



remained hidden. We struggled on to the top, in all nearly an hour's work of the most exhausting kind. The reward was in the beauty of the spot, the faintly-defined edges of clean snow and the convex surfaces bent slightly back from the steepness on every side to form the most graceful summit I have seen. To the North-east we saw clearly for a minute down the glacier. The rest was cloud, a thin veil, but all too much, inexorably hiding from us Changtse and Chang La.

A disappointment? Perhaps. But that sort of suffering cannot be prolonged in a mind sufficiently interested. Possibly it is never a genuine emotion; rather an automatic reaction after too sanguine hopes. And such hopes had no part in our system. We counted on nothing. Days as we found them were not seldom of the disappointing kind; this one had been of the best, remarkably clear and fine. If we were baffled that was no worse than we expected. To be bewildered was all in the game. But our sensation was something beyond bewilderment. We felt ourselves to be foiled. We were unpleasantly stung by this slap in the face. We had indeed solved all doubts as to the East face and North-east arête, and had solved them quickly. But the way to Chang La, which had seemed almost within our grasp, had suddenly eluded us, and had escaped, how far we could not tell. Though its actual distance from our summit might be short, as indeed it must be, the glacier of our quest appeared now at the end of a receding vista; and this was all our prospect.

Our next plans were made on the descent. With the relaxation of physical effort the feeling of dazed fatigue wears off and a mind duly strung to activity may work well enough. The immediate object was to reach our tents not too late to send a coolie down to the base camp the same evening; on the following morning a reinforcement of four men would enable us to carry down all our loads with sufficient ease, and with no delay we should move the whole party along the next stage back towards Langma La—and thus save a day. The main idea was simple. It still



seemed probable that the elusive glacier drained ultimately Eastwards, in which case its waters *must* flow into the Kharta stream; thither we had now to retrace our steps and follow up the main valley as we had originally intended; it might be necessary to investigate more valleys than one, but there sooner or later a way would be found. Only, time was short. At the earliest we could be back in the Kharta Valley on August 9. By August 20 I reckoned the preliminary reconnaissance should come to an end, if we were to have sufficient time before the beginning of September for rest and reorganisation at Kharta—and such was the core of our plan.

These projects left out of account an entirely new factor. In the early stages of the reconnaissance I had taken careful note of the party's health. One or two of the coolies had quickly fallen victims to the high altitudes; but the rest seemed steadily to grow stronger. Nothing had so much surprised us as the rapid acclimatisation of the majority, and the good effects, so far as they appeared, of living in high camps. Both Bullock and myself left the Rongbuk Valley feeling as fit as we could wish to feel. All qualms about our health had subsided. For my part I was a confirmed optimist, and never imagined for myself the smallest deviation from my uniform standard of health and strength. On August 7, as we toiled over the *nevé* in the afternoon, I felt for the first time a symptom of weariness beyond muscular fatigue and beyond the vague lassitude of mountain-sickness. By the time we reached the moraine I had a bad headache. In the tent at last I was tired and shivering and there spent a fevered night. The next morning broke with undeniable glory. A photograph of our yesterday's conquest must be obtained. I dragged myself and the quarter-plate camera a few steps up to the crest of the moraine—only to find that a further peregrination of perhaps 300 yards would be necessary for my purpose: and 300 yards was more than I could face. I was perforce content with less interesting exposures and returned to breakfast



with the dismal knowledge that for the moment at all events I was *hors de combat*. We learned a little later that Colonel Howard-Bury had arrived the night before in our base camp. It was easily decided to spend the day there with him—the day I had hoped to save; after the long dragging march down the green way, which on the ascent had been so pleasant with butterflies and flowers, I was obliged to spend it in bed.

Three days later, on August 11, our tents were pitched in a sheltered place well up the Kharta Valley, at a height of about 16,500 feet. Two tributary streams had been passed by, the first coming in from the North as being clearly too small to be of consequence, and the second from the South, because wherever its source might be, it could not be far enough to the North. Ahead of us we had seen that the valley forked; we must follow the larger stream and then no doubt we should come soon enough to the glacier of our quest and be able at last to determine whether it would serve us to approach Chang La. August 12, a day of necessary idleness after three long marches, was spent by the coolies in collecting fuel, of which we were delighted to observe a great abundance, rhododendron and gobar all about us, and, only a short way down the valley, the best we could hope for, juniper. The last march had been too much for me, and again I was obliged to keep my bed with a sore throat and swollen glands.

It seemed certain that the next two days must provide the climax or anticlimax of our whole reconnaissance. The mystery must surely now be penetrated and the most important discovery of all be made. A competition with my companion for the honour of being first was, I hope, as far from my thoughts as ever it had been. From the start Bullock and I had shared the whole campaign and worked and made our plans together, and neither for a moment had envied the other the monopoly of a particular adventure. Nevertheless, after all that had passed, the experience of being left out at the finish would not be agreeable to me;



I confess that not to be in at the death after leading the hunt so long was a bitter expectation. But the hunt must not be stopped, and on the morning of August 13, from the ungrateful comfort of my sleeping-bag, I waved farewell to Bullock. How many days would he be absent before he came to tell his story, and what sort of story would it be? Would he know for certain that the way was found? or how much longer would our doubts continue?

It was impossible to stay in bed with such thoughts, and by the middle of the morning I was sitting in the sun to write home my dismal tale. A hint from one of the coolies interrupted my meditations; I looked round and now saw, to my great surprise and unfeigned delight, the approaching figure of Major Morshead. I had long been hoping that he might be free to join us; and he arrived at the due moment to cheer my present solitude, to strengthen the party, and to help us when help was greatly needed. Moreover, he brought from Wollaston for my use a medical dope; stimulated by the unusual act of drug-taking, or possibly by the drug itself, I began to entertain a hope for the morrow, a feeling incommunicably faint but distinguishably a hope.

Meanwhile Bullock, though he had not started early, had got off soon enough in the morning to pitch his tents if all went well some hours before dark, and in all probability at least so far up as to be within view of the glacier snout. As the night was closing in a coolie was observed running down the last steep sandy slope to our camp. He brought a chit from Bullock: "I can see up the glacier ahead of me and it ends in another high pass. I shall get to the pass to-morrow morning if I can, and ought to see our glacier over it. But it looks, after all, as though the most unlikely solution is the right one and the glacier goes out into the Rongbuk Valley."

Into the Rongbuk Valley! We had discussed the possibility. The glacier coming in there from the East remained unexplored. But even if we left out of account



all that was suggested by the East arête of Changtse and other features of this country, there remained the unanswerable difficulty about the stream, the little stream which we had but just failed to cross in the afternoon of our first expedition. How could so little water drain so large an area of ice as must exist on this supposition ?

In any case we were checked again. The mystery deepened. And though the interest might increase, the prospect of finding a way to Chang La, with the necessary margin of time before the end of the month, was still receding, and, whether or no the unexpected should turn out to be the truth, the present situation suggested the unpleasant complication of moving our base once more somewhere away to the North.

On the following day with the gathering energy of returning health I set forth with Morshead : we walked in a leisurely fashion up the valley rejected by Bullock and had the surprising good fortune of a clear sky until noon. I soon decided that we were looking up the glacier where we had looked down on the 7th, as Bullock too had decided on the previous day : at the head of it was a high snow col and beyond that the tip of Changtse. What lay between them ? If a combe existed there, as presumably it did, the bed of it must be high : there could hardly be room, I thought, for a very big drop on the far side of the col. Might not this, after all, be a sufficiently good approach, a more convenient way perhaps than to mount the glacier from its foot, wherever that might be ? The near col, so far as I could judge, should easily be reached from this side. Why not get to the col and find out what lay beyond it ? The time had come to abandon our object of finding the foot of a glacier in order to follow it up ; for we could more easily come to the head of it and if necessary follow it down.

I was sanguine about this new plan, which seemed to have good prospects of success and might obviate the difficulties and inconvenience of shifting the base (possibly again to the Rongbuk side, which I had no desire to revisit)



and, as I still felt far from fit, I was in some hopes now that two more days would bring us to the end of our present labours. Bullock very readily agreed to the proposal. He brought no positive information from the col which he had reached, though he inclined to the idea that the water crossed at Harlung on our journey to Kharta, a moderate stream, but perhaps too clear, might provide the solution of our problem. A fresh bone was now thrown into our stew. A letter arrived from Howard-Bury with an enclosure from Wheeler, a sketch map of what he had seen more particularly East of the Rongbuk Glacier, on which the Eastern branch, with its Western exit, was clearly marked where we now know it to be. It was, unfortunately, a very rough map, professedly nothing more, and was notably wrong in some respects about which we had accurate knowledge. We were not yet convinced that the head of the East Rongbuk Glacier was really situated under the slopes of Everest, and not perhaps under the Eastern arm of Changtse. Still, we had some more pickings to digest. Our business was to reach the nearer pass, and I felt sure that once we had looked over it to the other side whatever doubts remained could be cleared up in subsequent discussion with Wheeler. Meanwhile, I hoped, we should have discovered one way to Chang La, and a sufficiently good one.

It took us in the sequel not two but four days to reach the pass which was ultimately known as Lhakpa La (Windy Gap). The story may serve as a fair illustration of the sort of difficulty with which we had to contend. It was arranged on the 15th that we should meet Bullock's coolies at the divide in the valley; they were bringing down his camp and we could all go on together: but our messenger succeeded in collecting only half their number and much delay was caused in waiting for the others. From here we followed the Western stream, a stony and rather fatiguing walk of two hours or so (unladen) up to the end of the glacier, and then followed a moraine shelf on its left bank,



I hoped we should find an easy way round to the obvious camping place we had previously observed from the Carpo-ri. But the shelf ended abruptly on steep stony slopes, clouds obscured our view, and after our misfortunes in the morning we were now short of time, so that it was necessary to stay where we were for the night. A thick layer of mist was still lying along the valley when we woke, and we could see nothing, but were resolved, nevertheless, to reach the col if possible. We went up, for the best chance of a view, to the crest of the hill above us, and followed it to the summit (6.30 a.m.). The view was splendid, and I took some good photographs; but the drop on the far side was more serious than our hopes had suggested. We tried to make the best of things by contouring and eventually halted for breakfast on the edge of the glacier a long way North of the direct line at 8.45 a.m. Before we went on we were again enveloped in mist, and after stumbling across the glacier in snow-shoes to the foot of an icefall, we turned back at 11 a.m. By that time we were a tired party and could not have reached the col; and even had we reached it, we should have seen nothing. Still we felt when we found our tents again that with all we had seen the day had not been lost, and we determined, before renewing our attempt on Lhakpa La, to push on the camp. There was still time to send a message down to the Sirdar so as to get up more coolies and supplies and move forward next day. From this higher camp we hoped that the col might be reached at an early hour, and in that case it would be possible for a party to cross it and descend the glacier on the other side.

The first coolies who came up in the morning brought a message from the Sirdar to the effect that supplies were short and he could send none up. The rations were calculated to last for another three days, but their distribution had been muddled. However, enough was subsequently sent up to carry us over into the next day, though it was necessary of course to abandon our project of a more distant reconnaissance. Our camp was happily established in the



usual snowstorm. The weather, in fact, was not treating us kindly. Snow was falling in these days for about eight to ten hours on the average and we were relieved at last to see a fine morning.

On August 18, with the low moon near setting, the three of us with one coolie set forth on the most critical expedition of our whole reconnaissance. Failure on this day must involve us in a lamentable delay before the party could again be brought up for the attack; at the earliest we should be able to renew the attempt four days later, and if in the end the way were not established here the whole prospect of the assault in September would be in jeopardy. We scaled the little cliff on to the glacier that morning with the full consciousness that one way or another it was an imperative necessity to reach the col. The first few steps on the glacier showed us what to expect; we sank in to our knees. The remedy was, of course, to put on rackets—which indeed are no great encumbrance, but a growing burden on a long march and on steep slopes most difficult to manage. We wore them for the rest of the day whenever we were walking on snow. About dawn the light became difficult; a thin floating mist confused the snow surfaces; ascents and descents were equally indistinguishable, so that the errant foot might unexpectedly hit the slope too soon or equally plunge down with sudden violence to unexpected depths. Crevasses forced, or seemed to force, us away to the right and over to the rocks of the left bank. We were faced with one of those critical decisions which determine success or failure. It seemed best to climb the rocks and avoid complications in the icefall. There was an easy way through on our left which we afterwards used; but perhaps we did well; ours was a certain way though long, and we had enough trudging that day; the rocks, though covered with snow to a depth of several inches, were not difficult, and a long traverse brought us back to the glacier at about 8.30 a.m.

Our greatest enemy as we went on was not, after all, the



deep powdery snow. The racket sank slightly below the surface and carried a little snow each step as one lifted it; the work was arduous for the first man. But at a slow pace it was possible to plod on without undue exhaustion. The heat was a different matter. In the glacier-furnace the thin mist became steam, it enveloped us with a clinging garment from which no escape was possible, and far from being protected by it from the sun's fierce heat, we seemed to be scorched all the more because of it. The atmosphere was enervating to the last degree; to halt even for a few minutes was to be almost overwhelmed by inertia, so difficult it seemed, once the machinery had stopped and lost momentum, to heave it into motion again. And yet we must go on in one direction or the other or else succumb to sheer lassitude and overpowering drowsiness. The final slopes, about 700 feet at a fairly steep angle, undoubtedly called for greater efforts than any hitherto required of us.

The importance of breathing hard and deeply had impressed itself upon us again and again. I had come to think of my own practice as a very definite and conscious performance adopted to suit the occasion. The principles were always the same—to time the breathing regularly to fit the step, and to use not merely the upper part of the lungs, but the full capacity of the breathing apparatus, expanding and contracting not the chest only, but also the diaphragm, and this not occasionally but with every breath whenever the body was required to work at high pressure. Probably no one who has not tried it would guess how difficult it is to acquire an unconscious habit of deep breathing. It was easy enough to set the machine going in the right fashion; it was another task to keep it running. The moment attention to their performance was relaxed, the lungs too would begin to relax their efforts, and often I woke from some day-dream with a feeling of undue fatigue, to find the cause of my lassitude only in the lungs' laziness. The best chance of keeping them up to their work, I found, was



to impose a rhythm primarily upon the lungs and swing the legs in time with it.

The practice employed for walking uphill under normal conditions is exactly contrary, in that case the rhythm is consciously imposed on the legs and the rest of the body takes care of itself.

During the various expeditions of our reconnaissance I came to employ two distinct methods of working the legs with the lungs. As soon as conscious breathing was necessary it was my custom deliberately to inhale on one step and exhale on the next. Later, at a higher elevation, or when the expenditure of muscular energy became more exhausting, I would both inhale and exhale for each step, in either case timing the first movement of lifting the leg to synchronise with the beginning, so to speak, of the breathing-stroke. On this occasion as we pushed our way up towards Lhakpa La I adopted a variation of this second method, a third stage, pausing a minute or so for the most furious sort of breathing after a series of steps, forty or thirty or twenty, as the strength ebbed, in order to gain potential energy for the next spasm of lifting efforts. Never before had our lungs been tested quite so severely. It was well for us that these final slopes were no steeper. It was difficult and tiring enough as it was to prevent the rackets sliding, though without them we could not possibly have advanced in such snow. But happily the consequences of a slip were not likely to be serious. We were able to struggle on without regarding dangers, half-dazed with the heat and the glare and with mere fatigue, occasionally encouraged by a glimpse of the skyline above us, a clean edge of snow where the angle set back to the pass, more often enveloped in the scorching mist which made with the snow a continuous whiteness, so that the smooth slope, even so near as where the foot must be placed next, was usually indistinguishable. We had proceeded a considerable distance and I was satisfied with our progress, when the leader broke the monotony; he was seen to hesitate in the act of stepping up, to topple



over and fall headlong downwards. This time he had guessed wrong ; his foot had hit unexpectedly against the steepening slope. Somehow he had passed in extreme fatigue from the physical state of stable equilibrium ; he had become such a man as you may "knock down with a feather," and this little misadventure had upset his balance. Mere surprise gave him strength to stop his slide. He raised himself, disgusted, to his feet again and after sundry gruntings the party went on.

Some little way further up Major Morshead, who was walking last in the party, with one brief exclamation to tell us what he intended, quietly untied the rope and remained where he was in his steps, unable to go further.

At length we found ourselves on flatter ground ; the pass was still invisible, how far ahead of us we could not guess. Unexpectedly we came upon the brink of a crevasse. We worked round it, vaguely wondering whether after all our pains we were to meet with many troubles of this sort. And then after a few more steps we were visibly on some edge of things ; we had reached the col itself.

Some twenty minutes later, as we sat on the snow gazing most intently at all that lay about us, Bullock and I were surprised by a shout. A moment later Major Morshead rejoined us, to the great rejoicing of all three.

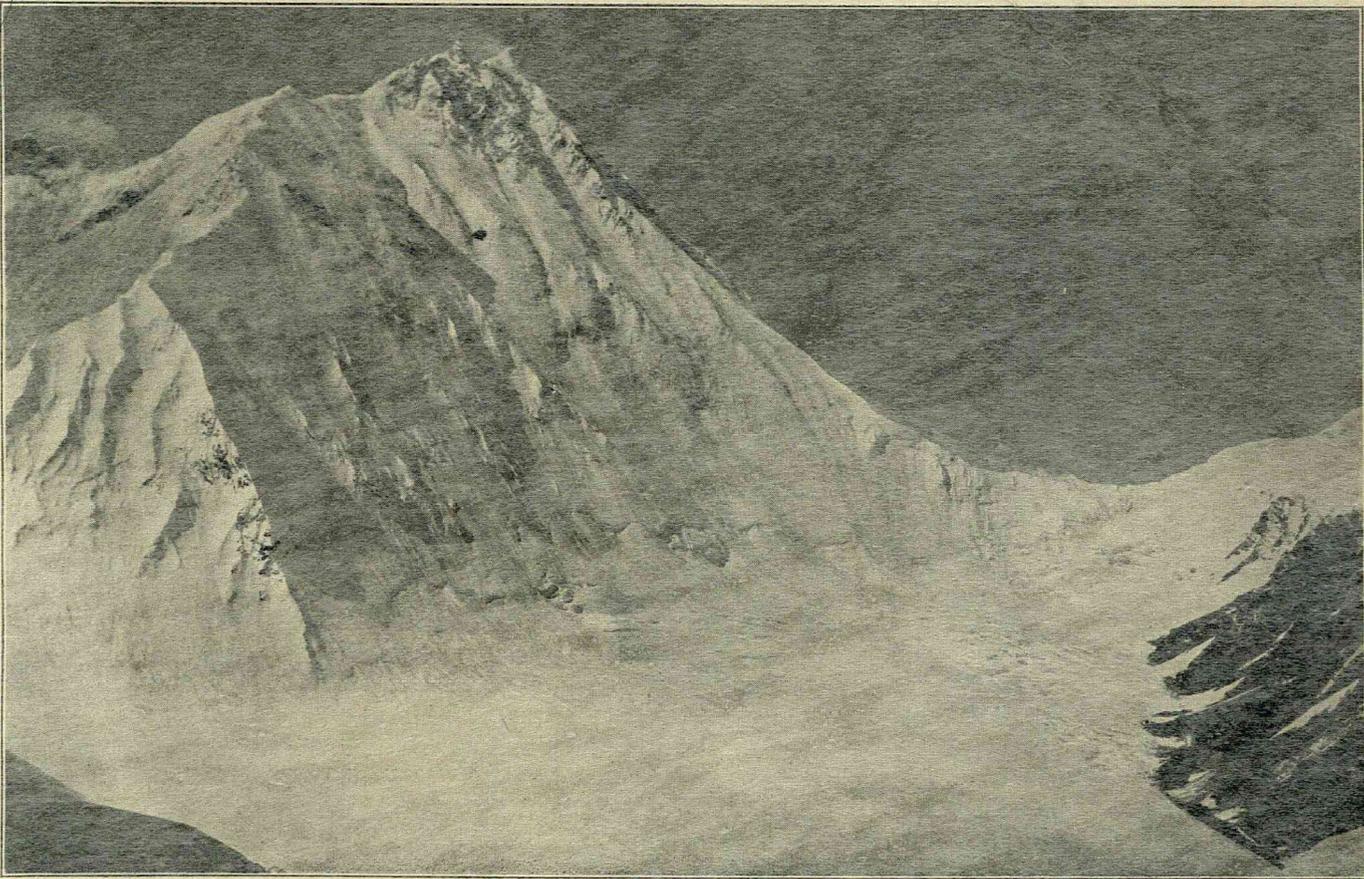
It was about 1.15 p.m. when the first two of us had reached Lhakpa La ; the clouds, which had been earlier only a thin veil, rent occasionally to give us clear glimpses, had thickened perceptibly during the last hour, so that we had now no hope of a clear view. In a sense, despite our early start from a high camp, we were too late. Little was to be seen above our level. The slopes of Everest away on our left were visible only where they impinged upon the glacier. But we were not actually in cloud on the col. The South-facing rocks of Changtse presented their profile, steep and jagged, an imposing spectacle so far up as we could see ; between them and Everest we looked down on a broad bay, the smooth surface of which was only occasionally



broken by large crevasses. The descent to it from where we were could also be seen well enough, and we judged it perfectly simple and not much more than 800 feet.* The East ridge of Changtse had no existence for us; we looked across at what presumably were the splayed-out slopes supporting it. Below them was a narrow glacier (it grew when we crossed it to broader dimensions), shaping its course somewhat to the West of North, joined after losing its white snow-covering by another and cleaner glacier coming steeply down from the left, then apparently bending with this confluent to the right, and finally lost to view. We could see no more; the mountain sides, which must hem it in on the North, remained completely hidden, and for all we had seen the exit of this glacier was still a mystery.

