insufficient acclimatization on the North Col, unfortunately strained his heart on this day, though he insisted on going as far as Camp V. On the way he found one of Captain Finch's oxygen cylinders, which was in perfect working order.

This new Camp V was at 25,700 feet, 500 feet higher than it had been placed before. It was on a fairly good platform which accommodated four Meade tents, but being on the north ridge it is very much exposed to wind. All the porters except eight were at once sent down with Greene to the North Col.

It was vitally important to get on to Camp VI next day, but another spell of bad weather set in and the high party was marooned at Camp V till the morning of the 25th, when it had to retreat, in the course of which several porters were attacked by frostbite. A party going up from the North Col in support met them halfway down the ridge, and the two parties returned together.

Misfortunes never come singly. There had been a heavy fall of snow, which rapidly made the continued occupation of Camp IV impossible, as avalanches started to slip down on to the ledge, threatening to overwhelm the tents. In order to keep up a position of attack, six climbers now took a camp (IVa) up on to the very crest of the North Col itself; an exposed position but safe from avalanches. With them went a newly picked lot of porters who occupied one of the arctic tents. There was no difficulty in procuring volunteers for this service. The rest of us, knowing that there would not be sufficient room at the new camp, descended to Camp III.

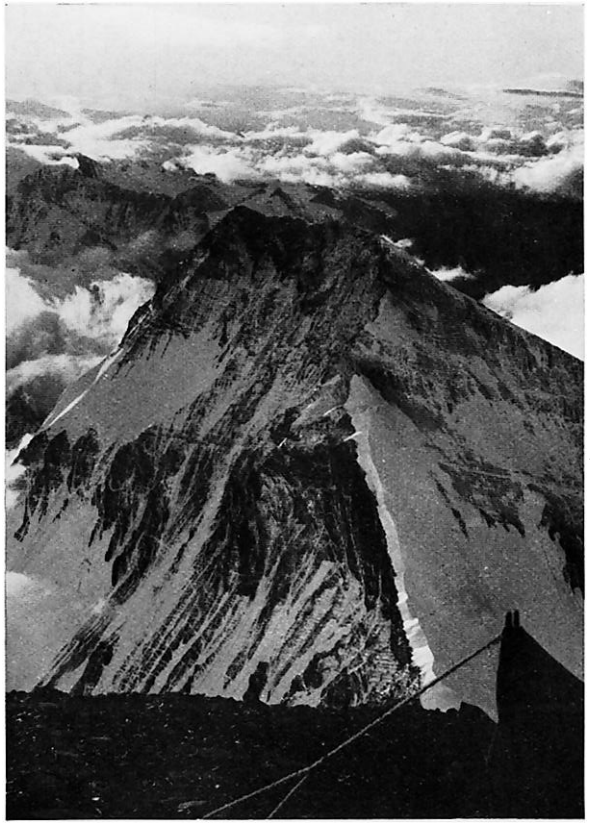
Camp V was reached again on May 28 by Wyn Harris, Wager, Longland, and Birnie, and on the 29th the first three, with eight porters, managed to



Telephotograph by Capt. Noel of the North Face from the 1924 Base Camp, showing 1933 climbing routes

Phot. F. S. S.

Cho Uyo and Gyachung Kang from Camp V



Phot. F. S. S.

Changtse from Camp V

place our sixth camp at a spot about halfway up the great "yellow band," 600 feet higher and more to the west than the Camp VI of 1924. The effort reflects the very greatest credit, not only on the porters, but on the men who led them, none of whom were fully conversant with their language.

Shortly after the single tent had been pitched one of this year's many blizzards rushed up from the west almost without warning, and in a few seconds it was impossible to see more than a few yards ahead, and all the goggles were iced up. Longland had the responsible task of bringing porters down and carried it out with perfect judgment in the very worst of conditions, verifying his direction by reaching the top of the north ridge and finding, a little lower down, the old Camp VI of 1924.

Next day Wyn Harris and Wager made the first assault on the summit. They had spent a bad night and the air was very cold, although the wind was not blowing at more than 10 miles an hour. They suffered a good deal before the sun's rays warmed things up a little. After about two hours' climbing, and at a point about 200 yards east of the first step and 60 feet below the crest of the north-east arête, they found lying upon gently inclined but smooth slabs an ice-axe. It looked perfectly new, the axe-head of bright polished steel. This axe can only have belonged to Mallory or Irvine, and we think it likely that it marks the site of a fatal accident in 1924, whether during the party's ascent or descent. We think that on the whole the former is the more probable, but it is only fair to state that Mr. N. E. Odell adheres to his conviction that he saw the two climbers both below and on the second step on the day when he followed them up in support. Curiously enough, Smythe and Shipton, while themselves following up in support of Wyn Harris and Wager, thought they saw the latter two on the second step, but satisfied themselves that rocks, over which clouds were racing, had given the illusion of human movement.

Wyn Harris and Wager were much embarrassed by having a dual objective: a reconnaissance of the second step combined with an attempt to reach the summit either by that route or by Norton and Somervell's route of 1924. In consequence, they lost much time in the neighbourhood of the second step, found it was impossible, and were forced to follow Norton and Somervell's route, traversing across the north face 200 or 300 feet below the crest. They crossed the great snow couloir and reached a point on its western wall approximately the same as that attained by Brigadier Norton. The height of this point is about 28,100 feet, and they were there at 12.30 p.m. in the day, having started at 5.40 a.m. Clearly there was no chance of reaching the summit, which would have required at least another four hours for its ascent, and of returning in safety. They might have gone on some little way up the very difficult rocks, for they were not completely exhausted; but had they done so it is doubtful if they would have reached camp again. They were perfectly right to turn when they did, and their work on this day was beyond praise.

On the way back they attempted once more to tackle the second step, but were too exhausted for further climbing. Wyn Harris retrieved the ice-axe, leaving his own in its place, and Wager struggled up a few feet to the crest, and is thus the only man who has looked down the great ice-fluted south-east

wall of Mount Everest. They reported their adventures to Smythe and Shipton at Camp VI, and managed to reach Camp V that evening.

Next day Smythe and Shipton were storm-bound in their little tent, snow falling to a depth of several inches and wind making it impossible to go out; but on June 1 things looked a little better, and although there was too much snow on the slabs to give any real hope of success they set forth. Shipton had neither eaten nor slept well at the high camp, and somewhere below the first step he realized that he must give up, following the rule that no man should go on till he was too exhausted to return unaided. Finding that Shipton was able to get back by himself Smythe quite rightly went on alone, and reached the same point as Wyn Harris and Wager, at 10 a.m. This left him ample time to reach the summit, but unfortunately the snow of yesterday had made the slabs at this point completely unclimbable; and Smythe had the mortification of having to turn when he was going quite well with success almost within view. To explain these conditions it is necessary to observe that snow hardly melts at all above 25,000 feet; and that at 28,000 feet it is of the consistency of castor sugar, affording no sort of support to the feet except in one or two places, where wind pressure has been able to harden it. As the slabs dip outward and downward the danger and difficulty of crossing them when snow lies upon them may be imagined.

Smythe returned by a slightly lower traverse, saw Shipton off on his way to Camp V, and then spent his third night, this time alone, at Camp VI. He slept for thirteen hours at a stretch, heedless of a gale which was blowing, and next day found his way down the whole way alone to the North Col. Shipton had spent the night at Camp V after a narrow escape from a blizzard. A similar storm assaulted Smythe on his descent, and he was several times blown off his feet. It is interesting to note that neither man suffered from any heart trouble as a result of their terrific experiences, though they did have slight frostbite. Wyn Harris and Wager, on the other hand, both suffered from temporarily dilated hearts.

There was nothing for it now but to take the whole party down to Base Camp for a rest. We hoped that possibly a break might occur in the monsoon which would enable another assault to be made soon. Greene examined everybody with great care at Base Camp, and passed nine men in all as fit for further service. A return up the glacier was begun on June 11, and Crawford and Brocklebank went on ahead to examine the North Col slopes. They found the fixed ropes buried 2 feet under snow and the slopes in such condition that any interference with them would inevitably have caused a big avalanche. We stayed for over a week at Camp III, watching Mount Everest get steadily whiter and whiter, and coming reluctantly to the conclusion that after the first big snowfall of the monsoon the mountain remains snow-covered till the autumn, when the west wind of Tibet comes to life again. That west wind is the only agent which will remove snow from the north face. We visited the Rapiu La and climbed the unnamed peak above it, obtaining wonderful views of the south-east face and south ridge of Mount Everest, and confirmed thereby our opinion above stated.

After this we returned once more to Base Camp and reported matters to the Mount Everest Committee, adding that various members were prepared

to stay on at the Base Camp and observe weather conditions for another month or two, and that the few remaining fit men had volunteered to make another assault should opportunity offer. The Mount Everest Committee however, after full consideration of the facts, very wisely recalled the expedition, and we left the Base Camp on the return march on July 2.

The majority were able to travel *via* the delightful Kharta valley, but the invalids, of whom there were three, had to be taken by the less attractive route of the Dzakar Chu. Shipton and Wager forced their way directly over the Himalayan range from Gyanka Nampa to Lachen, while Crawford and Brocklebank crossed the Choten Nyima La.

A short summary of what was learned from this year's expedition may be of some service:

1. The policy of slow acclimatization appears on the whole to have worked well. But the need for striking the balance between it and the parallel process of deterioration should never be lost sight of. Our plan was to establish the higher camps and go for the summit after not more than five days at Camp IV. In the event, bad weather interfered with every plan and upset every calculation.

2. I think it has been established beyond reasonable doubt that the second step is so severe an obstacle that it is a waste of time to attempt it any further, and that therefore the only reasonable route to the summit is that taken for the first time by Brigadier Norton. This route is definitely impossible unless the slabs are found dry and comparatively free of snow.

3. One result of slow acclimatization is the continued capacity to eat more or less normal food at considerable altitudes. A special high-altitude ration is hardly necessary for acclimatized men up to Camp V.

4. The selection of the best type of party will always be extremely difficult, for every man acclimatizes at a different rate and reacts in a different manner to altitude. One thing is certain: mere records of climbs done with guides are of little value in determining whether a man is capable of doing a full share of work on an expedition of this kind.

5. Still further improvements are possible in equipment, notably in the matter of material for tents and the substitution of sleeve openings for canvas doors. The arctic tents of this year were a great success, but might be improved still further.

6. The provision of wireless apparatus was of definite value. This might be extended in future to the use of very light receiving or even transmitting sets for use at the highest camps.

7. That Mount Everest will be climbed some day I have very little doubt; but it will need the coincidence of at least two things: firstly, not less than three days' consecutive fine weather; and secondly, the simultaneous reaching of the top of their form by not less than four men, and preferably six.

DISCUSSION

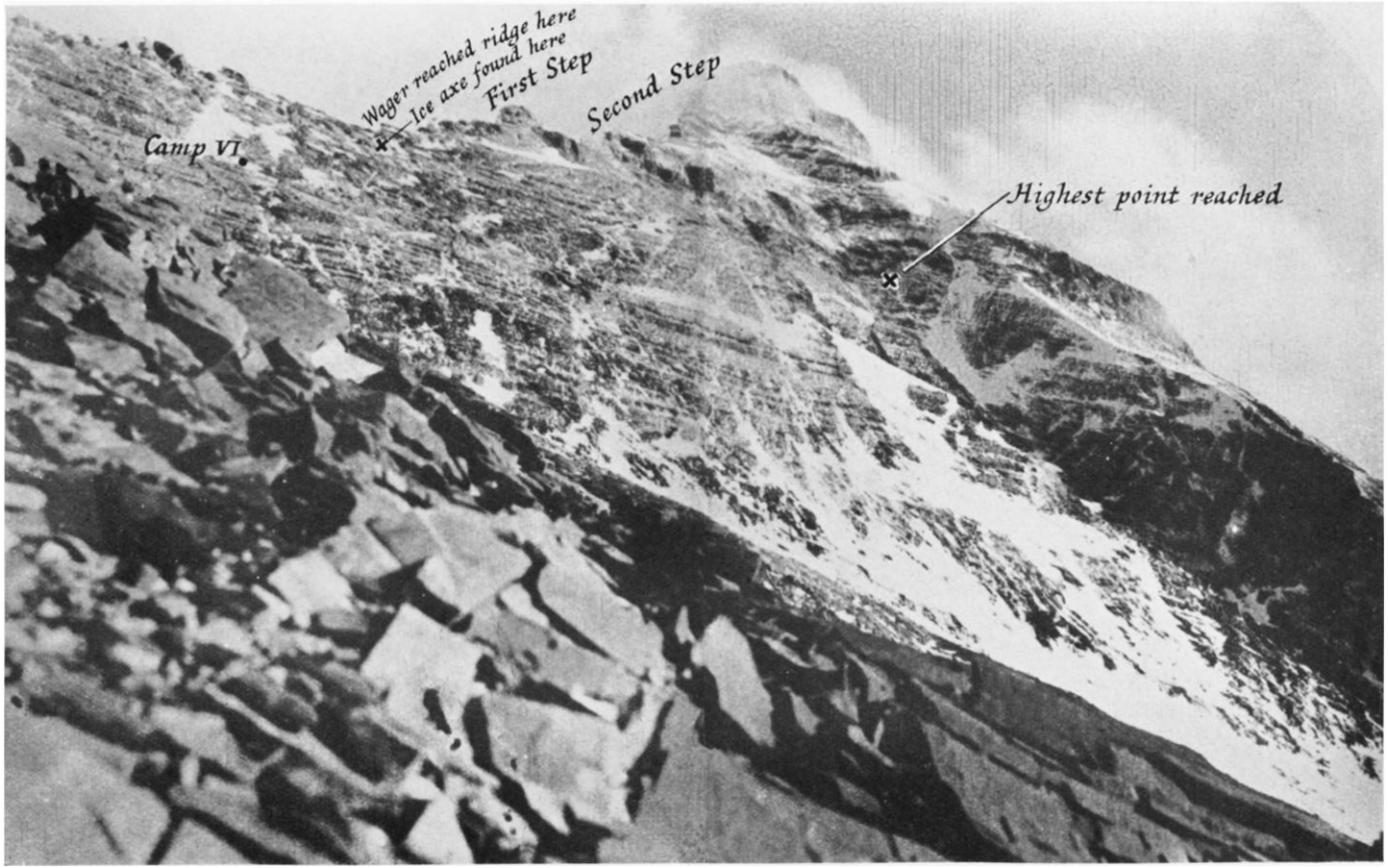
Before the paper the PRESIDENT (Major-General Sir PERCY COX) said: Before I turn to my duties as President this afternoon I should like to say how tremendously fortunate I feel that the first occasion on which I have the honour

Phot. F. S. S.

Looking north-east from Camp V

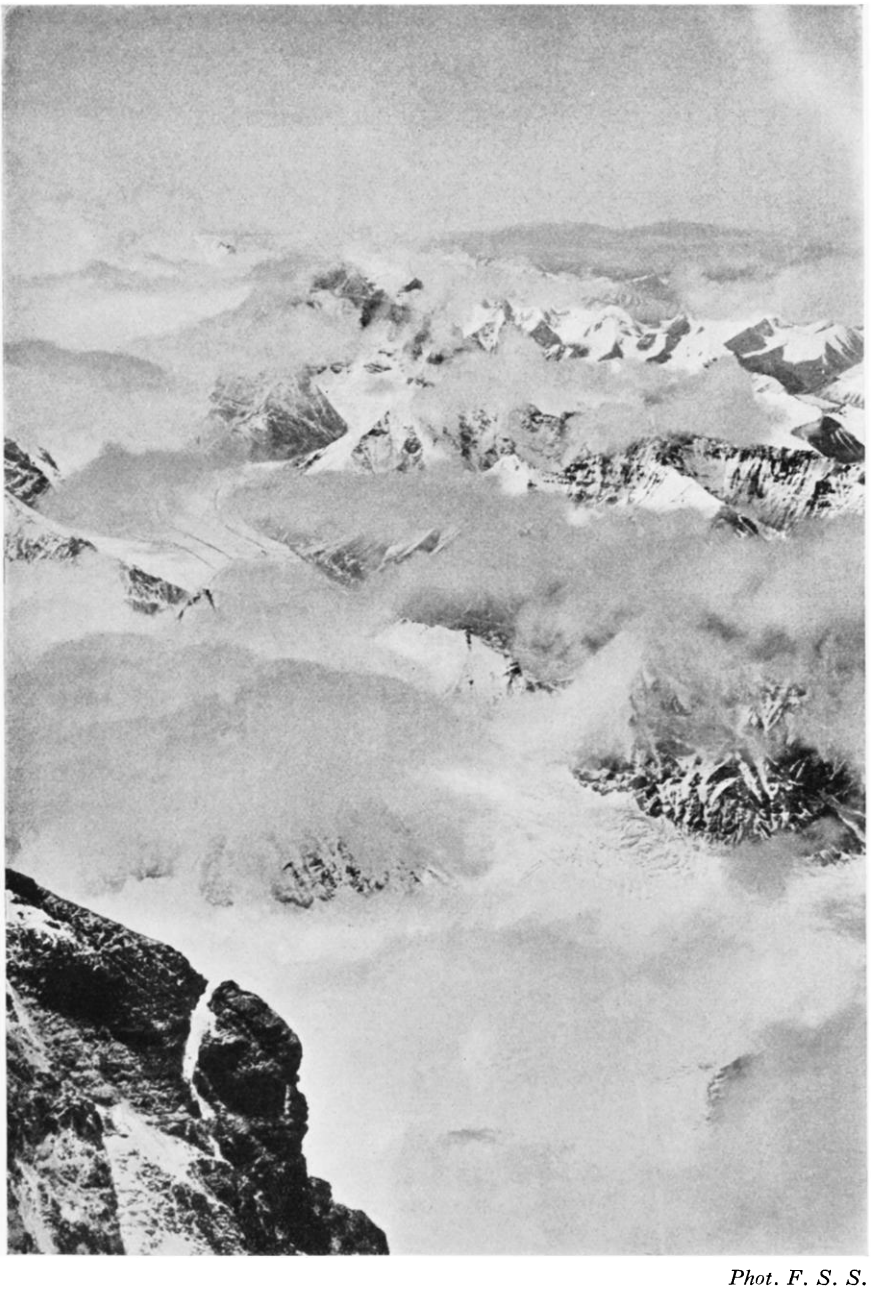
Phot. F. S. S.

Wyn Harris and Wager leaving Camp VI for Camp V on May 30, after the first assault



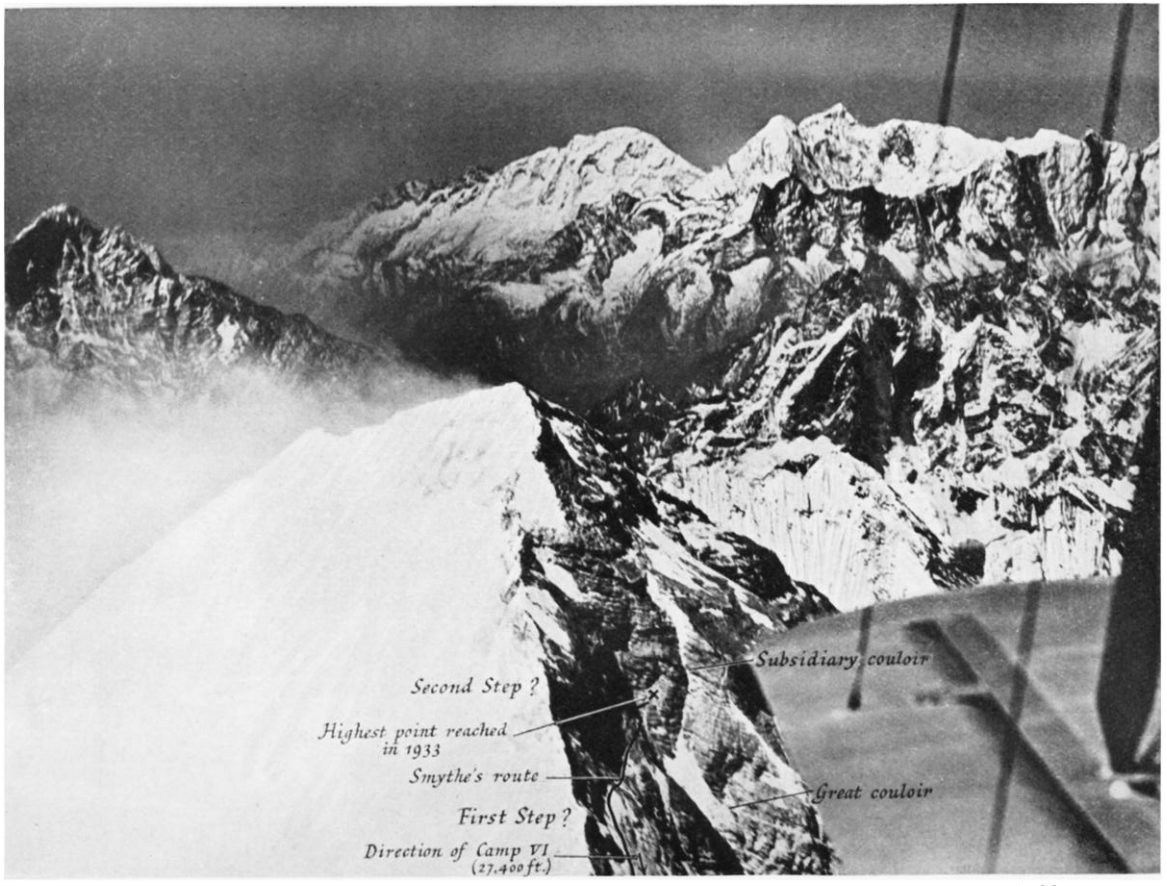
The North Face from above Camp V, May 29

Phot. L. R. W.



Phot. F. S. S.

Looking north from the east side of the great couloir at about 28,000 feet



The summit and last section of the north-east ridge; from a photograph taken on the Mount Everest Flight

of occupying this Chair should be one of such enormous interest. This will certainly be a red-letter day in my life.

Before introducing the lecturer, in case any of you would like to have your memories refreshed, I will briefly mention what has taken place in regard to the several expeditions for what I may call the "Assault on Mount Everest." For the last forty years the ambition to climb that mountain has been in the minds of Englishmen, whether serving in India or alpinists and mountaineers at home. In particular, General Bruce and Sir Francis Younghusband have probably had it in mind for quite that time. It was, of course, very difficult to arrange an expedition, quite apart from the question of climbing, as there were countries to negotiate with who were not always easy to deal with, and there was also the question of finance. But in 1920, after the Great War, interest in Mount Everest revived and a Committee was formed of members of the Alpine Club and of this Society to collect funds and endeavour to promote and organize an assault on the mountain.

In 1921, as a result of the efforts of that Committee, an expedition was sent out under Colonel Howard-Bury. It was not intended that that expedition should attempt to scale the mountain. Their duty was to make a reconnaissance, explore the approaches, and see if they could recommend any particular route. They sent in a most valuable report from which it was evident that the main factor in the problem of climbing Mount Everest was the weather. It is not possible to legislate for the weather or to know for long in advance what it is likely to be, but on one point they were convinced, namely that if the mountain was going to be climbed it could only be done in the early months of the year.

The next year another expedition was sent, under the command of General Bruce, to attempt the assault. They reached a height of 27,000 feet, that is, within about 1800 feet of the summit. They were beaten by the weather. In 1924 a third expedition went, and Norton and Somervell reached 28,000 feet; Colonel Norton, as he then was, whom I am glad to see present, reaching about 100 feet higher than Somervell on that occasion. Again the weather obliged them to beat a retreat. Unfortunately, when Norton and Somervell returned to camp, Irvine and Mallory decided to make a final attempt before abandoning the task. They had got, perhaps, a few feet higher, though it cannot of course be said for certain, when they were seen by Odell moving above the Second Step. Then the mountain became suddenly enveloped in cloud; the climbers were lost to sight and never seen again; and unless Mr. Ruttledge can tell us anything more, we know no more now than we did then as to their fate.

This year the expedition was entrusted to Mr. Hugh Ruttledge, our lecturer of this afternoon, and it is for me to tell you something about him. He entered the Indian Civil Service in 1909. Prior to that, as a young University graduate spending a holiday in the Alps, he came into touch with Edward Whymper, the great alpinist of Matterhorn fame. From that time Mr. Ruttledge has always been keenly interested in mountaineering. On going out to India in the Civil Service he was for many years stationed in the plains of India, for example at Lucknow, but whenever he came home he went in for mountaineering. In 1926 his duties fortunately took him to Almora, and Kumaon, where he was always in sight of the high Himalayas and among the foothills of the range. While there he naturally had great opportunities for climbing various peaks, and Mrs. Ruttledge accompanied him on many of his expeditions, including a perambulation of Mount Kailas, the sacred mountain famous among Tibetans. He and Mrs. Ruttledge were allowed the privilege of making the pilgrimage, with the result that Mr. Ruttledge is now a "Mahatma." You have heard of the title Mahatma in connection with Mr. Gandhi! The Society is indeed fortunate in

the catholic achievements of its alumni: we have Haji Abdullah Philby among our fellow members, and now Mahatma Ruttledge. But, so far as I know, Mahatma Ruttledge has not become a Buddhist!

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

Mr. L. R. WAGER: The last Mount Everest Expedition has been described as non-scientific; in fact, a distinguished member of this Society described it as "resolutely non-scientific." It would be fairer to say that our resolution was directed more to the primary objective, that of reaching the summit of the mountain. Nevertheless, Dr. Greene, as you have heard, made various observations and actually carried out experiments at a height of 25,000 feet, and Mr. Shebbeare, who is an all-round naturalist, was continually adding to his already considerable knowledge of the animals and plants of the country through which we travelled.

One interesting point that seems to have emerged this year is that plants, like animals, have an upward limit beyond which they cannot exist happily. At Camp I, at 19,000 feet, there were about twenty or thirty species of flowering plants belonging to twenty or thirty different genera. None of these existed at Camp II, which was only 1000 feet higher, and even lichens, of which there were three or four species at Camp I, could not be found at Camps II and III. It looks very much as though plants, through lack of oxygen or carbon-dioxide, or moisture, or some such essential, cannot grow above about 20,000 feet.

This year we endeavoured to make more systematic observations of the weather than had been carried out on previous expeditions. Mr. Ruttledge has already explained how very important this matter of the weather is. Mallory gave it as his considered opinion that the chances of any one party reaching the summit of Mount Everest were about fifty to one against, and these odds were largely, in his opinion, due to the very doubtful factor of weather. In the winter the north face of Everest is a dark rock face, because any snow that falls is soon blown away by the violent west winds which blow almost continuously. As the summer approaches a little more snow falls, the winds are less violent and gradually the mountain becomes snowed up. You have just seen photographs which give a good idea of the steepness of the Yellow Band, as we call it, which crosses the north face of the mountain at 28,000 feet. This band consists of overlapping slabs which dip north at 30° but which, like the tiles of a roof, give a face whose general slope is 40°–50°. A mere sprinkling of snow on these slabs covers up the small cracks and roughnesses of the surface which the climber has to rely on for foothold. The snow falls as very fine single-crystal powder, not in flakes, and of course gives no support to one's feet. Therefore it seems that the mountain must be climbed before any snow has fallen, or at any rate while the winds are sufficiently violent to blow away any snow that does fall.

The objection to climbing earlier in the year is the powerful and cold wind. It is rather strange that high up on the mountain the more exercise the climber takes the colder he becomes. That is because the least little bit of exercise causes violent panting, and since the air that the climber is breathing is at a fairly low temperature, there is a general cooling down from somewhere in the lung regions. This is rather a strange feeling which I remember Wyn Harris and I got, to some extent, when we left Camp VI early in the morning when the north side of the mountain was still in shadow. We had to stop occasionally in order to reduce the speed of our panting and warm ourselves up.

That then is the difficulty of climbing Mount Everest very early in the year, and the snow is the difficulty which arrives later. Can therefore the meteorologist

in Calcutta be depended upon to give us warning as to when the monsoon which brings the snow is going to occur? This year Dr. Sen, of the Meteorological Office in Calcutta, sent us daily weather reports, and of course being in a mountain region, we did not at first believe those reports at all. Then we began to realize that Dr. Sen's reports were actually forecasting the weather about two days before it actually came. He also told us when the monsoon was likely to occur; but that seemed so ridiculously early that we could not believe that either. Nevertheless he was right. In future I think we must accept what the meteorologists tell us, and make our arrangements accordingly.

It was an unpleasant surprise this year to find that even by May 30 the mountain had too much snow, although only a sprinkling, to allow it to be climbed, and one wonders what unpleasant surprise the next Mount Everest Expedition will have. But we must at least prepare against the difficulties we know. This is only a tentative suggestion, but I think the difficulty of the early monsoon should perhaps be prepared against by reaching the Base Camp a fortnight earlier even than this year, and allowing those who acclimatize early to make their attempt in the middle of May, when it is reasonably certain that the slopes will be free from snow. Those who acclimatize slowly would be in reserve to make their attempt if a good spell should occur in early June. Of course there will be violent cold winds in May, and it is not certain whether a climber can stand up to those winds or not. The one thing however which I think is quite certain is that as soon as the upper part of the mountain is sprinkled with half an inch of snow there is no hope of climbing it until the snow is blown away. I think Mallory's estimate of fifty to one as chances against climbing the mountain can be reduced. From our further knowledge of the weather, acclimatization, deterioration, and so on, I should think it would be fair to say the chances of any one party being able to get to the summit are perhaps now only five to one against.

Brigadier E. F. NORTON: On the walls of the Rongbuk Monastery there were in 1924 some crude frescoes, one of which depicted the demons of Mount Everest pushing a white man down off the mountain. I think the Lama who painted that picture was not a bad prophet, for before the departure of this year's expedition, when Mr. Ruttledge and I were discussing the chances, I remember saying, "Only two things can cheat you of the top: the failure of the porters to carry to Camp VI, or the weather." As you have heard to-night, weather, and nothing but weather, did cheat this party of the top—such weather in the month of May as we never anticipated, as we have never experienced before, even in 1924, followed by what was, I believe, the earliest monsoon of a century. I think it clear that the demons of Mount Everest had a hand in it this year!

But if they were cheated of their chance of the top, to this year's expedition can be attributed several achievements which will be a big contribution to ultimate success. First and foremost, I put the fact that they have removed once and for all the fear that the porters would break down and fail to carry Camp VI sufficiently high, a fear which has been the bugbear of everybody connected with this problem ever since Mallory and Geoffrey Bruce had to return for that reason in 1924.

Again, this year's expedition has made it a commonplace for parties to sleep night after night at the higher camps above Camp IV: to sleep not only two nights but a third night at Camp VI at 27,400 feet, and to sleep the clock round! That makes one smile when one looks back and thinks that in 1922 four of us started out from the North Col to see whether it was possible for human beings to exist without oxygen at 25,000 feet, and if they could exist, could they sleep? And particularly when one remembers that one of our leading scientists before the

departure of the 1924 expedition said to General Bruce, "You may put a party at 27,000 feet, but nobody will ever sleep there without oxygen."

Again, this year's expedition has proved that parties can continuously climb and descend that steep snow and ice wall below Camp IV, after monsoon conditions have set in, with impunity. There again they have removed one of the greatest bugbears of all previous expeditions, although personally I should feel a little happier if I knew the explanation of the immunity this year from a danger which overtook the 1922 expedition the very first time they tried it. I do not think we quite know why. Anyhow, they have proved that the odds are very much more against an avalanche after the monsoon has set in than we ever thought.

No one who has not himself tried to organize an assault on the mountain can realize what these three achievements of the 1933 expedition, coupled with their improvement in equipment and with their contribution to the acclimatization problem, mean as a contribution towards the success of a more fortunate party another year. Make no mistake: success was never on the cards this year. This expedition never had a chance. Mr. Ruttledge, the leader, succeeded in laying out on the mountain what we had regarded before he started as the ideal organization of the camps and the ideal disposition of the climbing parties. To him and to the porters, no less than to those who trained and led the porters, must go the credit for complete success in this department. And when we turn to the climbers, Wager and Wyn Harris did exactly what their job was. They disposed, I think, once for all of any hopes of the ridge route, and they cleared the way for Smythe's and Shipton's attempt. I consider that Smythe's single-handed attempt on that horribly dangerous wall under the conditions it was in at the time represents the legitimate limits of resolution and courage if it does not rather overstep them.

I said this year's expedition had cleared the way for future success, but in one respect I must admit that the prestige of the mountain has gone up and our optimism as to any one party succeeding on any one occasion has proportionately diminished. I am talking of the actual physical climbing difficulties. There is a tendency now, I think, to regard that wall, on which three successive parties have now been brought to a halt, with more respect than before. I have been fortunate in encountering that wall under better conditions than the others, and I personally have no doubt that it is negotiable, given rock completely clear of snow. With any depth of snow on it—and here I am only repeating what I said when I came back in 1924—there is no question that it is absolutely unsurmountable. And I think we can trust the demons of Mount Everest to see that we are very unlikely to find the rock completely clear of snow.

In conclusion, I should like to congratulate the speaker this afternoon on a very fine story told with all that modesty which has been so characteristic of the conduct of the whole of this year's expedition.

Mr. T. A. BROCKLEBANK: I am afraid I have not much to contribute to the discussion as I am not a man of science, but I hope I cannot be accused of being in any way "resolutely non-scientific." Brigadier-General Norton raised the question of the condition of the snow this year on the North Col slopes. I can only say that most of the time when it was open to traffic after the first difficulty of reaching the North Col had been surmounted there was, after a time, a good hard track most of the way up from which we hardly varied our route. That probably made the passage from Camp III to Camp IV a great deal safer than it would otherwise have been. On the other hand, the second time we went up the glacier on May 15 we attempted to reopen that route. By then the monsoon was in full blast, and not only was there a foot or two of new snow covering up

the fixed ropes but underneath that the old snow appeared to have remained, and one could drive an ice-axe in right up to its head, and even then there was no evidence that one had reached anything firm.

Mr. Ruttledge has told us this afternoon a great deal about various members of the party, but remarks about himself have been conspicuously absent. I shall always remember one little scene at Camp III on, I think, May 31, when those of us who were resting there were waiting and waiting for news of Wyn Harris and Wager. We had hoped to hear the previous evening some news of their attempt, and naturally by the next day we were all somewhat anxious. I think the only visible sign of Mr. Ruttledge's anxiety was when he went out of the tent—the whole mountain was covered in cloud—and solemnly trained the telescope on the mountain and looked into a perfectly blank cloud.

The PRESIDENT: You will all agree, I know, that we have had a most extraordinarily interesting lecture. The photographs have given us a vivid idea of what the party went through. Mr. Ruttledge himself, as Brigadier Norton has said, has spoken modestly and said little of his own part in the project, but we can all see from the man and from the story he has told what great qualities of leadership he must have displayed in running the expedition as he did and bringing the party back without casualty of any sort, a fact which does great credit to every member of the expedition and himself. I do not feel qualified to enter into the technical aspects of the ascent, of which we have heard from Brigadier Norton, but I do feel that as long as the summit of Everest remains unconquered there will always be some Englishman ready to undertake an expedition to climb it. For the present, as you will have gathered, the outlook does not appear very promising. I can only express the hope that if the Tibetan authorities relent in a year or so's time, Mr. Ruttledge may be able and fit enough to conduct an expedition again. I am sure we could not possibly have a better leader.

As you have been notified, Mr. Ruttledge has been good enough to agree to give us two lectures, one in the afternoon and one in the evening. Seeing that he is exceedingly busy with his book, this is no small task to impose upon him, but he has readily responded to our appeal for a second lecture in order that as many Members of the Society as possible may have an opportunity of attending the lecture. I will ask you to show in the usual manner your enthusiasm for the admirable lecture which he has given us this afternoon.

At the Evening Meeting the President introduced the lecturer in terms similar to those used in the Afternoon. Mr. Ruttledge then repeated the lecture printed above, and further discussion followed.

Mr. F. S. SMYTHE: After Mr. Ruttledge's most comprehensive account it is very difficult indeed to find anything else to say. The factor that cannot be stressed too strongly is, of course, the time factor. This year the plan of attack, with the exception of acclimatization, was substantially the same as in 1922 and 1924, and attacks were launched from the North Col. With too prolonged acclimatization, deterioration sets in, and when planning an attack this has to be considered. When Shipton and I first went up from the North Col to make a reconnaissance towards Camp V we climbed 1500 feet in about one and a half hours. At the same time, I very much doubt whether we should have been able to have climbed to 28,000 feet. When we went up later we found we could only manage about 600 feet an hour from the North Col to Camp V. But given the same easy ground above Camp VI, I think we could have climbed at 400 to 500 feet an hour; and so what you lose on the roundabouts of deterioration you gain in the swings of acclimatization.

With regard to attacks on the mountain, they must be launched from a camp as high as possible, and the question arises, is Camp IV on the North Col the best point from which to launch an attack? There are some who think that Camp V would be better. Camp V this year was most frightfully uncomfortable. We had little tents of aero-wing canvas. I am afraid I referred to them as "gossamer" canvas. The snow blew, not only through the entrance, but through the side of the tent and made life very uncomfortable indeed. If one could get up to Camp V a small Arctic tent like the tents we used up to Camp IV but weighing much less than 80 lb., and capable of sleeping four men and enabling them to live as comfortably as possible in it, I think one could spend some days at Camp V and choose the time for the attack. The possibility of getting three days' good weather is far less than the possibility of getting two days' good weather, and the possibility of two days is not half that of one day, but somewhere about one-tenth. If Camp V could be made really comfortable, and the attack launched from it, I think there would be a much greater chance of getting to the top.

As regards the position of the camps, it does not seem that Camp V can be improved upon. For one thing, a longer carry from Camp IV would be almost impossible. This year, with Camp IV at only 22,800 feet, and Camp V at 25,700 feet, it was as long a carry as any porter could possibly be expected to do. Camp VI was pitched well to the east this year with the idea of gaining the crest of the North-east Ridge to the east of the First Step, but we know now that the ridge is not the best route. Therefore the next expedition should endeavour to pitch Camp VI under the First Step.

As regards Brigadier Norton's traverse route, I think it would be much better to go lower along the Yellow Band, which is slightly concave in angle, for when coming back low down from my highest point I found it much easier climbing than going. It is necessary to get into the subsidiary couloir on the other side of the steep buttress, at the foot of which the main couloir and subsidiary couloir bifurcate. This subsidiary couloir is the most dramatic thing on Mount Everest, because it forms the only breach in the band which runs across the northern face of the final pyramid. It is much better to traverse the buttress low down because the upper part of it is steeper than the lower.

One of the difficulties of the final assault, apart from the time factor, will be getting back to Camp VI. The sudden storms which approach with no warning are very disconcerting. The storm which caught Shipton on the way down and the storm which caught me were the most sudden I have experienced on a mountain. They were unheralded by clouds and came out of a blue sky. In five minutes a wind probably over 80 miles an hour was blowing. If the climbing party is caught in such a storm it is not going to get back to Camp VI. There is 300 feet of very steep ground. It would probably be advisable to take some light line and fix it to a piton above the worst section. Then the climber, who is going to be pretty weak and tottery about his legs, may have a chance to get down without disaster.

General BRUCE: I should like to stress one point. I do not think we can be in any way disappointed that the summit was not reached. The expedition did all that men could possibly do. It may be that their performance has been equalled before, possibly on one or two occasions; but even that is doubtful. I really want to make one or two remarks with regard to the porters. I think it is becoming a tradition among Sherpas, and what makes me think so is that many came to join the expedition of their own accord. They came from Solar Khombu to join Mr. Ruttledge without compulsion. They were simply advised that they were wanted and forty-six men came. There could have been no compulsion.

Think of a very primitive people who are taken up to work on the great mountains without anything like the incentive or interest that we have, and who experienced from the first difficulties and dangers, and actually lost, on our 1922 expedition, no less than seven of their people in one accident, and another falling down a crevasse. You would have thought that might have put them off. But in 1924, when I went back I found 250 of them waiting to be chosen. Since then they have taken part in all the expeditions in the Eastern Himalaya, notably Dyhrenfurth's Expedition to Kangchenjunga, and both the Bavarian attempts on the same mountain; and on those expeditions they have suffered further losses and an immense amount of frost-bite. But that seems to egg them on more than ever. When I got up to Darjeeling this year they were absolutely tumbling over each other in their eagerness. The tradition of joining in the great exploration of the mountains has arrived, and I think in future first-class porters will always be forthcoming. I do not know whether there is anything in it, but after the first expedition they all said to me that the accident was the sacrifice claimed by the mountain and that now half the terror of the mountain would go. How far that modifies the case I cannot say, because they have had many accidents since. Still, that was the idea, and not only amongst the porters but amongst ordinary Nepalese. Lhakpa Chedi did not think much of that himself. He and I were old friends, as we had been travelling about Sikkim before these expeditions were thought of. That was about the time that I was told by the doctors that if I walked uphill I should die!

There is one question I should like to ask Mr. Ruttledge. When the expedition was driven off the mountain in 1922, during that winter the Lama at Rongbuk monastery had a beautiful picture painted which I understand was intended to depict the defeat of the 1922 expedition. I think it is probably in the monastery now, and I wonder whether Mr. Ruttledge saw it. It pictured the demons of Mount Everest driving the expedition off the mountain, and little demons spearing the unfortunate leader. I can certainly bear witness to the character of that very remarkable man, the Head Lama of Rongbuk, to bear out what he did this year, and, I think, what he has done for all expeditions; when the morale was low he blessed the porters and re-established their confidence. I do not think I have more to add except to wish "Good luck" to the next expedition to Mount Everest which may or may not go in 1936.

Mr. COLIN G. CRAWFORD: I should rather like to disagree with Mr. Ruttledge on one point. He disclaims any relationship with Mahatma Gandhi, but he certainly adopted Mahatma Gandhi's gospel of non-violence. As regards the expedition this year I should like to draw one or two comparisons between the 1922 expedition, of which I was a member, and the 1933 expedition, and although the points have already been somewhat laboured I would like to draw attention to the difference in weather conditions. I looked up my diary for 1922 and I noted that in my 1922 diary I mentioned the bad days, while in 1933 I mentioned the good days. In a period of one month, May 4 to June 4—this was mostly on the glacier and of course did not affect conditions at greater altitude—I only noted two days of sun and one day of very bad wind. Of course one always had the wind, and one only noted exceptionally powerful winds. In 1933 there were about two or three good days, all the rest being bad days. We had very bad weather in 1922. Still, if the weather in 1933 had been no worse than in 1922, I believe that the mountain would have been climbed.

Both Mr. Ruttledge and General Bruce have mentioned the improved morale of the porters. In 1922 one felt they were subdued by the mountain; there was an undercurrent of apprehension. In this year's expedition one did, of course, have failures, but they were laughed at. One gentleman succeeded in concealing

himself in the cook's tent for three days when he was required to carry; and when he was finally dragged out everybody laughed at him, instead of being rather impressed by the circumstances that must have produced his state of mind. Similarly, when one of the porters broke down on the North Col all the rest of the men just laughed at him. The porters have completely lost, as far as I can judge, their traditional fear of the mountain.

I am under the same disability as Mr. Smythe, who had, apparently, noted points to speak on and found Mr. Ruttledge had dealt with them all before. As to the Arctic tents: our equipment this year was very much more complete than in 1922, and I personally was never cold in an Arctic tent. Actually when one slept five or six in an Arctic tent one was far too hot. Our sleeping-bags were designed for more severe conditions than you could experience in an Arctic tent. In a Whymper or Meade tent I think conditions were none too warm, but in an Arctic tent one began to feel one was in an Indian hot season. I think those Arctic tents made all the difference this year in the successful occupation of the higher camps.

The President expressed the thanks of the Meeting to the lecturer and renewed his congratulations to the leader and all members of the Expedition.

Since a large number of Fellows and their friends were unable to obtain admission to the Evening Meeting on November 6, a third meeting was held on the evening of Wednesday, November 8, when Mr. Ruttledge very kindly repeated the lecture.

THE BOOK OF THE MOUNT EVEREST FLIGHT

FIRST OVER EVEREST: the Houston-Mount Everest Expedition 1933. By Air-Commodore P. F. M. FELLOWES, L. V. STEWART BLACKER, Colonel P. T. ETHERTON, and Squadron-Leader the MARQUESS OF DOUGLAS AND CLYDESDALE, . . . and an account of the filming of the flight, by GEOFFREY BARKAS. *London: John Lane* 1933. $9\frac{1}{2} \times 6$ *inches;* xx + 280 *pages; illustrations and maps.* 12*s* 6*d*

IN his Foreword to this book Mr. John Buchan, who is one of the Everest Flight Committee, proposes to make it clear that the purpose of the flight "was not to perform a feat of daring or endurance, to break a record, or do something for the first time.... The true purpose was austerely scientific: to show that the aeroplane and the air camera could be made the means of acquiring important knowledge which would otherwise be unobtainable." But circumstances have a little changed this austere purpose. What was promoted as The 1932 British Flight to Mount Everest became The Houston-Mount Everest Flight, and is now in the book's sub-title The Houston-Mount Everest Expedition 1933, while the element of rivalry is inevitably suggested by the triumphant title 'First over Everest,' and the newer orientation of ideas gallantly shown by the frontispiece.

Early in the year 1932 Major Blacker had submitted to our Society a plan "to reconnoitre and to map by air photographs the almost unknown southern slopes of the massif of Mount Everest," and after careful inquiry the Council had expressed to the Secretary of State for India their opinion that in the event of Major Blacker being accorded permission to fly over Mount Everest, results of scientific importance were likely to be obtained. The authors of the book lay full stress upon the value of this assurance as a first step towards official approval of their project, and are justified in claiming that the support which our Council then gave to the enterprise has been vindicated by the results. The hitherto almost unknown country to the south of Mount Everest has been reconnoitred and a part of it has been provisionally mapped. The photographs and identifications which were published in the *Journal* for July last gave the first results of the reconnaissance. At the Afternoon Meeting of the Society in December Mr. Salt described the plotting of the verticals made on the second flight. And that very much more can be extracted from the oblique photographs will appear in due time.

The greater, then, must be our regret that the perspective is somewhat distorted in the picture which the authors have drawn for the public presentation of their achievement in flying over Mount Everest. "In 1932," they write, "that awesome crest was still the last stronghold of Nature, her last donjon-keep into which man had never been able to look, and her last penetralia from which he had never been able to rend the veil," the truth being that in 1924 the third Mount Everest Expedition had reached within 1000 feet of the summit; that Mount Everest, at least on its northern face, was much better known than any major peak in the Himalaya except perhaps Kangchenjunga; and that there are hundreds of miles of the great range and dozens of first-class peaks that are not yet known at all. Political objections had hitherto prevented any approach to Mount Everest from the south. These objections had happily been so far relaxed for the Mount Everest Flight that permission was given for one, and eventually for a second flight, under severe restrictions of route. One may recognize to the full the enlightened liberality of the Nepal Government in relaxing so far, and yet deplore the tragic waste of opportunity for a really great

advance in our knowledge, which the Mount Everest Flight with its skilled personnel and fine equipment might have made if they had been allowed more liberty and more time.

Their photographic results were of three kinds: verticals, obliques, and movies. The last have not yet been produced; how far topographical results may be deduced from the small pictures has not yet been examined in detail. The oblique pictures, many of them very fine, have been widely exhibited and published. Some of the best are included in the book, but almost without comment, and with small use of the identifications available. On the other hand the fine picture facing p. 194 and labelled "one of the great declivities of Everest" has never been identified as such. Without the obliques the pictorial value of the flight would have been little, for verticals of high mountain country are mere puzzles until they are viewed in pairs with a stereoscope. Without the obliques we should have learned only the detail of a strip or two, but nothing of the general aspect of the southern face; and in the obliques there is stored away a great deal of topography that in course of time we shall be able to work out if the negatives are carefully preserved. Hence we cannot agree with the authors that "the geographical advantages of the obliques by themselves could only be trivial." We had hoped that the contrary was proved when we were allowed to publish a good selection of them with careful identifications in the July *Journal*. The gloomy opinion may however have been consoling when the observers realized that the Westland machines gave a very poor field of view for the oblique cameras. It was difficult on a straight course to get the desired pictures free of struts, wings, and fuselage, and the verticals demanded a straight course; nor in any case could the pilot afford to slew the machine continually and give the observer a chance to get all the pictures he desired abeam. It is therefore ungenerous to criticize the observers, as some have done, because they did not avoid interference by wings and struts. They had in fact too much to do, in very exacting conditions, and they did very well to get through so much of mutually conflicting programmes.

The most serious failure was that of the vertical cameras on the first flight. The cabled reports from Purnea admitted that something had gone wrong with them, some failure of the cameras or the operators which was not explained. The book suggests that the failure was due to unusually high dust haze, but the obliques show that this cannot be the explanation. It was the more unfortunate since on the second flight neither machine went over the summit. They had carefully worked out a course far to the west at first, so as to have less fight against the violent west wind at the greater heights; but clouds made it impossible to observe the drift, which was greater than they allowed for, and instead of coming in from the south-west over Namche Bazar they came in from nearly due south just west of Chamlang—one should read "eastward" instead of "westward" in the middle of p. 213—and the vertical strip could not be placed until some detail was identified with detail on an oblique of that mountain. How small was this product of so large and expensive an effort is shown without comment in the diagram inserted opposite p. 219, which has the air of being an afterthought, since it is not included in the list of illustrations.

The authors have left it to Mr. Buchan in his Foreword to assess the result of their enterprise, and he puts it thus:

> The difficulty of taking photographs at such an altitude will be made clear in the succeeding pages, but it is a great thing to have established that it is possible, and that we have a new and effective instrument for the survey of regions that cannot be traversed by the foot of man. It was not to be expected that the flights would reveal any startling new geographical features, but two

glaciers, hitherto unknown, have been discovered, and a small high-level lake, which may possibly be hot water.

This claims both too much and too little. That air photography is an effective instrument of surveying inaccessible country was already well known. Given the power of taking a camera to 33,000 feet, that it would work there is nothing surprising. The technique is interesting, but not revolutionary. On the other hand, the geographical features of Mount Everest's south face, now revealed, are startlingly different from those on the known faces. The thin overhanging buttressed southern wall of the western cym, the magnificent truncated spurs separated by profound couloirs, are unsurpassed. Not two new glaciers but whole fields of them behind Chamlang are now seen for the first time, but the little "hot lake" is neither so big nor anything like so high nor so near Mount Everest as was first reported. Let us repeat: the photographs taken on these two flights are of much geographical value in themselves, and not merely as a demonstration of possibilities for the future. But the full value of the negatives cannot be extracted from them at once, and a great responsibility rests upon those in whose keeping they are.

Those chapters in the book which deal with the actual flights are in great part a reproduction of the original messages to *The Times*. The account of the machines and the high-altitude equipment is full of technical interest, but it is not made clear how much of it is common practice and how much is novel. The two long chapters on the early history of the mountain and the exploration of Tibet are ancient matter extracted from the Records and Reports of the Survey of India, and a little out of scale; they do scant justice to the explorations of the first Mount Everest Expedition. There are some passages which will jar upon the mountaineer and some upon the surveyor, a little fulsomeness, and occasional extravagances of statement; but these do not much detract from the story of a great adventure, well planned and boldly carried through. The book is well produced at a very reasonable price, has many excellent illustrations, and an amusing anaglyph from a pair of verticals, with the necessary green and red spectacles in a pocket at the end.

PLOTTING THE VERTICAL PHOTOGRAPHS OF THE SECOND MOUNT EVEREST FLIGHT: *A paper read at the Afternoon Meeting of the Society on 11 December 1933, by*

LIEUT. J. S. A. SALT, R.E.

THE immediate neighbourhood of Mount Everest falls at the junction point of four sheets of the $\frac{1}{4}$-inch-to-the-mile series published by the Survey of India (71.L, 71.P, 72.I, 72.M). A special sheet, "Mount Everest and Environs," is also published on a scale of $\frac{1}{2}$ inch to the mile. On all these sheets the area lying to the north of the general boundary between Tibet and Nepal has been depicted according to the plane-table survey of Major Wheeler in 1921, as amplified by the work of the expedition of 1924. Most of Nepal has been surveyed by the Survey of India, but in the immediate neighbourhood of the Tibetan border, owing to the wild and uninhabited nature of the country, the work is not to be regarded as of the same order of accuracy as elsewhere. Many peaks however have been included by intersection in the general triangulation, and their positions are shown by means of black dots accompanied by spot-heights.

When the project for a flight over Mount Everest was first discussed, it was obvious that to achieve the maximum amount of scientific record in the short time of a single flight it would be necessary to carry out a photographic survey. There have been many methods devised for transferring the data contained on an air photograph to an ordinary map sheet. The choice of method normally depends on the nature of the country and the purpose to which the resulting map is to be put, and the vital factor which then conditions all operations is the amount of ground control it is possible or necessary to provide. Air photographs by themselves record the physical features of small areas of country but not the actual positions of these areas upon the surface of the Earth. The positions of some of the points appearing on the photographs must therefore be known, in order that the data as a whole may be tied in to an accurate framework. In most cases a considerable amount of such ground control is necessary, but since on the Mount Everest flight there was no possibility of providing any more than could be obtained from the existing maps, the method offering the greatest freedom in this respect was much to be preferred. It was decided therefore to use the method known as the "Arundel" method, which has been developed at the War Office and used with considerable success in many parts of the world.