Another great question remained unsolved. We had been able to make out the way across the head of the glacier towards the wall under Chang La; and the way was easy enough. But the wall itself, in spite of some fleeting glimpses and partial revelations, we had never really seen. We conjectured its height should be 500 feet or little more; and it was probably steep. It had been impossible to found an opinion as to whether the col were accessible. Nevertheless, I held an opinion, however flimsy the foundations. I had seen the rim of the col from both sides, and knew that above it on either hand were unserrated edges. When we added to whatever chances might be offered by the whole extent of the wall, which was considerable, the possibilities of finding a way to the col by the slopes of Everest to the South or by those of Changtse to the North, I felt we had enough in our favour. I was prepared, so to speak, to bet my bottom dollar that a way could be found, and was resolved that before we turned homewards this year we must get up from the East. When I thought of the 4,000 feet on the other side, the length combined with the difficulties, the distance that would necessarily separate us there from

* It turned out to be a full 1,200 feet.



NORTH-EAST OF MOUNT EVEREST AND CHANG LA
from Lhakpa La.

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any convenient base and all the limitations in our strength, I could have no reasonable doubt that here to the East lay the best chance of success.

It remained to determine by which of two possible routes we should reach the glacier-head between Lhakpa La and Chang La. Presuming that Wheeler was right we could use the old base at the foot of the Rongbuk Glacier which was only one stage, though a very long one, from Chöbuk, and proceed simply enough by two rough marches and one which should be easier to a camp at the foot of the wall or possibly to the col itself. On the East we could use as an advanced base a place two easy marches from Kharta; from there I reckoned one long day and two easy ones, provided the snow were hard, to Chang La. Against this route was the loss of height in crossing Lhakpa La; and for it the convenience of a good encampment on stones at 20,000 feet, better than anything we might expect to find at a similar elevation on the other side. So far the pros and cons. were evenly balanced. But there was one great and perhaps insuperable obstacle in working from the Rongbuk Valley. We had always found difficulties there in obtaining an adequate supply of fuel. There is no wood at Chöbuk or for some distance below it. A few small bushes grow in a little patch of vegetation by the riverside an hour higher up. But it is a very niggardly supply, and when I thought of the larger scale of the preparations we should now have to make, it became clear that we should have to rely on gobar, which, besides being a more extravagant fuel in the sense that it gives less fire for a given weight than wood, is also difficult to get in the Rongbuk Valley, for little enough is to be found there, and the monastery at Chöyling is a large consumer. On the other hand, in the Kharta Valley we were in a land of plenty. Gobar and rhododendron were to be had within a stone's throw of our present advanced base camp, and a little lower was an abundance of juniper. Food supplies also were better here; fresh vegetables and eggs, luxuries never seen on



the other side, could easily be obtained from Kharta, and even the sheep in this region could be praised at the expense of the Rongbuk breed, which was incomparably skinny; lurking in the thigh of one recently killed we had actually discovered a nugget of fat.

And presuming Wheeler were wrong? In any case we knew enough of the country to be sure that a valley further to the North would offer us little better than the Rongbuk Valley, for it must be situated in the drier area unvisited by the monsoon currents from the Arun. The conclusion was drawn as we came down from Lhakpa La more swiftly than the reader of these arguments might suppose. We had now found a way to approach Chang La—not an ideal way, because it would involve a descent, and not one that could be used immediately; but good enough for our purpose. If laden coolies could not be brought to the Lhakpa at present over so much soft snow they might find the march to their liking later; for good snow at angles not too steep involves far less labour than rougher ground; and might we not expect the snow to harden before long? The whole plan of campaign had been founded upon the belief that September would be the best month for climbing, and our greatest efforts, some sort of an assault upon the mountain, were timed to take place then. We must now proceed upon the assumption that what the wise men prophesied about the matter would come true; and they promised a fine September. About the beginning of the month the monsoon would come to an end; then we should have a succession of bright, clear days to melt the snow and cold, starry nights to freeze it hard. At worst the calm spell would only be broken by a short anger. In September, perhaps a fortnight hence, on these same slopes where now we toiled we should find a solid substance beneath our feet and an easy way.

The abiding thought, therefore, after the first rush downwards on the steep slopes below the col contained a measure of solid satisfaction. We had now brought to an



end our preliminary reconnaissance. Ahead of us was a new phase in our operations, and one which should hold in store for us the finest adventure of all, the climax of all reconnoitring expeditions, that advance which was to bring us as near to the summit as our strength would take us. As we plodded on, retracing our steps, some little satisfaction was highly acceptable. To the tired party even descent seemed laborious. We reached the edge of the glacier where we had come on to it at 5.30 p.m. But the march from there to our lower camp was both long and rough. Major Morshead, who had not been trained with Bullock and me to the pace of such expeditions, had kept up so far in the gamest fashion; but he was now much exhausted. The day ended with a series of little spurts, balancing over the snow-sprinkled boulders along and along the valley, in the dim misty moonlit scene, until at 2 o'clock in the morning we reached our lower camp, twenty-three hours after the early start.

On August 20 we went down to Kharta for ten days' rest and reorganisation. The party was gathering there for the assault, in which all were to help to the best of their powers. Col. Howard-Bury and Mr. Wollaston were there; Dr. Heron came in on the following day, and a little later Major Wheeler. A conversation with this officer, who had been working in the Rongbuk Valley since Bullock and I had left it, was naturally of the highest interest, and he now confirmed what his sketch-map had suggested: that the glacier on to which we had looked down from Lhakpa La drained into the Rongbuk Valley. But this certain knowledge could have no bearing on our plans; we remained content with the way we had found and troubled our heads no more for the present about the East Rongbuk Glacier.



CHAPTER XV

THE ASSAULT

In the agreeable climate of Kharta we were sufficiently occupied with the results of photography and preparations for the future; and there was time besides for unmixed idleness, which we knew how to appreciate. Our thoughts turned often to the weather. Local lore confirmed our expectations for September, and we looked each day for signs of a change. It was arranged, in hope if not in confidence, to move up on the first signs of improvement. Already before we came down to Kharta our Advanced Base Camp had been moved up; it was now situated at about 17,300 feet on a convenient grassy plateau and only a reasonable stage below our 20,000-foot camp, where some light tents and stores had also been left. At these two camps we had, in fact, left everything which we should not absolutely require at Kharta, so that few mountaineering stores would have to be carried forward from the Base when we came up again. Our first task would be to supply the Advanced Base with food and fuel, and a start had already been made by collecting here a pile of wood, nominally thirty loads. Transport in any case was not likely to be a difficulty in the early stages. Local coolies could easily be hired, and Howard-Bury was to follow us up after a short interval with all available strength to help in every possible way.

The first object which our plans must include was, of course, to reach Chang La; by finding the way to this point we should establish a line of attack and complete a stage of our reconnaissance. Secondly we must aim at reaching the North-east Shoulder. In so far as it was an object of reconnaissance to determine whether it was possible to climb



Mount Everest, our task could never be complete until we had actually climbed it; but short of that it was important to have a view of the final stage, and could we reach the great shoulder of the arête we should at least be in a better position to estimate what lay between there and the summit. Finally we saw no reason to exclude the supreme object itself. It would involve no sacrifice of meaner ends; the best would not interfere with the good. For if it should turn out that the additional supplies required for a longer campaign were more than our coolies could carry, we would simply drop them and aim less high.

In organising the assault we had first to consider how our camps could be established, at Lhakpa La or perhaps better beyond it at a lower elevation, at Chang La, and finally as high as possible, somewhere under the shoulder, we thought, at about 26,500 feet. From the camp on Chang La we should have to carry up ten loads, each of 15 lb., which would provide tents enough, and sleeping-sacks and food for a maximum of four Sahibs and four coolies; sixteen coolies were allowed for this task; twelve therefore would have to return on the day of their ascent and sleep at Chang La, and on the assumption that they would require an escort of Sahibs who must also sleep at this camp, four small tents must remain there, making six in all to be carried up to this point. The lower end of the ladder must be so constructed as to support this weight at the top. It was comparatively a simple matter to provide the earlier camps. The first above the advanced base—that at 20,000 feet—could be filled before we moved up to sleep there, the coolies returning on the same day whenever they carried up loads. And the same plan could be adopted for the second at Lhakpa La; only one journey there, I calculated, would be required before we started in force from the 20,000-foot camp to go straight ahead without delay. The crux would lie in the stage from Lhakpa La to Chang La. At the most we should have twenty-three coolies, sixteen who had been all along with the climbing party,



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longer to be the fit man he was at the end of July. And for my part I began to experience a certain lack of exuberance when going up hill. I came to realise that all such efforts were unduly exhausting; my reserve of strength had somehow diminished. The whole machine, in fact, was running down; the days continued to pass with their cloud and rain and snow, always postponing our final effort to a later date and a colder season; and with them our chances of success were slowly vanishing.

When at last the weather cleared, it was evident that the fate of our enterprise would be decided by the sun's power to melt the snow. In a subsequent chapter I shall have more to say about the snow's melting; it may suffice to remark here that, before we left the Advanced Base, I had good reason to expect that we should meet adverse conditions, and was resolved at the same time that nothing was to be gained by waiting. The coolies were lightly laden up to the First Advanced Camp and sufficiently unfatigued to proceed next day. On the 20th, therefore, leaving Bullock to accompany Wheeler, Morshead and I set forth to get fourteen loads up to Lhakpa La. We had one spare coolie who carried no load, and Sanglu, who was now our acting Sirdar, four of us in all, to break the trail for the loaded men. Snow-shoes were not carried because there were not enough to go round. Though our prospects of reaching a high point on Everest were already sufficiently dim, I intended to carry out the original plan until obliged by circumstances to modify it; it might prove necessary to spend an extra day in reaching Chang La, and in that case we could perhaps afford to stop short of Lhakpa La and establish our camp below its final slopes. But if the strain on this first day was likely to be severe, I argued that the coolies could rest to-morrow, and that the second journey in frozen tracks would be easy enough. That we should be passing the night a few hundred feet higher (at 22,500 feet) was a relatively unimportant consideration. The great matter was to put heart into the coolies; it would be infinitely more encouraging to reach the crest with a



sense of complete achievement, to see the clear prospect ahead and to proceed downwards on the other side.

Our start at an early hour on the 20th was propitious enough. It was the same moonlit glacier of our expedition a month before as we made good our approach to its surface. But the conditions were altered. For the first time since we had come to these mountains we experienced the wonderful delight of treading snow that is both crisp and solid. We walked briskly over it, directly towards Mount Everest, with all the hope such a performance might inspire. The night was exceedingly cold and there was no untoward delay. In less than an hour we were at the foot of the icefall. We were determined on this occasion not to avoid it by the rocks of the left bank, but to find a quicker way through the tumbled ice. At first all went well. A smooth-floored corridor took us helpfully upwards. And then, in the dim light, we were among the crevasses. To be seriously held up here might well be fatal to our object, and in the most exciting kind of mountaineering adventures we had the stimulus of this thought. We plunged into the maze and struggled for a little time, crossing frail bridges over fantastic depths and making steps up steep little walls, until it seemed we were in serious trouble. One leap proposed by the leader proved too much for some of the laden coolies and a good deal of pushing and pulling was required to bring them over the formidable gap. We had begun to waste time. Halted on a sharp little crest between two monstrous chasms Morshead and I discussed the situation, and thereafter gravely proceeded to reconnoitre the ground to our left. In ten minutes we came to another corridor like the first, which brought us out above the icefall.

We were well satisfied with our progress as we halted at sunrise, and it was a pleasant change to get our feet out of the snow and knock a little warmth into chilled toes. But our confidence had ebbed. Even as we entered the icefall our feet had occasionally broken the crust; as we came out of it we were stamping a trail.



Dorji Gompa, our unladen coolie, and perhaps the strongest man of all, took the lead when we went on, and plugged manfully upwards. But already the party was showing signs of fatigue. One coolie, and then two others, fell out and could not be induced to come further. I sent Dorji Gompa back to bring on one of their loads. Morshead, Sanglu and I took turns ahead and soon came to the worst snow we had encountered anywhere. In it no firm steps could be stamped by the leaders to save the coolies behind, and each man in turn had to contend with the shifting substance of fine powder. The party straggled badly. It was necessary for some of us to press on and prove that the goal could be reached. Many of the men were obliged to halt at frequent intervals. But time was on our side. Gradually the party fought its way up the final slopes. As we approached the pass I looked back with Morshead over the little groups along our track and saw some distance below the last moving figure another lying huddled up on the snow. I soon learnt the meaning of this: it was Dorji Gompa who lay there. He had carried on not one load as I had asked him, but two, until he had fallen there dazed and exhausted.

At length eleven loads reached the pass and two more were only 800 feet lower. If we had not done all we set out to do I was satisfied we had done enough. We had established tracks to Lhakpa La which should serve us well when they had frozen hard, and not too many loads remained below to be brought up two days later.

We now obtained a clear view of Chang La; it was possible to make more exact calculations, and it was evident we must modify our plans. We saw a wall of formidable dimensions, perhaps 1,000 feet high; the surface was unpleasantly broken by insuperable bergschrunds and the general angle was undoubtedly steep. The slopes of Everest to the South were out of the question, and if it were possible to avoid a direct assault by the North side the way here would be long, difficult and exceedingly laborious. The



wall itself offered the best chance, and I was in good hopes we could get up. But it would not be work for untrained men, and to have on the rope a number of laden coolies, more or less mountain sick, conducted by so small a nucleus as three Sahibs, who would also presumably be feeling the effects of altitude, was a proposition not to be contemplated for a moment. We must have as strong a party as possible in the first place, simply to reach the col, and afterwards to bring up a camp, if we were able, as a separate operation. With this idea I selected the party. Wollaston felt that his place of duty was not with the van; only Wheeler besides had sufficient mountaineering experience, and it was decided that he alone should accompany Bullock and myself on our first attempt to reach the col. Nevertheless, it seemed undesirable to abandon so early the hope that Bury and Morshead would be of use to us later on; and Wollaston clearly must start with us from the 20,000-foot camp where all had gathered on the 20th.

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

There was no question of bustling off before dawn on



the 23rd, but we rose early enough, as I supposed, to push on to Chang La if we were sufficiently strong. Morshead and I in a Mummery tent had slept well and I congratulated myself on an act of mutilation in cutting two large slits in its roof. The rest had not fared so well, but seemed fit enough, and the wonderful prospect from our camp at sunrise was a cheering sight. With the coolies, however, the case was different. Those who had been unwell overnight had not recovered, and it was evident that only a comparatively small number would be able to come on; eventually I gathered ten, two men who both protested they were ill casting lots for the last place; and of these ten it was evident that none were unaffected by the height and several were more seriously mountain-sick.* Under these circumstances it was necessary to consider which loads should be carried on. Bury, Wollaston and Morshead suggested that they should go back at once so as not to burden the party with the extra weight of their belongings, and it seemed the wisest plan that they should return. Certain stores were left behind at Lhakpa La as reserve supplies for the climbing party. I decided at an early hour that our best chance was to take an easy day; after a late start and a very slow march we pitched our tents on the open snow up towards the col.

It might have been supposed that in so deep a cwm and sheltered on three sides by steep mountain slopes, we should find a tranquil air and the soothing, though chilly calm of undisturbed frost. Night came clearly indeed, but with no gentle intentions. Fierce squalls of wind visited our tents and shook and worried them with the disagreeable threat of tearing them away from their moorings, and then scurried off, leaving us in wonder at the change and asking what next to expect. It was a cold wind at an altitude of 22,000 feet, and however little one may have suffered, the atmosphere discouraged sleep. Again I believe I was more

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



fortunate than my companions, but Bullock and Wheeler fared badly. Lack of sleep, since it makes one sleepy, always discourages an early start, and hot drinks take time to brew; in any case, it was wise to start rather late so as to have the benefit of warm sun whenever our feet should be obliged to linger in cold snow or ice steps. It was an hour or so after sunrise when we left the camp and half an hour later we were breaking the crust on the first slopes under the wall. We had taken three coolies who were sufficiently fit and competent, and now proceeded to use them for the hardest work. Apart from one brief spell of cutting when we passed the corner of a bergschrund it was a matter of straightforward plugging, firstly slanting up to the right on partially frozen avalanche snow and then left in one long upward traverse to the summit. Only one passage shortly below the col caused either anxiety or trouble; here the snow was lying at a very steep angle and was deep enough to be disagreeable. About 500 steps of very hard work covered all the worst of the traverse and we were on the col shortly before 11.30 a.m. By this time two coolies were distinctly tired, though by no means incapable of coming on; the third, who had been in front, was comparatively fresh. Wheeler thought he might be good for some further effort, but had lost all feeling in his feet. Bullock was tired, but by sheer will power would evidently come on—how far, one couldn't say. For my part I had had the wonderful good fortune of sleeping tolerably well at both high camps and now finding my best form; I supposed I might be capable of another 2,000 feet, and there would be no time for more. But what lay ahead of us? My eyes had often strayed, as we came up, to the rounded edge above the col and the final rocks below the North-east arête. If ever we had doubted whether the arête were accessible, it was impossible to doubt any longer. For a long way up those easy rock and snow slopes was neither danger nor difficulty. But at present there was wind. Even where we stood under the lee of a little ice cliff it came in fierce



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gusts at frequent intervals, blowing up the powdery snow in a suffocating tourbillon. On the col beyond it was blowing a gale. And higher was a more fearful sight. The powdery fresh snow on the great face of Everest was being swept along in unbroken spindrift and the very ridge where our route lay was marked out to receive its unmitigated fury. We could see the blown snow deflected upwards for a moment where the wind met the ridge, only to rush violently down in a frightful blizzard on the leeward side. To see, in fact, was enough; the wind had settled the question; it would have been folly to go on. Nevertheless, some little discussion took place as to what might be possible, and we struggled a few steps further to put the matter to the test. For a few moments we exposed ourselves on the col to feel the full strength of the blast, then struggled back to shelter. Nothing more was said about pushing our assault any further.

It remained to take a final decision on the morning of the 25th. We were evidently too weak a party to play a waiting game at this altitude. We must either take our camp to the col or go back. A serious objection to going forward lay in the shortage of coolies' rations. Had the men been fit it would not have been too much for them to return, as I had planned, unladen to Lhakpa La and reach Chang La again the same day. I doubted whether any two could be found to do that now; and to subtract two was to leave only eight, of whom two were unfit to go on, so that six would remain to carry seven loads. However, the distance to the col was so short that I was confident such difficulties could be overcome one way or another.

A more unpleasant consideration was the thought of requiring a party which already felt the height too much to sleep at least a 1,000 feet higher. We might well find it more than we could do to get back over Lhakpa La, and be forced to make a hungry descent down the Rongbuk Valley. There would be no disaster in that event. The crucial matter was the condition of the climbers. Were



we fit to push the adventure further? The situation, if any one of the whole party collapsed, would be extremely disagreeable, and all the worse if he should be one of the Sahibs, who were none too many to look after the coolies in case of mountaineering difficulties. Such a collapse I judged might well be the fate of one or other of us if we were to push our assault above Chang La to the limit of our strength. And what more were we likely to accomplish from a camp on Chang La? The second night had been no less windy than the first. Soon after the weather cleared the wind had been strong from North-west, and seemed each day to become more violent. The only signs of a change now pointed to no improvement, but rather to a heavy fall of snow—by no means an improbable event according to local lore. The arguments, in fact, were all on one side; it would be bad heroics to take wrong risks; and fairly facing the situation one could only admit the necessity of retreat.

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



CHAPTER XVI

WEATHER AND CONDITION OF SNOW

Without consulting the meteorologist at Simla it is difficult to accept assertions about the monsoon as ultimate truth. Beyond a general, rather vague, agreement as to what should normally be expected, opinions differ not a little as to the measure and frequency of divergences from the norm. And individuals who observe in one locality more or less than they hope or expect are apt to forget that their dearth or plenty may be elsewhere compensated by capricious incidence. Nevertheless it seems certain that this year's rainfall in North-east India was above the normal both in amount and duration. "We had good rain," people said, and I was tempted to reply, "We had bad snow." Travelling through India I frequently asked questions on this point, and almost invariably heard of an unusually bountiful rainfall, seldom of one which was merely sufficient. Inhabitants of Darjeeling, who have observed the hills in the changing seasons for many years, told me that it was almost unheard of that so much snow should fall in September and lie so low. The general tenor of such remarks may probably be applied to an area including not only Mount Everest itself and the great peaks in its neighbourhood, but also a considerable tract of country to the North. The monsoon, according to Tibetan information, started perhaps a little later than usual, but was still more late in coming to an end; the Tibetans ordinarily lie with an object, and there could be no object in deceiving us about the weather. It may be concluded the year was abnormally wet, though to what extent on Everest itself can hardly be divined.



During our outward journey through Sikkim we saw nothing of the high peaks. It was not until the day of our march to Phari Dzong (May 28) that we had a clear view of the snows, and we had then the good fortune to see Chomolhari late in the morning. But Chomolhari and the range to the North of it were less visited by clouds than the peaks further South. Pawhunri, Kanchenjunga, Chomiomo were less often visible, and even at this early season we began to observe the usual habit of clouds to rise from the valleys or to form about the summits at an early hour, to be dissipated not before evening. The weather was not necessarily bad because the peaks were veiled. When we first saw Everest from Kampa Dzong on June 6, it was obscured some three hours after sunrise, but the weather seemed fine: and on two subsequent days we made the same observation. On June 13, from the hills above Shiling, Bullock and I were trying to make out the Everest group through glasses for about three hours. When first we looked in that direction, it appeared that a storm was in progress, with dark clouds drifting up from the West; but Kanchenjunga at the same time was a glorious sight, and all the mountains were clear before sunset. The most splendid of the distant views was from Ponglet on June 19: we were up our hill half an hour after sunrise and half an hour later there was nothing to be seen. There may have been malice in the clouds that day. It was radiantly fine where we were; but in the afternoon we came under the edge of a thunderstorm which drenched the main body of the Expedition as they were approaching Tingri; and there was a definite break in the weather at this time.

I suppose this break may be taken as the forerunner of the monsoon on Mount Everest. Storms there may have been before; but, generally speaking, it had been fine over the mountains since the beginning of June, and though the evidence is slight enough it seems probable that Everest received little or no snow before June 20. When first we saw it, a few days later, from the Rongbuk



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Glacier, it was still comparatively black. It appeared a rocky mass with a white arm to the right, some permanent snow on the ledges and in the gullies of the face turned Northwards in our direction and some snow again on the high North-east arête; but with no pretensions to be a snow-mountain, a real sugar-cake as it seemed afterwards to become. We were lucky in having a few fine days at the outset of our reconnaissance. The conditions then were very different from those which obtained later. The recent snow must have melted quickly; we found clean ice on an East-facing slope at 21,000 feet and also at a gentler angle on one facing West. On Ri-ring the slopes were generally covered with snow near the crest, thinly but sufficiently, or we should never have got up; near the summit we found ice on both sides, North and South. It is impossible to say up to what height one might have found ice in June. Appearances suggested that on all but the steepest slopes above 23,000 feet the surface was hard snow rather than ice.

It was on the day following our ascent of Ri-ring, July 6, that we first experienced a real snowfall; and we woke next morning to find 3 or 4 inches covering the ground. In so far as an exact date can be ascribed to what is hardly a single event, July 6-7 may be taken as the beginning of the monsoon. We imagined at first that this snowfall was an important matter, sufficient to prevent climbing at any considerable height for several days. But from subsequent observations we came to treat such snowfalls with a certain degree of contempt. It was more often than not the case during the whole of July until the date of our departure that snow fell during the day—sometimes perhaps for a comparatively short period between noon and sunset, not seldom for many hours, intermittently during the day from the middle of the morning, and continuing into the night. But it was often so far as we were concerned a harmless phenomenon. Snow was precipitated from clouds so thin that they were easily penetrated by the sun's heat; it



melted where it lay, and the moisture so readily evaporated that the snow had hardly stopped falling before the ground was dry. One might suppose that a few hundred feet higher, where the snow could be seen to lie where it fell, the effects would be more severe; but it was remarkable after half a day's unceasing precipitation of this fine granular snow that one might go up early next morning, perhaps to 20,000 feet, and find no more than a thin covering of 2 or 3 inches on the stones.

In saying that this sort of weather was harmless, I am not denying that it hindered our operations; but from the point of view merely of the climber it was remarkably innocuous. A case in point is our ascent of Ri-ring. As we were nearing the summit a thunderstorm gathered to the North and dark clouds came up on every hand, threatening a violent disturbance. I have related in an earlier chapter how we hurried down, expecting at the least a cold unpleasant wind and some nasty snow showers; but the air remained calm and the temperature warm and such grains of snow as fell were hardly remarked in our flight. A more disagreeable experience was our first journey to the col from which we afterwards looked into the West Cwm of Everest; we reached the pass in the teeth of a wind which drove the snow into our faces; but the weather had no real sting, and the wind, though cold, seemed to touch us lightly. Wind, in fact, was never an enemy to be feared during the whole period of the monsoon, and snowstorms, though they prevented more than one expedition, never turned us back. The delays in our reconnaissance caused by bad weather were of course considerable; we were forced to push our camps higher than would have otherwise been necessary, and often found ourselves hurrying after a start before dawn in a desperate race with the clouds to reach a view-point before the view had disappeared. And the precipitation of snow on the glaciers forced us invariably to wear snow-shoes on *nevé*, and consequently limited the numbers in our parties.



I have already alluded to a more serious snowfall which took place from July 20 to 25. Another occurred during the first days of August and another again on August 20 and 21, when snow came down below 16,000 feet. In September, towards the end of the monsoon, the weather was more monotonously malicious and the snowfall tended to be heavier; I find two heavy falls noted particularly in my diary. But on the whole it was the habit of snow to fall lightly. It is remarkable, when one calls to mind such a big snowfall as may occur during the climbing season in the Alps before the weather is resolved to be fine, how little snow by comparison fell on any one day in the region of Mount Everest. And perhaps in the end the slopes were more laden by the smaller precipitations which deposited a daily accretion.

We naturally sought an answer to the interminable query as to how much melting took place at the highest altitudes. Melting of course was always quicker on rocks. But even on the glaciers it was remarkably rapid whenever the sun shone brightly, and we were more than once surprised after a period of cloudy weather with constant snow showers to find how much the snow had consolidated. It seemed to us on more than one occasion that while snow had been falling at our camps and on the lower peaks, Everest itself must have escaped. But, generally speaking, after July 6 the mountain was remarkably white and became increasingly whiter, and only at the least two perfectly fine days, which rarely came together, made any perceptible difference. It was remarkable how little ice was ever observable on the steep Eastern face, where one would expect to see icicles hanging about the rocks. It is my own impression for what it is worth, and its value I fear is small, that though snow will melt readily enough low down, at least up to 23,000 feet during the warmer weather even on cloudy days, at greater altitudes, perhaps above 25,000 feet, it rarely melts even in bright sunshine. In September this year I doubt if it melted at all above 23,000 feet after the weather cleared.



At lower elevations the direction and angle of the slope made all the difference. After one fine day the snow on a steep East slope had solidified to a remarkable degree at about 20,000 feet; on a North-facing slope at a similar elevation it had been quite unaffected; on flat surfaces 1,000 feet higher a perceptible crust had formed, but the snow remained powdery below it as on the day when it fell. After three and four fine days the snowy surface of a glacier was absolutely hard at about 20,000 feet and remained solid in the afternoon. Fifteen hundred feet higher we were breaking a hard crust and sinking in a foot or more. This condition may have been partly due to the local behaviour of clouds, which were apt to cling about a ridge overlooking the glacier and cast a shadow on this part of it. But higher, on more open ground, we met the same condition; and again the slopes facing North preserved a powdery snow which never changed before it was blown down in avalanches. Perhaps the most convincing phenomena were the powdery snow high up on the Eastern slopes under the North col and the snow on the Western slopes at a similar elevation under Lhakpa La, which was hardly more solid, while 1,000 feet lower we found excellent snow. It is difficult to resist the conclusion that altitude is a determining factor in the sun's power of melting. It is possible that a line might always be drawn on any given day above which the temperature of the air is too cold for snow to melt where it has fallen on snow, and another to meet the case where it covers rocks. From our all too limited observations in June I should judge that in the middle of summer such imaginary lines would be above the height of Everest, but in other and cooler seasons we should quickly find them lower and a long way below the summit.

In close connection with the snow's melting we had to consider the possibility of avalanches. Our observations on this head were so meagre that I can only make with the greatest diffidence a few statements about them. It is astonishing to reflect how seldom we either saw or heard



an avalanche, or even noticed the débris of one under steep slopes which had been laden with snow. Only on two occasions, I believe, were we confronted in practice with the question as to whether a slope could safely be crossed. The first was on August 7 in ascending the peak Carpo-ri, of which I have previously made mention. The heavy snowfall at the beginning of the month had ceased during the night August 4-5; the following days had been warm but cloudy, and on both there had been prolonged snow showers of the lighter sort in the afternoon and evening. On the night of August 6 we had hard frost at 17,500 feet, and there was a considerable sprinkling of fresh snow on the stones of the moraine. Between the col and the summit we met some very steep snow slopes on the South side: we carried no clinometer and I shall not venture to estimate their angles of inclination. It was on this occasion, as I have narrated, that in crossing a shallow scoop I was very much afraid of an avalanche, but was able to choose a safe line where we were protected and helped by an island of rocks. The snow here was inclined to be powdery; but it had solidified in some degree and, where we had to tread it, adhered sufficiently to the slope so as to give one a distinct confidence that it would not slide off wherever it might be crossed. Above this place we were able to avoid danger by following an edge where the snow was not so deep; but here again I noticed with surprise the adhesion between new snow and old. The ice below was not solid and smooth, but frothy and rough, and easily penetrated by a strong blow of the axe; it seemed to have been formed very quickly. The snow showed no inclination to slide off, though it was not of the substance in which a secure step could be made: and I concluded that the process of assimilation between the old surface and the new snow must proceed very rapidly whenever the temperature was warm enough. On the final slope, which was even steeper, more snow was lying—it was a more powdery substance: I was able again to escape danger on an edge dividing two faces; but it was surprising



that no avalanche had already taken place and that the snow contrived to stay where it was.

The other occasion when we had to face and determine the possibility of an avalanche was in traversing the slopes to the North Col. Here our feet undoubtedly found a solid bed to tread upon, but the substance above it was dubiously loose. It was my conviction at the time that with axes well driven in above us we were perfectly safe here. But on the way down we observed a space of 5 yards or so where the surface snow had slid away below our tracks. The disquieting thoughts that necessarily followed this discovery left and still leave me in some doubt as to how great a risk, if any, we were actually taking. But it is natural to suppose that at a higher elevation or in a cooler season, because the snow adheres less rapidly to the slopes on which it lies, an avalanche of new snow is more likely to occur.

TEMPERATURE

Before attempting to draw conclusions as to the relative chances of finding favourable conditions between one month and another, a few words must be said about temperature.

So far as the temperature of the air was concerned, we experienced no severe cold and suffered no hardships from first to last. I do not mean to affirm that it was always warm. We welcomed frost at nights as one does in the Alps. One night so early as July 18, in a camp above 19,000 feet, was exceptionally cold. At our two last camps in September the thermometer went down to two or three degrees below zero (Fahr.) and the wind at the final camp made it more difficult to keep warm; with as little protection as the coolies had, I should no doubt have shivered in my tent. The air also seemed very cold before sunrise on September 20, though we were walking fast; but it did not bite the tip of my nose or ears or cause any disagreeable result. In general it may be said that there could be no difficulty in providing equipment against any cold we encountered. Heat was a much more dangerous enemy, as I indicated



in describing our first ascent to Lhakpa La. Personally I never felt the sun's power on my head, but I felt it on my back so early as 8 a.m. as a definite attack on my energy and vital power, and more than once, though the sun was not shining, in crossing a glacier late in the day I was reduced from a state of alert activity to one of heavy lassitude.

The temperature of the snow is another consideration of very great importance. Even in July I felt the snow to be cold in the middle of the day towards the summit of Ri-ring, and when wearing snow-shoes in fresh snow under 20,000 feet coolies and all felt the cold in their feet. Later I apprehended a real danger from this source. The coolies were encouraged to anoint their feet with whale oil, and we avoided accident and even complaint: but I always admired their resistance to cold. Personally, though I am not particularly a cold-footed person, I took the precaution of wearing two pairs of long socks which were both new and thick, and a third from which, unfortunately, the toes had to be amputated owing to the timid miscalculation of my bootmaker: this equipment sufficed and I found my feet perfectly warm, while one of my companions was obliged to pull off a boot in order to restore circulation, and the other went on with numb feet and barely escaped frost-bite. And I must again emphasise the fact that this was on an Eastern slope well warmed by the sun in the middle of the morning and at an altitude no higher than about 22,500 feet. It may readily be concluded that forethought and care are in no respect more necessary than in guarding against frozen feet among a large party at the highest altitudes. And the difficulty of guarding against this danger might well determine the limits at either end of the warmest weather within which an assault should be launched on Everest itself or any one of the half-dozen or so highest peaks.

THE BEST SEASON FOR CLIMBING

It will hardly be doubtful from the whole tendency of my preceding remarks about weather and conditions that



my opinion inclines decisively to the earlier rather than the later season as offering the best chances of climbing Mount Everest. We cannot of course assume that because September was a bad month this year it will always be a bad month. But supposing the monsoon were to end punctually and a fair spell to have set in by the first day of September—even then it appears to me improbable that the fresh snow fallen during the monsoon would sufficiently melt near the top of the mountain two and a half months after midsummer. As to the prospects of wind, we can only be content with the statement that in this particular year the wind after the end of the monsoon would alone have defeated even the most determined attempt to reach the summit. A wind strong enough to blow up the snow must always, I believe, prevent an ascent. A superman might perhaps be found, but never a party of men whose endurance at high altitudes would warrant the risk of exhaustion in struggling for long hours against such adverse circumstances. For the earlier season it may be said again, as a simple observation upon which little enough can be built, that the appearance of the clouds before the monsoon did not suggest wind, but rather a calm air on the summit. What precisely the conditions may be, for instance, in May and June, 1922, or what we ought normally to expect, cannot be determined with certainty. Will the whole of the snow fallen during the monsoon of 1921 have melted before the next moonsoon, and if so by what date? Will the amount of snow on the mountain be the same in June, 1922, as twelve months before? Or will black and white appear in altered proportions? And if the snow has melted, where will ice be found? It might well be that under the North Col all the steeper slopes will have lost their snow. And what of the final arête? One conjecture seems as good as another, and the experience of more travelled mountaineers will suggest the most probable answer to these questions with an instinct less fallible than mine. Nevertheless, I think it may be said that the chances are all in favour of the earlier



season. We know, for instance, about this year that snow must have melted since the last monsoon and actually was melting fast in June, but the summer's snow does not always melt before the winter—not this year, for instance: the chances, therefore, of finding it melted in June are better than those of finding it melted in September. It may be contended that it might then have melted too much so that a party would find ice where they would wish to find snow. But one must prefer the lesser of two evils. Ice is far from an insuperable obstacle on Mount Everest; almost anywhere above Chang La crampons would overcome it: but powdery snow, in case the snow has melted too little, is a deadly handicap. Finally, the earlier is the warmer season with less danger to vulnerable feet and requiring a lighter equipment.



CHAPTER XVII

THE ROUTE TO THE SUMMIT

The reader who has carefully followed the preceding story will hardly have failed to notice that the route which has been chosen as the only one offering reasonable chances of success remains still very largely a matter of speculation. But the reconnaissance, unless it were actually to reach the summit, was obliged to leave much unproved, and its value must depend upon observations in various sorts and not merely upon the practice of treading the snow and rocks. Speculation in this case is founded upon experience of certain phenomena and a study of the mountain's features; and it is by relating what has been only seen with known facts that inferences have been drawn.

It may perhaps be accounted a misfortune that the party of 1921 did not approach Chang La by the East Rongbuk Glacier. The Lhakpa La proved a bigger obstacle than was expected. But in conditions such as we hope to find before the monsoon, this way would have much to recommend it. It avoids all laborious walking on a dry glacier, and with hard snow the walk up to the pass from the camp on stones at 20,000 feet should not be unduly fatiguing. Still the fact remains that the descent from the Lhakpa La on to the East Rongbuk Glacier is not less than 1,200 feet. Would it not be better to follow up this glacier from the Rongbuk Valley? The absence of wood on this side need not deter the party of 1922. For them plenty of time will be available sufficiently to provide their base with fuel, and the sole consideration should be the easiest line of approach; and though no one has traversed the whole length of the East Rongbuk Glacier, enough is known to



choose this way with confidence. Here, as on other glaciers which we saw, the difficulties clearly lie below the limit of perpetual snow, and the greater part of them were avoided or solved by Major Wheeler, who found a practicable way on to the middle of the glacier at about 19,000 feet, and felt certain that the medial moraine ahead of him would serve for an ascent and be no more arduous than the moraines of the West Rongbuk Glacier had proved to be. The view of this way from the Lhakpa La confirmed his opinion, and though it may be called a speculation to choose it, whereas the way from the East has been established by experiment, it is a fair inference from experience to conclude that the untraversed section of the East Rongbuk Glacier, a distance which could be accomplished very easily in one march if all went well, will afford a simple approach to Chang La.

The Eastern wall, about 1,000 feet high, by which the gap itself must be reached, can never be lightly esteemed. Here reconnaissance has forged a link. But those who reached the col were not laden with tents and stores; and on another occasion the conditions may be different. There may be the danger of an avalanche or the difficulty of ice. From what we saw this year before the monsoon had brought a heavy snowfall it is by no means improbable that ice will be found at the end of May on the steepest slope below Chang La. In that case much labour will be required to hew and keep in repair a staircase, and perhaps fix a banister, so that the laden coolies, not all of whom will be competent ice-men, may be brought up in safety.

The summit of Mount Everest is about 6,000 feet above Chang La; the distance is something like $2\frac{1}{2}$ miles and the whole of it is unexplored. What grounds have we for thinking that the mountaineering difficulties will not prove insuperable, that in so far as mere climbing is concerned the route is practicable? Two factors, generally speaking, have to be considered: the nature of the ground and the general angle of inclination. Where the climber is confined to a narrow crest and can find no way to circumvent an



obstacle, a very small tower or wall, a matter of 20 feet, may bar his progress. There the general angle may be what it likes: the important matter for him is that the angle is too steep in a particular place. But on a mountain's face where his choice is not limited to a strict and narrow way, the general angle is of primary importance: if it is sufficiently gentle, the climber will find that he may wander almost where he will to avoid the steeper places. Long before we reached Chang La Mr. Bullock and I were fairly well convinced that the slope from here to the North-east Shoulder was sufficiently gentle and that the nature of the ill-defined ridge connecting these two points was not such as to limit the choice of route to a narrow line. Looking up from the North Col, we learnt nothing more about the angles. The view, however, was not without value; it amply confirmed our opinion as to the character of what lay ahead of us. The ridge is not a crest; its section is a wide and rounded angle. It is not decorated by pinnacles, it does not rise in steps. It presents a smooth continuous way, and whether the rocks are still covered with powdery snow, or only slightly sprinkled and for the most part bare, the party of 1922 should be able to go up a long way at all events without meeting any serious obstacle. It may not prove a perfectly simple matter actually to reach the North-east arête above the shoulder at about 28,000 feet. The angle becomes steeper towards this arête. But even in the last section below it, the choice of a way should not be inconveniently restricted. On the right of the ascending party will be permanent snow on various sloping ledges, an easy alternative to rocks if the snow is found in good condition, and always offering a *détour* by which to avoid an obstacle.

From the North-east Shoulder to the summit of the mountain the way is not so smooth. The rise is only 1,000 feet in a distance of half a mile, but the first part of the crest is distinctly jagged by several towers and the last part is steep. Much will depend upon the possibility



of escaping from the crest to avoid the obstacles and of regaining it easily. The South-east side (left going up) is terribly steep, and it will almost certainly be out of the question to traverse there. But the sloping snow-covered ledges on the North-west may serve very well; the difficulty about them is their tendency to be horizontal in direction and to diverge from the arête where it slopes upwards, so that a party which had followed one in preference to the crest might find themselves cut off by a cliff running across the face above them. But one way or another I think it should be possible with the help of such ledges to reach the final obstacle. The summit itself is like the thin end of a wedge thrust up from the mass in which it is embedded. The edge of it, with the highest point at the far end, can only be reached from the North-east by climbing a steep blunt edge of snow. The height of this final obstacle must be fully 200 feet. Mr. Bullock and I examined it often through our field-glasses, and though it did not appear insuperable, whatever our point of view, it never looked anything but steep.

* * * * *

To determine whether it is humanly possible to climb to the summit of Mount Everest or what may be the chances of success in such an undertaking, other factors besides the mere mountaineering difficulties have to be considered. It is at least probable that the obstacles presented by this mountain could be overcome by any competent party if they met them in the Alps. But it is a very different matter to be confronted with such obstacles at elevations between 23,000 and 29,000 feet. We do not know that it is physiologically possible at such high altitudes for the human body to make the efforts required to lift itself up even on the simplest ground. The condition of the party of 1921 in September during the days of the Assault cannot be taken as evidence that the feat is impossible. The long periods spent in high camps and the tax of many exhausting



expeditions had undoubtedly reduced the physical efficiency of Sahibs and coolies alike. The party of 1922, on the other hand, will presumably choose for their attempt a time when the climbers are at the top of their form and their powers will depend on the extent of their adaptability to the condition of high altitude. Nothing perhaps was so astonishing in the party of reconnaissance as the rapidity with which they became acclimatised and capable of great exertions between 18,000 and 21,000 feet. Where is the limit of this process? Will the multiplication of red corpuscles continue so that men may become acclimatised much higher? There is evidence enough to show that they may exist comfortably enough, eating and digesting hearty meals and retaining a feeling of vitality and energy up to 23,000 feet. It may be that, after two or three days quietly spent at this height, the body would sufficiently adjust itself to endure the still greater difference from normal atmospheric pressure 6,000 feet higher. At all events, a practical test can alone provide the proof in such a case. Experiments carried out in a laboratory by putting a man into a sealed chamber and reducing the pressure say to half an atmosphere, valuable as they may be when related to the experiences of airmen, can establish nothing for mountaineers; for they leave out of account the all-important physiological factor of acclimatisation. But in any case it is to be expected that efforts above 23,000 feet will be more exhausting than those at lower elevations; and it may well be that the nature of the ground will turn the scale against the climber. For him it is all important that he should be able to breathe regularly, the demand upon his lungs along the final arête cannot fail to be a terrible strain, and anything like a tussle up some steep obstacle which would interfere with the regularity of his breathing might prove to be an ordeal beyond his strength.