An air photograph taken absolutely vertically over flat country would be a true plan to some definite scale depending on the focal length of the lens and the height of the aircraft above the ground. On a similar photograph of hilly country the result would no longer be a true plan, since the higher ground would now be nearer to the camera and therefore photographed at a larger scale than the low ground. The distortions involved in this all take place radially from the centre of the photograph, so that a tall chimney near one of the margins would appear as a short straight line pointing away from the centre of the picture. In practice it is impossible to ensure that the camera is pointing in a truly vertical direction at exposure, and under these conditions

the point from which height distortions are radial is no longer the centre of the picture (principal point) but the plumb point, *i.e.* the point where the plumb line from the perspective centre of the lens cuts the plane of the photograph. There is a further effect of this tilt: such a photograph, even of flat country, is distorted in that the image on that side of the negative tilted nearer to the ground is at a smaller scale than that on the other side. It can be easily shown that this distortion takes place radially from a point known as the isocentre, situated roughly halfway between the principal point and the plumb point. There are therefore two sets of distortions, each set taking place radially from a different point, whose positions we can only discover if we know the magnitude and direction of the tilt. These quantities however cannot be readily obtained, as a spirit-level, or similar contrivance, is unable to distinguish between gravity and acceleration. But for small tilts the two points lie quite close to the principal point, whose position is always available from the calibration data, and the question arises as to what kind of error would result from the assumption that all distortions take place radially from the principal point. We wish to assume, that is, that angles subtended at the principal point by points of photographic detail are equal to the angles that would be measured to the corresponding points by a theodolite situated at the point corresponding to the principal point on the ground. It can be shown theoretically, and is borne out practically, that the errors resulting from this assumption can be tolerated on the ordinary scales of plotting provided that the tilts are kept below about 2° and the variation of ground height does not exceed 10 per cent. of the altitude of flight. These conditions are normal, and such photographs may then be considered as records of true angles measured from the principal point. If therefore a strip of vertical photographs is taken in such a way that each one overlaps its neighbour by rather more than 50 per cent., there will be a small area of ground common to every three successive pictures. The above radial assumption therefore enables us to construct a graphical triangulation in which a traverse containing the principal points is connected up by means of three-ray intersections to points on either side. Its scale and orientation are as yet unknown, but may be obtained from any two known points situated within it. If several such strips are flown alongside with a small lateral overlap their graphical plots may be joined up by means of points in the common overlaps. Together they thus form a block, to which the two-point condition still applies. Finally, the detail may be plotted by intersections and tracing from the photographs.

A further possibility is opened up by the fact that since the overlap between successive pictures is at least 50 per cent. every point on the ground is photographed from two points of view. If now we so arrange matters that when two neighbouring photographs are placed side by side the observer's right eye sees the right-hand picture and *vice versa*, he will get the same impression of the ground that would have been obtained by a giant with an inter-ocular distance so large that his eyes were situated at the original positions of exposure. In the same way that the giant would see the landscape in the solid, the human observer can connect up the two photographic images to form a fused impression of the landscape in stereoscopic relief. In ordinary vision

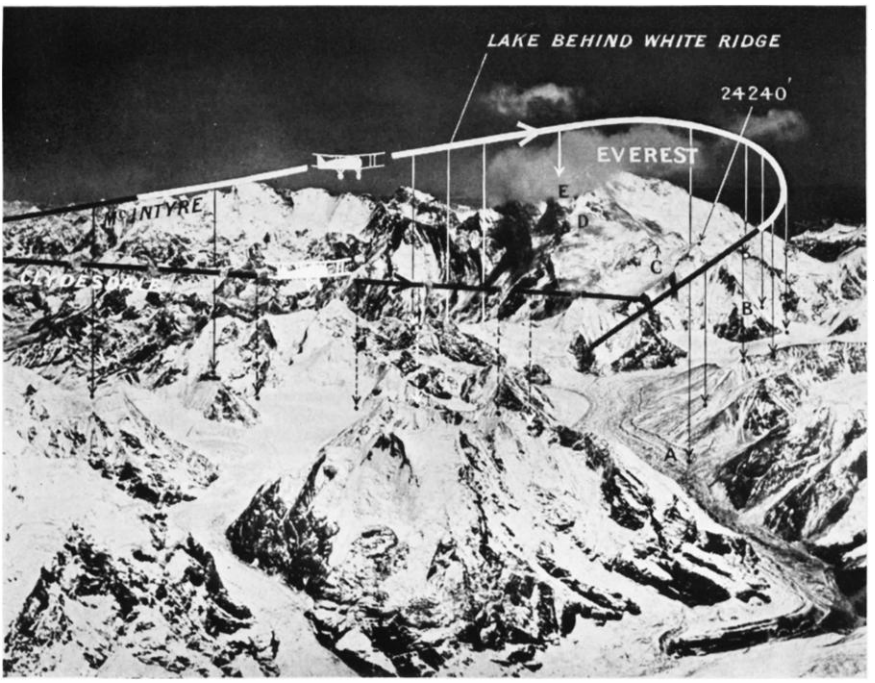


Plate 1. Area between Makalu and Everest

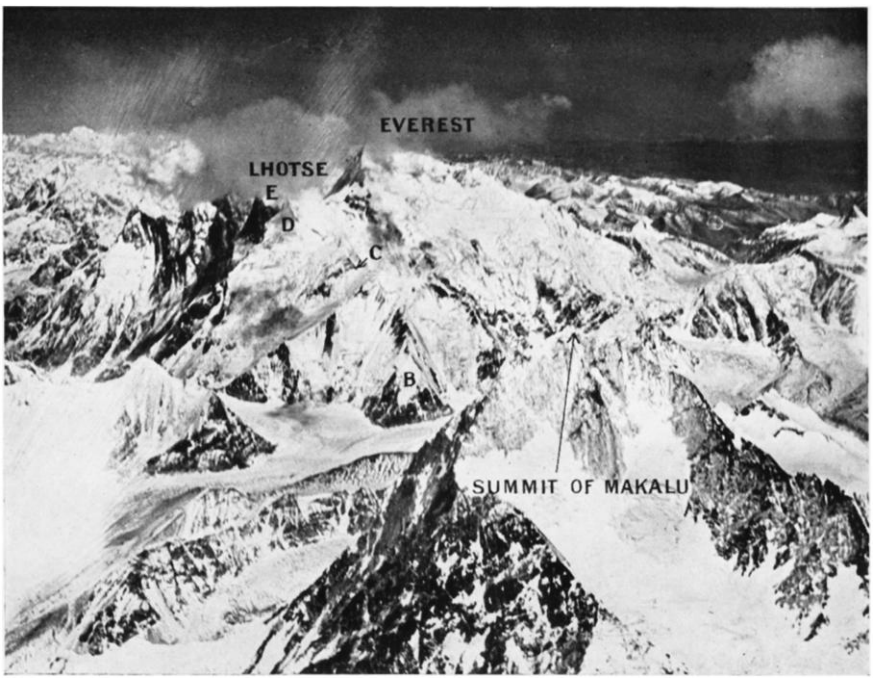


Plate 2. Mount Everest from south-east of Makalu

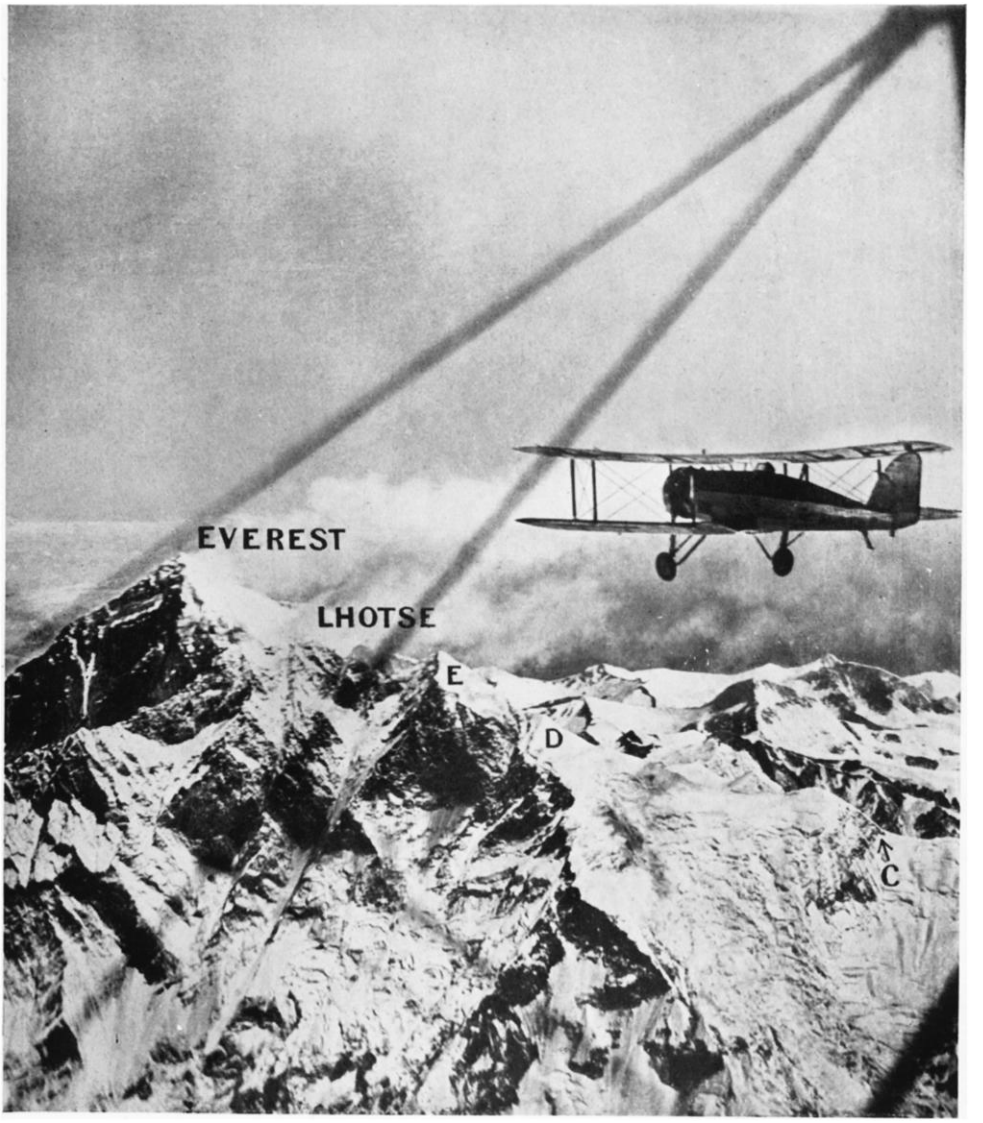


Plate 3. South-east slope of the Everest massif

the eyes converge on to the observed object and automatically focus themselves (accommodation) for its distance away. With a definite accommodation there is thus associated a definite convergence. But for viewing directly a pair of photographs stereoscopically, the eyes are focussed for their distance away but converged for a greater distance, since the two images of any one point are separated by at least the width of a single picture. If this width is greater than the inter-ocular distance (about 2^1_2 inches) the eyes would actually have to diverge. The art of negative squinting however cannot be indulged in without eye strain, and to bring accommodation and convergence into harmony a stereoscope is used. In this method a pair of fine grids superposed on the photographs may be adjusted to give the impression of a network floating in space. If the tilts are small, by varying the apparent height of this network it may be used as a horizontal reference plane, and, if a few spot-heights are known, contours may be drawn in by eye. These contours will all be at a different scale, but may be transferred to the map in the same way as detail.

Such, in brief, is the method it was proposed to adopt. In normal practice it involves a high class of flying with correspondingly small tilts, and is limited to a moderate variation in ground height. On the Mount Everest flight the conditions of flying would be so severe that far larger tilts were to be expected, and the variation in ground height would be more than 90 per cent. of the altitude of flight. Though these extreme conditions might be expected to invalidate the method, a few computations indicated that it was still the most propitious to adopt. In addition to being a practical solution it would also provide very valuable experimental data for further research on the method itself.

To collect the maximum amount of survey material a series of parallel strips would be the ideal. This objective however was soon realized to be too ambitious, and it was finally decided that all that would be possible would be a single strip to the peak and another on the return journey. These two strips would both contain an image of the summit, the position and height of which are known from trig. intersections, and since their other extremities would fall over the foothills, various points would no doubt be found, the positions of which are given on existing maps. In this way, scale and orientation of the plot could be guaranteed. The general line of such strips was planned to run up the Arun valley.

Before leaving England the pilots made certain experiments in which they attempted to imitate the actual conditions of the proposed flight. Apart from the general difficulties of high-altitude flying and the operation of a camera in extreme cold, the most important feature was the setting of the time interval between exposures to ensure the necessary percentage overlap. To cover the maximum amount of ground it is necessary to fly as high as possible. On an ordinary flight over undulating country the time interval can then be set (usually about 20 to 30 seconds) for the mean height above the ground and thereafter kept fixed. But in this case the ground would be steadily rising underneath the aircraft, and, were the time interval set for the lower ground maintained, the overlap would steadily diminish until there were gaps between the photographs, and therefore no means of connecting them at all.

On the other hand, if the time interval were set in advance as correct for the high ground, and the excessive overlap over the low ground regarded as merely a fault on the right side, the number of photographs required for the strip would be enormously increased, and there would be a danger of the film running out before reaching the objective. What was required was an organized way of steadily diminishing the time interval as Mount Everest was approached, and a rehearsal of this procedure was carried out at Farnborough.

The camera used was the Williamson Eagle Type III, fitted with a Ross Xpres (E.M.I.) F/4 lens, of 5-inch focal length. The size of the picture being 5 inches by 5 inches it follows that the side of the square patch of ground covered by a single photograph is equal to the height of the aircraft above the ground. This is the maximum field that can be covered by a single lens with adequate illumination and represents a high achievement of the lens-maker's art.

In addition to the vertical strips arrangements were made to take a series of obliques with a camera held in the hand. The actual survey value of such photographs is limited, but it was thought that a considerable amount of reconnaissance data might be extracted from them, and they might help in the identification of some of the peaks. The pictorial effect of these photographs would also be of general interest.

The story of the flight and of the many difficulties encountered has been told elsewhere. This account must continue at the point where the photographs arrived back in England.

There were two distinct flights to and from Mount Everest, and on each occasion an attempt was made to complete a vertical strip in each direction. On the first flight the obliques were very successful, but the negative rolls of the verticals revealed severe fogging, so that prints from them were of little value. On the second flight however fewer obliques were taken, but the negatives of the verticals showed excellent definition which enabled first-class prints to be produced. It was estimated by the expedition that the mountain was approached from the south-west. Lord Clydesdale and Flight-Lieut. McIntyre kept together at first, and then, while McIntyre flew directly towards Everest, Clydesdale turned off right-handed towards Makalu. During this latter stage the machines were not visible to each other, but it was certain that on the return journey McIntyre must have crossed Clydesdale's track somewhere to the west of Makalu. It was intended to start both cameras when the machines were over valleys in the lower ground recorded on the existing maps, and McIntyre on approaching Everest had banked in the "plume" so as to include the summit in the vertical strip, and then made direct for home. It seemed certain therefore that known points would be available at each end of this latter strip in order to determine its orientation and scale, and that the other strip could be tied in to it even if no further points were available in the direction of Makalu.

The first task was to plot a graphical triangulation for each strip. The material was as follows (see Fig. 1).

Clydesdale's Strip. No. 1

The camera was started when the machine was over a deep ravine well below the snow-line. Continuing in a north-north-east direction—as far as

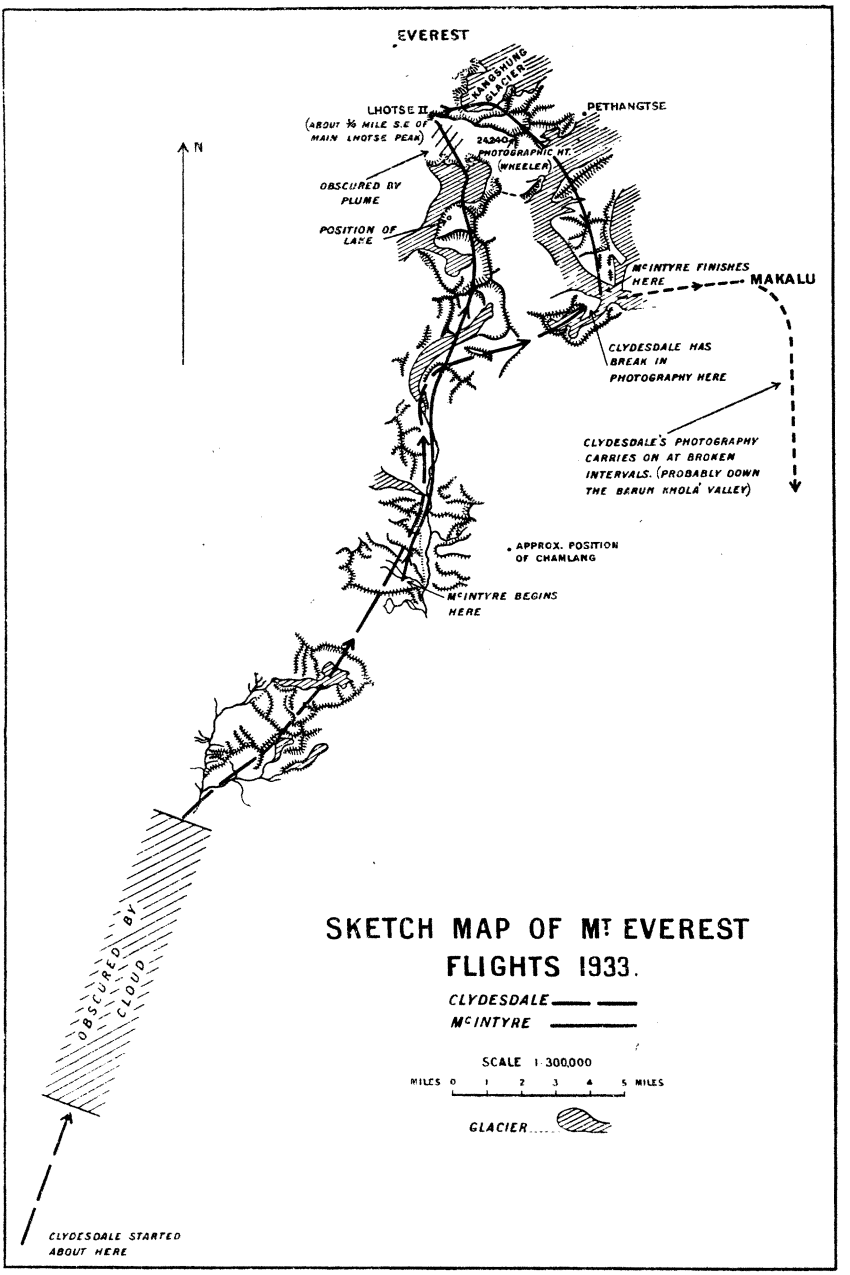

EVEREST
LHOTSE II
(ABOUT ½ MILE S.E. OF MAIN LHOTSE PEAK)
PETHANGTSE
24,240 ft. PHOTOGRAPHIC HT. (WHEELER)
OBSCURED BY PLUME
POSITION OF LAKE
N
McINTYRE FINISHES HERE
MAKALU
CLYDESDALE HAS BREAK IN PHOTOGRAPHY HERE
CLYDESDALE'S PHOTOGRAPHY CARRIES ON AT BROKEN INTERVALS. (PROBABLY DOWN THE BARUN KHOLA VALLEY)
APPROX. POSITION OF CHAMLANG
McINTYRE BEGINS HERE
OBSCURED BY CLOUD
CLYDESDALE STARTED ABOUT HERE
SKETCH MAP OF Mt EVEREST
FLIGHTS 1933.
CLYDESDALE
McINTYRE
SCALE 1:300,000
MILES 0 1 2 3 4 5 MILES
GLACIER

Fig. 1

could be estimated from the shadows—for a few miles, it ran over a bank of clouds which almost completely obscured the ground for about 9 miles, after which it revealed a valley, clearly at a much greater elevation and with snow appearing in large masses. (N.B. The distances given here are those subsequently determined. At this stage of the proceedings the scale of the photographs was not known, and distances along the strip could only be measured in terms of the number of overlaps.) After a further 15 miles, during the latter half of which the two machines photographed very much the same line of country, the strip turns through nearly 60° to starboard, and, after crossing a vast snow plateau, reaches a very prominent glacier and then stops. The remaining photographs on the negative appear in short groups, as if the camera had functioned intermittently, and these therefore, unless independent ground control can be found, cannot be connected to the main body of the strip. The longitudinal overlap throughout is about 90 per cent.

McIntyre's Strip. No. 2

The camera was started on the same line of flight as the other strip but about 22 miles farther on, so that the first 7 miles of McIntyre's strip cover the same ground as Clydesdale's before the latter turned to starboard. This strip continues in the same direction over a magnificent mountain mass, in which lie the heads of several glaciers, and then runs into the plume of Mount Everest which obscures all but fragments of the detail. (The overlap in this section was about 95 per cent.) Here the machine banked heavily (as can be observed by the lateral tilt) and McIntyre believed that in so doing he had been able to secure a picture of the summit taken by the vertically mounted camera. Turning on a fairly small radius through nearly 180° the strip makes its way down a broad glacier and finally stops, by the hand of Providence, with a photograph covering almost exactly the same area as that in the last picture of the main series of Clydesdale's strip. The overlap in this latter section was 75 per cent. to 80 per cent. The two tracks here cross at right angles. The reason for stoppage was that owing to the large initial overlap the film magazine had been prematurely exhausted.

The work of constructing the graphical triangulation, or "minor control plot," as it is called, was not entirely straightforward. On Strip No. 1 the principal difficulty was the section obscured by cloud. Where no ground is seen it is hardly possible to plot anything, but an attempt was made to bridge the gap in this way: On those photographs on which the cloud bank first appears, by graphical construction some estimate can be made of the speed and direction of the movement of the clouds relative to the ground. Thereafter definite cloud features can be regarded as moving trig. beacons and a method can accordingly be devised for eliminating the disturbing effect of their movement. In this case however, though the clouds appeared to move in an orderly manner, they defeated the surveyor by changing their shape, and succeeded in causing a gap in the strip. The rest of the strip, with the exception of the above-mentioned separated sections, proved to be fairly plain sailing. By this method of plotting an estimate can be made of the order of tilt encountered, and this was not infrequently large.

On Strip No. 2 a start was made by tying it into the same scale along the

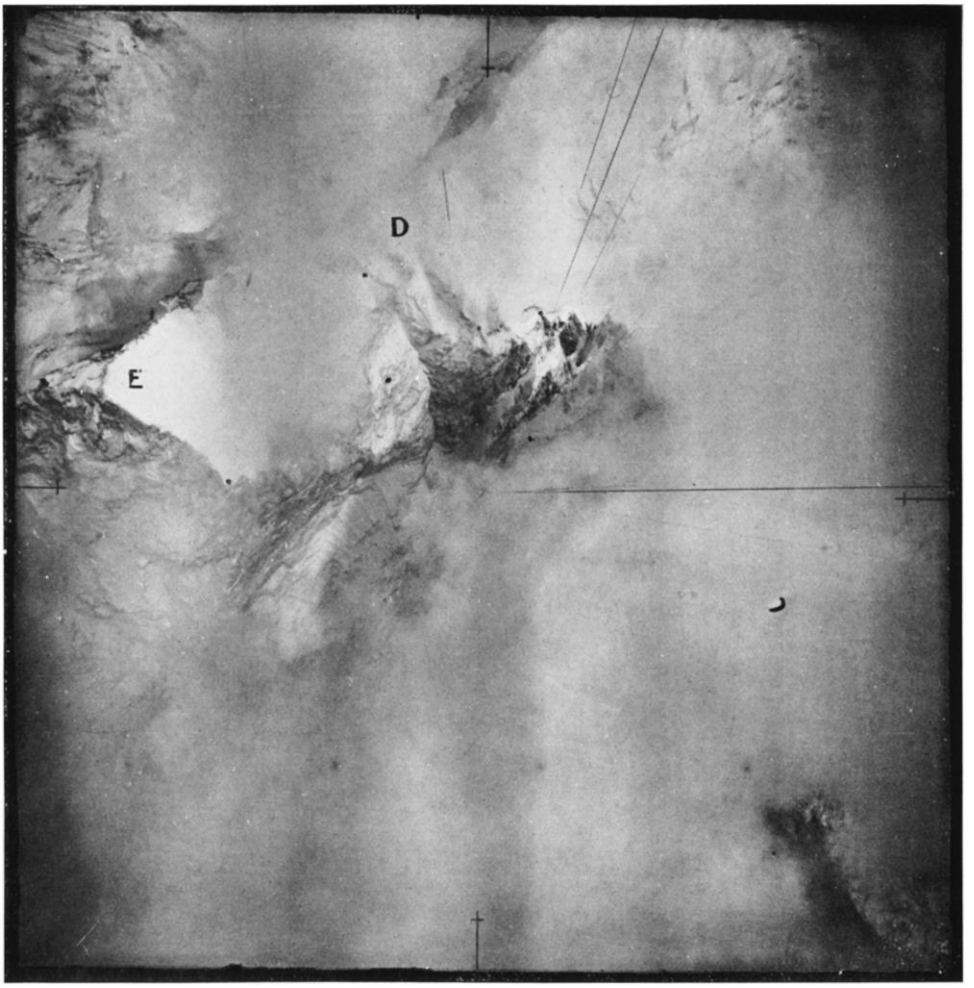


Plate 4. Vertical photograph showing ridge culminating in Lhotse II: the highest point appearing on the vertical strips

Plate 5. Vertical photograph showing western slope of Chamlang

stretch common to Strip 1, but difficulties were met with on approaching the plume of Mount Everest, where the banking of the machine had caused very large lateral tilts. The plotting here appeared so unreliable that it was extremely doubtful if the scale and orientation of the second part of the strip would be properly related to the first. Resource was therefore had to the providential right-angle join between Strips 1 and 2.

By resecting the last photograph of Strip 2 on to the last overlap of Strip 1, the second part of Strip 2 was plotted backwards. Its scale should therefore be the same as that of Strip 1, to which the first part had already been made equal, and the relative orientation should likewise be correct. On the backwards plot difficulties started as before with the large tilts caused by banking in the plume, but the gap to be bridged was then small and had firm abutments on either side. Errors could therefore be smoothed out.

At this stage the principal parts of both strips had thus been plotted in skeleton form and were joined together to form a whole. The next problem was to find within this plot points whose positions were known. The first question to decide was whether the summit of Mount Everest actually appeared on the photographs. Projecting out of the hazy masses partially obscured by the plume was a definite peak of roughly the same type of formation as Mount Everest but with the orientation of its faces rather different. It was thought however that the orientation of the plot itself might have been estimated wrongly, and this peak was therefore accepted provisionally. At the southern end there was a striking resemblance between the forked ravine and the valley junction shown a few miles north-east of Namche Bazar on the map. Assuming these two points, therefore, the plot was provisionally scaled and oriented, and the detail, roughly intersected on the plot, was compared all over with that shown on the map. The results were not too promising.

At this stage the evidence of the oblique photographs was introduced. Most of these had been taken on the first flight and therefore did not necessarily correspond to the course covered by the verticals, but starting with the most general views taken some distance away, the many features shown were gradually analysed and various points of detail occurring on the verticals were identified. Only the more striking results of the examination can be dealt with here.

Reference to Plate 1 will show very clearly the general lie of the most interesting sections of both strips, the right-angled junction appearing at A. Here the first great doubt as to the correctness of the provisional scaling and orientation arose, for by comparing the detail beyond A with the same features on Plate 2, it seemed clear that the glacier must run south-east past Makalu, which would then be very nearly abeam from A. But, according to the plot, A should fall far nearer to Everest and more to the south-west of the line joining Everest and Makalu. This indicated that the scale might be too small and the orientation too easterly. An attempt was made therefore to trace out point by point on the obliques the detail shown on the verticals of the south-east slope of the Everest massif.

At the start this presents no difficulties; the feature at B, for instance, appears in the middle of the vertical strip. Comparison of detail may then be

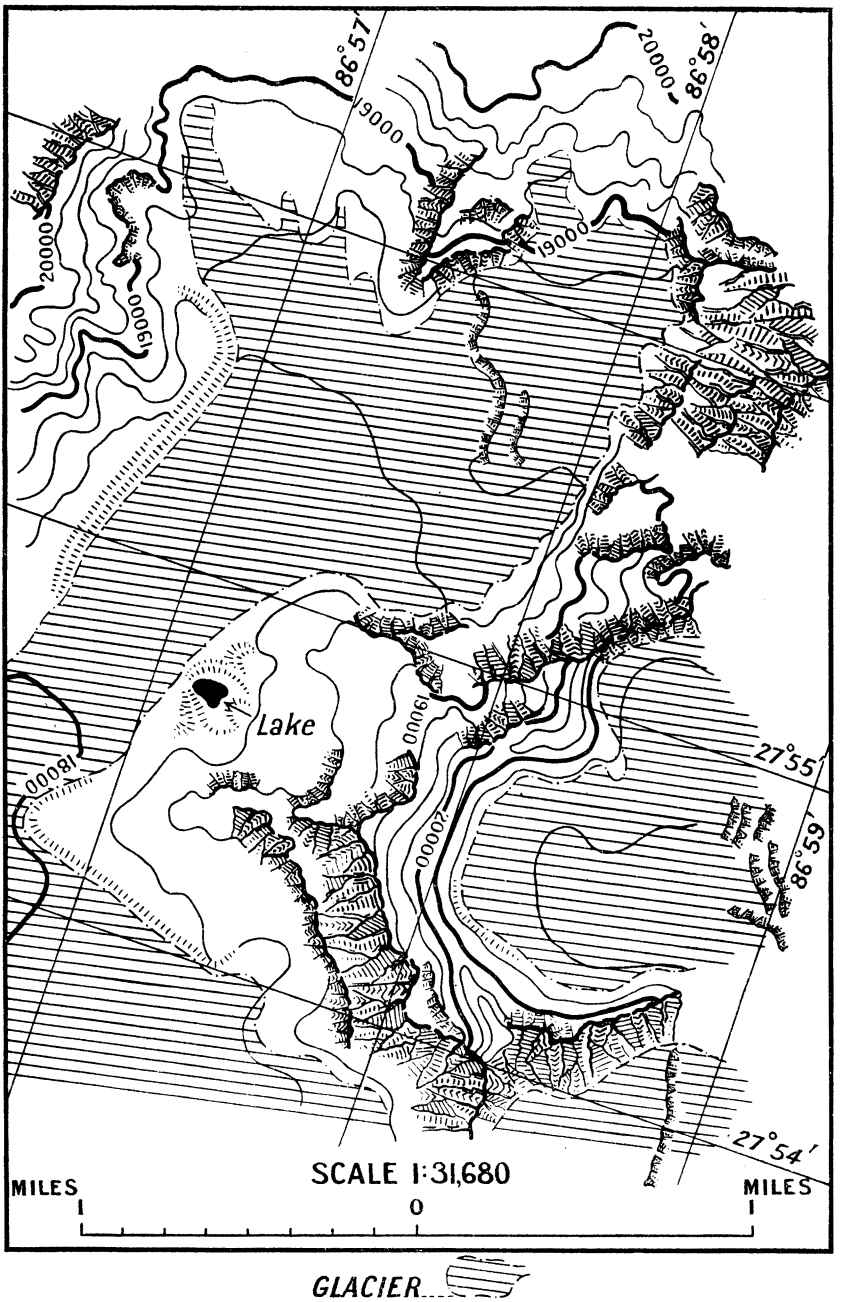

TOPOGRAPHY IN REGION OF LAKE
86°57'
86°58'
20000
19000
18000
Lake
27°55'
86°59'
27°54'
SCALE 1:31,680
MILES
1
0
1
MILES
GLACIER

Fig. 2

Plate 6. Vertical of the area surrounding the lake

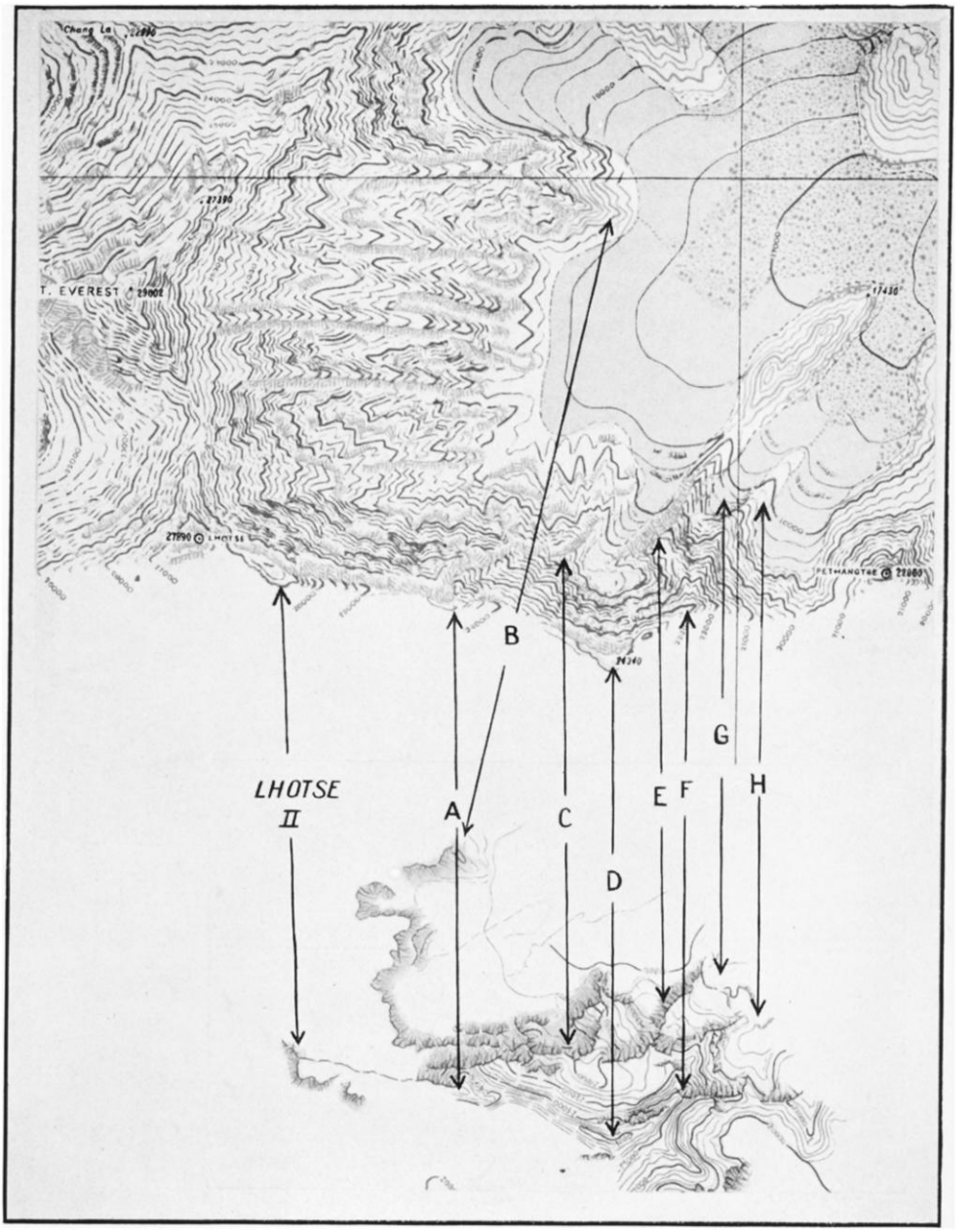


Fig. 3. Comparison between common ground covered by Major Wheeler's ground photographic survey of 1921 and the plot from the Everest flight

made along the ridge, where the point C appears clearly on the verticals and on Plate 3. Continuing along the ridge we can identify the feature at D with that shown on Plate 4. Finally the peak E on Plate 3 is seen to be the same as E on Plate 4. This is the second and smaller of the two peaks of Lhotse, the first of which is shown as an intersected point on the map and is named Lhotse on Plate 3. It has therefore been called Lhotse II, and is indicated by a small ringed contour on Major Wheeler's map. But this was the point previously thought to be the summit of Everest. Though the disillusionment was damping, the verifying of a first definite point was gratifying.

The next stage was to find some other definite point, and this was rendered more difficult by having made a false identification of the starting-point. Ultimately the situation was saved by the two photographs published opposite p. 59 of the *Journal*, July 1933. The arguments for identifying the peak as Chamlang—an intersected point—will not be repeated here, but having done so, although these obliques were taken on the first flight and the verticals on the second, it seemed probable that the course followed on the two occasions would be roughly the same, and therefore some of the detail appearing in the oblique might also appear on one of the verticals. This proved to be the case, and it will be seen that the ground in the top left-hand corner of the vertical shown in Plate 5 is the same as that shown halfway up the right-hand side of Plate 9 in the July paper. The same feature can be seen in Plate 10. By means of certain graphical constructions on the obliques, the approximate position of a point in this feature was obtained relative to the summit of Chamlang, and thus a second and reasonably definite point was obtained.

Though two points are sufficient to determine scale and orientation, a third point supplies the answer to the surveyor's prayer—a check. Further inspection revealed the identity of one of the peaks in the north-east corner of the plot as that shown on Major Wheeler's map as a "Photograph Intersected Point," and heighted 24,240 feet (shown on Plate 1).

The whole plot was therefore rescaled and reoriented on these three points as control, and the agreement between them was most satisfactory. It showed that the true course on the approach to Everest was a little east of north and not north-east, as previously supposed, and that the preliminary scale adjustment had given a scale very much too small. This agreed with and corrected the original discrepancy observed. Subsequent examination of all other areas has revealed general agreement, with some striking examples in the small area north-west of Pethangtse common to the air survey and to Major Wheeler's work. In the area immediately south of Everest there is very little resemblance between the plot and the existing map, but this was to be expected, since in that region the map shows clear signs of artistic imagination rather than sober survey. The scale of the plot thus adjusted is 1/23,190, and on this the physical features have been plotted with very fair accuracy by means of intersection and interpolation.

Under normal circumstances the contours would be plotted on the photographs by measurement and observation in a stereoscope, using as control a fairly close network of spot-heights. In this case the only heights which could be assumed were those three points used as control, and the height of one

of them, near to Chamlang, could only be estimated by somewhat uncertain methods of graphical construction on the obliques. The tilts, moreover, were in many cases severe and made any stereoscopic measurements, even had there been an adequate number of spot-heights, somewhat fortuitous. It was therefore necessary to evolve a more suitable method. Now, the plot as constructed is at a definite scale, whereas ground at different heights photographs at different scales. There will therefore be a discrepancy between the plotted position of any point and the uncorrected position obtained by a direct tracing from the photograph, and this discrepancy will depend on the depth of the point below the aircraft and the tilt of the photograph. In this type of country the former effect is very much larger than the latter, and, since the position of each point is the result of intersections from three photographs, by measuring all these discrepancies and taking the mean, the tilt effect tends to be eliminated. The results can then be turned into differences of height by applying simple formulae. By this means a number of spot-heights can be deduced, and using these as control the contours can be drawn in by observing the physical features in a stereoscope in the ordinary way. An example of the result of this method is shown in Fig. 2.

Though this account must confine itself to the actual survey work and cannot undertake to analyse the physical forms depicted, attention must be drawn to one remarkable feature shown in Fig. 2 and on the corresponding photograph in Plate 6—a small lake. The shape is roughly triangular with maximum length and breadth of 560 feet and 440 feet respectively. That it is a lake may be deduced from the following evidence: the surface can be clearly seen as flat in a stereoscope; the surface is very dark in colour; if a solid surface, snow would collect and make the colour lighter. The water must therefore be in a liquid state and presumably is in connection with some source of heat below. Its altitude is 18,090 feet. In the stereoscope one can see clearly that the lake lies in a small crater, which rests in the side of the main mountain slope just above its junction with the glacier below. The ridge line of the crater is about 70 feet above the level of the lake. On the glacier side of the crater there is a V-shaped notch, and level with the bottom of this and along the inside of the crater runs what is apparently an old shoreline from the time when the lake at a higher level drained through the notch into the valley. The difference between the two levels is about 25 feet. The mountain side cuts the glacier about 30 feet below the level of the lake.

The final result of the plot from the vertical photographs is shown in the folding map. The original scale is 1 inch to the mile (here unavoidably reduced to half inch to the mile) and the contour interval 250 feet, so that the work may be readily compared with Major Wheeler's map where common ground is covered. It is possible that more detail may be extracted from the obliques and added to this plot, but any such work will be of a much lower order of accuracy, and what is shown here may be regarded as the main substance of the survey results. The principal problem throughout has been the question of ground control and the identification of points, and in view of these difficulties the method chosen was undoubtedly correct. It is possible that more accurate detail could be extracted in any given area by using the photographs in an automatic plotting machine, but bearing in mind the

approximate nature of the control available it is doubtful if this would do more than adorn with ornament a not entirely stable structure. From the survey point of view it is certain that such a procedure would be thoroughly unpractical. This is not to say that from the point of view of a survey problem the method would be without scientific interest, nor does it infer that extra local detail might not be of value for certain purposes, *e.g.* glaciology.

DISCUSSION

Before the paper the PRESIDENT (Major-General Sir PERCY COX) said: Most of those present are probably aware that the idea of flying over Mount Everest was not altogether new in 1932, when the plan ultimately carried into effect took shape; but when the idea of flying over the mountain first occupied the minds of airmen, it was not a practical proposition because there was then no engine in the market which was competent to carry to a height of about 33,000 feet the load that would be necessitated by a party sufficiently well equipped for really scientific work. In 1932 Colonel Blacker was inspired by the belief that the new Pegasus engine made by the Bristol Aeroplane Company, a British engine of course, could accomplish the task, and thanks to his perspicuity and initiative at that time the Mount Everest flight took shape.

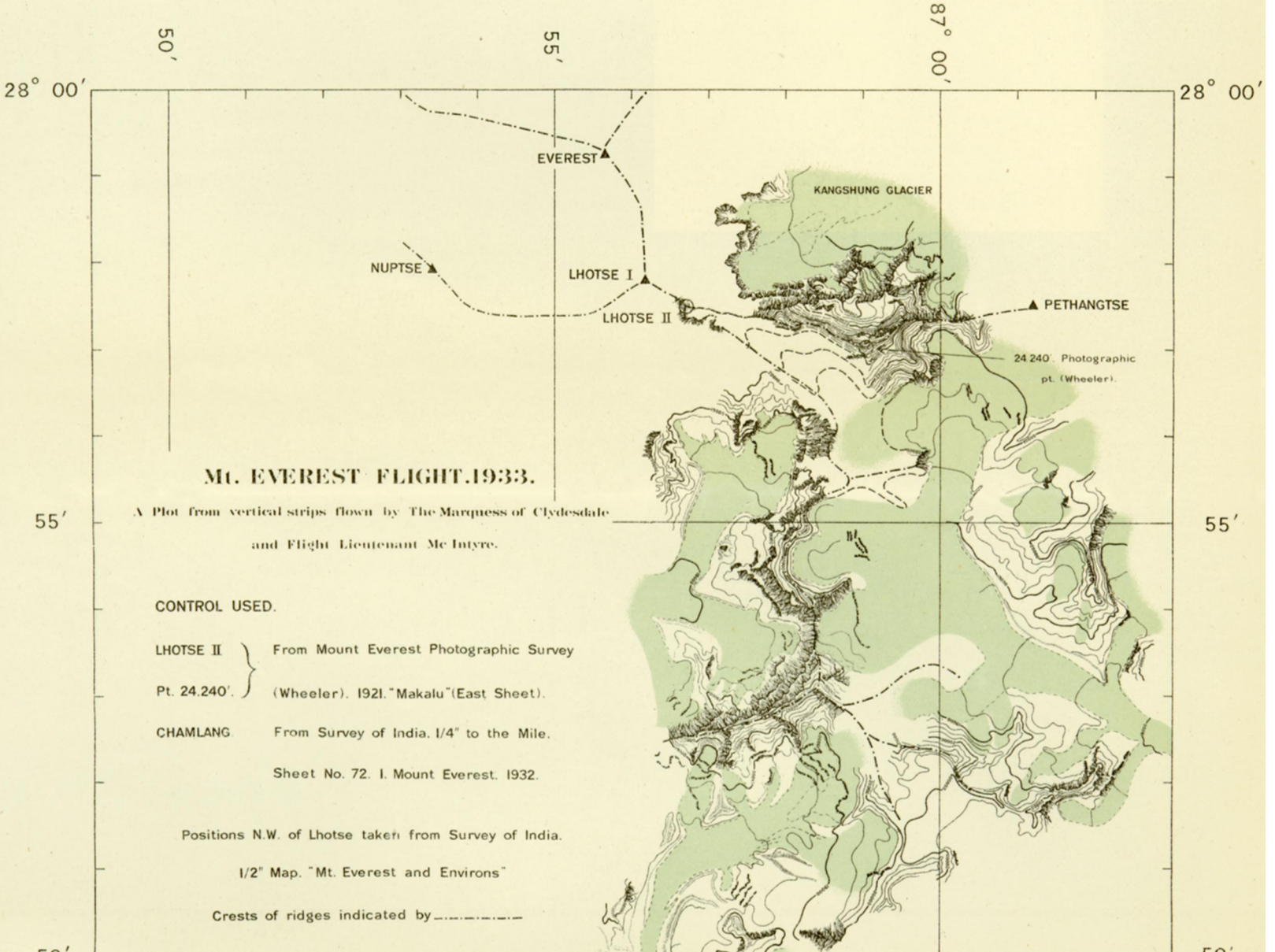
Colonel John Buchan, in a foreword he has written to the book, 'First Over Everest,' which has just been published, is at pains to impress upon the reader that the purpose of the flight "was not to perform a feat of daring and endurance, to break a record, to do something for the first time. . . . The true purpose was austerely scientific." It was on that account that the enterprise received the support and co-operation of the Council of this Society. We were of opinion that the results to be expected from the flight over Mount Everest would be of undoubted scientific importance and interest, and it is of some of those aspects of the flight that we are going to hear to-night.

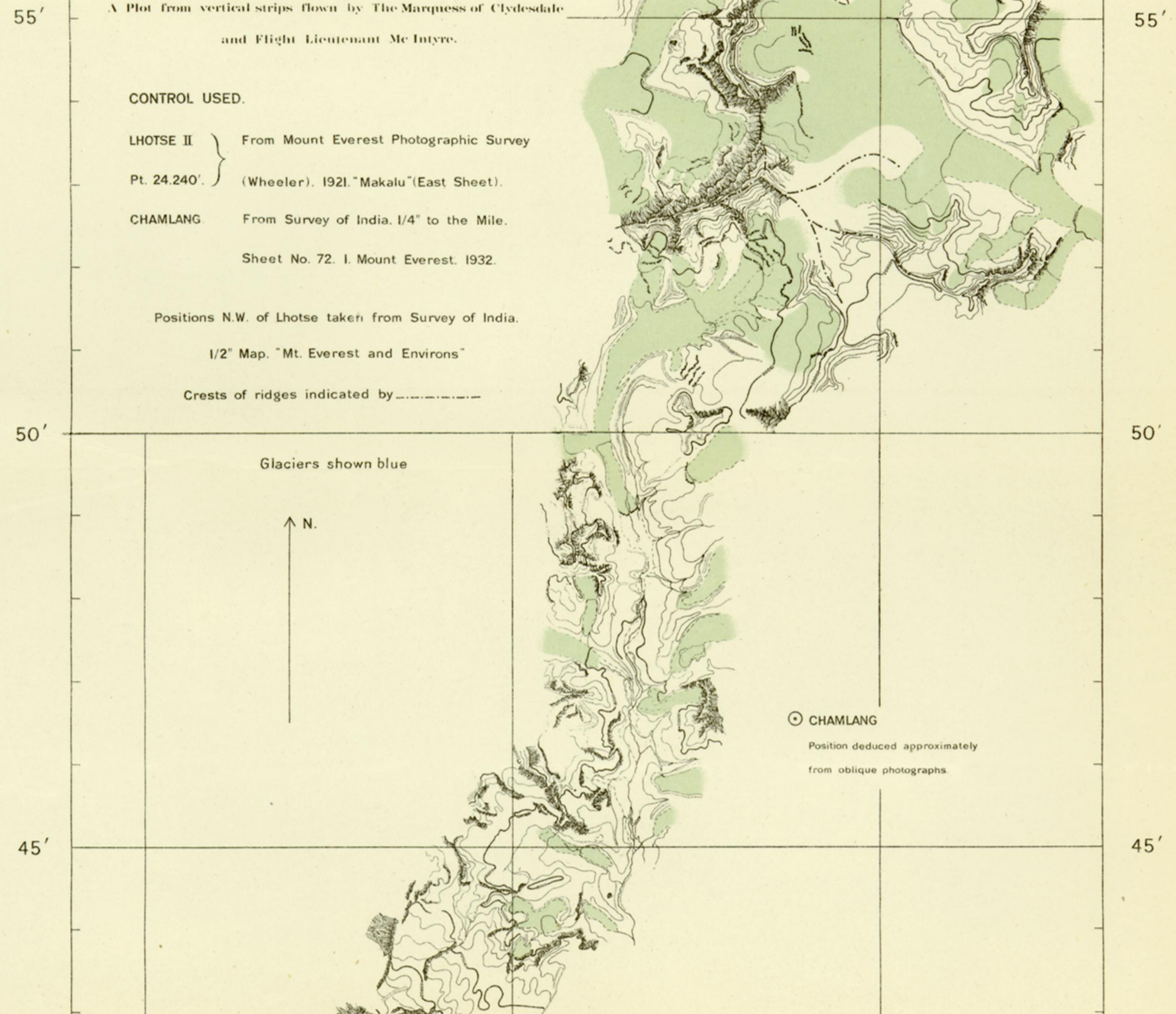
The reader of the paper is Lieutenant Salt, R.E., who is a member of Colonel MacLeod's staff in the Geographical Section of the General Staff at the War Office. Lieutenant Salt is especially employed on research into methods of mapping from air photographs, and he has made a close study of the Everest flight from that point of view. I may mention that the plotting of the vertical photographs taken by the Mount Everest Flight was undertaken by Colonel MacLeod as providing an exacting test of the Arundel Method developed by the Geographical Section of the General Staff for mapping from air photographs. I now call upon Lieutenant Salt.

Lieutenant Salt then read the paper printed above, and a discussion followed.

The PRESIDENT: I call first upon Colonel MacLeod, Chief of the Geographical Section of the General Staff at the War Office.

Colonel MACLEOD: There are some who might say that a comparatively small strip of mapping, such as Lieutenant Salt has described, is rather a small result from what, after all, was a pretty big expedition. That, of course, depends on what the expedition set out to achieve. Admittedly, south of Mount Everest there is a blank on the map, and any blank on the map is an incentive to somebody to go and fill it in; it is a gap in our knowledge which is worth filling in for its own sake. But it must be admitted that there is not much prospect of anybody going to that part of the world for the moment, so, looked at from that point of view, the filling in of this particular gap is rather an academic matter. But when Air-Commodore Fellowes and Colonel Blacker consulted me as to what they ought to try to do on the flight, they made it quite clear that their object was not


50′
55′
87° 00′
28° 00′
28° 00′
EVEREST
KANGSHUNG GLACIER
NUPTSE
LHOTSE I
LHOTSE II
PETHANGTSE
24.240′. Photographic pt. (Wheeler).
55′
55′
Mt. EVEREST FLIGHT.1933.
A Plot from vertical strips flown by The Marquess of Clydesdale and Flight Lieutenant Mc Intyre.
CONTROL USED.
LHOTSE II
Pt. 24.240′.
From Mount Everest Photographic Survey (Wheeler). 1921. "Makalu" (East Sheet).
CHAMLANG
From Survey of India. 1/4" to the Mile. Sheet No. 72. I. Mount Everest. 1932.
Positions N.W. of Lhotse taken from Survey of India. 1/2" Map. "Mt. Everest and Environs"
Crests of ridges indicated by


55′
A Plot from vertical strips flown by The Marquess of Clydesdale
and Flight Lieutenant Mc Intyre.
CONTROL USED.
LHOTSE II
Pt. 24.240′.
From Mount Everest Photographic Survey
(Wheeler). 1921. "Makalu" (East Sheet).
CHAMLANG
From Survey of India. 1/4" to the Mile.
Sheet No. 72. I. Mount Everest. 1932.
Positions N.W. of Lhotse taken from Survey of India.
1/2" Map. "Mt. Everest and Environs"
Crests of ridges indicated by
50′
Glaciers shown blue
N.
CHAMLANG
Position deduced approximately
from oblique photographs.
45′

Geographical Section, War Office, 1933.

Published by the Royal Geographical Society

approximate nature of the control available it is doubtful if this would do more than adorn with ornament a not entirely stable structure. From the survey point of view it is certain that such a procedure would be thoroughly unpractical. This is not to say that from the point of view of a survey problem the method would be without scientific interest, nor does it infer that extra local detail might not be of value for certain purposes, *e.g.* glaciology.

DISCUSSION

Before the paper the PRESIDENT (Major-General Sir PERCY COX) said: Most of those present are probably aware that the idea of flying over Mount Everest was not altogether new in 1932, when the plan ultimately carried into effect took shape; but when the idea of flying over the mountain first occupied the minds of airmen, it was not a practical proposition because there was then no engine in the market which was competent to carry to a height of about 33,000 feet the load that would be necessitated by a party sufficiently well equipped for really scientific work. In 1932 Colonel Blacker was inspired by the belief that the new Pegasus engine made by the Bristol Aeroplane Company, a British engine of course, could accomplish the task, and thanks to his perspicuity and initiative at that time the Mount Everest flight took shape.