As a way out of these difficulties of breathing, the use of oxygen has often been recommended and experiments were made by Dr. Kellas,* which will be continued in 1922.

* See *Geographical Journal*.



Even so there will remain the difficulty of establishing one or perhaps two camps above Chang La (23,000 feet). It is by no means certain that any place exists above this point on which tents could be pitched. Perhaps the party will manage without tents, but no great economy of weight will be effected that way; those who sleep out at an elevation of 25,000 or 26,000 feet will have to be bountifully provided with warm things. Probably about fifteen, or at least twelve loads will have to be carried up from Chang La. It is not expected that oxygen will be available for this purpose, and the task, whatever organisation is provided, will be severe, possibly beyond the limits of human strength.

Further, another sort of difficulty will jeopardise the chances of success. It might be possible for two men to struggle somehow to the summit, disregarding every other consideration. It is a different matter to climb the mountain as mountaineers would have it climbed. Principles, time-honoured in the Alpine Club, must of course be respected in the ascent of Mount Everest. The party must keep a margin of safety. It is not to be a mad enterprise rashly pushed on regardless of danger. The ill-considered acceptance of any and every risk has no part in the essence of persevering courage. A mountaineering enterprise may keep sanity and sound judgment and remain an adventure. And of all principles by which we hold the first is that of mutual help. What is to be done for a man who is sick or abnormally exhausted at these high altitudes? His companions must see to it that he is taken down at the first opportunity and with an adequate escort; and the obligation is the same whether he be Sahib or coolie; if we ask a man to carry our loads up the mountain we must care for his welfare at need. It may be taken for granted that such need will arise and will interfere very seriously with any organisation however ingeniously and carefully it may be arranged.

In all it may be said that one factor beyond all others is required for success. Too many chances are against the



MOUNT EVEREST
from the 20,000 foot camp—wind blowing snow off the mountain.

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climbers ; too many contingencies may turn against them. Anything like a breakdown of the transport will be fatal ; soft snow on the mountain will be an impregnable defence ; a big wind will send back the strongest ; even so small a matter as a boot fitting a shade too tight may endanger one man's foot and involve the whole party in retreat. The climbers must have above all things, if they are to win through, good fortune, and the greatest good fortune of all for mountaineers, some constant spirit of kindness in Mount Everest itself, the forgetfulness for long enough of its more cruel moods ; for we must remember that the highest of mountains is capable of severity, a severity so awful and so fatal that the wiser sort of men do well to think and tremble even on the threshold of their high endeavour.



CSL

NATURAL HISTORY

By A. F. R. WOLLASTON

CHAPTER XVIII

AN EXCURSION TO NYENYAM AND LAPCHE KANG

By a liberal interpretation of the expression "Mount Everest" we considered it necessary to explore the surrounding country as far as a hundred miles or more from the mountain, East, North and South; in all directions, that is, excepting toward the forbidden territory of Nepal. So it happened one day in July that Major Morshead and I, already nearly fifty miles from Everest, set out in a South-westerly direction, he anxious to add a few hundred square miles of new country to his map, and I intent on animals and plants. Our way lay across the Tingri Plain to Langkor, both names famous in the annals of Tibetan Buddhism. The following story was told us by an old monk in the monastery at Langkor:—

Many generations ago there was born in the Indian village of Pulahari a child named Tamba Sangay. When he grew into a youth he became restless and dissatisfied with his native place, so he went to visit the Lord Buddha and asked him what he should do. The Lord Buddha told him that he must take a stone and throw it far, and where the stone fell there he should spend his life. So Tamba Sangay took a rounded stone and threw it far, so that no one saw where it fell. Many months he sought in vain until he passed over the Hills into Tibet, and there he came to a place where, although it was winter, was a large black space bare of snow.



The people told him that the cattle walked round and round in that space to keep it clear from snow, and in the middle of it was a rounded stone. So Tamba Sangay knew that the stone was his, and there he made a cell and dwelt until he was taken on wings to Heaven. And the place is called Langkor, which means "the cattle go round," to this day. The people for many miles about had heard the stone as it came flying over the Hills from India; it made a whistling sound like *Ting*, so the country came to be called Tingri, the Hill of the Ting.

We visited the Langkor monastery and saw the casket in which the stone of Tamba Sangay is kept, only to be opened once a year by a high dignitary from Lhasa. Close by was a fair-sized river, the bridge over which had been carried away by a recent flood. The greater part of the population was busily engaged in repairing the bridge, to the accompaniment at frequent intervals of hideous blasts on a large conch-shell: this, we were told, was to keep the rain away and stop the floods. Rain fell heavily in spite of the noise, but the bridge was finished before nightfall.

On the following day we had a long pull of many miles up to the Thung La, a pass of 18,000 feet, from which we had hoped for fine views over the surrounding country. A driving storm of snow blotted out the views and covered the ground, so that nothing was to be seen but little clumps, a few inches high, of poppies of the most heavenly blue. Going down the steep track beyond the pass I was stopped by hearing the unfamiliar note of a bird, so it seemed: the cry was almost exactly that of a female peregrine when its eyrie has been disturbed, but coming from a labyrinth of fallen rocks it could not be. Tracking the note from one rock to another, I came suddenly within a few yards of a large marmot, which sat up and waved her tail at me; she called again and two half-grown young ones appeared close by; then all dived into a burrow. These marmots are larger and far less timid of mankind than the marmots of the Alps.



A few miles below the pass the valley widened into an almost level bottom of half a mile or more, with steep bare limestone hills on either side. Here and there were small hamlets, where the inhabitants used the water of the river to irrigate their fields of barley and of blazing golden mustard, whose sweetness scented the valley in the sunshine. Like most of the butter, which is made in vast quantities in Southern Tibet, the mustard seed produces oil for monastery lamps. At one place we came across a spring, almost a fountain, bubbling out of the foothill, of clearest sparkling mineral water that would be the envy of Bath or of Marienbad; in a few yards it had become a racing stream a dozen feet in width.

Four days of leisurely walking down the valley brought us to the village of Nyenyam, where the whole population, a most unpleasant-looking crowd of four or five hundred people, came out to stare at us. A few only were Tibetans; the majority were obviously of Indian origin, calling themselves Nepalese, but without any of the distinctive features of that race. We had received some weeks earlier a cordial invitation from the Jongpens of Nyenyam to visit the place, and we were accordingly much disappointed to find that no person of authority came out to welcome us. A Jongpen, it should be said, is an official appointed by the Lhasa authorities to administer a district and collect revenues: in a place of any importance, as at Nyenyam, there are often two, the idea being that one will keep an eye on the other and prevent him from over-enriching himself. We visited these worthies, whom we found dressed in priceless Chinese silk gowns and cultivating the extreme fashion of long nails on all their fingers, in strange contrast to the squalor and dilapidation of their dwelling, and were annoyed to find that they denied all knowledge of the invitation. The bearer of the message was produced and lied manfully in their cause; the name of Nyenyam was not, as it happened, mentioned in our passport, and we were made to look somewhat foolish. Finally the Jongpens said (with their



tongues in their cheeks and reminding us of a vulgar song) that they were very glad to see us, but they hoped that we would go. They then went out of their way to give us false information about the local passes and made our prolonged stay in the place impossible by discouraging the traders from dealing with us.*

Nyenyam, though more squalid and evil-smelling than any place in my experience, is of some importance as being the last Tibetan town before the frontier of Nepal is reached. It is well placed on a level terrace above the junction of the Pö Chu with an almost equally big river flowing from the glaciers of the great mountain mass of Gosainthan. Immediately below the town the river enters the stupendous gorge that cuts through the heart of the Himalaya to the more open country of Nepal, 8,000 feet below. To the West of Nyenyam rises a great range of mountains culminating in the beautiful peaks of Gosainthan, which we had hoped to visit, and somewhere to the East lay the mysterious sacred mountain of Lapche Kang. Our friends the Jongpens assured us that there was no direct route to Lapche, that we must go back the way by which we had come, and so on; but we were weary of their obstructions and made up our minds to find a way to the holy places.

So far our transport animals had been the yak, or the cross-bred ox-yak, a stronger beast; we were now going through country where only coolies could carry loads. We retraced our steps a few miles up the valley to a village ruled over by a friendly woman, the widow of the late headman. True, she demanded for the coolies an exorbitant wage, which we cut down by about a half, but she pressed into our service every able-bodied person in the neighbourhood, young and old, men and women. They have a fair and simple way of apportioning the loads. All Tibetans, men and women alike, wear long rope-soled boots with woollen cloth tops extending toward the knee, where they are secured by garters,

* In fairness it must be said that this was the only occasion on which we met with anything but help and civility from Tibetan officials.



long strips of narrow woven cloth. When all the loads are ready, each person takes off one garter and gives it to the headman, who shuffles them well and in his turn hands them over to some neutral person who knows not the ownership of the garters. He lays one on the top of each load, and whose garter it is must carry the load without any further talk. It is amusing to watch the excitement in their faces as the garters are dealt out, and to hear the shrieks of delight of the lucky ones and the groans of the less fortunate. It makes one feel weak and ashamed to see a small girl of apparently no more than fourteen years shouldering a huge tent or an unwieldy box, until one remembers that they begin to carry almost as soon as they can walk and are accustomed to far heavier loads than ever they carry for us.

Our path led us up a steep side-valley from the Pö Chu, ascending over a vast moraine to the foot of a small glacier about two miles in length. Here I saw a rare sight: a Lämmergeier (bearded vulture) came sailing down in wide circles and settled on the ice barely a hundred paces from us, where he began to peck at something—a dead hare perhaps, but it was impossible to see or to approach nearer over the crevasses. The Lämmergeier, vulture though it is, is one of the noblest birds in flight that may be seen: hardly a day passes in the high mountains without one or more swooping down to look at you, sometimes so near that you can see his beard and gleaming eye; but to see one on the ground is rare indeed. The long-tailed aeroplane at a very great height resembles the Lämmergeier more than any other bird.

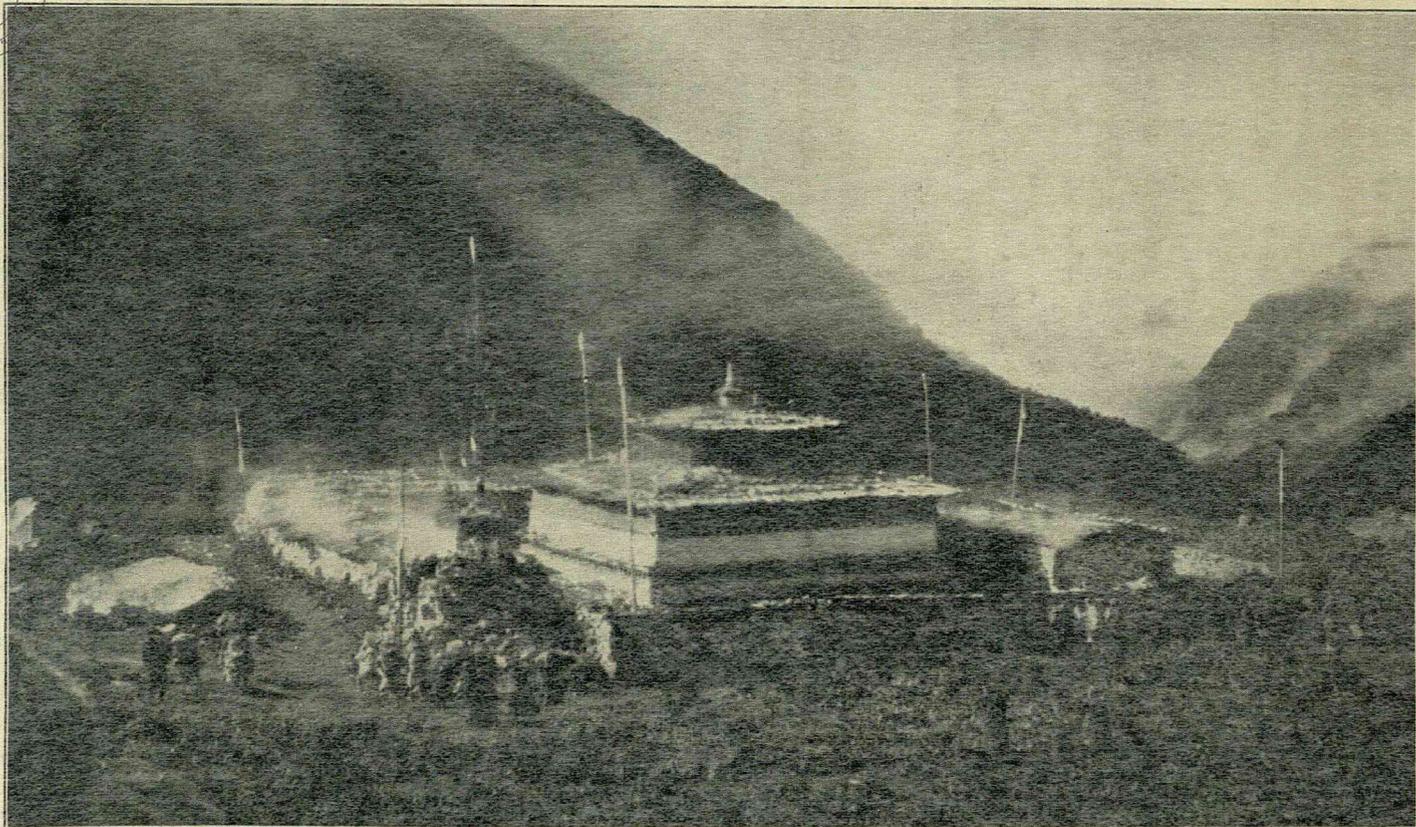
We struggled up the glacier, inches deep in soft new snow, crossed crevasses by means of rotten planks which gravely offended our mountaineering sense, and came through dense fog to our pass at its head. Here began the sacred mountain of Lapche Kang, and on the rocks beside the pass, and on many of the pinnacles high up above the pass as well, were cairns of stones supporting little reed-stemmed flags of prayers. Some of our party had brought up from below



such little flags, which they planted where their fancy prompted. As we went down on the other side we came to countless little "chortens," miniature temples, and, where the ground was level for a space, to long walls of stones, each one inscribed with the universal Buddhist prayer OM MANI PADME HUM.

Yaks are most satisfactory beasts of burden ; if their pace is slow—it is seldom more than two miles an hour—they go with hardly a halt, cropping a tuft of grass here and there, until daylight fails. But the Tibetan coolie is of quite another nature ; he (or she) starts off gaily enough in the morning, but very soon he is glad to stop for a gossip or to alter the trim of his load, and then it is time to drink tea, and again at every convenient halting-place more tea, not the liquid that we are accustomed to drink, but a curious mixture of powdered brick-tea, salt, soda and butter, of a better taste than one would suppose. So on this occasion it was long after noon when we had crossed the pass, and when the day began to fade in a drenching cloud of rain, the Tibetans found shelter in some caves, and persuaded us to camp. An uneven space among rocks just held our tents ; we dined off the fragrant smoke of green rhododendron and soaking juniper, and we slept (if at all) to the roar of boulders rolling in the torrent-bed a few feet from where we lay.

But it was well that we had not stumbled on in the dark. In the morning light we walked over grassy "alps" still yellow with sweet-scented primulas, and the steep sides of the narrowing valley below were bright with roses, pink and white spiræas, yellow berberis and many other flowers. Soon it became evident that we were approaching a place of more than ordinary holiness ; every stone had its prayer-flag, and the tops of trees, which began to appear here, were also decorated. Great boulders were defaced with the familiar words engraven on them in letters many feet in height. In a little while we came to a small wooden hut filled from floor to roof with thousands of little flags brought there by pilgrims ; the posts and lintel of the door were smeared with



TEMPLE AT LAPCHE KANG.

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dabs of butter, and the crevices of the walls were filled with little bunches of fresh-cut flowers. Outside was a rude altar made of stones from the river-bed, where a Lama was burning incense and chanting prayers.

We passed through the village, a tiny hamlet of a dozen houses, and came to the celebrated temple of Lapche. A square stone wall, about 60 yards each way, on the inner side of which are sheds to shelter pilgrims, encloses a roughly paved courtyard where stands the temple, a plain square building of stone with a pagoda-like roof surmounted by a burnished copper ornament. There is nothing remarkable about the temple excepting the hundred and more prayer wheels set in the wall at a convenient height for the pilgrims to turn as they walk round the building. Inside are countless Buddhas, the usual smell of smoky butter-lamps, and an effigy of the saint. The whole place is dirty and dishevelled, in the supposed care of one old woman and a monk, and nobody would believe that this is one of the most famous places in the country and that every year hundreds of Buddhists from India and from all parts of Tibet make pilgrimage to it.

Mila Respa, poet and saint and (it is said) a Tibetan incarnation of Buddha, spent his earthly life in this mountain valley, living under rocks and in caves, where the faithful may see his footprints even now. He seems to have been not lacking in a sense of humour. He was walking with a disciple on the mountain one day, when they found an old yak's horn lying in the path. Mila Respa told the disciple to pick it up and take it with him. The disciple refused, saying that it was useless, and passed on without noticing that the saint himself had picked up the horn and put it under his cloak. Soon afterwards a mighty storm descended on them—whether or not it was caused by the saint is not known. He took the horn from under his cloak and crept inside it. "Now," said he, when he was safely sheltered from the rain, "you see that nothing in the world is useless."

We stayed for two days at Lapche Kang, picking flowers



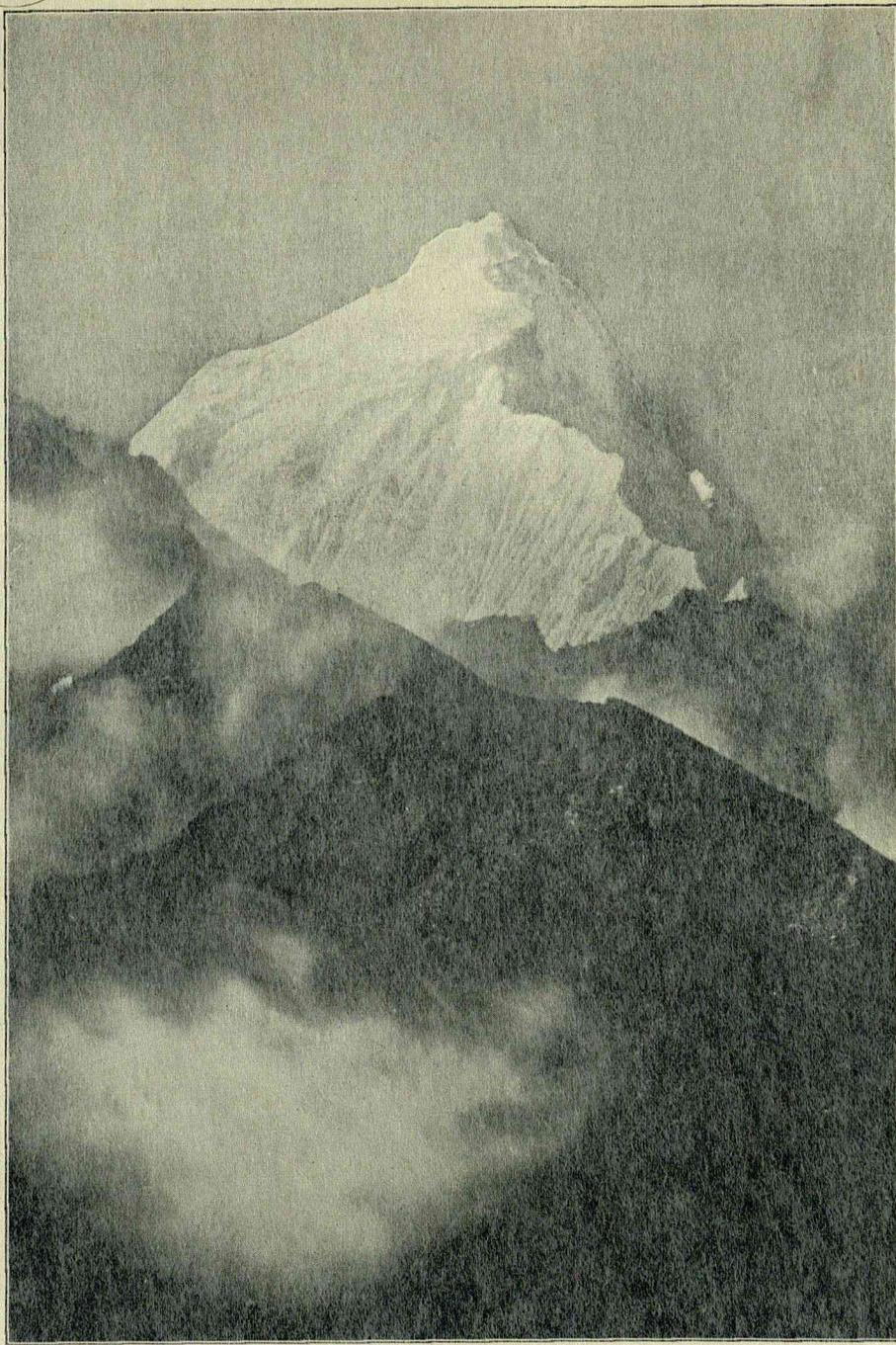
and enjoying the beauty of the place, in spite of the clouds which swept up from the South and filled the valley from early morning onwards. To a naturalist it was a tantalizing place; there were many unfamiliar birds that we had not seen in Tibet, but in such a sacred place I dared not offend the people by taking life, and I even had some qualms in catching butterflies. One of the prettiest sights I saw was a wall-creeper, like a big crimson-winged moth, fluttering over the temple buildings in search for insects.