Colonel John Buchan, in a foreword he has written to the book, 'First Over Everest,' which has just been published, is at pains to impress upon the reader that the purpose of the flight "was not to perform a feat of daring and endurance, to break a record, to do something for the first time. . . . The true purpose was austerely scientific." It was on that account that the enterprise received the support and co-operation of the Council of this Society. We were of opinion that the results to be expected from the flight over Mount Everest would be of undoubted scientific importance and interest, and it is of some of those aspects of the flight that we are going to hear to-night.

The reader of the paper is Lieutenant Salt, R.E., who is a member of Colonel MacLeod's staff in the Geographical Section of the General Staff at the War Office. Lieutenant Salt is especially employed on research into methods of mapping from air photographs, and he has made a close study of the Everest flight from that point of view. I may mention that the plotting of the vertical photographs taken by the Mount Everest Flight was undertaken by Colonel MacLeod as providing an exacting test of the Arundel Method developed by the Geographical Section of the General Staff for mapping from air photographs. I now call upon Lieutenant Salt.

Lieutenant Salt then read the paper printed above, and a discussion followed.

The PRESIDENT: I call first upon Colonel MacLeod, Chief of the Geographical Section of the General Staff at the War Office.

Colonel MACLEOD: There are some who might say that a comparatively small strip of mapping, such as Lieutenant Salt has described, is rather a small result from what, after all, was a pretty big expedition. That, of course, depends on what the expedition set out to achieve. Admittedly, south of Mount Everest there is a blank on the map, and any blank on the map is an incentive to somebody to go and fill it in; it is a gap in our knowledge which is worth filling in for its own sake. But it must be admitted that there is not much prospect of anybody going to that part of the world for the moment, so, looked at from that point of view, the filling in of this particular gap is rather an academic matter. But when Air-Commodore Fellowes and Colonel Blacker consulted me as to what they ought to try to do on the flight, they made it quite clear that their object was not

primarily to fill up gaps on the map. They wanted, first, to show what could be done by British pilots and British aircraft in a difficult flight, and they wanted to demonstrate the value of some particular kind of air survey technique for filling in gaps in the map, not only round Mount Everest, but at any place. They selected the Mount Everest area as representing the most difficult proposition in both respects that anybody was ever likely to be up against.

It was in the light of these objectives that I advised them as to what they ought to attempt. I recommended that they should attempt an out-and-back "strip" only. Originally they had a rather more ambitious programme in mind. They wanted to cover a large area, but it seemed to me that was not essential. I felt it was more important that they should try out the technique which the Air Survey Committee has been working on for a long time past, and which the Committee have tested under less exacting conditions. That technique, as Lieutenant Salt has explained, depends on certain approximations (for example one assumes the photographs are vertical), and if its approximations are not justified the technique will break down. We have tested the technique on ground where the heights to be plotted are of the order of 10 to 15 per cent. of the flying height of the aeroplane, and found it works very well. But when it was a matter of dealing with heights which are 90 per cent. the flying height, it was doubtful whether the approximations would be permissible. Indeed, it was by no means certain that with that immense relief one would be able to get a measurable stereoscopic impression at all.

To cut a long story short, I advised that it would be best to concentrate on getting one good out-and-back strip, and I emphasized the importance of starting and finishing over points which could be identified with absolute certainty. That was what Colonel Blacker set out to try to do in the first flight, but unfortunately something went wrong with the camera; the film was either over-exposed or got fogged, and that particular strip was of no use. Lord Clydesdale and Flight-Lieutenant McIntyre made another attack on the mountain and succeeded in getting a good strip, but unfortunately owing to the strength of the wind at great heights they could not approach the mountain up the Arun valley, as I had recommended; they had to approach from the west, and were not able to do the out-and-back flight. The result was they could not say categorically where they had started. They told us where they thought they had started, and they were not absolutely certain where they had finished. Thus instead of a certain point to begin at and to close on, we had no points at all. Lieutenant Salt has explained how we set about the problem. What he did not say was actually where they did go. They told us they thought they had gone up one valley, and we worked on that supposition for a time but produced an answer which was obviously wrong. Ultimately we found they had gone up an adjoining valley, and we were able to identify that.

The net result is, I think, of great interest. Although the technique has been tested on the flight under most unfavourable conditions, as you saw, the little check that we have been able to give it, that is to say comparison with Wheeler's map, shows exceedingly good accordance. Starting with only theoretical arguments from the sort of basis on which the plotting has been carried out, one would say that such a good agreement was coincidence. Possibly it is; but the fact remains, as Lieutenant Salt has said, that this air survey technique each time it has been tried has given better results than theory would lead one to expect. I think therefore the results of the Mount Everest Flight have been most encouraging. They have, in fact, established what Air-Commodore Fellowes and Colonel Blacker set out to establish. They have tested this technique under the most unfavourable possible conditions and shown that

it can be worked; that it will give an answer. They have shown that it could be used, if necessary, to map the rest of the Himalaya. Moreover the experience of the flight has revealed a number of the difficulties. Undoubtedly, if it is ever desirable to repeat this sort of mapping, we shall be in a very much better position to advise how it should be handled.

Lieut.-Col. STEWART BLACKER: I feel I must say that whatever contribution our expedition has been able to make to the advancement and interests of science has been above all due to the kind, cordial, and spontaneous co-operation of those from whom we solicited help. First of all there came the Council and Secretary of the Royal Geographical Society, but not the least important part of the help so generously accorded us came from Colonel MacLeod and from Mr. Salt in the War Office. We cannot be too grateful for the valuable and (I use the word advisedly) inspired work which Mr. Salt has put in on behalf of the scientific results of our expedition. He has expounded the nature of the work and its tribulations in that lucid and masterly manner to which we are accustomed from him.

In this work of plotting he was confronted by abnormal and harassing difficulties, and I feel that I owe it to him to convey the apologies of the expedition for having handed him these problems for solution. However, the difficulties were not all of our own making. The especially difficult problems of plotting, apart from the unavoidable ones due in this case to the remarkable differences in height shown on one portion of each picture and another, were due firstly to the fact that we were forced to make the flight at a disadvantageous time of the year. We were compelled to do this for economic reasons which I need not enlarge upon now; but it would obviously have been preferable to have undertaken the flights in the months of October or November, when we might reasonably have expected not to have been troubled either by masses of clouds filling the valleys for days on end nor with winds of high velocity which made devastating demands upon our fuel supply. In any case we are convinced that in October and November we should have had a much wider choice of suitable days for the flights and therefore have been relieved of great anxiety on this score.

The anxiety was the greater because it must be remembered that we had sanction from the Government of Nepal only to carry out a single flight, and that once we had crossed the frontier we were morally committed and had to see the thing through, even if conditions were not really suitable. This brings me to the matter of the diplomatic sanctions. Generous as these were they still prescribed that we should fly to the mountain from British territory and back again by the most direct route. This, as it turned out, limited our action and gave rise to difficulties which we were in turn compelled most unwillingly to transmit to Mr. Salt. Had it not been for the wording of this sanction, and had we known as much then as we know now about the great winds from the west at 25,000 and 30,000 feet, we should have been well advised to have started for the flight from somewhere 100 miles farther west than we did either from Darbangha or from Raxaul, or even, given permission, from Khatmandu, and to have landed considerably farther east, *e.g.* at Siliguri or Jaipalguri, well downwind of the mountain. By using tactics, or rather strategy, of this sort we should have secured for ourselves a bigger margin of fuel and have been able to expose twice as much survey film, insomuch that it would have been possible for the pilot to have circled about above the mountain whilst the observer replaced the used film magazine by a fresh one without hazarding the vital continuity of the strip. Anxiety on the score of fuel supply was always present in our minds. We wanted not only to fly to the mountain, but to fly back. Then again, we had difficulties imposed on us because we were not allowed into Tibetan territory. Had it not

been for all these alien considerations the survey work of the flight would have been very much simpler and would not have been beset with the difficulties which have caused Mr. Salt such hard work to circumvent. We are all convinced now that the task of carrying out as much more air survey as would be necessary to map the remainder of the unmapped portions south of the Everest massif would be a straightforward problem which one would be very happy to undertake, given freedom from the restrictions to which I have referred.

The mapping is however not a matter of vertical photography exclusively. Both the "still" cameras and the ciné cameras were expected to contribute their quota. I think Colonel MacLeod and Mr. Hinks will support me when I say that from the early conferences onward we intended to rely more on the oblique photographs, or at least to rely to a considerable degree on the results of the oblique photographs as regards the steep ground between 29,141 feet and the South Peak, because vertical photographs probably would not have overlapped. The wind on the occasion of the second flight was, we estimated, 110 m.p.h., so that if we had gone straight over the summit, as we did in the first flight, our ground-speed downwind would have been something like 235 m.p.h. As the camera took between five and six seconds to re-wind itself, it would have been practically impossible to get overlapped vertical photographs unless we had been 3000 feet up over the summit. Therefore we relied on oblique photographs, and we were very fortunate, as the slides showed, in that we were able to get two oblique photographs pointing steeply down at short range on to the actual summit. We hope, as Mr. Salt has suggested, that a certain amount more of the configuration of the ground, sketched in with the form-lines, will be obtainable from a more detailed study of the obliques not only from the still cameras, but from the cinematograph film which affords a certain number of "stereoscopic pairs." These remain to be disclosed to the public.

The results of the expedition, apart from the point of view of mapping, have been sufficient to make us feel that we have learned a great deal, and I think I am speaking on behalf of the rest of the expedition when I say that if we were invited to tackle the complete map of the bald patch from the air we should be happy to do so.

It is very appropriate that the Arundel method should have been used so near the Arun valley, and especially gratifying to me because I live in the other Arun valley myself. It is also gratifying that it should have been a British method that has produced this plot of country which is certainly not easy. I think Lady Houston, to whose generosity the whole expedition is due, would have been pleased to know it was a British method of plotting, as well as a British engine and aeroplane, used in the flights.

Finally, I have to explain that the whole of the expedition consisted of amateurs, except our very expert cinematographer, Mr. Bonnet, and that these were our first flights over a mountain 29,000 feet high.

The PRESIDENT: We had hoped that one of the pilots would have been present. Unfortunately Lord Clydesdale is in Switzerland and Lieutenant McIntyre was doubtful whether he could get here. Evidently he has not been able to come. Perhaps Mr. Colin Williamson, the designer and maker of the vertical cameras, would like to add a word or two.

Mr. COLIN WILLIAMSON: I would like to take this opportunity of congratulating Mr. Salt not only on his very interesting paper but also on his patience and the impartial way in which he has collected and co-ordinated the information from the photographs taken during the flight.

I do not pretend to be an expert on survey matters, but I have been very closely connected with the photographic equipment from its commencement,

and I should like to make one or two comments on the references made to the cameras. It was very disappointing to hear that the film of the first flight had been fogged, and I should be interested to know whether the heating of the magazines had anything to do with the fogging; whether we over-estimated the heat that was required to maintain the film at the correct temperature? Secondly, I understand that the overlap was very much greater than was intended. That was probably due to the fact that the flight did not actually take place at the same height above the ground as was originally intended and for which the interval between exposures was calculated. Thirdly, there is the question of the tilt of the photographs. Lieutenant Salt stated that the angle of tilt of the photographs was not available. I wonder whether, if the cameras had been made so that the horizon, either actual or imaginary, had been actually photographed at the same time, that would have assisted Lieutenant Salt in getting a more correct survey.

It will, I feel, be admitted that the excellence of the photography not only does justice to the equipment but also reflects the very greatest credit on the none too highly experienced operators. Mr. Salt has succeeded in extracting much more information from the photographic results than one would have thought possible, and the important part he has played in the survey cannot be too highly stressed.

Lieut.-Col. STEWART BLACKER: During the first flight there was a phenomenal dust haze, and we did not get clear of that until we had climbed to 19,000 feet. This had the effect of rendering the details of the ground, and our southern "ground controls," quite obscure.

On the first flight however we were able to fly on a dead straight course, precisely to the summit of the mountain. It may be of interest to describe our special procedure of navigation which made this accuracy possible.

The observer had a Hughes Drift Sight in the floor of his cockpit. He set this roughly from the wind speed forecast for him by the meteorological Upper Air Sounding Station, by means of their sounding balloons. Then, in flight, his task was to check the angle of drift by observing the passage of visible points on the ground, rotating the sight until they moved apparently parallel to the cross wires. He then read off the corrected angle and telephoned it to the pilot, who then had to place a point on the under surface of the leading edge of his upper plane, corresponding to the angle of drift, over the summit of the mountain. By this plan, which worked perfectly, the machine flew in a practically straight path, on a bearing of 342°, to the summit. But for this procedure, the track over the ground would have been curved, which was not what was required for air survey, and would have hampered the subsequent plotting.

On the second flight unfortunately there was a thick blanket of cloud of which the top surface was about 18,000 feet. This blanket of cloud covered the whole of the central portion of the country of Nepal and prevented the observers from picking up any objects on the ground by which to measure the drift. That, in combination with the very powerful wind from the west, which I estimated at 110 m.p.h., brought the course of both machines rather farther to the east than was originally intended. If we had been able to use the Hughes Drift Sight on the second flight our course would have been considerably more accurate, in fact as accurate as it was in the first flight.

Professor KENNETH MASON: As certain bald patches on the Survey of India map have been mentioned, perhaps I may make a few remarks on the existing $\frac{1}{4}$-inch map of Nepal. Up to about 1924 our map of Nepal was simply derived from the route surveys of Indian explorers, such as Hari Ram, and native reports. In that year the Surveyor-General obtained permission to send into the country a few surveyors trained by British officers, but British officers were

not allowed to go in themselves. Sir Edward Tandy begged to be allowed to send in cameras with which the Indians could take photographs, but he was not allowed to do so. Between November 1924 and March 1927 some eighteen Indian surveyors surveyed 55,000 square miles on the $\frac{1}{4}$-inch scale, contoured at 500 feet. They were not trained mountaineers and they could not, of course, visit the whole country; the heads of the glacier valleys must therefore be considered as "bald patches." It is expeditions such as that of the flight over Everest and others equipped with stereophotographic apparatus that can help us to fill in these blanks.

I should like to ask Mr. Salt whether, in his opinion, if earlier Mount Everest expeditions had taken stereophotographic pairs of photographs from the ground and plotted them in a machine, there would not have been a better control for plotting the mountains that were photographed during the flight. It seems to me that ground stereophotogrammetry and air survey could be linked up very much more than is done at present. Very little interest in ground stereophotogrammetry is taken in this country, whereas some nine or ten European countries are working at the method now. Could Mr. Salt tell me whether ground stereophotogrammetry with accurately plotted contours would have given a better control than an occasional odd point picked out from Major Wheeler's map?

The PRESIDENT: Our Secretary has taken the strongest and most expert interest in the flight and survey. I ask him to make some observations.

Mr. HINKS: I should like to say a word on behalf of the despised obliques. Mr. Salt referred kindly to certain detective work which we assumed in the obliques rather early in the summer, of which the first fruits were published in the July *Journal*. But that detective work is not finished, and we have been devoting ourselves to ascertaining how many of the points on the Survey of India triangulation diagrams, which appear as numbered points upon the diagrams, can be identified in the oblique photographs. Although they no doubt appear also upon the Nepal map they cannot be properly represented in the detail because, as Professor Mason has said, the detail at the heads of the valleys and glaciers is scanty. It seems to me that when we bring together material picked up partly from the Survey of India diagrams, partly from ground photographs, such as those taken by the late Dr. Kellas from the Kang La, we shall be able to make a sketch-map somewhat better in detail than the $\frac{1}{4}$-inch map of Nepal, and vastly more extensive than the strip so beautifully plotted at the War Office; a sort of sketch-map which will not be a mere reconnaissance sketch but will contain quite a lot of geographical material derived from the despised obliques that could not be derived from the verticals because they did not cover the ground.

I make this plea for the obliques largely in order to emphasize the point that they are of more value than has sometimes been assumed, and probably they will become of increasing value. I am rather anxious for the safety of the original negatives, and hope whoever controls them will realize that they are not things that have lost their value when they have provided very interesting and magnificent illustrations for journals and books, or even provided the first illustrations which we had in our *Journal* in July. It seems to me that the value of the negatives will increase year by year. Gradually we shall know more about the surrounding country; gradually we shall get more ground control, and it is by no means impossible that ten or twenty years hence we may put all those negatives into a plotting machine and do some reasonably accurate contouring with them. That will be precipitated if, as Professor Mason asked, some ground stereophotogrammetry could be practised.

It has been long a favourite dream of mine that some one would borrow the phototheodolite belonging to the Society and make a series of photographic stations along the Singalila ridge. From there one would be able to plot not the whole ground but many of the crests that we see in the oblique views of Mount Everest. A process such as that would provide the greatest amount of ground control and make possible the fuller utilization of the obliques. Whether that is possible or not, I hope all means will be taken to preserve undamaged and for use one hundred years hence these exceedingly valuable negatives produced as a result of the Mount Everest Flight.

The PRESIDENT: I will ask the lecturer to reply to one or two of the points raised during the discussion.

Lieutenant SALT: With regard to Mr. Williamson's suggestion that by photographing the horizon the tilt can be obtained, this method can be used, and is, in fact, used in Finland at the present time with a camera built specially for the purpose. But in the region of Mount Everest the horizon has a habit of not coinciding with sea-level and also of being somewhat jagged. I do not think that such a method would have been of much value on the occasion of the flight, but I think that had a bubble-level been recorded, we might have been able to make use of the deduced tilts. They are not true tilts because an aircraft cannot distinguish between acceleration and gravity, but they would certainly be better than nothing.

As to the possibility of using ground photogrammetry in conjunction with this kind of work, it is difficult to make any definite statement without seeing the country, but provided that suitable points of vantage are available, that is to say high up and subtending a reasonable base, it would probably be extremely useful. I imagine most of the really prominent peaks which can be viewed from the existing trig. stations have actually been intersected, but I do not know. In any case, by means of photogrammetry a great many more subsidiary peaks, which it would be difficult to identify other than by the stereoscopic method, could be fixed sufficiently well to serve as ground control for the purpose of reconnaissance air survey.

One word about the "despised obliques." When difficulties arise in reconnaissance surveys, one often hears the remark "Why not sketch it in from the obliques?" But the problem in practice is not quite so easy. You cannot simply put the oblique up on an easel and sketch in by hand. All that an oblique gives is a round of angles taken in space from an unknown point. If you consider what is necessary in order to make use of that information—the number of known points for purposes of resection in space, and the fixing of further points by intersection—you will realize that the process may be complicated. Therefore if I am guilty of despising the obliques, it has been mainly because of the fear of having more work to do!

Colonel Blacker mentioned the fogging of the photographs. All I can say about these photographs is that they give the *appearance* of having been fogged. That might be due to light coming from a variety of sources into the camera, reflected possibly in some obscure way, or it might, as Colonel Blacker suggested, be due to a duststorm which would have the effect of adding diffused light over the whole photograph. One cannot decide that point upon the evidence of the photographs alone. Therefore one cannot make any statement more precise than that the photographs appear to have been badly fogged.

In response to Colonel Blacker's kind remarks about me, I may say that the only inspiration required for this kind of work is the twin daughter of necessity, and, in any case, the work gave a great amount of pleasure.

The PRESIDENT: I am sure you all realize what an extraordinarily difficult and

intricate task it was that Lieutenant Salt undertook when he was put on to collate the photographs and to get them on to the map. He has clearly mastered very thoroughly the subject he was dealing with, and has given us a most lucid description, as far as lucidity is possible, of the process which he went through to obtain the results at which he arrived in that sketch which he put before us. It is impossible for me—I am not an expert in the subject under discussion—to enter into details of the scientific aspects of the expedition. I only ask you to join with me in thanking Lieutenant Salt very much indeed for his most efficient and interesting paper.

The
GEOGRAPHICAL JOURNAL

Vol LXXXIII No 3 R.G.S. *March 1934*

THE ASSAM BORDER OF TIBET: *A paper read at the Evening Meeting of the Society on 22 January 1934, by*

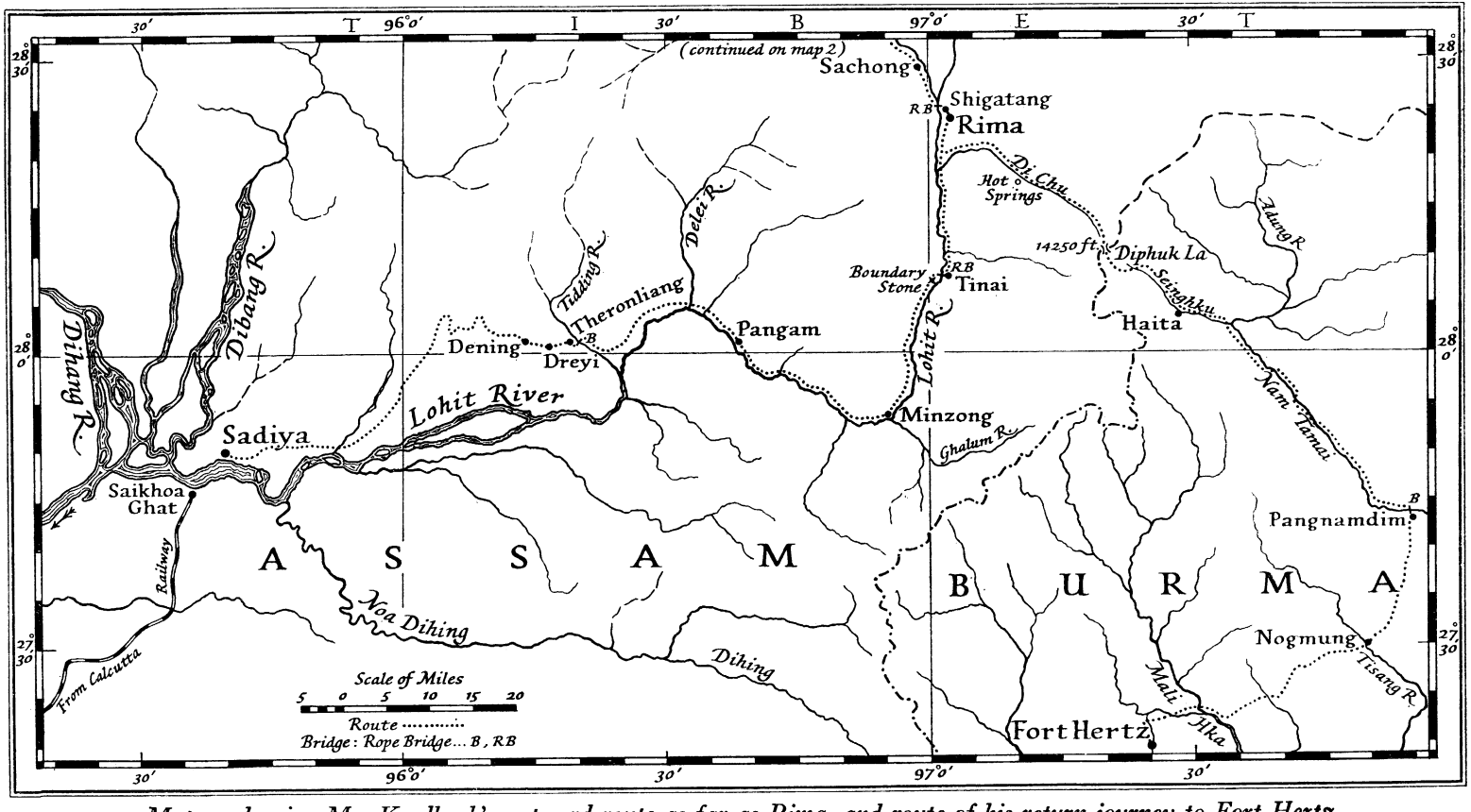
RONALD KAULBACK

IN November 1932 Captain Kingdon Ward asked me to accompany him on a journey into south-eastern Tibet. Needless to say, I accepted with alacrity, feeling more than fortunate to have the chance of learning at first hand from so experienced and well-known an explorer. The objects of the expedition were two: to search for new and rare plants, and to survey the country from Rima onwards. The botanical side of the expedition was wholly Captain Kingdon Ward's province, and it was my job to make the map.

At the end of February 1933 we travelled up from Calcutta to Sadiya—or rather to Saikhoa Ghat, the railhead—by train. Saikhoa Ghat is no more than a tiny village on the left bank of the Lohit, and we covered the last 8 miles from there to Sadiya by car, crossing the river halfway by a ferry, which consists of two native boats connected by a platform.

From Sadiya there are three possible routes through the mountains into Tibet. The first of these is the valley of the Dihang, or Tsang Po, the main stream of the Brahmaputra. This was closed to us on account of the hostile attitude of the Abors, and we should never have got through that way, even if the Indian Government had given us permission to try. The second, the Dibang Valley, besides being comparatively short, and with a pass at its head, is almost uninhabited, and we should have had great difficulty in procuring coolies. The third and only practicable route is the Lohit Valley, which leads up into Zayul, the most south-easterly province of Tibet.

The Lohit Valley is chiefly inhabited by two Mishmi clans, the Digaru and the Miju, which speak different languages and are rather jealous of each other. Formerly they were as hard to control as the Abors, but of late years they have acquired a certain amount of respect for the Government, and now cause little or no trouble. In the cold weather numbers of them come down into Sadiya to find work in the tea-gardens of Assam, bringing goods to trade in the market, such as musk, skins, roots, and certainly quantities of opium. Then, in the spring, they start back on their journey home, and it is at this time that it is least difficult to get hold of coolies to take one through their country.



Map 1, showing Mr. Kaulback's outward route as far as Rima, and route of his return journey to Fort Hertz

In Sadiya we spent some days in dividing our baggage into loads of 60 lb. each, and in finding sufficient coolies to take us into Tibet. Mr. Crace, the Political Officer, and his wife were very kind, and gave us a great deal of help, and after a grand farewell dinner with them, we pushed off on the morning of March 9. We covered the first 40 miles to Dening, where the road ends, in the Political Officer's car, while the local bus followed with personal baggage and our three Tibetan servants. The greater part of our goods had already been sent to Dening by bullock-cart. The coolies for this stage of the journey had been recruited from the Digaru Mishmis. There were sixty-five of them under the nominal command of a certain Nimnoo, reputed to be the most influential Headman among them, but this meant little as the Mishmis are very independent, and their Headmen have little real control over them. We spent that night at Dening, and next morning set off for Dreyi, about 12 miles uphill. We were held up here for one day owing to the non-arrival of some of our coolies, but on the 12th we climbed the last 1000 feet to the top of the Tidding Saddle, and descended to Theronliang, the last Rest House, on the banks of the Tidding River. That night Captain Kingdon Ward held a conference with the various local Headmen, and by dint of much diplomacy persuaded them to provide transport as far as Pangam, where we were to be met by Jaglum, the most influential man on the Upper Lohit.