Having found Lapche Kang, where no European had before penetrated, and having placed it on the map, our next object was to go over the ranges Eastward to the Rongshar Valley, the head of which had been visited by members of the Expedition a few weeks earlier. This was accomplished in two long days of rather confused climbing over two passes of about 17,000 feet, crossing sundry glaciers and stumbling over moraines, and nearly always in an impenetrable fog. Our views of mountains were none at all, but the beauty of the flowers at our feet was almost compensation for that. Among many stand out two in particular, both of them primulas. One was ivory-white, about the bigness of a cowslip, with wide open bells and the most delicate primrose scent: the other carried from four to six bells, each as big as a lady's thimble, of deep azure blue and lined inside with frosted silver.*

As we went down the last steep slope into the Rongshar Valley, the clouds parted for a few moments, and across the valley and incredibly high above our heads appeared the summit of Gauri-Sankar,† one of the most beautiful of Himalayan peaks, blazing in the afternoon sun. It was a glorious vision, but it rather added to our regret for the views of peaks that we might have seen. The next morning at daybreak the whole mountain was clear from its foot in the

* Both of these are new species; the former has been described as *Primula Buryana*, the latter as *P. Wollastonii*.

† Gauri-Sankar (23,440 ft.) was for many years confused with Mount Everest, which is still misnamed Gauri-Sankar in German maps.



GAURI-SANKAR.



Rongshar River (10,000 feet) up through woods of pine and birch, to rhododendrons and rocks, and so by a knife-edged ridge of ice to its glistening summit. It recalled to me the Bietsch-horn more than any other Alpine peak, a Bietsch-horn on the giant scale and seemingly impassable to man.

The valley of the Rongshar, like the Nyenyam and other valleys we had visited, though within the Tibetan border, is really more Nepalese in character. The climate is much damper than in Tibet, as one can see by the wisps of lichen on the trees and the greenness of the vegetation far up the mountain sides, especially at this season of monsoon, when the South wind blows dense clouds of drenching moisture through the gorges. Like those valleys the Rongshar is sacred, which is inconvenient when the question of food supply is pressing. The people had cattle and flocks of goats; they would sell us an ox or a goat, but we must not kill it within the valley, or ill-luck would come to them. They were a friendly and good-tempered people, much given to religion. In many places we had seen prayer wheels worked by water, but here for the first time we saw one driven by the wind. Though it does not do much work at night, it probably steals a march on the water wheels in winter, when the streams are frozen.

We walked up the valley of Rongshar, which in July should be called the Valley of Roses; on all sides were bushes, trees almost, of the deep red single rose in bloom, and the air was filled with the scent of them. After a journey of about 150 miles through unknown country we came to the village of Tazang, which had been visited by some of us before. Thence over the Phüse La (the Pass of Small Rats) we came into real Tibet again, and so in a few days to the Eastern side of Mount Everest.

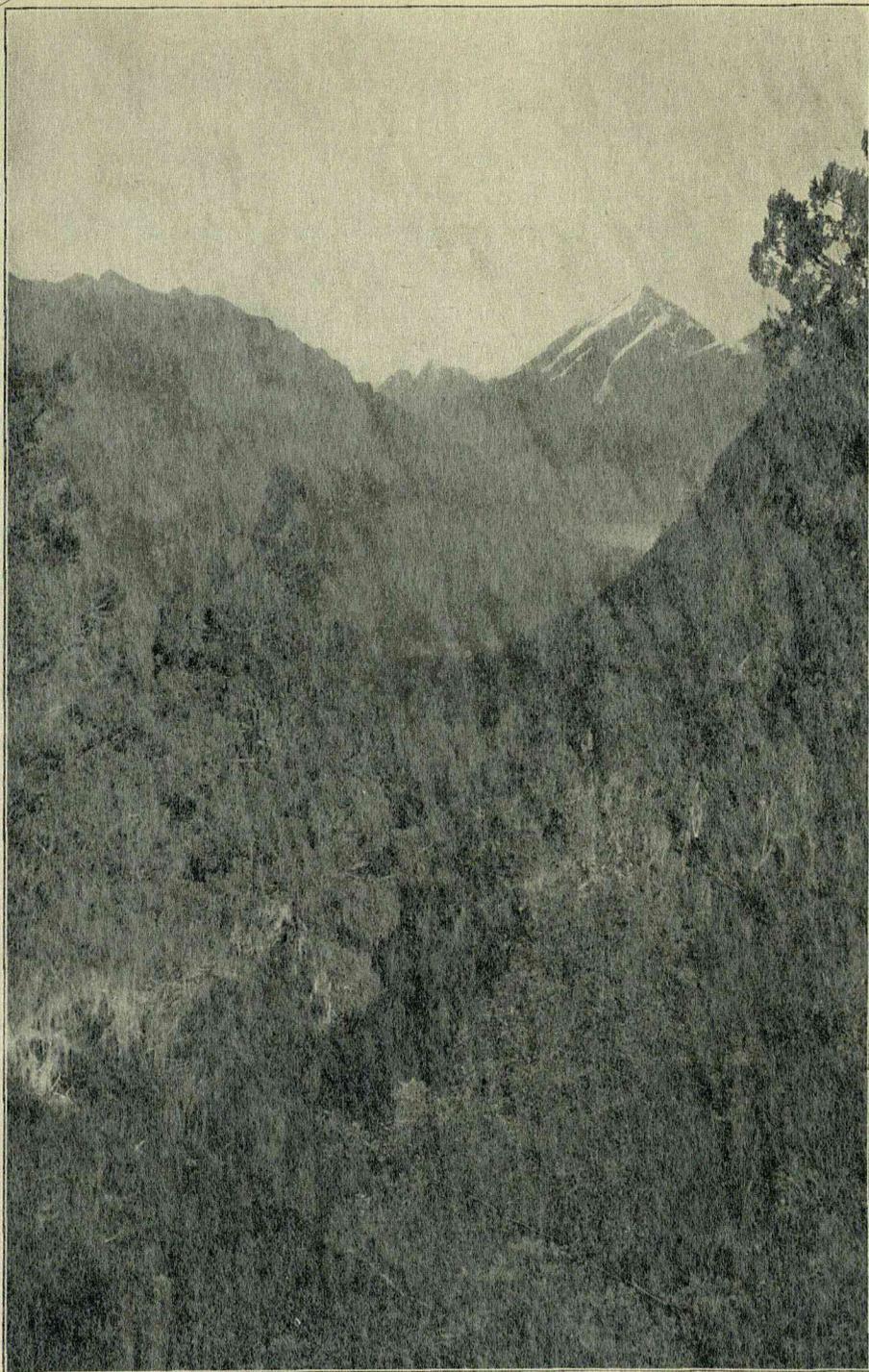


CHAPTER XIX

NATURAL HISTORY NOTES

To a naturalist Tibet offers considerable difficulties: it is true that in some places animals are so tame that they will almost eat out of your hand; for instance, in the Rongbuk Valley the burrhel (wild sheep) come to the cells of the hermits for food, and in every village the ravens and rock-doves are as fearless as the sparrows in London. But against this tameness must be set the Buddhist religion, which forbids the people from taking life, so that, whereas in most countries the native children are the best friends of the naturalist, in Tibet we got no help from them whatever. Also, in order to avoid giving possible offence, we were careful to refrain from shooting in the neighbourhood of monasteries and villages, and that was a very severe drawback, as birds congregated principally about the cultivated lands near villages. Another difficulty we found was in catching small mammals, which showed the greatest reluctance to enter our traps, whatever the bait might be. One species only, a vole (*Phaiomys leucurus*), was trapped; all the others were shot, and that involved a considerable expenditure of time in waiting motionless beside burrows. In spite of these disadvantages we made considerable collections of mammals and birds, and we brought back a large number of dried plants and seeds, many of which it is hoped will live in the gardens of this country.

Crossing over the Jelep La from Sikkim into Tibet in the latter part of May we found the country at 12,000 feet and upwards at the height of spring. The open level spaces were carpeted with a dark purple and yellow primula (*P. gammieana*), a delicate little yellow flower (*Lloydia tibetica*)



LOWER KAMA-CHU.



and many saxifrages. The steep hillsides were ablaze with the flowers of the large rhododendrons (*R. thomsoni*, *R. falconeri*, *R. aucklandi*) and the smaller *Rhododendron campylocarpum*, an almost infinite variety of colours.* A descent through woods of pines, oaks and walnuts brought us to the picturesque village of Richengong, in the Chumbi Valley, where we found house-martins nesting under the eaves of the houses. Following up the Ammo Chu, in its lower course between 9,000 and 12,000 feet, we found the valley gay with pink and white spiræas and cotoneasters, red and white roses, yellow berberis, a fragrant white-flowered bog-myrtle, anemones and white clematis. Dippers, wag-tails and the white-capped redstart were the commonest birds along the river-banks. From Yatung we made an excursion of a few miles up the Kambu Valley, and there found a very beautiful *Enkianthus (Enkianthus himalaicus)*, a small tree about 15 feet high, with clusters of pink and white flowers; in the autumn the leaves turn to a deep copper red.

At about 11,000 feet is a level terrace, the plain of Lingmatang, where the stream meanders for two or three miles through a lovely meadow covered in the spring with a tiny pink primula (*P. minutissima*): it looks a perfect trout stream, but what fish there are (*Schizopygopsis stoliczcae*) are small and few in number.

Between 11,000 and 13,000 feet you ascend through mixed woods of pine, larch, birch and juniper with an undergrowth of rhododendrons and mountain ash. The larches here have a much less formal habit of growth than those of this country, and in the autumn they turn to a brilliant golden colour. The berries of the mountain ash, when ripe, are white and very conspicuous. At this altitude *Rhododendron cinnabarinum* reaches its best growth, in

* We marked many of the best-flowering specimens with the intention of collecting their seeds on our return in the autumn. Unfortunately when we came over the Jelep La in October it was in a heavy snowstorm which made collecting impossible.



bushes of from 8 to 10 feet in height, and the flowers have a very wide range of colour. In the woods hereabouts may often be heard and sometimes seen the blood pheasant, and here lives also—but we did not see it—the Tibetan stag.

At about 13,000 feet at the end of May you find a yellow primula covering the ground more thickly than cowslips in this country; the air is laden with the scent of it, and growing with it is a pretty little heath-like flower (*Cassiope fastigiata*) with snow-white bells. Here and there is seen the large blue poppy (*Meconopsis* sp.) and a white anemone with five or six flowers on one stem. Soon the trees get scantier and scantier, pines disappear altogether and then birches and willows and junipers, until only dwarf rhododendrons (*R. setosum*) are left, covering the hillsides like purple heather.

In a few miles the country changes in character completely, and you come out on to the open plain of Phari. Here at 14,000 feet we saw the common cuckoo sitting on a telegraph wire and calling vigorously. This is Tibet proper, and henceforward you may travel for scores of miles and hardly see any plant more than a few inches high. In some places a little trumpet-shaped purple flower (*Incarvillea younghusbandii*) is fairly common, it lies prone on the sand with its leaves usually buried out of sight; and as we went Westward we found a dwarf blue iris (*I. tenuifolia*). Animals are few and far between: the Kiang, the wild ass of Tibet, is occasionally seen in small parties; they are very conspicuous on the open plains in full daylight, but almost invisible at dusk. The Tibetan gazelle is fairly numerous, and it is not uncommon to see one or two in company with a flock of native sheep and taking no notice of the shepherd, but when a stranger tries to approach they are off like a flash. Another animal of the plains is the Tibetan antelope (*Pantholops*), which is found in large numbers a little to the North of the region we visited, but the only signs of it we saw were the horns used as supporting prongs for the long



muzzle-loading guns of the Tibetans. The Tibetan antelope was probably the Unicorn described by the French priest Huc in 1845.

The only mammals that are commonly seen on the plains are the small mouse-hares or pikas (*Ochotona*), which live in colonies on the less stony parts of the plain, where their burrows often caused our ponies to stumble; they scurry off to their holes at your approach, but if you wait a few moments you will see heads peeping out at you from all sides. These engaging little creatures have been called "Whistling Hares," but of the three species which we found none was ever heard to utter a sound of any kind. The Tibetan name for them is Phüse. It is interesting to record that from one specimen I took three fleas of two species, both of them new to science.

Birds are few on these stony wastes, larks, wheatears and snow-finches being the commonest. Elwes' shore-lark was found feeding young birds at the beginning of June, when the ground was not yet free from snow, and the song of the Tibetan skylark, remarkably like that of our own skylark, was heard over every patch of native cultivation.

A small spiny lizard (*Phrynocephalus theobaldi*) is common on the plains and on the lower hills up to 17,000 feet; it lives in shallow burrows on the sand and under stones.

Rising out of the plain North of the Himalayas are ranges of rounded limestone hills, 18,000 to 19,000 feet high, running roughly East and West. The hills between Phari and Khamba Dzong are the home of the big sheep (*Ovis hodgsoni*), which are occasionally seen in small companies. There are many ranges to the West of Khamba Dzong, apparently well suited to this animal, but it was never seen. On the slopes of these hills are found partridges (*Perdix hodgsoniæ*), and in the ravines are seen Alpine choughs, rock-doves (*Columba rupestris*) and crag-martins. Once or twice at night we heard the shriek of the great eagle-owl, but the bird was not seen.

At rare intervals on these plains one meets with small



rivers, tributaries of the Arun River ; along their banks is usually more grass than elsewhere, and here the wandering Tibetan herdsmen bring their yaks to graze. The wild yak is not found anywhere in this region. It might be supposed that so hairy an animal as the yak would become dirty and unkempt. Actually they are among the cleanest of creatures, and they may often be seen scraping holes in soft banks where they roll and kick and comb themselves into silky condition. The usual colour of the domesticated yak is black, more rarely a yellowish brown. A common variety has a white face and white tail. The calves are born in the spring, late April or early May.

Here and there the rivers overflow their banks and form lakes or meres, which in the summer are the haunt of innumerable wild-fowl: bar-headed geese and redshanks nest here, families of ruddy shelducks (the Brahminy duck of India) and garganey teal are seen swimming on the pools. Overhead fly sand-martins, brown-headed gulls, common terns and white-tailed eagles. Near one of these lakes one day I watched at close distance a red fox stalking a pair of bar-headed geese, a most interesting sight, and had the satisfaction of saving the birds by firing a shot in the air with my small collecting gun just as the fox was about to pounce on his intended victim.

Tinki Dzong is a veritable bird sanctuary. The Dzong itself is a rambling fort covering a dozen or so of acres, and about its walls nest hundreds of birds—ravens, magpies, red-billed choughs, tree-sparrows, hoopoes, Indian redstarts, Hodgson's pied wagtails and rock-doves. In the shallow pool outside the Dzong were swimming bar-headed geese and ruddy shelducks, with families of young birds, all as tame as domestic poultry. A pair of white storks was seen here in June, but they did not appear to be breeding. In the autumn the lakes in this neighbourhood are the resort of large packs of widgeon, gadwall and pochard. The Jongpen explained to us that it was the particular wish of the Dalai Lama that no birds should be molested here, and for several



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years two lamas lived at Tinki, whose special business it was to protect the birds.

Crossing over a pass of about 17,000 feet (Tinki La), the slopes gay with a little purple and white daphne (*Stellera*), said by the natives to be poisonous to animals, we came to a plain of a different character, miles of blown sand heaped here and there into enormous dunes, on which grows a yellow-flowering gorse. Here, near Chushar, we first met with rose-finches (Severtzoff's and Przewalsk's) and the brown ground-chough (*Podoces humilis*): the last-named is a remarkable-looking bird, which progresses by a series of apparently top-heavy bounds, at the end of which it turns round to steady itself; in the middle of June it was feeding its young in nests at the bottom of deep holes in sand or old mud walls.

Following up the valley of the Bhong-chu we crossed the river by a stone bridge near Shekar Dzong. Here we found a colony of white-rumped swifts nesting high up in cliffs and ruddy shelducks nesting in holes among the loose boulders below. Occasionally we saw a pair of black-necked cranes, which are said by the natives to breed near lakes a little to the North, but we had no opportunity of visiting them. The slopes of the hills facing South were covered with a very pretty shrub (*Sophora*) with blue and white flowers and delicate silvery grey leaves, and among the loose stones a small clematis (*C. orientalis*) was just beginning to appear. Groups of small trees, like a sea buckthorn, growing 15 to 20 feet high, indicate a gradual change in the climate as you go Westwards. Here also for the first time we began to find a few butterflies, of the genera *Lycæna* and *Cobias*.

At Tingri we found ourselves in a large plain about 20 miles long by 12 wide; a large part of the plain is saturated with soda and is almost uninhabited by bird or beast. In our three weeks' stay at Tingri we collected several mammals, including a new subspecies of hamster (*Cricetulus alticola tibetanus*) and a number of birds. This was the only place where we ever received any natural history specimen from a Tibetan.



A woman came into our camp one day and, after making certain that she was not observed by any of the villagers, produced from a sack a well-worn domestic cat's skin stuffed with grass and a freshly killed stoat (*Mustela longstaffi*). The skin of the stoat is highly prized by the Tibetans, who say that it has the property of restoring faded turquoises to their former beauty. About the houses of the village were nesting tree-sparrows, hoopoes, rock-doves and ravens, the latter so tame that they hardly troubled to get out of the way of passers-by. In a tower of the old fort lived a pair of the Eastern little owl (*Athene bactriana*), which appeared to live principally on voles. On the plain the commonest birds were the long-billed calandra lark, Brook's short-toed lark, the Tibetan skylark, and Elwes' shore-lark, all of which were found with eggs, probably the second brood of the season, at the beginning of July. The nest of the yellow-headed wagtail, rare at Tingri, was found with eggs, and Blanford's snow-finch was found feeding its young more than 2 feet down the burrow of a pika (*Ochotona curzoniæ*). The common tern and the greater sand-plover nested on the shingly islands in the river.

Plants at Tingri were few and inconspicuous: a small yellow cistus, the dwarf blue iris, a small aster and a curious hairy, claret-coloured flower (*Thermopsis*) were the most noticeable. Along the rivers which traverse the plain is very good grazing for the large flocks of sheep and goats of the Tibetans; the sheep are small and are grown entirely for wool. By a simple system of irrigation a large area of land near Tingri has been brought into cultivation. The principal crop here is barley, which constitutes the chief food of the people; they also grow a large radish or small turnip, the young leaves of which are excellent food. The animals usually used for ploughing are a cross between the yak and ordinary domestic cattle, called by the Tibetans "zoh"; they are more powerful than the yak and are excellent transport animals. We found barley grown in many districts up to 15,000 feet—it does not always ripen—and in the



valley of the Dzakar Chu near its junction with the Arun River is a small area where wheat is grown at an altitude of about 12,800 feet. Peas are grown in the Arun Valley near Kharta, where they ripen in September and are pounded into meal for winter food of cattle as well as of the Tibetans themselves. Mustard is grown in the lower valleys below 14,000 feet. It is to be regretted that we did not bring back specimens of these hardy cereals.

During the course of an excursion of about three weeks in July to the West and South of Tingri we covered a large tract of unexplored country, much of which is more Nepalese than Tibetan in character. Going over the Thung La we found numerous butterflies of the genus *Parnassus*, and near the top of the pass (18,000 feet) we found for the first time the beautiful little blue *Gentiana amœna*; it is not easy to see until you are right over it, when it looks like a little square blue china cup; some of the flowers are as much as an inch in diameter. Here also was just beginning to flower the dwarf blue poppy (*Meconopsis horridula*), which grows in a small compact clump, 6 to 8 inches high, with as many as sixteen flowers and buds on one plant; the flowers are nearly 2 inches across and of a heavenly blue. In this region, too, we met for the first time marmots, which live in large colonies at about 16,000 feet; the Himalayan is larger than the Alpine marmot, and it has a longish tail which it whisks sharply from side to side when it is alarmed; it has a twittering cry, curiously like that of a bird of prey.

Continuing down the valley of the Pö Chu to Nyenyam, we found several birds that we had not met hitherto, notably the brown accentor, Himalayan tree-pipit, Adams's snow-finch, the Himalayan greenfinch and Tickell's willow-warbler. At about 12,500 feet we first found the white-backed dove (*Columba leuconota*), which inhabits the deep gorges of the Himalayas but does not extend out on to the Tibetan plain. Beside the big torrent that flows South from Gosainthan we saw a pair of that curious curlew-like bird, the ibis-bill (*Ibidorhynchus struthersi*); it was evident that they had



eggs or young on an island in the torrent, at about 13,800 feet, but unfortunately it was impossible to reach it.

The most conspicuous flowers in this region were a little bushy cistus with golden flowers the size of a half-crown, a dwarf rhododendron (*R. lanatum*) with hairy leaves, a white potentilla with red centre, which carpeted the drier hillsides, a white gentian (*G. robusta*), and a very remarkable louse-wort (*Pedicularis megalantha*) with two quite distinct forms—one purple, the other yellow.

Crossing a pass to the East of Nyenyam, we camped on a level spot covered densely with white primulas (*P. Buryana*) six to eight inches high; an inch or two of snow fell during the night, and so white are these flowers that it was difficult to see them against the snow. Near the top of another pass we found at about the same altitude, 15,000 feet, another primula (*P. Wollastonii*) with three to six bells on each stem, the size of a small thimble, of a deep blue colour, and lined inside with frosted silver. In the moister valleys hereabouts a pretty pink-flowered polygonum (*P. vacciniifolium*) rambled everywhere over the rocks and boulders. The Rongshar Valley in July was chiefly notable for the large gooseberry bushes, 10 to 12 feet high, and for the profusion of red and white roses. A wall-creeper, the only one we saw in Tibet, was seen creeping about the temple at Lapche, a few miles to the West of Rongshar.