Next day we crossed the river by the remains of the suspension bridge built in 1912 by the Sappers and Miners, and found ourselves in Unadministered Territory. The mule track ends on the western bank of the Tidding river, and from there on the path is narrow and bad. Up the Lohit Valley the steepness of the mountains is amazing, but nevertheless they are covered with dense forest, through which the path winds in and out. One can rarely see more than a few yards at a time, owing to an undergrowth of great bramble thickets, and when one does come to an open space, so much does the valley twist and turn that a view of 2 miles up or down is quite exceptional. We had a considerable amount of rain on this part of the journey, which made progress slow, and we averaged only 6 to 7 miles a day, although as a rule we marched for about seven hours. I found moreover that to be tall was a handicap, and often had to beware of overhanging branches, under which the Mishmis could pass with ease. They, on the whole, are a small race, 5 feet 6 inches being quite a good height among them. They bear a close resemblance to the Darus and Khanungs of northern Burma, and it seems probable that they all lived originally in south-eastern Tibet, being driven south by an influx of Tibetans consequent upon pressure from China—the Khanungs and Darus to the east, and the Mishmis to the west of the Lohit–Irrawaddy Divide.

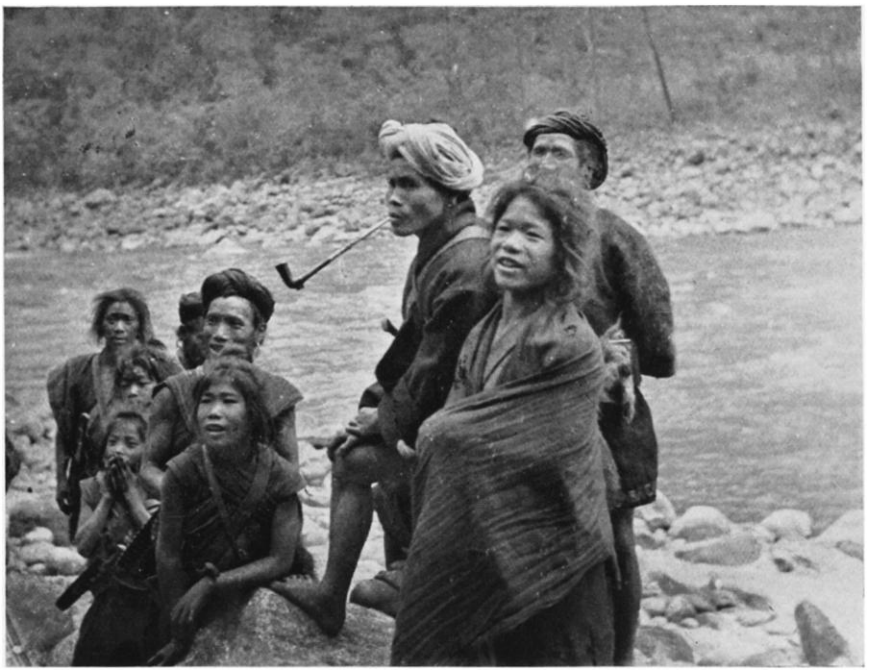
Though cheerful enough among themselves, the Mishmis were a surly lot in their dealings with us, always arguing, and generally making themselves unpleasant. They are very inquisitive, and numbers of them would squat outside our tents to watch us whenever we made a halt. During the sixteen days we spent in their country we saw few villages, although there are quite a number hidden away off the main path. Each village consists of two or three huts, some 40 feet long, built of bamboo and thatch, and surrounded by a few patches of buckwheat and maize. Both Digarus and Mijus run a very profitable business as opium smugglers, and we passed a number of clearings where the

most lovely white poppies were flourishing. Besides selling the opium, they use it largely themselves as a stimulant, and we frequently saw our coolies, before the start of a march, taking a few whiffs of it from primitive water-pipes of bamboo. They are very fond of tea, and it seems strange that they grow none themselves, more especially since Assam proper is only next door, so to speak. I can only ascribe this to laziness, as the Kachins of northern Burma manage to grow it under conditions very similar to those in the Mishmi Hills. Bamboo plays a large part in the lives of the Mishmis. Indeed, it is hard to see how they could exist without it, as from it they make almost every conceivable thing: bridges, ropes, arrows, helmets, bow-strings, baskets, houses—even cooking-pots.

Since on this part of the journey we were constantly on the move, we hardly expected to see much in the way of fauna, but even so it was rather disappointing. Although as we went through the jungle the only noises to be heard, apart from the chattering of the coolies, were the cries of birds, we seldom saw any, and then as a mere flash across the path from one tree to another. As for mammals, we saw two or three squirrels and flying-foxes, caught some small bats, and on one occasion heard barking deer: nothing more thrilling in the way of reptiles and batrachians than some common brown lizards, a tree-frog, a large toad, and a snake.

On March 18 we reached Pangam, on the edge of the Miju country (without however seeing the village), and were met by Jaglum with a fresh batch of coolies. Five days later we came to Minzong, and camped there one day. Minzong is at the confluence of the Ghalum and Lohit rivers. The former is now no more than a little stream some 15 yards wide and very shallow, which flows down a large valley a quarter of a mile across at the base. Since after Minzong the whole character of the Lohit Valley changes from purely water-worn to glacial, it seems probable that in the days when a glacier stretched right down to Minzong from the north, the Ghalum must have been the main stream of the Lohit, and that owing to the disappearance of the ice-cap it has since shrunk in size. This supposition would explain the discrepancy in breadth and importance between the Ghalum itself and its valley.

Leaving Minzong, we gradually emerged from the deciduous region, and entered the pine country, and on March 28 we were greatly cheered to see in the distance, for the first time, the snow peaks of Tibet. Next morning we passed the Boundary Stone, on the right bank of the river, 2 miles south of the village of Tinai. The stone has an English inscription marking the end of the road built in 1912 by the Sappers and Miners, though the road itself has been swallowed by jungle long since. There is also a Chinese notice on the rock showing the limit of their claims when they overran Tibet in 1910. I say "Boundary Stone," but no one seems to have any very clear idea as to where the boundary actually is in the Lohit Valley. To judge by the map issued by the Survey of India, the Sadiya Frontier Tract extends at least as far north as the confluence of the Di Chu and the Lohit. But since, once north of this stone, the inhabitants of the valley are found to be exclusively Tibetan in dress and custom, and to speak the dialect of Zayul, and since tribute is paid to the Dzong-pön of that province from Tinai onwards, there seems to be no doubt that the frontier (*de facto* at least) is at this point.



Jaglum (with pipe) and Miju Mishmis

Cloth-weaving at Shigatang

Rice-fields in the Rong Tö valley

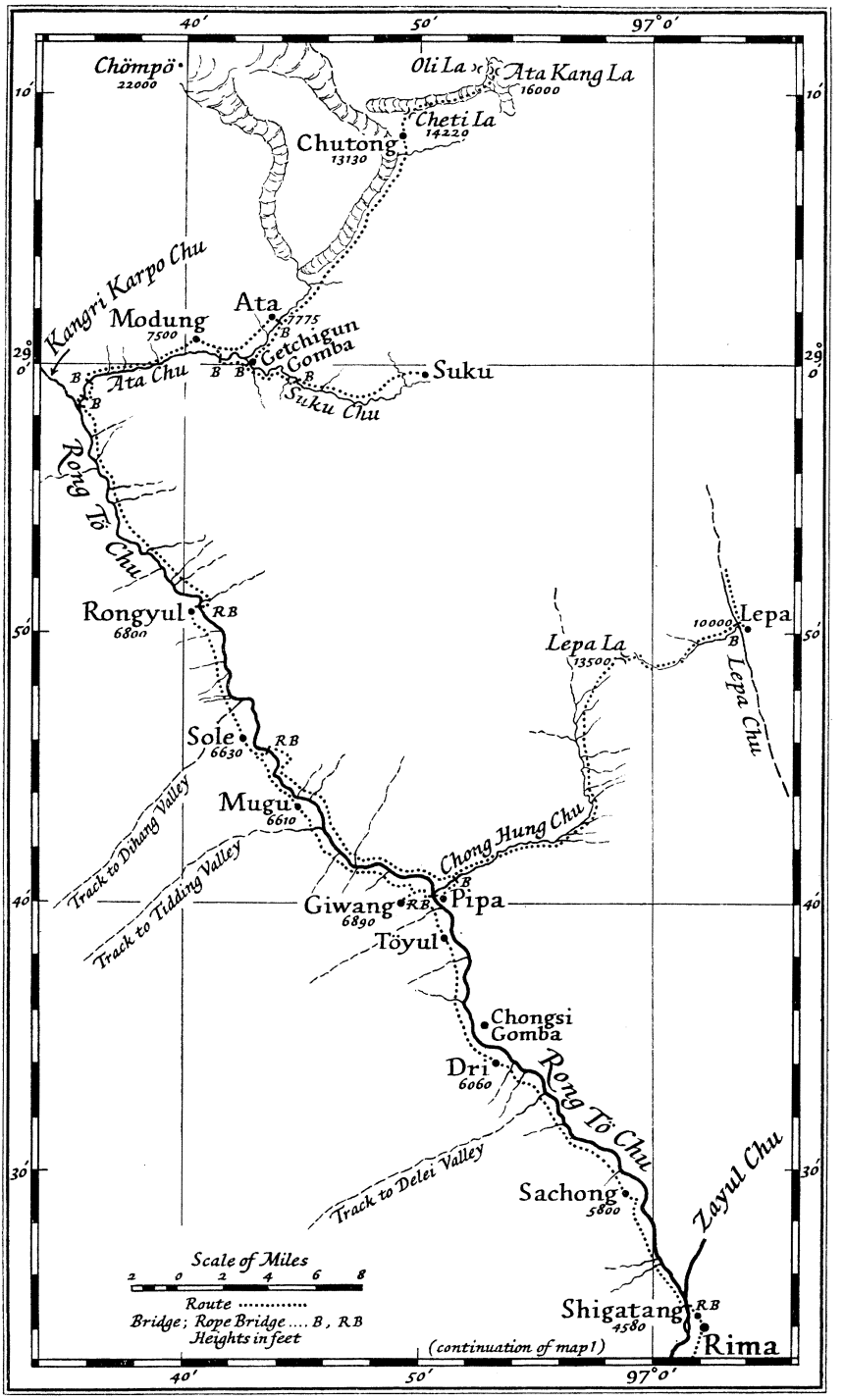
Ploughing at Rima

On the afternoon of the same day we crossed the Lohit by rope bridge, and camped close to Tinai. These bridges are most interesting. They consist of a single rope, made of twisted bamboo, stretched across the river. Each man has a wooden slider which he puts on the rope, and to which he fastens himself by leather thongs. If the two banks of the river are more or less of a height, he pulls himself across hand over hand ; but if, as in this case, there is a considerable slope, he just lets go and slides over at speed. It is a slow business crossing these bridges with a train of coolies, as each load has to be taken over separately, and on this occasion we took about five hours over the job.

At Tinai we camped in the rice fields, the first rice we had seen. Out of the jungle at last, we could see several miles up and down the valley, and after the restricted views of the last fortnight it was almost like being in a new world. The path improved also, and on April 2, after a steep climb of 1000 feet, we dropped down on to the level floor of the Rima Valley, which was dotted with herds of cattle and ponies. We had sent on Chumbi, our head servant, the previous day, to make arrangements for our arrival, and suddenly we saw a little cavalcade of ponies approaching rapidly. It turned out to be Chumbi and some local Tibetans with ponies for our use. We climbed into some very uncomfortable wooden saddles, covered with red felt rugs, and riding past Rima, a village of twelve houses, we made a triumphal entry into Shigatang, where a crowd of nearly a hundred had gathered to watch us come in. We were formally received by the headman, and taken into his house, where refreshments of buttered tea, walnuts, and rice-spirit were served by his wife.

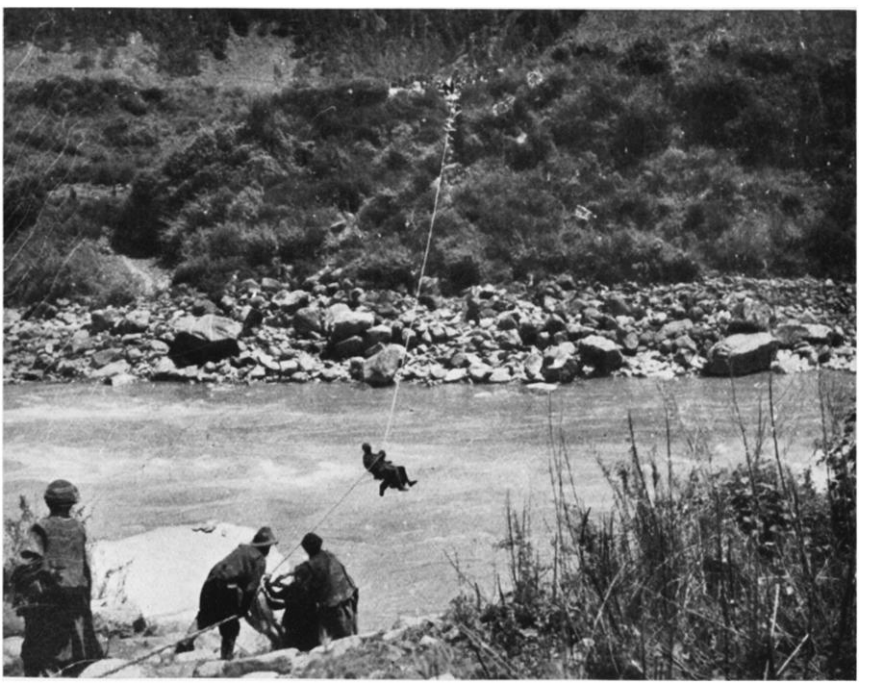
Shigatang is really only a miserable little village about 1 mile north of Rima. It has three houses and seven or eight small huts. Once a year however it becomes a place of great importance, as during the cold weather the Dzong-pön of Zayul moves down from Sanga-chu Dzong, his headquarters, and takes up his abode there with a large following. Owing to the presence of this official almost all the available space in Shigatang was already occupied, but Captain Kingdon Ward was able to find a barn with a leaky roof to sleep in, while I pitched my tent in the headman's compound. We had also the use of another shack for living-room and kitchen. The houses in this part of Tibet are built entirely of wood held together without nails or metal of any kind. Ingeniously constructed of interlocking logs, the walls are surprisingly weather-proof, but the roofs, which are made of roughly cut boards, often let in the rain. Four rooms seems to be the average number, and as a general rule the houses stand on piles 8 to 10 feet high. The space underneath is used as a stable for the cattle, ponies, and pigs, though I think the main idea of the piles is to keep the houses dry. All round Rima, and up the Rong Tö Valley as far as Rongyul, rice, barley, and wheat are extensively cultivated.

Until quite recently this district of Rima was used as the penal settlement of Tibet, as it was considered to be the hottest and most uncomfortable place in the country, and the present population appears to be the result of intermarriage between the convicts and the neighbouring tribes on the borders, and now vary in colour from very dark to olive. They speak a strange dialect, and though they can understand a pure Tibetan with comparative ease, they are themselves not always understood by others, owing largely to their pronunciation.

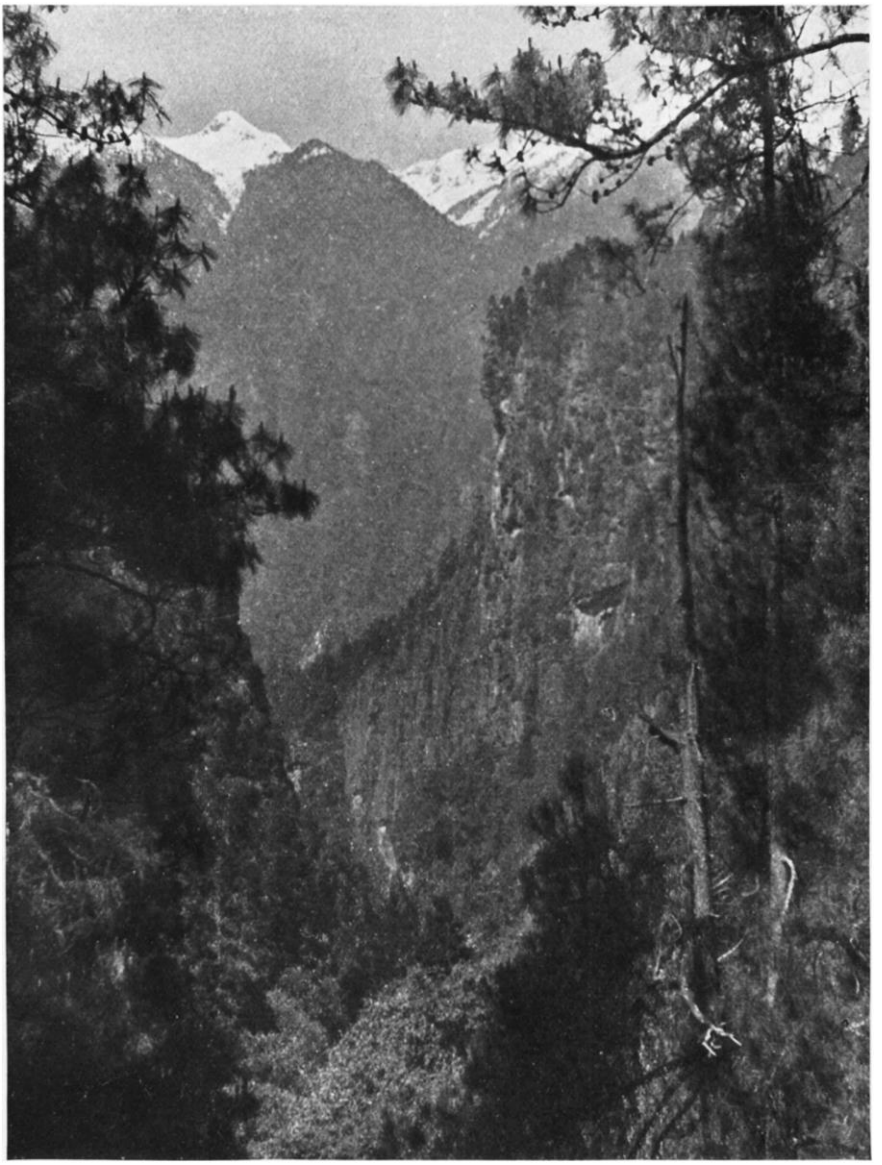


Map 2, showing the more northerly part of Mr. Kaulback's route

Cantilever bridge near Modung



Rope bridge over the Zayul river



The Ata Chu Gorge from near Modung

In 1883 A—K came down the Zayul Chu to Shigatang, hoping to return to India by way of the Lohit Valley. Finding that the Mishmis would allow no one to pass through their country, he turned up the Rong Tö Valley on his way back to Darjeeling. It was our intention to follow his route at least as far as Shiuden Gomba, a large monastery in the district of Nagong. At Shigatang we took observations for boiling-point, giving a height of 4580 feet, which is in fair agreement with A—K's figure of 4650. The height shown on the present map is 5460, but that is certainly in error. After waiting sixteen days for the arrival of some baggage we had sent in advance from Sadiya, we crossed the river on April 18 by rope bridge three-quarters of a mile north of Shigatang, and a short distance below the confluence of the Zayul Chu and the Rong Tö Chu, and moved up the valley of the latter. At this confluence it was interesting to see that while the Zayul Chu was coming down perfectly clear, the Rong Tö Chu was milky with glacier mud. A—K had halted at Dungtang, a small hamlet about 3 miles from the bridge, but we continued for a further 2 miles and spent the night at the much larger village of Sachong, on top of a steep spur.

The Rong Tö Valley is glacial in origin, averaging about a mile across at the base and with steep sides. The rocks are entirely of granite, and the floor and sides are covered with pine forest. The path is good and marching easy. Every village has its terraced rice fields, cut in the alluvial fans washed down from above by the side streams, and in many cases these are irrigated by water brought down from as much as 1500 feet above the crops in well-built flumes of logs.

We left Sachong next morning, and made a march of about 10 miles to Dri, a village of seven houses, where we found half a dozen Mishmis, who had spent the winter there, earning their keep by making baskets and doing other odd jobs. They came from the head waters of the Delei River, along the path indicated by A—K on his map, and it was interesting to find that some of them recognized Captain Kingdon Ward from his expedition into the Delei Valley of 1928. The whole way up the Rong Tö Valley we had a considerable amount of rain, as the hills to the south and south-west are comparatively low, few ridges exceeding 13,000 feet in height. As a natural result most nights were cloudy, but I was very lucky in that I generally found a starry sky if I badly wanted to take a latitude. On the 22nd we reached Giwang, and remained there nine days. There was no point in hurrying our journey along, as the Ata Kang La, the 16,000-foot pass which marks the boundary between Zayul and Nagong, could not possibly be open until the end of June at the earliest. The main villages in the valley are situated at the ends of the coolie-stages, and we lived in considerable comfort in the various houses which had rooms set apart for the use of travellers, only being worried by fleas and leaky roofs.

At Giwang word came in that a Mishmi courier who was coming up from Sadiya with mails and Rs.500 in silver was only a short distance behind us. We were very excited at this, but he failed to arrive, and our hopes gradually dwindled away. A fortnight later at Sole we heard that he had been robbed and murdered. The Dzong-pön was most energetic in his search for the criminal, and interrogated the entire countryside for a radius of 10 miles, but without result. However by good fortune, although the money was never recovered, the mail was found later on by the side of a path. Two miles below

Sole the main path crosses the river by rope bridge and continues on the left bank. A—K had followed this, while we, on the contrary, remained on the right bank for a time. Directly we heard of the courier's death Captain Kingdon Ward started back for Shigatang to see the Dzong-pön about the matter, and I took the baggage on to Rongyul, and waited for him there. He covered the six marches there in two days, remained there only twenty-four hours, and did the seven stages back in three days—a truly magnificent effort.

On parts of the march up to this point we passed through masses of the most beautiful sky-blue irises growing as daisies do in England. We found also wild strawberries and raspberries in profusion, and pear, peach, and walnut trees, though the last three were not in fruit. Rongyul, about 6800 feet high, is the most northerly village in this part of Zayul where rice is grown.

On May 24 we started off again, crossed the river by yet another rope bridge, and once more followed in A—K's footsteps along the main path. That night we camped in the forest, about 4 miles south of the junction of the Kangri Karpo Chu and the Ata Chu, which together form the Rong Tö. Sandflies were troublesome at this camp. Next morning we came to the mouth of the Ata Chu Gorge, which was a remarkable sight. The river foams down between vertical walls of rock, perhaps 40 yards apart, and 1500 to 2000 feet high, having literally cut its way through the solid granite. A quarter of a mile from the mouth of the gorge there is a cane suspension bridge leading across to the right bank of the river, and from there one has a steep climb of 1000 feet up the rock wall, over a bad path which consists largely of ladders of notched logs, and narrow galleries of wood fastened to the cliff with pegs, with a clear drop into the river beneath. From the top of the climb the way gradually leads down again to within 200 or 300 feet of the water, and then continues more or less easy going to Modung, a prosperous village half a mile from the river. A—K remarked, when he passed through, that the Headman of Modung was very rich, and it seemed as though history were repeating itself, for the present Headman is also undoubtedly wealthy, and has, being very pious, richly endowed the monastery of Getchi, some 4 miles from the village. As the office of Headman is hereditary, it is more than probable that the present holder of the title is the grandson of A—K's acquaintance. We found all but one of the Headmen to be pleasant and obliging, the exception being at Dri, and even he changed his tone after his village had been fined Rs.150 by the Dzong-pön for the theft of a stores box. The inhabitants of Zayul profess Buddhism, but, apart from the Lamas, they are not very earnest worshippers, and A—K records that they have full belief in the sacrifice of pigs and fowls, and that they burn their dead like the Hindus. We however came across no evidence of blood sacrifices, and saw no funerals of any kind at all. The usual practice of erecting prayer flags and heaps of Mani stones prevails here, as it does everywhere else in Tibet, and also that of using prayer wheels. Incidentally, it amused us to see large non-stop prayer wheels being driven by water power, so that a ceaseless rain of invocations should pour into the ears of the gods.

After two days at Modung we moved 6 miles up the valley to Ata, the last village south of the Ata Kang La. Two miles from this village the Ata Chu has its source in a large glacier roughly 1000 yards in breadth. On the way Captain Kingdon Ward's only pair of climbing boots was lost through the

inefficiency of one of the coolies, who removed them from the basket in which they had been put, and balanced them on top of a load, so that in crossing a cantilever bridge over the Ata Chu they fell into the water beyond hope of recovery. A very sad blow. The mercury from A—K's artificial horizon had leaked away before he reached Shigatang, so that the whole of his way from there on he was unable to correct his map by taking latitudes. It says a great deal for the excellence of his work that at Ata—after approximately 60 miles, during many parts of which it was no easy matter to make a traverse—he was a bare 6 miles in error. Indeed, from first to last the accuracy of his observations both in survey and in general matters was very great.