From the beginning of August our headquarters were at Kharta in the Arun Valley, about 20 miles East of Mount Everest, and from there we made excursions South to the Kama Valley, and West up the Kharta Valley in the direction of Everest. Kharta itself is curiously situated as regards climate: the wide dry valley of the Arun narrows abruptly and the river passes into a deep gorge, where it falls rapidly at a rate of about 200 feet to the mile on its way to Nepal. The heavy monsoon clouds roll up the gorge to its mouth, where they are cut off sharply, so that within a mile you may pass from the dry climate of Tibet to the moist, steamy air of a Nepalese character, with its luxuriant vegetation.



In the immediate neighbourhood of Kharta were several birds we had not met elsewhere, notably Prince Henry's laughing thrush (*Trochalopteryx henrici*), which is very much venerated as a sacred bird by the Tibetans, the Central Asian blackbird, almost indistinguishable from our blackbird except by its voice, the solitary thrush, Indian brown turtle-dove, and a meadow-bunting (*Emberiza godlewskii*), probably a migrant from the North.

Several species of small gentians and two very fragrant onosmas were flowering in August, and in this place *Clematis orientalis* attains its best growth, clambering over the trees and the houses of the natives; the flower of this clematis has a very wide range of colour from an apricot yellow to almost black. About the houses are often planted junipers and poplars, and it was about 10 miles from Kharta that we saw a poplar nearly 40 feet in girth, which we were informed was five hundred years old.

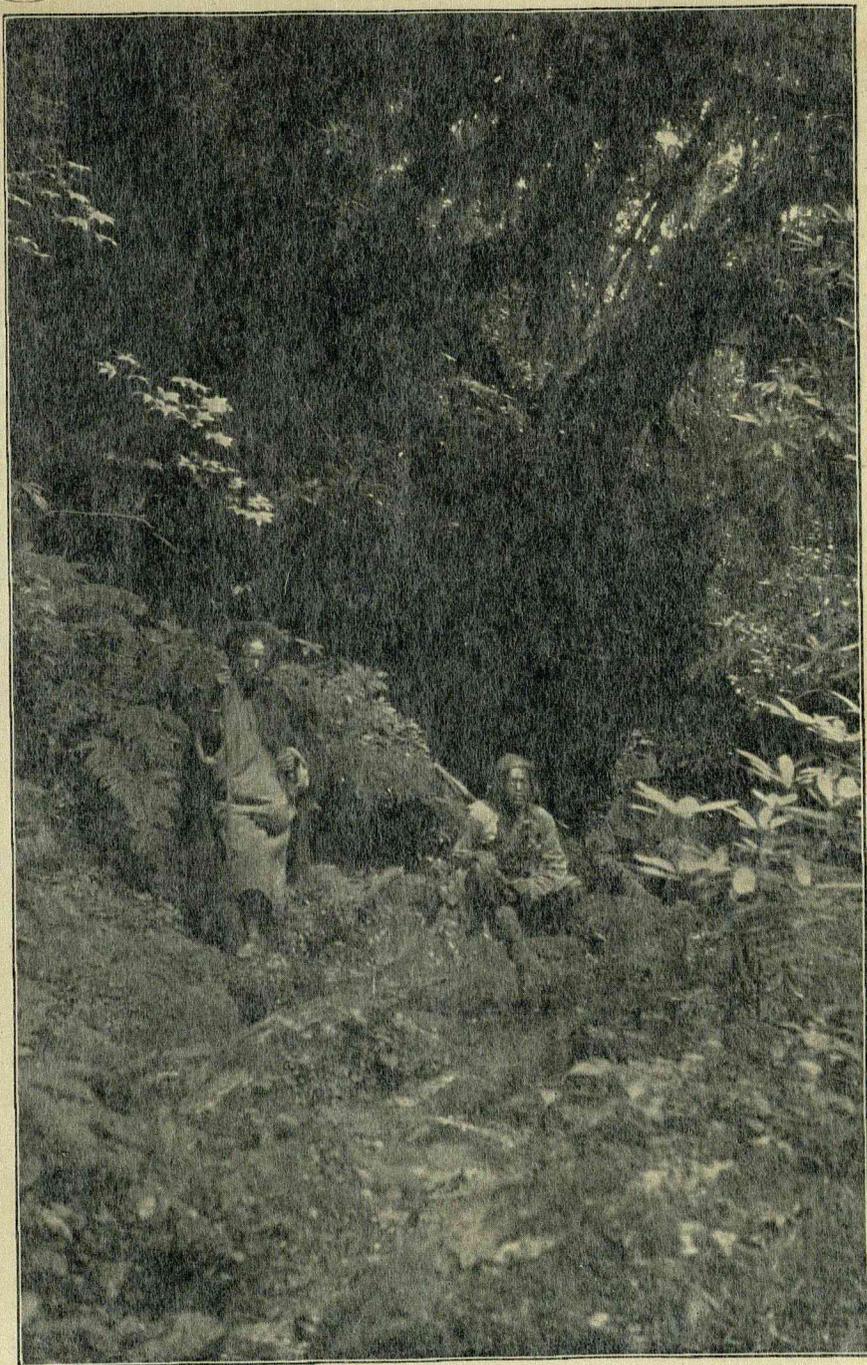
A few miles to the south of Kharta is a valley filled with a dozen or so of small lakes or tarns, inhabited apparently only by tadpoles (*Rana pleskei*); no fish could be seen. Not far from here was discovered an interesting toad of a new species (*Cophophryne alticola*). Growing about the lakes were large beds of purple and yellow iris (*I. sibirica*, near); the steeper banks were blue with a very striking campanula (*Cyananthus pedunculatus*); growing out from among the dwarf rhododendrons in dry places were tall spikes of a claret-coloured meconopsis, now going to seed—some spikes had as many as twenty seed-pods; and in the moist places beside the lakes and streams was the tall yellow primula (*P. elongata*), growing to a height of over 30 inches.

Ascending from the lakes to the Chog La we saw a small black rat amongst the huge boulders of a moraine; it appeared to be a very active little animal, and though four or five were seen at different times in similar situations we failed to secure a specimen. Near the Chog La we found the snow-partridge (*Lerwa lerwa*), and one was shot out of a flock of



very beautiful blue birds—Hodgson's grandala. Another very handsome bird in this region is the red-breasted rosefinch, which is found up to 18,000 feet. Descending from the Chog La towards the Kama Valley we found at 16,000 feet the giant rhubarb (*Rheum nobile*), and at 14,000 feet we picked quantities of the wild edible rhubarb. A little lower down we came to large blue scabius, 3 to 4 feet high, a dark blue monkshood and quantities of the tall yellow poppy. Rhododendrons, birches and junipers begin at about 13,500 feet, and at 12,000 feet the junipers are the predominating tree; they are of immense size, upwards of 20 feet in girth and from 120 to 150 feet in height and of a very even and perfect growth. Here we met with the Sikkim black tit (*Parus beavani*), and a little lower down among the firs (*Abies webbiana*) we came upon bullfinches (*Pyrrhula erythrocephala*). At 11,000 feet I saw a langur monkey (*Semnopithecus entellus*), the only monkey I saw in Tibet. Excepting one solitary bat, the only other mammal we saw in this valley was another species of pika (*Ochotona roylei nepalensis*), which appears here to be confined to a zone between the altitudes of 12,000 and 14,000 feet; it is not found in dry valleys.

Among the trees in the lower Kama Valley grow many parnassias, a tall green fritillaria, a handsome red swertia and a very sweet-scented pink orchis. We found the tubers (but not the flowers) of an arum, which the Tibetans collect and make of it a very unpalatable bread. We went down through large rhododendrons, magnolias, bamboos, alders, sycamores, all draped in long wisps of lichen (*Usnea*), to the junction of the Kama with the Arun River, where we found ourselves in the region of the blue pine. The lower part of the Kama Valley is unpleasantly full of leeches, and in the course of an excursion to the Popti La (14,000 feet), one of the principal passes from Tibet to Sikkim, we were astonished to find them very numerous and active at an altitude of 12,000 feet. At our low-altitude camps in this valley hundreds of moths were attracted by the light of our



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camp fire, and a few came to the dim candle lamps in our tents. A collector who came here with a proper equipment could not fail to make a large collection of moths.

Proceeding up the Kharta Valley in the beginning of September we found that most of the roses and rhododendrons had gone to seed, but some of the gentians, particularly *Gentiana ornata*, were at their best. Near our camp at 17,000 feet, along the edges of streams, a very handsome gentian (*G. nubigena*) with half a dozen flowers growing on a single stem was very conspicuous, and growing with it was an aromatic little purple and yellow aster (*A. heterochæta*); in the same place was a bright yellow senecio (*S. arnicoides*) with shining, glossy leaves. A curious dark blue dead-nettle (*Dracocephalum speciosum*) was found on dry ground at the same altitude. In the stony places grew up to 19,000 feet the dwarf blue meconopsis mentioned above, and many saxifrages, notably a very small white one (*S. umbellulata*). On the steeper rocks from 16,000 feet to the snow-line (roughly 20,000 feet) were found edelweiss (*Leontopodium*) of three species. Very noticeable at these altitudes are the curious saussureas, large composites packed with cotton wool; if you open one of them on the coldest day, even when it is covered with snow, you find it quite warm inside, and often a bumble bee will come buzzing out.

Another very interesting plant at 17,000 to 18,000 feet is a dwarf blue hairy delphinium (*D. brunneanum*) with a strong smell. The Tibetans dry the flowers of this plant and use them as a preventive against lice. This has its disadvantages, for when a Tibetan dies his body is undertaken by the professional butcher, who cuts it up and exposes it on the hills to be disposed of by the vultures and wolves. A body tainted with the delphinium flowers is unpalatable to the scavengers, and it is known that a man must have been wicked in life whose body is rejected by the vultures and wolves.

The smallest rhododendrons (*R. setosum* and *R. lepidotum*) disappear before 19,000 feet, after which vegetation is almost



non-existent. A few grasses and mosses are still found to 20,000 feet, and the highest plant we found was a small arenaria (*A. musciformis*), which grows in flat cushions a few inches wide up to 20,100 feet.

Mammals in the upper Kharta Valley are not numerous. A pika of a new species (*Ochotona wollastoni*) is found from 15,000 to 20,000 feet, and a new vole (*Phaiomys everesti*) was found at 17,000 feet. The small black rat previously seen was here too, and an unseen mouse entered our tents and ate our food at 20,000 feet. Fox and hare were both seen above 18,000 feet, and undoubted tracks of them on the Kharta Glacier at 21,000 feet. Wolves were seen about 19,000 feet, and those tracks seen in snow at 21,500 feet, which gave rise to so much discussion, were almost certainly those of a wolf. Burrhel were fairly common between 17,000 and 19,000 feet, and we found their droppings on stones at 20,000 feet.

Birds of several species were found from 17,000 feet upwards. The Tibetan snow-partridge (*Tetraogallus tibetanus*) is common in large parties up to the snow-line. Dippers (*Cinclus cashmiriensis*) are found in the streams up to 17,000 feet, and at about the same altitude lives in the big boulders of moraines a small and very dark wren, which is almost certainly new, but only one immature bird was brought home. Snow-finches and the Eastern alpine accentor appeared to be resident up to the snow-line. Several migrating birds were seen in September at 17,000 feet and above, among them Temminck's stint, painted snipe, pintailed snipe, house-martin and several pipits. More than once at night the cry of migrating waders was heard, curlew being unmistakable, and (I think) bar-tailed godwit.

Our camps at 17,000 feet and at 20,000 feet were visited daily by lammergeier, raven, red-billed chough, alpine chough and black-eared kite, and I saw twice a hoopoe fly over the Kharta Glacier at about 21,000 feet; a small pale hawk flew overhead at the same time. The highest bird seen was a lammergeier (bearded vulture); when I was



taking photographs from our camp on the Lhakpa La (22,350 feet) I saw one of these birds come sailing over the top of the North peak of Everest and apparently high above the peak, probably at an altitude of not less than 25,000 feet.*

* Detailed accounts of the collections made will be found: Mammals, *Annals and Magazine of Nat. Hist.*, Feb. 1922. Birds, *Ibis.*, July, 1922. Insects, *Annals and Magazine of Nat. Hist.*, May and June, 1922.



CHAPTER XX

AN APPRECIATION OF THE RECONNAISSANCE

BY PROFESSOR NORMAN COLLIE, F.R.S.

President of the Alpine Club

The chance of wandering into the wild places of the earth is given to few. But those who have once visited the Himalaya will never forget either the magnificence or the beauty of that immense mountain land, whether it be the valley country that lies between the great snow-covered ranges and the plains, where wonderful forests, flowers, clear streams and lesser peaks form a fitting guard to the mighty snow-peaks that lie beyond, or the great peaks themselves, that can be seen far away to the North, as one approaches through the foot-hills that lead up to them. The huge snow-covered giants may be a week's journey away, they may be far more, yet when seen through the clear air of the hills, perhaps 100 miles distant, they look immense, inaccessible, remote and lonely. But as one approaches nearer and nearer to them, they ever grow more splendid, glistening white in the mid-day sun, rose-red at dawn, or a golden orange at sunset, with faint opalescent green shadows that deepen as the daylight fails, till when night comes they stand far up in the sky, pale and ghostly against the glittering stars. Those who have been fortunate enough to see these things, know the fascination they exert. It is the call of the great spaces and of the great mountains. It is a call that mocks at the song of the Lotus-eaters of old, it is more insidious than the Siren's call, and it is a call that, once heard, is never forgotten.

One may be contented and busy with the multitudinous



little events of ordinary civilised life, but a chance phrase or some allusion wakes the memory of the wild mountain lands, and one feels sick with desire for the open spaces and the old trails. The dreams of the wanderer are far more real than most of the happenings that make up the average man's life. It may be the memory of some desolate peaks set against an angry sky, or of islands set in summer seas, or some grim fight with deserts of endless sands, or with tropical forests that have held their growth for a thousand years; it may be the memory of rushing rivers, or lakes set in wild woods where the beavers build their houses, or sunsets over great oceans—the spell binds one, the present does not exist, one is back again on the old trail—"The Red Gods have called us out, and we must go."

There is no part of the world where lofty mountains exist at all comparable with the Himalaya. Elsewhere the highest is Aconcagua, 23,060 feet. But in the Himalaya there are over eighty peaks that tower above 24,000 feet, probably twenty above 26,000 feet, six above 27,000 feet, and the highest of all, Mount Everest, is 29,141 feet.

The huge range of mountains, of which the Himalaya forms the chief part, is by far the greatest mountain range in the world. Starting to the North of Afghanistan, it sweeps Eastwards, without a break, to the confines of China, over 2,000 miles away. Yet in this vast world of mountains, very few have been climbed. For many years to come the Himalaya will provide sport for the mountaineer when most of the other mountain ranges of the world will have been exhausted, as far as exploration and new ascents are concerned.

Mountaineering is a sport of which Englishmen should be proud; for they were the first really to pursue it as a pastime. The Alpine Club was the first mountaineering club, and if one inquires into the records of climbing and discovery amongst the mountains of the world, one usually finds that it was an Englishman who led the way. It is the Englishman's love of sport for its own sake that has



enticed him on to battle with the dangers and difficulties that are offered with such a lavish hand by the great mountains.

As a sport, mountaineering is second to none. It is the finest mental and physical tonic that a man can take. Whether it be the grim determination of desperate struggles with difficult rocks, or with ice, or whether it be the sight of range after range of splendid peaks basking in the sunshine, or of mists half hiding the black precipices, or the changing fairy colours of a sunrise, or the subtle curves of the wind-blown snow, all these are good for one. They produce a sane mind in a sane body. The joy of living becomes a real and a great joy, all is right with the world, and life flies on golden wings. It is, of course, true that there are many other beautiful and health-giving places besides the mountains. The great expanses of the prairie lands, the forests, the seas set with lonely islands, and in England the downs and the homely lanes and villages nestling amongst woods, with clear streams wandering through the pastures where the cattle feed—all these are good ; but the mountains give something more. There things are larger, man is more alone, one feels that one is much nearer to Nature, one is not held down by an artificial civilisation. And although the life may be more strenuous (for Nature can be savage at times, as well as beautiful), and the struggle may be hard, yet the battle is the more worth winning.

Nowhere in any mountain land does Nature offer the good things of the wilds with more prodigal hand than in the Himalaya. On the Southern slopes, coming down from the great snow-peaks, are the finest river gorges in the world, wonderful forests of mighty trees, open alps nestling high up at the head of the valleys, that look out over great expanses of the lesser ranges ; and as one ascends higher and higher, the views of the great peaks draped in everlasting snow, changing perpetually as the clouds and mists form and re-form over them, astonish one by their magnificence.

All things that the Himalaya gives are big things, and



now that the mountaineer has conquered the lesser ranges, he turns to the Himalaya, where the peaks stand head and shoulders above all others. Up to the present, however, owing to the difficulties of distance and size, none of the greater peaks have been climbed.

In climbing the great peaks of the Himalaya, the difficulties are far greater than those of less lofty ranges. On most of the highest the mere climbing presents such difficulties that it would be foolish to attempt their ascent. Thousands of feet of steep rock or ice guard their summits. Unless climbing above 24,000 feet is moderately easy, and no strenuous work is required, it could not be accomplished. For in the rarefied air at high altitudes there is insufficient oxygen to promote the normal oxidation of bodily tissue. Above 20,000 feet a cubic foot of air contains less than half the amount of oxygen that it does at sea-level. As the whole metabolism of the body is kept in working order by the oxygen supplied through the lungs, the obvious result of high altitudes is to interfere with the various processes occurring in the system. The combustion of bodily material is less, the amount of energy produced is therefore less also, and so capacity for work is diminished progressively as one ascends.

But that one is able still to work, and work hard, at these altitudes is evident by the experiences of Dr. Longstaff and Mr. Meade. On Trisul, 23,360 feet, Dr. Longstaff in ten and a half hours ascended from 17,450 feet to the summit. Whilst on Kamet, Mr. Meade's coolies carried a camp up to 23,600 feet. Dr. Kellas also in 1920 found his ascent on moderately easy snow above 21,000 feet approximated to 600 feet per hour. All these climbers were, however, acclimatised to high altitudes. The effect on anyone making a balloon or aeroplane ascent from sea-level would be different. Tissaudier in a balloon ascent fainted at 26,500 feet and on regaining consciousness found both his companions dead. Even on Pike's Peak, 14,109 feet, in the United States, many of those who go up in the railway suffer from faintness,



sickness, breathlessness and general lassitude. Yet there are places on the earth,—the Pamirs,—where people live their lives at higher altitudes than Pike's Peak, without any effects of the diminished pressure being felt. They are acclimatised; their bodies, being accustomed to their surroundings, are good working machines.

Although it is true that at high altitudes there is less oxygen to breathe, the body rapidly protects itself by increasing the number of red blood corpuscles. These red corpuscles are the carriers of oxygen from the air to the various parts of the body. An increased number of carriers means an increase of oxygen to the body. It is just possible, therefore, that anyone properly acclimatised to, say, 23,000 feet would be able to ascend the remaining 6,000 feet, to the summit of Mount Everest. Moreover, if oxygen could be continuously supplied to the climbers by adventitious aid there is little doubt that 29,000 feet could be reached.

The physiological difficulties met with in ascending to high altitudes are doubtless of a very high order, but can to a certain extent be eliminated by ascending gradually, day after day, so as to allow the body to accommodate itself by degrees to the new surroundings.

There are, however, other difficulties that must be reckoned with, such as intense cold and frequent high winds. In any engine where loss of heat occurs, there is a corresponding loss of available energy. A bitterly cold wind not only robs one of much heat, but lowers the vitality as well. At altitudes above 24,000 feet, the temperature is often arctic, and the thermometer may fall far below zero. On the other hand, the rays of the sun are intense. The ultra-violet rays, that are mostly cut off by the air at sea-level, are a real source of danger where there is only one-third of an atmosphere pressure, as in the case at the summit of Mount Everest.

The mountaineer also encounters dangers in the Himalaya, on the same scale as the difficulties. A snow-slide on a British mountain or in the Alps is an avalanche; often in



the Himalaya it becomes almost a convulsion of nature. The huge ice-fields and glaciers that hang on the upper slopes of the mountains, when let loose, have not hundreds of feet to fall, but thousands, and the wind that is thereby produced spreads with hurricane force over the glaciers below, on to which the main body of the avalanche has fallen. Sometimes even the broken debris will rush across a wide glacier.

Rock falls also assume gigantic proportions in the Himalaya. But all these dangers can be largely avoided by the skilled mountaineer, and he can choose routes up a mountain where they are not likely to occur. Some risks, however, must be always run, but they can be reduced to a minimum.

On Mount Everest, as we now know, most of these dangers will be less than on any of the other very high mountains in the Himalaya. Also there are no difficulties in the approach to Mount Everest from India. In this respect it differs from such peaks as K² and others. As a rule the highest mountains in the Himalaya always lie far back from the plains in the main chain, beyond the foot-hills and the intervening ranges. To approach them from the South in India, weeks of travel are often necessary, up deep gorges, and over rivers, where it is next to impossible to take baggage animals. Fortunately the approach to Mount Everest by the route from Darjeeling to Phari Dzong and thence over an easy pass into Tibet avoids all these difficulties. In Tibet a high tableland, averaging 13,000 feet, is reached.

Travelling in Tibet, North of the main range of the Himalaya, is entirely different from that on the South of the range. Instead of deep-cut gorges, a rolling, bare, stone-covered country exists, over which it is easy to take baggage animals, the only obstacle being the rivers that sometimes are not bridged, and are often swollen by the melting snow. From Kampa Dzong to Tingri Dzong, the base of operations for the Expedition, is an open country. Mount Everest lies 40 to 50 miles South of Tingri Dzong; the approach also is without difficulty.



The ascent of Mount Everest was not the primary object of the Expedition of 1921. A mountain the size of Mount Everest cannot be climbed by simply getting to it and starting the ascent immediately.

A reasonable route has to be discovered to the summit ; which usually can only be done by a complete reconnaissance of the mountain. This has been admirably done, and a most magnificent series of photographs has been brought back by the members of the Expedition.

Mount Everest consists of a huge pyramid, having three main arêtes, the West, the South-east, and the North-east. It is the last, the North-east arête, that is obviously the easiest, being snow-covered along most of its length. Nowhere is it excessively steep, and nowhere are there precipices of rock to stop the climber. We now know that it can be reached, by means of a subsidiary ridge, from a col 23,000 feet, the Chang La, that lies to the north of the North-east arête. This col was the highest point on Mount Everest reached by the Expedition, and had it not been for savage weather a considerably higher altitude would have been attained ; for above the col for several thousand feet lay an unbroken snow-slope.

It was only after much hard work, and over two months' exploration, that a route to this col was discovered. As is usually the case even with mountains far smaller than Mount Everest, it can be seen that if a point, often a long way below the summit, can be reached, not much farther difficulty will be encountered. But the puzzle is, how can that point be arrived at from below ?

Quite early in the exploration of Mount Everest it was obvious that if the 23,000-foot col could be reached, most of the physical difficulties of the approach to the mountain would have been surmounted. But it was not so obvious how to win to the col. It lies on the South-east at the head of the main Rongbuk Glacier ; it was therefore to this glacier that the mountaineers, Messrs. Mallory and Bullock, went from Tingri Dzong on June 23. They spent a month exploring



the country to the North and the West of Mount Everest from the Rongbuk Glacier. Much valuable information was accumulated. A peak, Ri-Ring, 22,520 feet, was climbed and a pass on the West ridge of Mount Everest was visited, from which were seen views of the South-west face of the great mountain and also many high peaks in Nepal. Unfortunately, however, no feasible route from the main Rongbuk Glacier to the 23,000-foot col could be found. The next attempt was made by leaving the Rongbuk Glacier and exploring the Kama Valley that flows South-east from Mount Everest. Here a most magnificent ice-world was discovered. For a chain of giant peaks running South-east from Mount Everest to Makalu, 27,790 feet, guards the whole of the South-west side of the valley. But as an approach to the North-east arête of Mount Everest this valley was found to be useless. From the point of view, however, of exploration it was most fortunate that this valley was visited. The photographs of Makalu and its satellite Chomo-Lönzo, N.⁵³, 25,413 feet, are superb; moreover the lower reaches of the Kama Valley, as it dips down to the deep Arun Valley, was full of luxuriant vegetation, totally different from the wind-swept wilderness of Tibet.

The Kharta Valley, that runs North-east from Mount Everest, was the next exploited, to see whether from it an easy approach to the North-east arête existed. But by this time the monsoon weather was at its worst. Days of rain and mist, with snow higher up, succeeded one another, making climbing impossible. However, towards the end of September a high camp at 22,500 feet was made at the head of the Kharta Valley. From this camp the 23,000-foot col, Chang La, was finally reached, by crossing the head of a glacier that ran to the North. Higher climbing was out of the question; a furious North-west gale lasting for four days drove the party off the mountain.

The glacier mentioned above, running to the North, was found to be a tributary of the main Rongbuk Glacier, and has been named the East Rongbuk Glacier. There is no



doubt that the easiest route to Chang La, the North Col, will not be all the way round by the Kharta Valley, but up this East Rongbuk Glacier.

Several other interesting expeditions were carried out by other members of the party. Colonel Howard Bury visited the group of five great peaks (25,202 to 26,867 feet), that lie about 15 miles North-west of Mount Everest. He explored the Kyetrak Glacier to its summit the Khombu La, also crossed the Phüse La with the Rongshar Valley that drains down into Nepal. Later he visited another pass on the ridge that connects Mount Everest with Makalu. From this pass most interesting views of the country South of Mount Everest were obtained.

Major Wheeler's and Major Morshead's map of the country that lies between the Himalaya and the Bramapootra River will be of the highest value, and the results of Dr. Heron's geological survey and Mr. Wollaston's collections of birds, beasts, insects and flowers, when they have been thoroughly examined, will certainly yield much new scientific information. The Expedition therefore has accomplished all that was expected of it, and has brought back material of the greatest interest, from a part of the world about which almost nothing was known, and into which Europeans had never been.

The attempt to ascend Mount Everest itself necessarily had to be postponed, but this year the Expedition that is being sent out will have for its primary object the ascent of the mountain. There will be easy access to the base of the peak from Chöbuk, where a base camp will be established, and from thence a feasible route on to the summit of the great North-east arête has been discovered.

Most fortunately this year General Bruce was able to undertake the leadership of the Expedition. His unrivalled experience of climbing in the Himalaya and particularly his special capacity for handling Himalayan people will be invaluable to the Expedition. Not only will he be able to organise and instil the right spirit into the coolie corps upon



whom so much will depend for ultimate success, but he will also be able to give much wise advice to the actual climbers who are to take part in the ascent of the mountain.

Moreover, with his long experience of dealing with Asiatics he can be trusted to deal with the Tibetan people and officials in such a way as to retain their present good-will.

As the main object of the Expedition this year is to make a definite attempt to reach the summit of Mount Everest, it has been decided that the actual climbing party should be as strong as possible. But a limit to the size of the Expedition was imposed by the necessity of respect for the feelings of the Tibetans, and a warning had been received from Lhasa to keep the numbers as small as possible. For, although the authorities at Lhasa might be friendly enough, and although there might be no difficulty in obtaining transport from the district round Tingri Dzong, where animals were plentiful, yet a large party might press hardly on the inhabitants in the matter of food, such as wheat and barley. This consideration had therefore to be regarded. Still it was thought that the district would not be unduly pressed by a party of twelve Europeans. This number will include a climbing party of six chosen mountaineers, with two in reserve, making eight in all. With General Bruce, a doctor (who would also be a naturalist), a photographer and a painter, the expeditionary force of Europeans will be complete.

Colonel E. L. Strutt, C.M.G., has been chosen as second in command. He possesses first-rate mountaineering experience, and has been Vice-President of the Alpine Club.

Mr. Mallory fortunately has been able to accept the invitation of the Committee to return to Mount Everest again this year. The remainder of the climbing party are: Captain George Finch, who was unable to join the Expedition last year on account of his health; Mr. T. H. Somervell, a surgeon, a member of the Alpine Club and an extremely energetic climber; Major E. F. Norton (Royal Artillery); and Dr. A. W. Wakefield, renowned for his strenuous climbing in the Lake District and work in Labrador. Besides these six



mountaineers, Captain Geoffrey Bruce and Captain C. J. Morris, both of Gurkha Regiments, and able to speak the language of the Himalayan coolies, will assist General Bruce both in looking after and encouraging the coolies, and also help in the general arrangement and organisation of the Expedition as a whole. They also are accustomed to mountaineering and will act as a reserve to the six climbers.

As doctor and naturalist Dr. T. G. Longstaff has been invited to join the Expedition. He has made many climbs in the Himalaya and other mountain regions, including the ascent of Trisul, 23,360 feet. He is not expected to join the climbing party, but his experience will be of great benefit to the Expedition generally.

As photographer, Captain J. B. L. Noel has been selected. He had reconnoitred in the direction of Mount Everest in 1913. For several years he has made a special study of photography in all its various branches.

But besides photographs of the mountains, the Expedition is anxious to bring back pictures which would alone be able not only to serve as a record of the infinitely delicate colouring of that lofty region, but at the same time would show how probably some of the grandest scenery of mighty mountains should be represented from the point of view of an artist.

Difficulty was experienced in finding a suitable painter, for painters capable of doing justice to mountain scenery, and who are also physically fit to travel amongst them at such altitudes as those round Mount Everest, are few. We have, therefore, to depend on Mr. Somervell to paint us pictures.

In the meantime communications were also passing between Colonel Bailey, the Political Agent in Sikkim, and the Mount Everest Committee regarding the enlistment of coolies for the special corps, and the engagement of the very best headman obtainable to look after them. Many of the coolies who were with the Expedition in 1921 had volunteered to rejoin this year. But a stronger corps and more carefully



selected men were needed. The Maharaja of Nepal has been asked to allow some of the most famous Gurkha mountain climbers to join the Expedition, and the Government of India has been asked to put two or three non-commissioned Gurkha officers at the service of General Bruce, to assist him generally in looking after the coolies, and seeing that they were properly fed and paid, and that they behaved themselves properly.

The members of last year's Expedition on their return were freely and fully consulted as to equipment and provisioning of this year's party; the experience gained last year has been therefore made use of in every way possible. Suggestions for the improvement of the Mummery-Meade tents have been adopted. Better clothing has been provided for the coolies. General Bruce has purchased leather coats, waistcoats, socks, jerseys and boots from the equipment provided for our troops in North Russia during the war, which will be admirably suited for the majority of the coolies, whilst for the few chosen for high climbing on Mount Everest itself, clothing precisely similar to that worn by the British climbers has been provided.

Captain Farrar and the equipment committee have provided a most varied and ample supply of provisions which was despatched to India in January. The Primus-stoves have been overhauled and retested by Captain Finch.

Colonel Jack and Mr. Hinks have carefully examined all the instruments brought back. The aneroids have been retested, and all broken instruments replaced.

The photographic outfit has been considerably enlarged, including a cinematograph instrument. The question of supplying oxygen has been most thoroughly gone into. All flyers in aeroplanes at high altitudes find oxygen absolutely necessary. In mountain climbing, however, the almost insuperable difficulty is the weight of the apparatus supplying the oxygen. As far as possible, this weight has been reduced to a minimum. A large number of cylinders, the lightest and smallest obtainable, have been sent out full of compressed

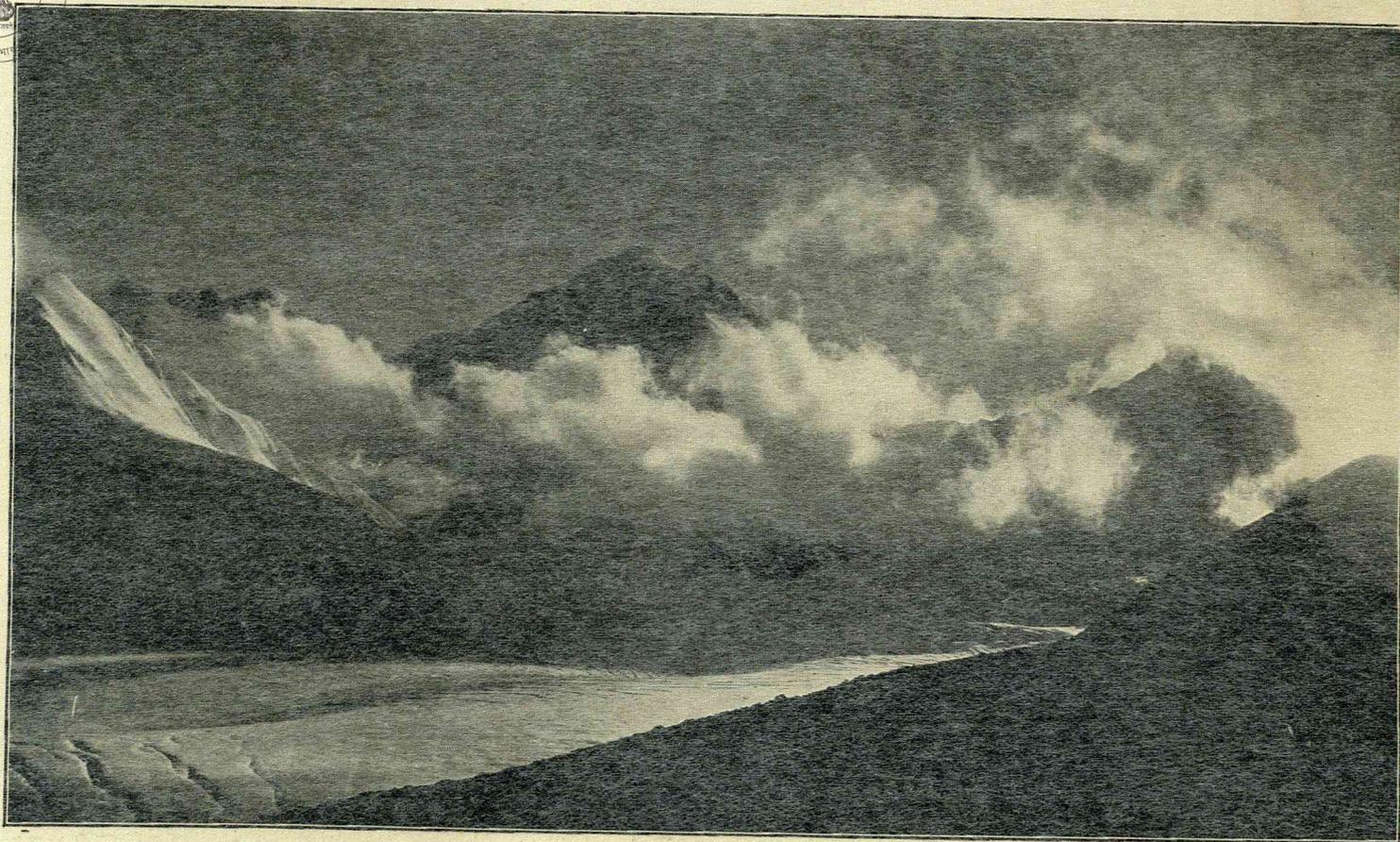


oxygen, and it is hoped that they will be capable of being used by the party that will attempt to climb to the summit of Mount Everest. If the climbers are capable of carrying them, and so getting a continuous supply of oxygen during the whole of the climb, there is little doubt that climbing up to 29,000 feet is possible. In aeroplanes considerably higher altitudes have been reached with the help of oxygen. Moreover, there is this fact in favour of the climbers on Mount Everest, they will be acclimatised to altitudes of 20,000 feet, whilst anyone in an aeroplane is not so acclimatised, having risen from sea-level. The climbers will have to accommodate themselves only to an increased height of 9,000 feet, whilst those in an aeroplane have to suffer a diminution in pressure equivalent to 29,000 feet.

Finally, arrangements have been made with the Press for the publication of telegrams and photographs from the Expedition. Full information of the progress of the Expedition will therefore be available for the public, and it will be possible to follow the climbing party, after they leave the base camp, which will be somewhere near Chöbuk, as they ascend the East Rongbuk Glacier to the advanced base under the North col. Afterwards all the preliminary arrangements will be reported, and finally there will be an account of the great attempt to reach the summit.

The Expedition will be starting nearly two months earlier than in 1921. The weather in May and June, before the monsoon breaks in July, apparently is more or less settled, and so the most must be made of it. In 1921 from the end of July till September high climbing was impossible. It is therefore obvious that a determined attempt to climb Mount Everest should be made before the monsoon sets in.

The ascent from the North col, Changa La, 23,000 feet, to the summit of Mount Everest, 29,000 feet, is only 6,000 feet, and the distance to traverse is about 2 miles. As far as can be judged from the numerous photographs of Mount Everest, the climbing is straightforward with no insurmountable difficulties in the form of steep rock precipices. There



MOUNT EVEREST AT SUNSET
from the 20,000 foot camp, Kharta Valley.



CSL

will be no glaciers overhanging the route which might send down avalanches, and no excessively steep ice-slopes.

But the final ascent will test the endurance of the climbers to the utmost. Many people have found the last 1,000 feet of Mont Blanc more than they could accomplish. The last 1,000 feet of Mount Everest will only be conquered by men whose physique is perfect, and who are trained and acclimatised to the last possible limit, and who have the determination to struggle on when every fibre of their body is calling out—Hold! enough!

The struggle will be a great one, but it will be worth the while. To do some new thing beyond anything that has been previously accomplished, and not to be dominated by his environment, has made man what he is, and has raised him above the beasts. He always has been seeking new worlds to conquer. He has penetrated into the forbidding ice-worlds at the two poles, and many are the secrets he has wrested from Nature. There remains yet the highest spot on the world's surface. No doubt he will win there also, and in the winning will add one more victory over the guarded secrets of things as they are.



APPENDIX I

THE SURVEY

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

The personnel selected to form the Survey Detachment under my charge were as follows: Brevet-Major E. O. Wheeler, M.C., R.E., Mr. Lalbir Singh Thapa, Surveyors Gujjar Singh and Turubaz Khan, Photographer Abdul Jalil Khan, sixteen khalasis, etc.

The tasks allotted to the detachment were:—

- (1) A general survey of the whole unmapped area covered by the Expedition, on a scale of 1 inch to 4 miles.
- (2) A detailed survey of the immediate environs of Mount Everest on the scale of 1 inch to 1 mile.
- (3) A complete revision of the existing $\frac{1}{4}$ -inch map of Sikkim.

With the exception of a few rough notes and sketches by early travellers and missionaries in the seventeenth and eighteenth centuries, our first knowledge of the Southern portion of the Tibetan province of Tsang dated from the epoch of the Survey of India by trained native explorers in the middle of the nineteenth century. Thus, much of the area visited by the Expedition in 1921 was traversed by the explorer Hari Ram during the course of his two journeys in 1871–2 and 1885 respectively. At that time, however, foreign surveyors were not regarded with favour in Tibet; work could only be carried on surreptitiously, and the resulting map merely consisted of a small-scale route traverse which gave no indication of the surface features beyond the explorer's actual route.

The first rigorous survey undertaken in the neighbourhood was that carried out by Captain C. H. D. Ryder, R.E. (now Colonel Ryder, C.I.E., D.S.O., Surveyor-General of India), during the Tibet Mission of 1903–1904. During the stay of the Mission at Kampa, the $\frac{1}{4}$ -inch survey was carried as far West as longitude 88° ; while, on the subsequent return march up the Tsangpo Valley, surveys were extended as far as the Southern watershed of the great river—the so-called Ladak Range—in latitude 29° approximately,



West of longitude 88° there thus remained a stretch of unsurveyed country some 14,000 square miles in area, between the Ladak Range on the North and the Great Himalaya Range on the South—the latter forming the Northern frontier of Nepal. The Mount Everest Expedition provided an opportunity of making good the whole of this area, with the exception of some 2,000 square miles at the extreme Western end, into which, in view of the restrictions of the Indian Foreign Department, I did not feel justified in penetrating.

Fortunately, Colonel Bury's plans contemplated an outward Northerly journey via Shekar and Tingri to the Western flanks of Mount Everest, whence the reconnaissance of the mountain was to be carried out from West to East, parallel to the Northern frontier of Nepal. This rendered feasible the mapping of the whole unsurveyed area between the Southern watershed of the Tsangpo and the Great Himalaya Range, as far West as longitude 85° 30', without in any way infringing the Foreign Department's orders and restrictions.

For the purpose of the detailed survey of the Mount Everest regions, it was arranged for my Assistant, Major Wheeler, to make a thorough test of the Canadian pattern of photo-survey apparatus, of which he had had previous experience in the Canadian Rocky Mountains. This method of survey, which had not hitherto been employed in India, is particularly adapted for use in high mountain regions. Fortunately, the experimental outfit, which had recently been ordered from England, was delivered just in time to accompany the Expedition. Wheeler's account of his season's work will be found in Appendix II.

With a view to carrying out the revision survey of Sikkim while awaiting the arrival of the members of the Expedition from England, the Survey Detachment was authorised to assemble at Darjeeling early in April, six weeks before the date fixed for the start of the Expedition. In spite of an unusually wet and cloudy spring, the three surveyors made such good use of their time that 2,500 square miles of country were completed before the advance of the Expedition necessitated the temporary abandonment of this work.

After completing the necessary preliminaries with Colonel Bury, I myself left Darjeeling on May 13, intending to rejoin the remainder of the Expedition in Sikkim. Continuous rain, however, rendered the latter task impossible; the Sikkim roads were, moreover, blocked in several places by severe landslips, so that I was only with difficulty able to reach Kampa by the 28th. It transpired, however, that there was no cause for hurry, since the main body of the Expedition, travelling via the Chumbi Valley, had encountered greater difficulties



than mine, and did not arrive at Kampa until June 5. While awaiting their arrival, I filled in the time by occupying and re-observing from Colonel Ryder's old triangulation stations of 1903, overlooking the Kampa Plain.

I had received no news whatever of the Expedition or of the outside world since leaving Darjeeling three-and-a-half weeks previously. Consequently the death of my old friend Dr. Kellas on the very day of their arrival at Kampa came to me as a very severe shock.

The Sikkim revision-survey having been so much hampered by bad weather, I decided to take only two of the three surveyors with the Expedition into Tibet, leaving Surveyor Turabaz Khan to complete the comparatively dry areas of Northern Sikkim before the arrival of the monsoon. This he succeeded in doing at the cost of considerable personal discomfort, returning to Darjeeling in July.

It was not until we reached the summit of the Tinki Pass on June 11 that we found ourselves for the first time looking into unsurveyed country. From here onwards as far as Tingri the survey was kept up by Lalbir Singh, whose unflagging energy alone enabled him to keep pace with the long marches of the Expedition. Each morning he was away with his plane-table and squad of coolies long before our breakfast was served, seldom reaching camp before nightfall. The gathering clouds and other ominous signs of a rapidly approaching monsoon, however, forbade any respite.