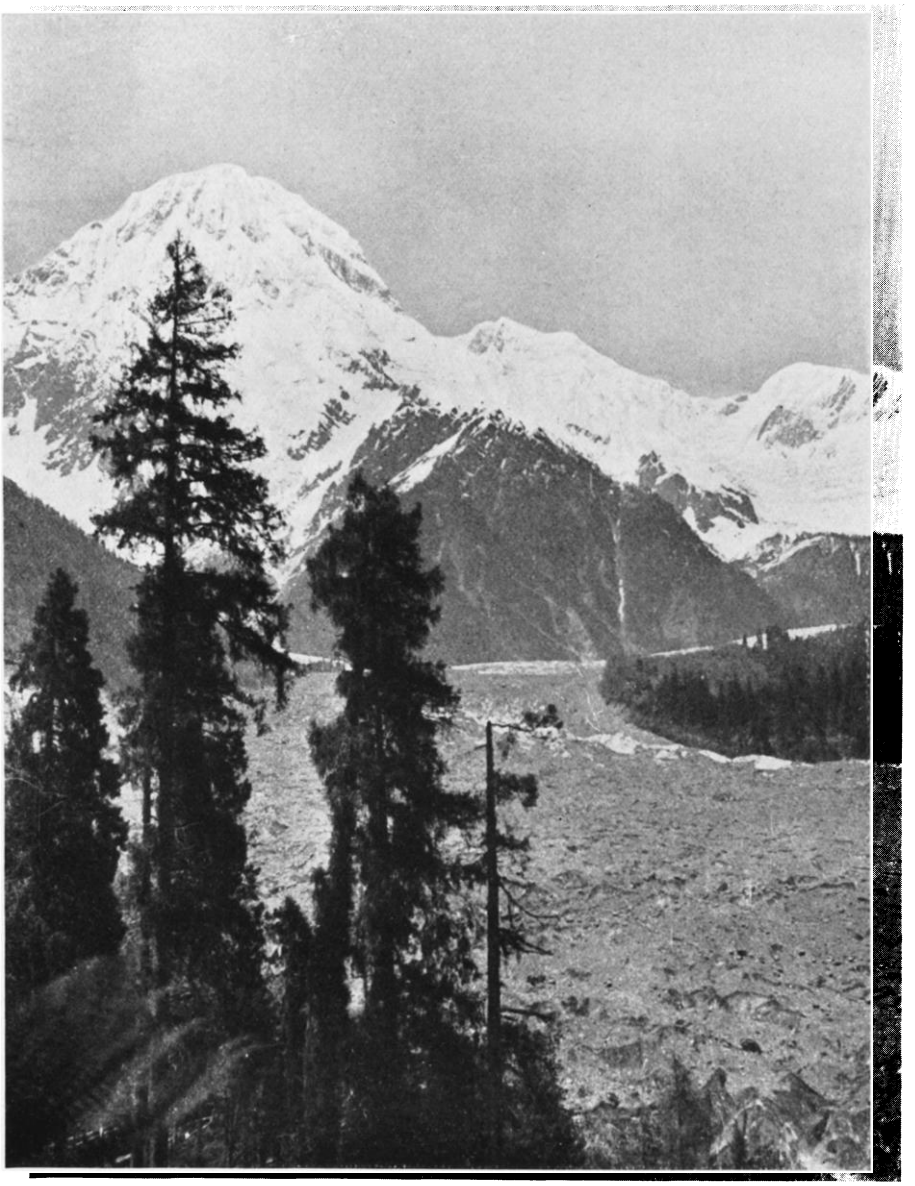
We remained in this neighbourhood from May 29 till June 20, as the Cheti La—a pass south of the Ata Kang La—was still closed. Ten miles north-west of Ata is a fine snow peak of 22,000 feet, beautifully regular in shape, and called by the natives Chömpö. Moving to a camp up a side valley in the direction of this mountain, we found a second glacier almost equal in size to the first. Both these glaciers are in evident retreat. A—K had mentioned that by following a stream which flowed from the east into the Ata Chu, 3 miles above Modung, one came after 8 miles to the village of Suku, but that he had not been there. We verified this, finding that, as usual, he was quite correct, and furthermore that there was an excellent path continuing beyond Suku, three days march to Sanga-chu Dzong. The Headman's house was interesting, as, unlike the houses we had already seen, the entire courtyard of 20 yards square was roofed in, and divided into stalls for cattle, of which there were a large number in the vicinity, as well as a flock of thirty sheep.

On June 20 we felt that the Cheti La at least ought to be open, and accordingly left Ata and marched up the left side of the valley above the glacier for some 6 miles, much of the way lying through a forest of rhododendrons. We camped that night at 9780 feet, and next day had a stiff march to the camping ground of Chutong, at just under 13,200 feet. We were on the edge of the tree-line, and below us and on both sides were thousands of rhododendrons, the sight of which rejoiced Captain Kingdon Ward's heart. The camping-ground at Chutong is on a small ledge, the ground in front sloping very steeply down to the glacier, and behind rising as abruptly for the last 1000 feet to the Cheti La. We intended to wait here a few days for flower collecting, and accordingly sent back our coolies to Ata. Our first day there was fine and clear, and looking south we could see right across to the Mishmi Divide, now covered by the clouds of the monsoon. In the morning we went up to the pass, which is shaped rather like a bowl, with a hollow, 100 feet deep, in the middle. The north side of the pass is very steep indeed, and projecting over the lip was a large snow cornice effectually blocking the way, so we realized that there would be no hope of getting over for at least ten days. After this we had fourteen days of almost continuous rain, during which time we wandered about the slopes looking for flowers, or sat in a rough shelter in front of a fire, playing chess. As far as I was concerned, botanizing simply meant that I collected anything I saw, in the pathetic hope that perhaps something would prove of value. It was very seldom indeed that I brought back anything but rubbish. Occasionally, one of us would wander up to see if the pass were clear, and at last Captain Kingdon Ward decided that we could cross, and sent for the coolies.

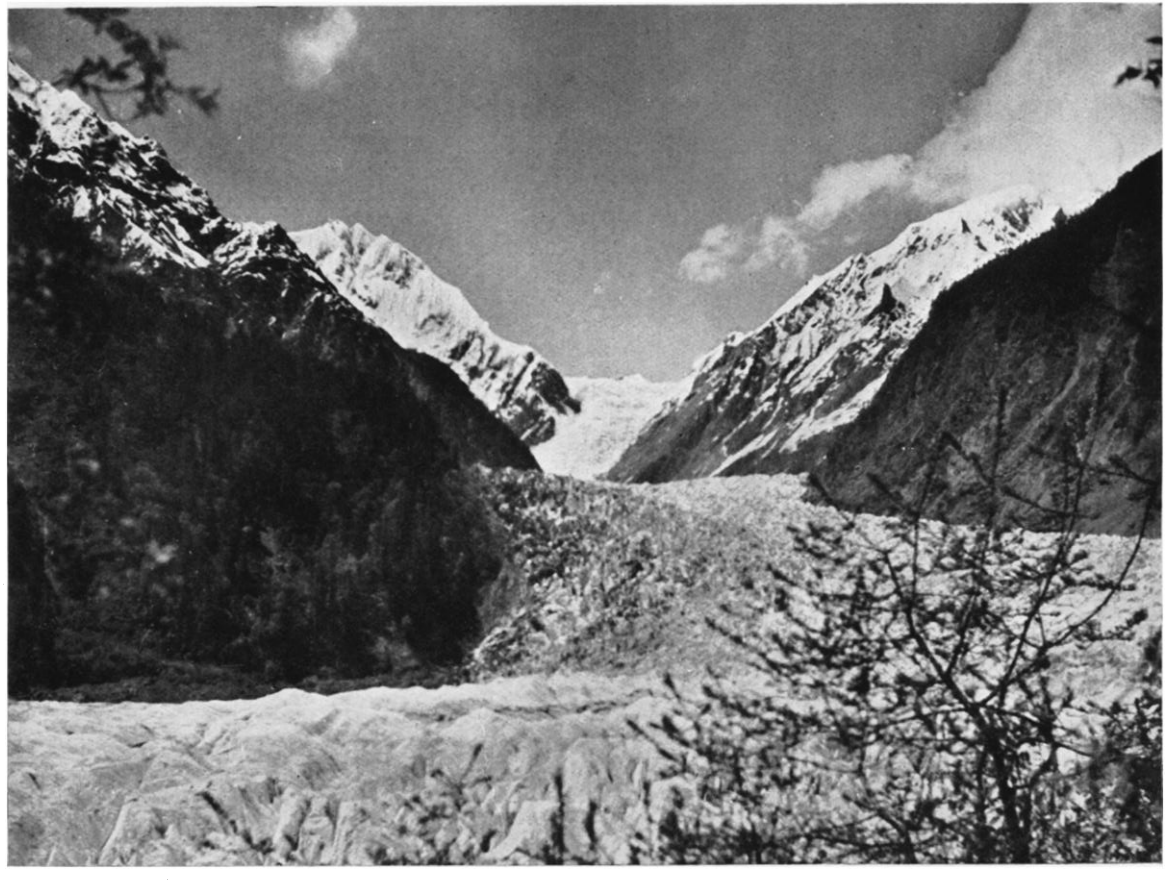
On July 10 we continued over the Cheti La (14,218 feet) and descended on to a glacier beyond, which slopes down steeply from east to west. A—K stated that the foot of this glacier was joined to the main glacier I have already mentioned, and which rises from the slopes of Chömpö, but actually there is a space of 400 yards between the two. Unless it is retreating at a speed of 24 feet a year, he must therefore have been mistaken. We camped on the glacier for six nights, rather more than a mile below the Ata Kang La, finding it very hard to keep warm while we were there. The glacier starts by flowing from south to north from immediately south of this pass, but after 2 miles it divides into two, one arm continuing towards the north, while the other turns sharply west past the Cheti La. The Ata Kang La is on the saddle where these two branches separate, and is about 16,000 feet high. Half a mile to the west, and 500 feet higher, is a subsidiary pass, very steep on both sides, called the Oli La, which is only used when the snow on the glacier has melted, and it is hard to negotiate the crevasses in the ice. I had no permission to go beyond the Ata Kang La, and so, on the morning of July 15, I accompanied Captain Kingdon Ward and his coolies just as far as the summit of the pass, and there said good-bye. I felt very gloomy, as much on account of parting with a fine companion as of having to turn back when only 20 miles from Shiuden Gomba. I watched the little party dwindle to specks on the snow to the north, before finally turning back down the glacier to our last camp.

I left the next day, and without stopping at Chutong, reached Ata the following evening. Pinzho, the cook, came back with me, while the other two servants stayed with Captain Kingdon Ward. Camped on the glacier—and even towards the end of our stay at Chutong—stores had begun to get rather low, but when we arrived at Ata, we found that they had just killed one of their cattle (which are all half-bred yaks) and so we were able to make up for short rations. We moved steadily back down the valley, stopping however at Getchi Gomba, as the result of a pressing invitation from the monks. It is a simple little place, with houses to hold thirty lamas, and a small whitewashed temple of one room and an attic. We arrived at an awkward time for our hosts, as they were just beginning a silent fast of two days. During the frequent religious services, the silence rule did not apply, and they were able to let themselves go with prayer-trumpets, gongs, cymbals and chants: at all other times they were restricted to signs. Just before I left the monastery the silence ended, and almost the first words to be heard were addressed to me, to tell me that the monastery was thinking of building some new houses, and that funds were short.

We reached Sole without incident on July 26. A—K had stated that there was a nomad camp, he believed, called Lepa, some 25 miles up a valley opposite Giwang, on the left bank of the river. I was anxious to go to Lepa, and crossed the Rong Tö by the rope bridge below Sole, taking only three coolies with me, in order to travel as light as possible. At the end of 10 miles this valley, from running east and west, turns abruptly to the north. After another 5 miles there is a steep climb of 4500 feet to the top of the Lepa La, a pass 13,500 feet high, over a range of mountains which runs almost due north and south, and which may be a continuation of the Neching Gangra range. A few miles east of the pass, at an altitude of 10,000 feet, is Lepa, by no means a nomad camp.



Chömpö: rubble-covered glacier in foreground



Ata: main glacier and ice-fall

but a village of ten houses, each with proper stables for the cattle, of which there are large numbers in the place. Close beside it flows the Lepa Chu, from north to south. A fine mule track runs up its valley to Sanga-chu Dzong, but although the river is a tributary of the Zayul Chu, there is no path of any sort going south, owing to a most difficult gorge lower down. At Lepa there are many fields under barley, but the crop, which was ripening when I saw it, looked poor and stunted. I spent one night in Lepa, and then hurried back to pick up Pinzho and the baggage at Töyul.

On August 8 we reached Shigatang once again and found it a changed place. The Dzong-pön had gone back to Sanga-chu Dzong for the hot weather, taking his camp followers with him, and I felt as if I had walked into a modern version of Noah's Ark, for all I saw on the first day were two aged crones, two old men, two goats, two pigs, two hens, and two small donkeys, though to be strictly truthful, I must admit that I found three or four other people the next day. The great problem now was to get coolies, and I had to scour the countryside for two days' journey round about to find them, so empty had the district become with the departure of the Governor.

My route now lay up the Di Chu Valley, and over the pass into north Burma. We left Shigatang on August 19, and made a fairly short march to the confluence of the Lohit and the Di Chu. The following day we turned up the Di Chu Valley, which is steep and very narrow, and thickly forested for most of its length. For the last 5 miles of its course the river has the stupendous gradient of about 400 feet a mile, although higher up the slope is much smaller. We had to move slowly up this valley on account of a bad path, and we had a certain amount of difficulty in camping at night, as on the steep slopes we were seldom able to find a level spot large enough to take even a tent by itself, let alone to provide room for Pinzho and the coolies. On August 23 we camped close to some hot springs. People do not as a rule associate Tibet with volcanic activity, but as a matter of fact there are quite a number of hot springs scattered about, even up to 13,000 feet. These in the Di Chu Valley are only about 11,000 feet high, and are quite small and uninteresting to look at, though the water is too hot to get into.

There were three Tibetan hunters there when we arrived, out after Takin. Both sides of the valley bore hundreds of Takin tracks, and the hunters assured me that the animals come down into the valley for two months every summer, specially to take the waters. The method of hunting which these men favoured was amusing. The hunter goes out in the evening, and lays a large number of snares round the springs. Before dawn next morning he takes up his position in some convenient bush. After a bit, with any luck, there will come a crashing and breaking of branches as some beast blunders into a snare, and gets roped up. Instantly all is excitement. The hunter loads his aged matchlock and creeps up stealthily to within 10 or 12 yards of his trapped victim. With great care he fires his gun, and there is a tremendous explosion. There are no sights on the weapon, and the bullet may go almost anywhere, but honour is satisfied, and throwing caution to the winds, he dashes forward with a knife and kills the animal. We stopped here a day to replenish our larder with fresh meat, and the coolies seized the opportunity to go hunting themselves. They showed how fond they were of meat by eating the liver and the heart raw.

The next day we made a march of nine and a half hours, and camped in the last fringe of forest, about 5 miles from the pass. On August 27 we crossed over into Burma. The pass, which is called the Diphuk La, is 14,250 feet high, and after struggling up, it was most cheering to find that the top was covered with a delightful carpet of blue poppies and small primulas, instead of the plain barren rock, which was all that could be seen from below. A thousand feet below the pass, on the Tibetan side, are two small snow-fed lakes, each about half a mile long, and of the most glorious sapphire-blue. After a short rest on top of the pass, we marched about one and a half hours down the other side to a cattle camp at about 13,000 feet at the head of the Seinghku Valley. This camp consists of three hovels, with a population of three men, two old women, and two small girls, who look after the fifty or so half-bred yaks which make up the herd. The cattle are all brought up in the summer for grazing, from lower down in the valley. We camped 200 yards from the settlement, and I paid off my Tibetan coolies; they all went back with the exception of two, who said that they would like to come with me to Fort Hertz, as they had a great desire to see the world. They were excellent coolies and always cheerful, so I agreed, and they made themselves useful by helping Pinzho, until a fresh batch of coolies arrived from Haita three days later. These new men were Khanungs, and as soon as they saw my Tibetans they went for them with knives. I asked what was the matter, and was told that these two men were well-known slavers, who had stolen some children only a few months before, and taken them back into Tibet. The culprits blandly admitted this, and said that under the circumstances perhaps they had better be off. They picked up their things, and had vanished from sight within half an hour. Slavers or not, they were good fellows, and I was sorry to see them go.

On August 31 we started off again, and camped in the forest at 9000 feet, with a roaring fire outside the tent to discourage the leeches, which were present in large numbers; and the next two marches—the first down to Haita, and the second from there to the Adung–Seinghku confluence—were about as bad as they could possibly be, as far as these pests were concerned. The first of these lay through dripping jungle, and the second through long grass. Below this confluence the river is called the Nam Tamai, and from there on we had never more than ten or twelve leeches on a march, and our only trouble now was shortage of supplies. Twice we were able to get hold of a fowl, and on two or three occasions some fish, but except for these the only food available was corn cobs and cucumbers. Luckily we still had a little rice, and a good supply of butter and tea, and although it meant pretty short rations there was no actual discomfort. There are a few rope bridges in this part of the country, similar to those found in Zayul, but by far the greater number of bridges are built on the suspension pattern, of cane, with a footpath of a couple of bamboos. They give one a most uncomfortable feeling of instability with their rocking and swaying. Travelling down the Nam Tamai there was no longer any need for a tent, as at every convenient camping-place there is a bamboo hut, built for the Assistant Commissioner at Fort Hertz, who makes a journey once a year as far as the Adung–Seinghku confluence. The valley is not very thickly populated, but sometimes we came across scattered villages, the huts of which strongly resemble those of the Mishmis.

Camp on moraine below the Ata Kang La

Approaching the top of the Ata Kang La

Small temple, Shigatang

Nogmung

On September 15 we reached Pangnamdim (without seeing the village which is up the slope somewhere), and the next morning crossed the Tamai by a mule suspension bridge, supported by steel cables. We now climbed out of the Tamai Valley, our immediate objective being the large Shan village of Nogmung, on the banks of the Tisang River. This took us four days to reach, during which the path led across three steep ridges and one river. Nogmung was the first civilized-looking place we had seen since Sadiya, with its houses neatly arranged in rows, and everything comparatively neat and clean. It had no shops, but was very proud in the possession of a school, at which the ages of the scholars in the one and only class varied from twenty to about four. There was a Shan Government official there, who was most helpful in getting new coolies. He welcomed me on my arrival with a large dish of plantains and a mug of Nestle's café-au-lait (another sign of civilization), both of which I much appreciated.

At the end of the path the river bank at Nogmung was covered all day with a fluttering carpet of gorgeous green-and-black butterflies, and every morning at sunrise we were woken by a chorus of gibbons, saluting the day. Altogether a very pleasant spot. We remained there three days in complete idleness, for the usual reason—waiting for coolies—and then, making two double marches, reached Fort Hertz on the evening of September 24, just two hundred days since leaving Sadiya.

DISCUSSION

Before the paper the PRESIDENT (Major-General Sir PERCY COX) said: Mr. Kaulback is a young Rugbeian and Oxford undergraduate, and on this, the first occasion on which he was able to materialize his ambition to travel and explore, he had the very good fortune of getting into touch with Captain Kingdon Ward, whom we all know so well; a Gold Medallist of this Society, who has frequently in the last five-and-twenty years read papers to us and written in the *Journal* on exploration on the Chinese frontier of Tibet, and the region that we are to hear about this evening, the Assam-Burma frontier of Tibet.

We are fortunate, too, in having with us two old hands, Colonel F. M. Bailey, also a Gold Medallist of this Society, and Lord Cranbrook, both of whom travelled considerably in that region, an extraordinarily interesting one, as it includes the headwaters of those fine rivers, beginning from the east, the Yangtze, the Mekong, the Salween, the Irrawaddy, the Tsang Po, and the Brahmaputra; where there is an enormous amount, even now, to be done in the way of exploring the divides and collecting, in all branches of natural history.

Unfortunately, Mr. Kaulback, owing apparently to a clerical omission, was referred to in Mr. Kingdon Ward's passport not by name but as "and party." When it came to the passport being examined by the local authorities, this stumped them altogether; they would not allow Mr. Kaulback to enter as "and party," and so—very bad luck for him—he had to turn back. Mr. Kingdon Ward went on, and we have heard to-day by telegram that he reached the Salween, travelling eastward after Mr. Kaulback left him. Mr. Kaulback is going to deal with the part of the journey up to the moment he left Mr. Kingdon Ward.

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

The PRESIDENT: As I told you, we have Colonel Bailey with us, who just before the war went on an expedition to discover where the Tsang Po cut through the mountain range and came down to the Brahmaputra. I will ask him to speak to us.

Colonel F. M. BAILEY: The only portion of this journey that I know is up to Rima. From Rima the lecturer went off the track I took. There have been great changes since I came down the Lohit Valley in 1911. In the first place, what took me seven days Mr. Kaulback did in a few hours in a car. It took me seven days walking through the jungle and very often cutting the way for several hours at a time. In my day the Mishmi had no umbrella. In other ways, his clothing and properties seem to be very much the same.

The lecturer said he could not vouch for the fact that the *takin* go to take the waters of the hot springs. I can. I went to try to get *takin*, first of all, on the Western-China frontier. I failed to get them there. I spent nine days hunting them, but I found nothing but old tracks in that region. I discovered that *takin* move about in herds and can be found at certain times in certain places. When I went to the hot spring which Mr. Kaulback visited there were many hundreds there, actually drinking the water. I lived opposite them for three days, and in the course of that time I shot six, the skins of which I took back with me. I saw those animals standing in the hot water, fighting to get it, and I saw one bull take a calf, who had come too much forward and was interfering with him, and throw the calf right up in the air. I had great difficulty in getting up to the springs. I do not know what the road is like now. It took me three days to reach them from the main alley, crawling over slippery rocks, in the rains of July. I did not go over the pass at the head of the valley, as it was off my road. I was trying to get back into India as fast as I could. In fact, I got into the country by accident.

I heard no good of the Mishmis. The first European visitors to the Lohit valley were two French priests, Krick and Boury, who were trying to enter Tibet; they were killed by the Mishmis in 1854. Mr. Needham, the Political Officer at Sadiya, nearly reached Rima in 1887, but found the forest humming with arrows and bullets, and decided to return. His successor, Mr. Williamson, in 1911 penetrated some distance up the valley. Later in the same year he was murdered by Abors. I intended to have a look at the Mishmis and see whether they would take me through their country or not. The first night I camped, the Tibetans ran away and left me with the Mishmis. I had nothing to do but go on. With great difficulty I got through to Assam.

The PRESIDENT: I think you will agree with me that we have had an extremely nice lecture. As you know, this is the opening of Mr. Kaulback's career as a traveller and explorer, and he evidently is a man of great promise. I can hardly imagine a neater lecture. His slides have been extraordinarily well arranged so as to fit in smoothly with his talk, and have run very excellently. As to his travels, he made little of the privation from the food point of view, but it must have been extremely severe at times, travelling and working strenuously with nothing but rice to eat. I have been in the same position as regards a rice diet, and it did not seem even to get to curry.

As to the results of his journey, Mr. Kaulback does not claim to have made any great addition to the map, but he has surveyed the country which he went through, and we can be sure that Captain Kingdon Ward will have some more to tell when he returns. Meanwhile, I think we have been very fortunate in getting Mr. Kaulback to give his account of the part that he travelled with Captain Kingdon Ward. I ask you to express your appreciation of his lecture in the usual way.

The
GEOGRAPHICAL JOURNAL

Vol LXXXIII No 5 R.G.S. *May 1934*

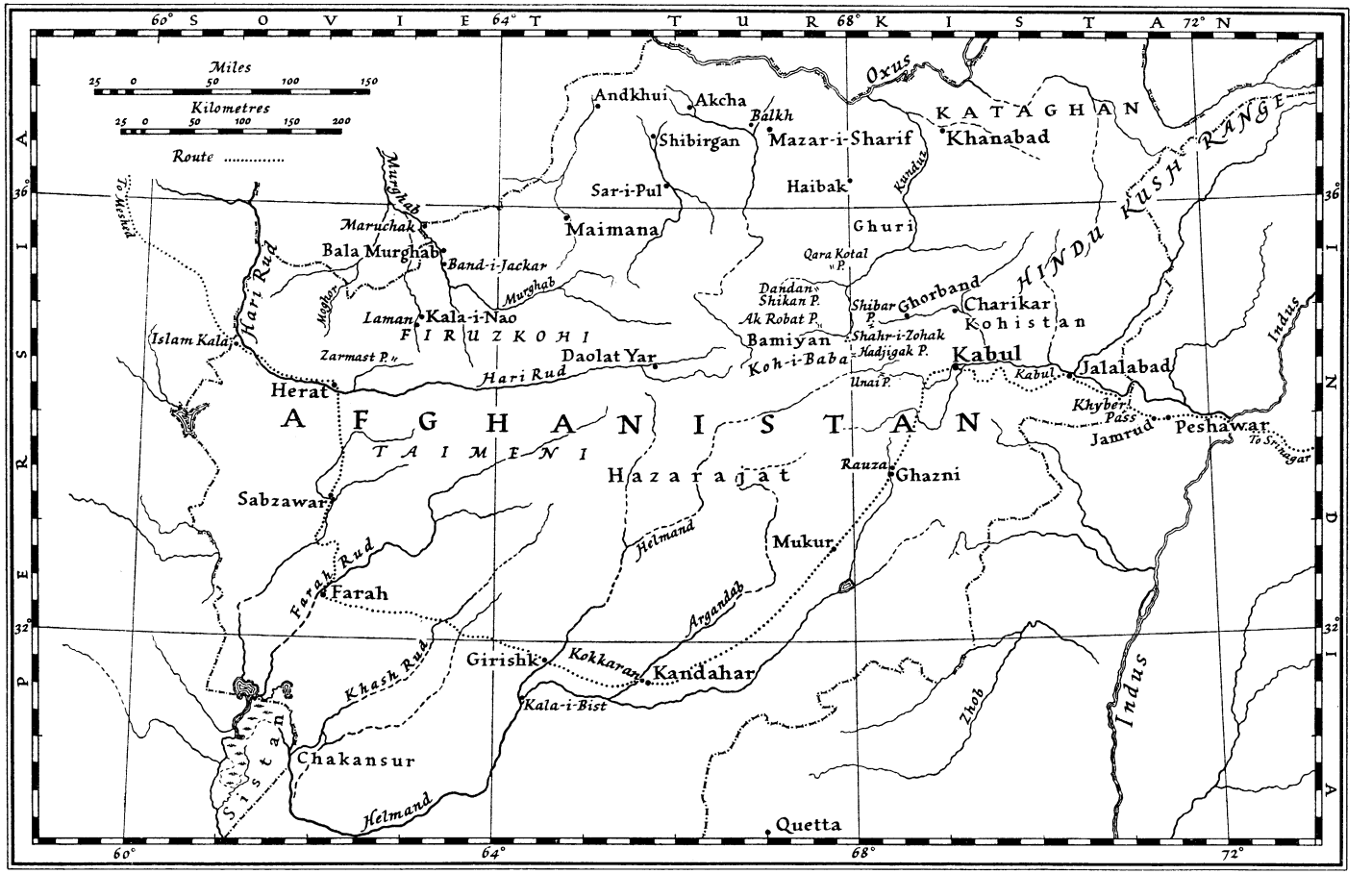
IN PERSIA AND AFGHANISTAN WITH THE CITROËN TRANS-ASIATIC EXPEDITION: *A paper read at the Evening Meeting of the Society on 20 November 1933, by*

JOSEPH HACKIN

TO begin with, I wish on behalf of the Citroën-Haardt Expedition to express our sincere thanks for the most valuable help which the Royal Geographical Society so generously gave to the expedition. When in 1930 the plans of the expedition were suddenly changed, and it was decided to go through Afghanistan and northern India, the Society supplied the late Mr. Haardt with many maps and furnished him with important information which otherwise would have taken many months to obtain. I feel therefore all the more honoured to speak before this distinguished audience, and I hope that the little information I am able to give on the geography and the ethnography of Afghanistan may be of some interest to the Society.

The original project as conceived and worked out by G. M. Haardt included an itinerary from Beirut to Peking without any break in the use of mechanical transport; but circumstances to which I have alluded and into the details of which I shall not now enter compelled the leader of the expedition to allow for a detour by southern Afghanistan, north-western India, and the Kashmir Hunza. This route presented in the region of the Pamirs such obstacles as were bound to break the mechanical continuity. For the original plan comprising a single group of cars leaving Beirut for Peking, a different organization had to be substituted: the expedition was divided into two groups, one starting from Beirut, the other from Peking, making towards each other and endeavouring to reduce as far as possible the break in continuity imposed by the unusually difficult nature of the ground. I joined the first group, Beirut–Pamir, which was to leave its cars on the other side of Gilgit to proceed northwards on horseback. The meeting of the two groups took place at Aqsu, in Chinese Turkistan.

The material collected by the Citroën-Haardt Expedition in Afghanistan shows the interest and the diversity of the ethnic elements which make up the population of the country. As these ethnic features have a rich historic background, the expedition had the opportunity of observing many ancient monuments on its route: Pre-Islamic monuments which call to mind the



Routes of the Citroën Trans-Asiatic Expedition in Afghanistan

remarkable fusion of Hellenism, Buddhism, and Iranian Mazdeism; Islamic monuments which bear witness to the astounding rise and splendour of the Ghaznavids' capital; and, at Herat, the remains of the glory of the Timurid age. Moreover the expedition could also note the influence of human races, different in origin and formation, on the country itself.

Entering Afghanistan by Herat, the expedition of G. M. Haardt and L. Auduoin-Dubreuil proceeded to Kabul by the southern road which passes almost entirely through purely "Afghan" country, through Farah, Girishk, Kandahar, and Ghazni. A northern itinerary, which the expedition had originally planned to take, was partially reconnoitered by M. de Vassoigne, who went from Herat to Maimana. Moreover I have recently had the opportunity of passing along the new route Kabul–Mazar-i-Sharif–Balkh–Shibirgan–Andkhui–Maimana–Herat. In this way the expedition as a whole has collected data on several itineraries which form a large circuit in Afghanistan.

The expedition is greatly indebted to the Government of His late Majesty Nadir Shah for facilitating the task of its artist, cameramen, photographers, archaeologist, and other specialists who were enabled to collect documents and materials for future study. Thanks to the efficient and thorough help of the Afghan Government and to that of the local authorities who acted on instructions from H.R.H. the Prime Minister, the expedition did not lose a single day, and was given the opportunity of studying certain ethnic elements relatively distant from its route.

I regret to say that I can only give you in this lecture an incomplete and fragmentary account of the value of the material collected, as the limited time does not permit me to dwell on details.

All travellers who have stayed at Herat have noted its great importance and the richness of its soil. Until recently however, owing to the poor condition of the tracks which connected it, it has been isolated from other parts of Afghanistan. This quasi-isolation, which greatly hampered the trade of the province, will end with the completion of two new roads. One, a mountain road passing through the Hazarajat, will bring Kabul within three days' travel of Herat. It has already been constructed as far as Daolat Yar. The other, 450 miles long, connects Herat with Mazar-i-Sharif, the capital of Afghan Turkistan. This road serves such important economic centres as Andkhui and Maimana, and connects the north-eastern part of the Chahar Aimak country (Taimeni, Hazarah, Firuzkohi, Jemshedi) with Herat. Although certain sections of this track will have to be further improved, the journey from Mazar-i-Sharif can, at the present time, be made in less than four days.

The monuments of Herat, especially those of the Timurid epoch, have been greatly damaged. The Mosque (Musallah) and the School (Madressa), two monuments of the fifteenth century, have been described by Colonel Yate, who saw them in 1885, shortly before they were destroyed. Their place is still marked by the minarets which were spared and which preserve in certain places delicately and beautifully designed *kashi* (tile work). With a telephoto lens we secured several good photographs of the principal motives of decoration on these minarets. I should also like to mention the so-called Shah Rukh Tomb, which is in point of fact not only the tomb of Shah Rukh, great-grandson

of Tamerlane, but also of Baisangor, grandson of Tamerlane. At Gazarga, which is a great pilgrimage centre, is the much-venerated tomb of Abu Ismail Khwaja Ansari, who died in A.D. 1088; there also is the mausoleum of Dost Muhammad Khan, the Great Amir of Afghanistan, who, after a victorious campaign, died in Herat in A.D. 1863.

Beyond Sabzawar we come to the country where pure Afghan is spoken and where the population belongs to the Durrani group. The first tribe that we meet there is the Nurzei. After the collapse of Nadir Shah's Empire in the eighteenth century, the Durrani tribes, under the inspiring leadership of Ahmed Shah, assumed supremacy over all the other tribes of Afghanistan.

Farah, the first important town after Sabzawar, occupied a small portion of the area of the former Prophtasia. It is one of the markets situated on the border of the rich province known in antiquity by the name of Sakasthana. Wars and invasions have, in great part, transformed the present-day Sistan into desert. The region of Chakansur, which has been one of the important centres of ancient Sakasthana, has however been partially reclaimed, and eventually cultivation will be possible in the entire area after the construction of irrigation canals branching off from the Khash Rud and the Helmand River, in the Nasirabad region. This work is being carried on by the Sariks Turkoman, newcomers to the country. Those Turkoman belong to the same tribe that has reclaimed and cultivated the ancient marshes of the Murghab, between Bala Murghab and Maruchak, in north-western Afghanistan.

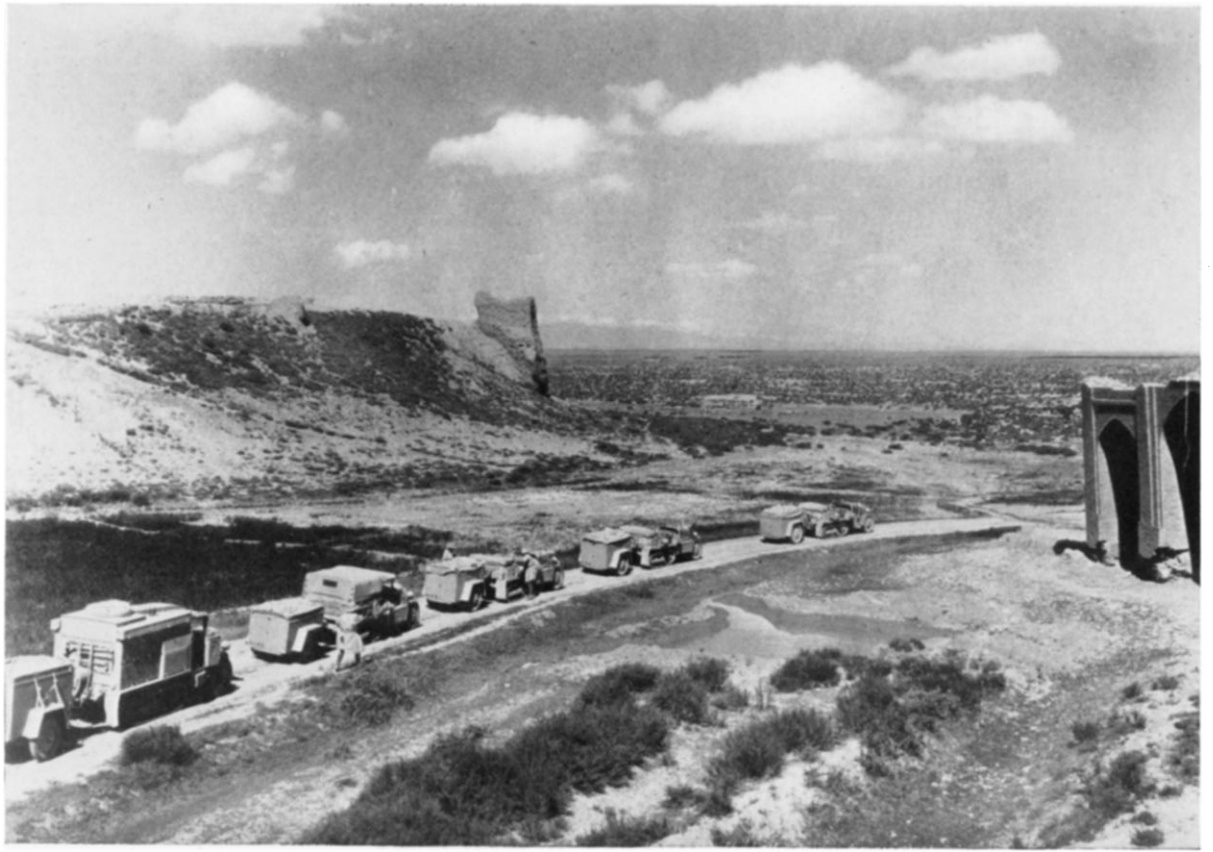
At Girishk the expedition was fortunate in finding several representatives of the Durrani group, members of the tribes of the Barakzei, Muhhammadzei, Popelzei, and Alizei of Zamindawar, one of the most important tribes of the region. Before the arrival of the expedition at Girishk I had, with Commander Pecqueur, the opportunity of making a trip to Kala-i-Bist, where we saw some advanced elements of the Achekzei tribe. Kala-i-Bist, one of the favoured residences of Mahmud of Ghazni, is beautifully situated at the confluence of the Helmand and the Argandab rivers. Its citadels suffered greatly when besieged by Nadir Shah in the eighteenth century. The only monument of the Ghaznavid period still remaining at Kala-i-Bist is an arch of burnt brick, decorated with motives of sober elegance.

In the Doab country, between the Helmand and the Argandab, the few rare villages are inhabited by the Nurzei, the Atchekzei, and the Alizei. The Argandab may be considered the extreme limit of the territory populated by the tribes of the Durrani group. Having crossed the Argandab we came to the land of the Ghilzai. Near the ford of the Argandab, at Kokkaran, stands the tomb of the great hero of the Ghilzai epic, whom European historians call Mir Weis (Mir Faez) and his compatriots Hadj Mir Khan.

H.E. the Minister of the Interior of Afghanistan, Muhammad Goul Khan, who was at Kandahar, greatly facilitated our task by summoning there men of both the Durrani and the Ghilzai groups, and by organizing several singing and dancing festivals. The Durrani group was represented by men of the Popelzei tribe, and the Ghilzai by the Taraki. Although the fundamental theme of their dances is the same, the nuances vary. The movements of the Popelzei are, I should say, more elegant and more languid than the rude movements of the Taraki, who dance to a much faster rhythm.

The Bamiyan valley

Phot. M. O. Williams



Entering Afghanistan at Islam Kala

Phot. M. O. Williams

Thanks to the Governor of Ghazni, two other ethnic groups were summoned to Mukur. The first was represented by the Alikhel and the second by the Karotee tribesmen. The dances and the songs registered at Mukur by the expedition on sound films are typically Afghan. Here we were in the heart of the Ghilzai country, and no one but the Andar, who live in the vicinity of Ghazni, could give a better idea of the fierce beauty of the Afghan dances. Beyond Mukur, the Ghilzai come into contact with the Hazarah, mountaineers of Mongol origin, descendants of the military colonies brought there at the beginning of the thirteenth century by the great conqueror Genghiz Khan. The long-haired Hazarah Jaguri have retained a particularly pure Mongol type and their relations with the Ghilzai Suleimankhel were not always especially cordial.

Ghazni, the ancient capital of Mahmud, is in great part the fief of the Andar, who may be considered as some of the best representatives of the Ghilzai type. The Andar, the Suleimankhel of Zurmatt, and the Wardak come frequently to the bazaar of Ghazni, which is the great market for *pustins*, sheepskin coats decorated with delicate embroideries. In the city of Mahmud, ruthlessly sacked by the Ghoride Sultans, there only remain a few monuments, but they are all important specimens of the Muslim art of the eleventh and twelfth centuries. The towers of Victory erected by Mahmud and his great-grandson Ma'asud the Third, the tomb of the father of Mahmud Subuktegin, the tomb of Mahmud itself in the village of Rauza, the Mosque of the Sultan Abd-ur-Rezak, which is a remarkable example of a fortified mosque, all magnificently illustrate the Ghaznavid art which was so pitilessly dealt with by Ghoride invaders. It is possible to say without hesitation that Ghazni is to Islam what Bamiyan is to Buddhism. From the top of the citadel of Ghazni one sees an immense area of ruins; the town of Mahmud, then two towers preserved by their massiveness from the Ghoride's fury, and, at the foot of the hills among luxuriant vegetation, the tomb of the Great Conqueror.

On the way from Ghazni to Kabul the road leads through a part of the territory of the Wardak. The Wardak belong to the Ghilzai group, but they are better policed and more amiable than the others. Their dances have not the crudeness of the Karotee and the Alikhel dances which we saw at Mukur. Their movements are a triumph of suppleness and grace.

During our stay at Kabul we attended several receptions and were granted a Royal audience. Then the expedition went on to Bamiyan. We reached this famous archaeological site by a road which traverses a part of ancient Kapiça (the Kohdaman and the Kohistan of to-day), an ancient lacustrine basin of remarkable fertility. The road then followed the torrential course of the Ghorband, and reached the divide between the Oxus and the Indus basins at the Shibar pass in a region populated by the Hazarah. It joined the ancient road from Kabul to Bamiyan by the passes of Unai and Hadjigak near the ruins of the Shahr-i-Zohak citadel destroyed by Genghiz Khan in A.D. 1222. The word *Bamiyan*, an Iranian name, is the normal Persian derivative of the word *Bamikan*, which is used in the pehlvi *Bundahes* (J. Marquart, P. Pelliot). Until the time of the Mongol conquest (A.D. 1222) Bamiyan might have been one of the most important centres of Middle Asia. Situated about halfway between Balkh (Bactra of the Greeks) and Peshawar (ancient Purushapura) on one of

the great international trade-routes, its valley was a natural halting-place for caravans. After the hardships endured in crossing the high passes of the Hindu Kush, caravan leaders and merchants could regain their strength there before continuing the difficult journey. The importance of Bamiyan must have been further increased during the Buddhist epoch when the Balkh–Peshawar route represented, as Mr. A. Foucher said, "a link between the Indian and the Scythian halves of the Empire of the great conqueror Kushana Kanishka" (first century A.D.).

At that time the city of Balkh, which had become an international trading centre, was situated at the cross-roads of the three most important highways of Asia: one leading west, towards the Roman Empire; one leading north-east, towards China; and one leading south-east, towards India. It was also at that time that the barbarian Emperor, miraculously converted to Buddhism, used his power and wealth to satisfy his ardent religious zeal. A peculiarity of the local topography was responsible for the fortune of Bamiyan, for "in the middle part of the valley the northern cliffs of tertiary conglomerates offered to the pick and chisel of artisans high vertical surfaces which were used to advantage by the patrons and their architects" (Foucher).

During the second and third centuries A.D., Buddhist institutions multiplied with great rapidity at Bamiyan owing to the impetus given by the patronage of such rulers as Kanishka and his successors. The advent of the Sassanian dynasty in the third century and the extension of its conquest towards the east did not seem to impede the development of the sanctuaries and monasteries at Bamiyan. The rulers of the valley, successors of the great Kushanas, fell under the influence of their powerful neighbours, and between the fourth and the seventh centuries Bamiyan became a centre of Iranian art, or, to be more exact, of Irano-Buddhist art. Bamiyan apparently did not suffer greatly from the brief occupation of the Ephtalites in the fifth century. Pilgrims from far-distant China continued to wend their way towards India, passing through Bamiyan; the most famous of them, Hsuang Tsang, whom Sir Aurel Stein calls his "Patron Saint," saw the sanctuaries of the celebrated valley in A.D. 632. Less than thirty years after the visit of this famous pilgrim the Arabs made their first appearance in the valley, but the sanctuaries remained intact. A Korean monk, Huei Chao, who had passed there at the beginning of the eighth century, found them still in a good state of preservation. The Sanscrit manuscript in tardive *Gupta* characters, discovered by the writer in the "G" grotto, belongs in all probability to this epoch.

The Buddhist occupation of Bamiyan must have come to an end in the ninth century. During the Mongol invasion Bamiyan was a part of the Khvarezmian domains. Mütügen, the grandson of Genghiz Khan and son of Jagatai, was killed during the siege of Shar-i-Gholghola, the Muhammadan citadel of Bamiyan. In the *Tarikh-i-Jehan Goshai* it is stated that after this event "the Mongol army made all the more haste to conquer the city, and when it was taken, Genghiz Khan ordered as punishment that all living things therein—men as well as animals—be killed; that no prisoners be taken; that not even a child in his mother's womb be spared; that after the capture of the city no one should ever live there, and that nothing should be built on its ruins, which were named Mao Baligh, the 'Bad City'." The chronicle adds: "True,

Crossing the Argandab near Kandahar

Phot. M. O. Williams

Bulalah, near Bamiyan *Phot. M. Morizet*

The Bala Hissar, Herat *Phot. M. O. Williams*

nowadays no animated creature lives there." These events took place in the first months of the year A.D. 1222 (619 Hejira), and Genghiz Khan's malediction still seems to hang over the ruins of Shar-i-Gholghola. Since that time Bamiyan ceased to count among the important cities of Afghanistan, and the abandonment of the great continental highways, supplanted after the fifteenth century by maritime routes, completed the downfall of the old city.

To-day Bamiyan is the residence of a Governor of the third class, who is under the Hakim-i-Qaland, who resides at Charikar. The natural frontiers of the district of Bamiyan, which belongs to the *vilayet* of Kabul, are the Shibar Pass on the east, the Ak Robat Pass on the north, the Band-i-Emir on the west, and the Koh-i-Baba on the south. Bamiyan has also great interest for the ethnologist. The population of the valley (properly speaking) consists chiefly of Tadjiks of the Iranian race, but the tributary valleys are populated by the Hazarah, who represent the Mongol element. In the high valleys of the Foladi live a small number of Kizilbash who are of Turkish origin. The Afghans come to graze their herds in the high valleys from May to September by virtue of the privileges granted to them in 1896–97 by the Amir Abd-ur-Rahman Khan. These Afghans belong to the following clans: the Taraki, the Akakhel, the Omarkhel, the Mandozei, the Dauletzei, and the Ahmedzei Suleimankhel. The first four clans go to pastures of the Band-i-Emir region, the Dauletzei to the heights dominating the Ghandak region, and the Ahmedzei to the high valley of the Foladi and neighbouring pastures. The Tadjik, the Hazarah, and the Kizilbash represent the settled element, while the different Afghan tribes, who obey the rhythm of periodic migrations, represent the nomadic element. In the high valley of the Circa, at an altitude of roughly 8500 feet, the settled population grow two varieties of wheat—an autumn wheat (*tirmai*) which is sown in the second half of October, and a spring wheat (*ba'ari*) which is sown about the end of March. The spring wheat ripens first.

The new road which connects Kabul with Mazar-i-Sharif, the capital of Afghan Turkistan, does not pass through Bamiyan. The ancient track which follows the Bamiyan valley and goes over the passes of Ak Robat, Dandan Shikan, and Qara Kotal before coming to the Bactrian plain, is now almost abandoned. Bamiyan will be connected with the new Herat–Kabul road by a branch which is actually under construction. In this way the picturesque region of Band-i-Emir and the mountainous region of Deh Zengui, which is in the heart of the Hazarah country, will be made easily accessible.

The road from Kabul to Mazar-i-Sharif branches off from the Kabul–Bamiyan road after 123 miles, and, taking an entirely new course, follows the Bamiyan river through grand rocky gorges. Five and a half miles from the bifurcation stand the ruins of the city of Shahr Khoshak and of its citadel dominating a great curve of the river. They were probably destroyed by Genghiz Khan. As far as Doab-Mikhizanin the road passes through the Hazarah country. It does not however go as far as the confluence of the Bamiyan and the Kunduz rivers. Leaving the valley it crosses the Kampirak and the "Caravan" Passes and, following the line of a series of hillocks, comes to the Ghuri plain. Numerous Afghan elements belonging to the Akakhel, Tinzei, Utrel, and Ahmedzei (Suleimankhel) camp there. A little before

Ghuri, at 120 miles, a new road branches off toward Khanabad (Katagan). The new road joins the old one at Haibak. The ethnic elements now show a marked difference, as here we come into contact with the Turkistan Usbegs whom we met at Mazar-i-Sharif. The Tadjiks and the Usbegs live in contact at Balkh, the former capital of Bactria. The city with its many Buddhist and Muhammadan ruins is dominated by an imposing citadel.

The industrious Usbegs have greatly modified the aspect of the country between Akcha and Shibirgan, by reclaiming and cultivating great areas of marshes overgrown with reeds. These areas, uncultivated less than ten years ago, now produce rich corn and cotton crops. The Andkhui region, in the Turkoman country, also shows remarkable development. There the area of irrigated land will be further extended after the construction of a great dam in the mountainous district of Gurzivan. The execution of this project, which is actually under consideration, will relieve the ever-growing over-population of this oasis.

The Turkoman occupy the region between Andkhui, Bala Murghab, and Maruchak. There also, especially between Bala Murghab and Maruchak, vast marshy areas have been reclaimed and transformed into cultivated field and pasture by this industrious population. The cultivation of corn and cotton, the breeding of sheep famous for their skins (*karakul*), and the manufacture of rugs are the principal sources of prosperity in this region. To show the progress achieved in this part of Afghanistan, it is sufficient to compare the actual prosperity with the conditions that existed there in 1885, as described by Colonel C. E. Yate, then a Member of the Commission for the Delimitation of the Russo–Afghan frontier[1]:

> The heat just now in the Maruchak valley is tremendous. Not that I believe it registers anything excessively high by the thermometer, as with a good roof over one's head one would hardly feel it, but in the sun it is overpowering. The whole valley is uninhabited, and the ground is one dense tangled mass of thistles, flowers, grasses, and weeds of every description, standing between two and three feet high, and full of horse-flies and mosquitoes. For the last ten days there has not been a breath of wind, and very often a heavy dew at night. This all dries in the sun and the steam or heat rising from this and the damp ground and the dense vegetation, all now drying up, without a breath of air to carry it off, almost suffocates one.

Colonel Yate however foresaw that a period of tranquillity like that from which Afghanistan now benefits might bring great improvement to the land.

> Once, however, [he remarks] the place has been populated and cleared, I see no reason why it should not become another garden again. With good land and climate, lots of water, and the hills around to go to in summer, what more could settlers want? At present, certainly Maruchak is nothing but a mass of thistles.

The present improvement of this unproductive land has also brought about a change of climate, which, although hot, is now perfectly healthy.

The settled Turkoman are not the only inhabitants of this region. There are also a good number of more or less settled Afghan herdsmen belonging to

[1] 'Northern Afghanistan,' by Col. C. E. Yate, pp. 220–224.

the Ghilzai group (Shakzei and Otak tribes). The Afghans, especially the Ghilzai, have penetrated the whole northern part of Afghanistan, which proves their great vitality. They are particularly numerous in the valley of the Sar-i-Pul river, where they constitute important groups living in contact with the Usbegs. The Afghans are also to be found beyond Bala Murghab, near Moghor, but in this region they belong to the Achekzei tribe. Taking into consideration the fact that the majority of this tribe lives on the Afghan–Baluchistan borders, where they are definitely settled, it must be admitted that this expansion is in reality a quasi-separation.

There are also some other Afghans of the Durrani group in this region, but beyond Bala Murghab the bulk of the population consists of Jemshedi and Firuzkohi, who belong to a group known by the name of Chahar Aimak. My opinion is that these ethnic elements, considerably different in physical aspect from the pure Hazarah, represent a mixture of Hazarah and Tadjik. Colonel Yate rightly places one of the limits of the country of the Firuzkohi at Band-i-Jackar, near the bridge over the Murghab, at a place where the river is greatly constricted. From there the road leads through Kala-i-Nao, Hadji Khoshnor, and Laman to the Zarmast pass, which is about 8000 feet high. The pass is reached by a good road climbing slopes covered by juniper trees. In this way we returned to Herat.

I cannot flatter myself that I have described vividly enough the diverse aspects of this country where the interest of the traveller is so greatly attracted by man and nature. Many observations of the most varied order cannot, alas, find place in the scope of a lecture, and I had therefore to limit myself to a few rapid notes. My sole object has been to show you, by travelling with you along the new Afghan tracks, the quality and the richness of the ethnic elements and the remarkable effort which is being made to improve the general economic conditions of the country.

DISCUSSION

Before the paper the PRESIDENT (Major-General Sir PERCY COX) said: The lecturer this evening is Monsieur Joseph Hackin. The Citroën Trans-Asiatic Expedition was one of a series undertaken by the Citroën organization, well known both for the quality of their cars and for new inventions in the direction of motor transport, and also for bringing various remote and uncivilized portions of the world within the purview and reach of civilization, not only in the interests of their own organization but also in the interests of science generally. The first expedition was made across the Sahara ten years ago. Soon after that followed one from Algeria, straight across Africa to the Cape. We are to hear about the third expedition.

Two years ago we had, with very great regret, to announce the death of Monsieur Haardt who was the Citroën organizer of this expedition and of the Trans-Saharan Expedition. Unfortunately, he died in China of pneumonia.

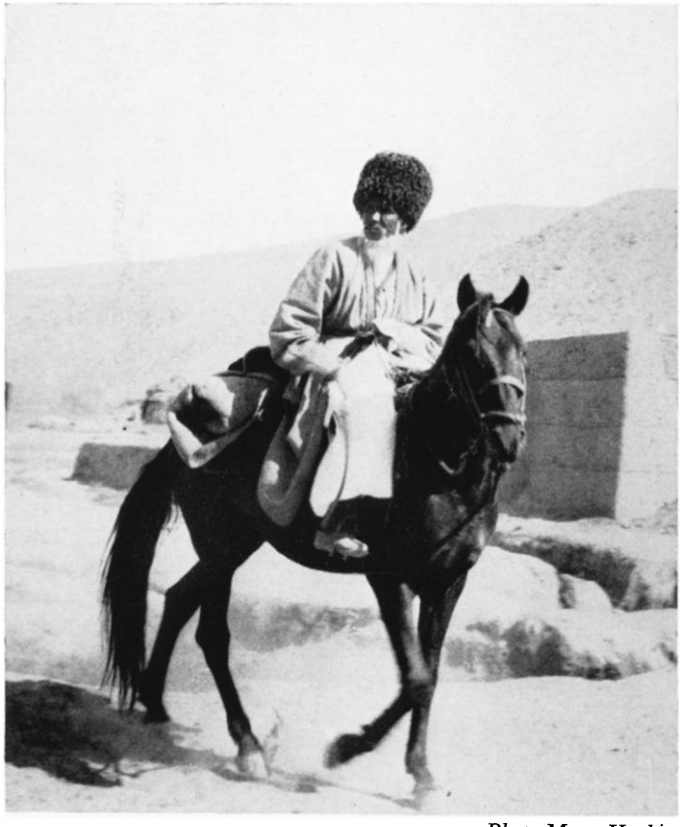
To-night we welcome Monsieur Joseph Hackin, and it is my duty to introduce him and tell you something of his record. He is the Director of the Musée Guimet in Paris, a private museum originated by the gift of a very valuable collection by a M. Guimet, particularly associated with China and the East, Buddhism and Chinese archaeology. Monsieur Hackin is first and foremost an archaeologist, and it seems to me that it has been a great stroke of fortune that the learned Director of that Museum should have succeeded in obtaining leave

Phot. Mme. Hackin

Sariks Turkoman women, Maruchak

Phot. M. Morizet

Sher Jan, son of the Malik of the Dauletzei



Phot. Mme. Hackin

A Turkoman, Bala Murghab