On arrival at Tingri, after spending a week in fruitless efforts to observe the triangulated peaks of the main Himalayan Range through the dense monsoon clouds which were daily piling up more and more thickly from the South, I departed on June 26 with Surveyor Gujjar Singh on a short trip to explore and map the upper valley of the Bhong Chu.

Our first march led across the wide Tingri Plain, past the hot spring village of Tsamda, to the hamlet of Dokcho, at the Southern extremity of the Sutso Plain. This plain is covered with the ruins of numerous villages and watch-towers, the haunt of countless rock-pigeons. They are all of loftier and more substantial construction than the miserable hovels which form the scattered hamlets of to-day—indicating, apparently, the former presence of a large and warlike population. It is impossible even to hazard a guess at the age of these ruins, which may have preserved their present state for generations in the comparatively arid climate of Tibet. Many of the towers are 60 feet or more in height; roofs and floors have all disappeared, but



the massive mud walls in many instances still bear the marks of the wooden shuttering used in their erection. This method of construction is unknown, I believe, in Tibet at the present day.

The next day's march, skirting the Western edge of the plain, brought us to the village of Phuri, where the river flows in a flat-bottomed, cultivated valley, between bare brown hills. On the 28th we camped at Menkhap-to, the highest village in the valley. The headman, a sort of local "warden of the marches," refused to see me and shut himself up in his house, guarding his door with three huge mastiffs who effectively frustrated the efforts of my messengers to establish communications. Evidently he feared the subsequent results to himself of harbouring strangers. The remaining villagers were quite friendly, however, and supplied all my requirements. One man, the owner of a gun, surprised me by a request for 12-bore cartridges just after I had greatly shocked his neighbour's Buddhist susceptibilities by killing a butterfly for my collection! Much snow is reported to fall at Menkhap-to, which is deserted during the winter months, when the inhabitants descend to Menkhap-me ("lower Menkhap") and the Sutso Plain.

Above Menkhap-to the road leaves the main valley and proceeds Westwards over a spur known as the Lungchen La (17,700 feet). This spur commands an extensive view across the wide, uninhabited Pekhu Plain, with its three lakes, as far as the snowy range running North-west from the summit of Gosainthan. On a fine day, the whole panorama can be sketched in from a couple of fixings on either side of the pass; unfortunately, at the time of our arrival bad weather had set in, and the whole snow-range was hidden in cloud. I had therefore to leave Gujjar Singh camped near the summit of the pass to await a fine day for the completion of his surveys, and myself returned at the end of the month to Tingri, where I rejoined Mr. Wollaston, who had been detained at headquarters by an outbreak of enteric fever amongst the Expedition servants.

Wild game is plentiful in the Upper Bhong Valley. I shot numerous hares, some ram-chakor and a bar-headed goose during the trip; while Gujjar Singh caught a young, week-old barhal lamb on the summit of the Lungchen Pass, which, however, died after three weeks in captivity. Gazelle are common on the Sutso Plain.

By the end of June, Lalbir Singh had finished the inking of his previous surveys, and was ready for fresh work. Accordingly, after spending a couple of days in examining his board, and checking the spelling of his village names with the aid of the local Tibetan officials,



I despatched him on a lengthy programme of work in Pharuk and Kharta. It was three months before I saw him again.

About this time a messenger arrived from the Dzongpen of Nyenyam, inviting us to visit his district, which lay four marches to the South-west, in the valley of the Po Chu or Bhotia Kosi R. Although Nyenyam was not one of the districts specifically mentioned in our passport, Wollaston and I decided, with the concurrence of Colonel Bury, to avail ourselves of the opportunity of visiting this little-known area.

Leaving Tingri on July 13, with the interpreter Gyaldzan Kazi and Surveyor Gujjar Singh, who had now returned after completing his work on the Lungchen Pass, we camped that evening at Langkor, a small village at the Western edge of the Tingri Plain. A cantilever bridge which spans the Gya Chu opposite the village had been carried away by floods shortly before our arrival, and the whole population of the hamlet, male and female, were busily engaged in its reconstruction, working in relays to the accompaniment of prolonged and vigorous blasts on a "conch" which a monk was diligently blowing in order—as it was explained to us—to avert further rainfall until the bridge should be completed. His efforts were rewarded with tolerable success, as the rain held off all day in spite of the threatening storm-clouds which loomed up from the South-west.

The most interesting feature of Langkor is an ancient temple, an appanage of the great Drophung monastery of Lhasa. This building, which is said to be over 1,000 years old, contains a sacred stone alleged to have been hurled across the Himalayan Range from India, and to have pitched in the Tingri Plains. The name Tingri is said to be derived from the noise ("ting") made by the falling stone. The stone is carefully preserved inside a wooden box, which is opened with much ceremony on the first day of the Tibetan new year. The temple, which is managed by a committee of fifteen civilian monks (nyakchang), also contains a library of 4,400 books, and an image of the Indian saint Tamba Sanye which is popularly believed to have grown by itself from the ground *in situ*.

Crossing the Tang La (17,980 feet) in a driving snowstorm, a long march of 22 miles brought us next day to the bleak village of Tulung, in the upper valley of the Po Chu. As we descended the Western side of the pass the snow-clouds gradually dispersed, disclosing glimpses of the magnificent twin summits of Gosainthan (26,290 feet), 30 miles to the West. Several of our coolies succumbed to mountain sickness on the pass, with the result that my bedding and the kitchen box only reached camp at 9 p.m.



On July 15 our road lay for 8 miles along the flat valley of the Po Chu; the river then turns sharply Southwards, passing for 3 miles through a gorge of granite and schist. Bushes of wild currant, gooseberry, berberis and dog-rose here begin to appear, and around the village of Targyeling, where we camped, were smiling fields of mustard and buckwheat, in addition to the usual Tibetan crops of barley and dwarf pea. After a month spent in the bleak Tibetan uplands, it was a relief to pitch our tents in a homely green field, alongside a rippling brook lined with familiar ranunculus, cow parsley, forget-me-not, and a singularly beautiful pale mauve cranesbill, and to feast our eyes on the glorious purple of the wild thyme which clothed the hillsides in great patches of colour.

The next day, still following the course of the Po Chu, we reached Nyenyam, a large and very insanitary village which is known under the name of Kuti by the Nepalis who constitute the majority of its inhabitants. These Nepali traders (Newars) have their own Hindu temple in the village. There is also a Nepalese chauki (court-house) with a haqim (magistrate) invested with summary powers of jurisdiction over Nepali subjects; he is specially charged with the settlement of trade disputes, and with the encouragement of Tibeto-Nepalese trade and commerce.

As is customary in all important districts of Tibet, there are here two Dzongpens, who by a polite fiction are known as "Eastern" and "Western" (Dzongshar and Dzongnup) respectively. Actually, the functions of the two Dzongpens are identical; the *raison d'être* of the double regime being an attempt to protect the peasants from extortion by the device of providing two administrators, who, in theory at least, act as a check upon each other's speculations. At the time of our arrival, those two worthies were so busy preparing a joint picnic that we had considerable difficulty in getting their attention.

I spent three days in exploring the neighbourhood of Nyenyam, while Wollaston was engaged in his botanical and zoological pursuits. Gujjar Singh, with the plane-table, was detained by bad weather higher up the valley. Below Nyenyam the river enters a very deep, narrow gorge; pines and other forest trees begin to appear. The road, which here becomes impassable for animals, crosses the river four times in 6 miles by cantilever bridges before reaching the village of Choksum, but I could find no trace of the portion described by explorer Hari Ram in 1871 as consisting of slabs of stone 9 to 18 inches wide supported on iron pegs let into the vertical face of the rock at



a height of 1,500 feet above the river. At Choksum (10,500 feet) the river falls at an average rate of 500 feet per mile. The Nepal frontier is crossed near Dram village, some 10 miles further down stream, but owing to the vile state of the weather, which rendered even the roughest attempts at surveying impossible, I abandoned all idea of reaching the spot.

On July 20 we retraced our steps 9 miles up the valley to Tashishong, where we found Dr. Heron encamped, together with Gujjar Singh, whose work had been hung up for a week by continued cloud and rainfall. Heron returned Northwards next day, while we followed a rough easterly track leading over the Lapche Range to the village of the same name in the valley of the Kang Chu. The weather on this day was atrocious, and our last pretence of accurate surveying broke down. We were unable to reach Lapche village by dusk, and spent a somewhat cheerless night on boulders in drenching rain at 14,600 feet, with no fuel except a few green twigs of dwarf rhododendron.

Lapche (La-Rimpoche, "precious hill") is sacred as the home and birthplace of Jetsun Mila Repa, a wandering lama and saint who lived in Southern Tibet in the eleventh century, and who taught by parables and songs, some of which have considerable literary merit. The two principal works ascribed to him are an autobiography, or namtar, and a collection of tracts called Labum, or the "myriad songs." They are still among the most popular books in Tibet.* His hermit-cell still remains under a rock on the hillside, and his memory is preserved by an ancient temple and monastery, the resort of numerous pilgrims, alongside which we pitched our tents.

Lapche village is situated on a spur overlooking the junction of two branches of the Kang stream—the latter being a tributary of the Rongshar River, which, in turn, joins the Bhotia Kosi River in Nepal. The extreme dampness of the local climate is indicated by the trailing streamers of lichen which festoon the trees, and by the pent roofs of the buildings. The village contains some ten or twelve houses, of which half are occupied by Tibetans and half by Nepalese subjects (Sharpas)—each community having its own headman. The inhabitants were very friendly and pleasant, and gave us a good deal of information. The village is deserted during the winter months, when the whole population migrates across the border into Nepal. The Tibetans pay no taxes to Nepal during their half-yearly sojourn

* *Journey to Lhasa and Central Tibet*, by S. C. Dass, C.I.E., page 205, footnote by Hon. W. W. Rockhill.



in the lower valley; conversely, the Nepalis during their summer residence in Lapche are not subject to Tibetan taxation or to the imposition of ulag (forced labour). The Tibetans of Lapche pay their taxes in the form of butter direct to the Lapche monastery, the head lama, or abbot, of which resides at Phuto Gompa near Nyenyam. The Nepal frontier is some 10 miles below Lapche, opposite the snow-peak of Karro Pumri. Katmandu can be reached in eight days, but the track is bad and very little trade passes this way.

Transport arrangements necessitated a day's halt at Lapche, which was fortunately enlivened by the timely arrival of a large parcel of letters and newspapers, which Colonel Bury had thoughtfully sent after us from Tingri—almost the last news of the outside world which we were to receive for over two months.

From Lapche we proceeded to the Rongshar Valley, crossing the Kangchen and Kangchung ("big snow" and "little snow") passes. Descending the hill to Trintang village, where we camped on July 25, the clouds lifted momentarily, disclosing an amazing view of the superb snow summit of Gaurisankar towering magnificently above us just across the valley. This mountain, which is called by the Tibetans Chomo Tsering, or Trashi Tsering, is the westernmost of a group of five very sacred peaks known collectively as Tsering Tse-nga ("Tsering five peaks"). Unfortunately, owing to constant clouds, I was unable to identify with certainty the remaining four peaks of Tingki Shalzung, Miyo Lobzung, Chopen Drinzang and Tekar Drozung. Owing to the sacred nature of the Rongshar Valley, the slaughtering of animals is strictly forbidden; the large flocks and herds of the villagers are only sold for slaughter in the adjoining districts of Tingri and Nepal, and we were only able to buy a sheep on promising not to kill it until after quitting the valley.

Trintang village occupies a plateau 1,750 feet above the level of the river; 1,400 feet below is the village of Tropde, to which the Trintang residents all descend in winter. Rongshar Dzong, which is situated in the lower village, has no importance; at the time of our visit the Dzongpen had gone to his home on leave of absence, leaving his affairs in the hands of a steward.

A day's halt being necessary in order to collect transport, I took the opportunity of descending the Rongshar Valley as far as the Nepal frontier, while Gujjar Singh endeavoured, without much success, to pick up the threads of his survey by identifying the snowy peaks which occasionally afforded brief glimpses through rifts in the clouds. The Rongshar River drops 1,400 feet in 7 miles between Tropde and



the Nepal frontier, which is crossed at an altitude of roughly 9,000 feet.

On July 27 we marched 20 miles up the Rongshar Valley to the village of Tazang (Takpa-Santsam, "limit of birch trees"), which, as its name implies, is situated at the extreme upper limit of the forest zone. On the way we passed the village and monastery of Chuphar, whence a track leads South-east over the difficult snow-pass of Menlung ("vale of medicinal herbs") to the villages of Rowaling and Tangpa in the Kangphu Valley of Nepal.

Tazang had already been visited by Colonel Bury, a month previously. The local headman was too drunk, on the evening of our arrival, to send out the necessary messages summoning the village transport-yaks from their grazing grounds. In consequence, our baggage was only got under weigh at 11 a.m. next morning, and we were compelled to pitch our tents at a grazing camp (16,500 feet) after only covering 9 miles. The weather showed signs of improvement in proportion as we receded from the Himalayan gorges, but dense banks of cloud still obscured all the hill-tops. An easy march over the Phuse La (17,850 feet) brought us on the 29th to the bleak village of Kyetrak, situated at the foot of the great Kyetrak Glacier, on the extreme Southern edge of the Tingri plain—an area which we had already surveyed six weeks previously.

From Kyetrak we proceeded via the Lamna La to Chöbuk, thence following the tracks of the Expedition headquarters which Colonel Bury had just transferred from Tingri to Kharta in the lower Bhong Chu Valley. On reaching headquarters on August 2, we found Colonel Bury in sole occupation—Mallory and Bullock having left that very morning on a reconnaissance of the Eastern approaches to Mount Everest.

The weather during the whole of August was such as to render out-of-door survey operations impossible. Gujjar Singh was occupied during the month in adjusting and inking his surveys, while I filled in several days in making tracings of all work so far completed, after which, for the remainder of the season, I joined the mountaineers, whose doings are recorded elsewhere in this book.

On the return journey in October I despatched Gujjar Singh from Gyankar Nangpa to complete the remaining portions of the Sikkim revision-survey; at the same spot I picked up Lalbir Singh, who, after completing his survey of the Pharuk and Kharta areas, had crossed the Bhong Chu below Lungdo and worked his way back via Tashirakar and Sar. Travelling via Kampa and Lachen Valley,



we reached Darjeeling on October 16. Tracings of the new survey were hastily finished and sent to press, with the result that a complete preliminary $\frac{1}{4}$ -inch map in six colours was published before the last members of the Expedition had sailed for England. A $\frac{1}{2}$ -inch preliminary sketch-map of the environs of Mount Everest was also prepared by Major Wheeler at the same time for the use of the mountaineers in discussing the details of their next year's climb.

The out-turn of work during the Expedition was as follows :—

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

The surveyors all worked splendidly under difficult and trying conditions. Major Wheeler had probably the hardest time of any member of the Expedition, and his success in achieving single-handed the mapping of 600 square miles of some of the most mountainous country in the world is sufficient proof of his determination and grit. It is difficult for those who have not actually had the experience to conceive the degree of mental and physical discomfort which results to the surveyor from prolonged camping at high altitudes during the monsoon, waiting for the fine day which never comes. Such was our fate for four months during the Expedition of 1921, yet on looking back one feels that the results were well worth while. The discomforts soon fade from recollection ; the pleasures alone remain in one's memory, and there is not one of us but would gladly repeat our season's experiences, if so required.



APPENDIX II

THE PHOTOGRAPHIC SURVEY

BY MAJOR E. O. WHEELER, M.C.

I had purchased a set of photo-topographical surveying instruments of the Canadian pattern, on behalf of the Survey of India, while on leave in 1920. A trial of this method of surveying mountainous country was to be carried out in Garhwal in 1921; but when Survey of India officers were asked for to accompany the Mount Everest Expedition, I was detailed to carry out the trial there. Possibly a word of explanation of the method used may not be amiss.

The "Canadian" method—if I may call it so; for although it was invented and has been used elsewhere, it has been far more extensively applied in Canada than in any other part of the world—may be briefly described as "plane-tabling by photography." It requires, equally with the plane-table, an accurate framework, on which to base the detailed survey; and simply substitutes a small (3-inch vernier) theodolite and camera for the sight-rule and plane-table. Stations are fixed and photographs oriented by means of the theodolite; the photographs, which are taken so as to be as nearly as possible true perspectives, represent the country as it would be seen by the plane-tabler, and detail on them may be fixed by intersections or sketched in by eye in exactly the same way as on the plane-table.

Angles are read and photographs taken in the field; and, if considered necessary to test exposures or protect photographic plates from deterioration due to climatic conditions, development of plates is also carried out there. Otherwise, the map is made wholly in the office, using either contact prints or enlargements, from the negatives taken in the field. The latter are usually preferable. The main advantages at high altitudes over the plane-table are, that a much larger area can be covered in a given time in the field, that the instruments are more portable for difficult climbing, that there is no necessity to do accurate drawing with numbed fingers, and that



the draughtsman may see the country from several points of view at one time. On the other hand, more equipment is necessary, and—a great disadvantage sometimes, as in this case—the map does not come into being as one goes along.

After carrying out various preliminary adjustments and tests at the office of the Trigonometrical Survey at Dehra Dun, I reached Darjeeling on April 30, and Tingri on June 19, travelling with Expedition Headquarters via Phāri Dzong.

En route Tingri, we had caught glimpses of Everest and the neighbouring peaks; so that by the time we arrived there, I was able, with the help of the existing maps and what local information we had obtained, to decide on the area I would attempt to survey. I say “attempt,” for little was really known then about the geography, and still less about the weather conditions throughout the summer. As it turned out in the end, the area had to be much curtailed, and certain parts surveyed in considerably less detail than I should have liked: almost wholly on account of the weather. Although it was often fairly clear at 6 a.m. or so, photographs taken before 8, particularly at the latter end of the season, were of little use for surveying purposes.

However, at the outset, I had hoped to map, on the scale of 1 inch = 1 mile, the whole area between the Arun Gorge on the East and the Rā Chu on the West: and from the Nepāl-Tibet boundary Northwards for some 20 miles; i.e. to the point where the various streams, flowing in a Northerly direction from the high boundary ridge, issue from the mountains proper into the more rolling foot-hills on the Southern outskirts of the Tibetan Plateau. This area includes Mount Everest itself near the centre of its Southern side, Makālu and Pk. 25,413 to the South-east, Pks. 23,800 (Khārtaphu), 23,420, and 23,080 to the North-east and North, and Pks. 25,990 (Gyāchung Kang), 25,202, 25,909 and 26,867 (Cho Oyu) to the North-west; and comprises some 1,000 square miles of country: a suitable season's work, given reasonably fine weather. This unfortunately we did not get.

On June 24, the day after Messrs. Mallory and Bullock had started for the Rongbuk Valley, Dr. Heron and I marched South across the plain to the village of Shārto, *en route* Kyetrāk, in the Rā Chu Valley, where I intended to establish my base camp while surveying the Kyetrāk Glacier and West face of the Cho Oyu—Gyachung Kāng group. The next day we moved on to Kyetrāk, 1 mile below the snout of the glacier, and made camp there. This bleak village and the route to it and over the Phūse La have already been described.



June 26 was fine, so after crossing the Rā Chu on local ponies, ourselves and our ice-axes and rucksacks perched on Tibetan saddles—a cold and uncomfortable proceeding in the early morning—we ascended the 18,000-foot hill immediately West of the village. Up to 1 p.m. we had excellent views across and up the Kyetrāk Valley ; but only a glimpse of Gauri Sankar (Chomo Tsering) to the South-west, where heavy clouds soon began to roll up. Cho Oyu and Pk. 25,909 and their spurs unfortunately cut out all distant views to the South-east, as they did everywhere in the upper part of this valley ; so that my first view of Everest was from Tingri a month later. Next day, we started shortly after daylight for a spur on the East side of the valley ; unfortunately—and this happened in the case of almost every peak I started for until mid-September—clouds began to roll up, and we were forced to stop to take the photographs before we had reached a really good view-point.

Colonel Bury arrived at Kyetrāk shortly after we got back to camp. On the 28th he and Heron started off early for a flying visit to the Kyetrāk Glacier and Nangba La ; I started later, after getting kit together, for a camp half-way up the glacier, and about 6 miles from Kyetrāk. About 2 p.m. I found a comparatively dry spot on shale at 18,000 feet, and pitched my tents there, the last of the coolies arriving only at 6 p.m. The place was bleak enough, but was as far as I could get that day, and seemed suitable for two climbs—one on either side of the glacier.

My equipment consisted of the camera, theodolite, and a small plane-table—to help in identifying triangulated points—by way of instruments, which were carried by three coolies who remained with me. Ten other coolies slept at the base camp at Kyetrāk, and carried stores up to me or moved the camp, as required ; the camp consisted of a Whymper tent for the three coolies and a Meade for myself ; bedding, food, a Primus stove and tin of kerosene for my own cooking, and yak dung fuel for the coolies. My servant remained at the base camp and sent up cooked meat and vegetables ; otherwise I cooked for myself.

June 29 and 30 were useless days ; but on July 1 the weather cleared a bit, and after crossing the glacier, I went up a sharp rock shoulder of Cho Rapzang. The peak was mainly loose granite blocks at a steep angle, so that progress was slow ; it was noon when I reached the top (about 19,500 feet), and as I did so the clouds settled down, and it began to snow. However, at 4 p.m. it cleared sufficiently for some work to be done ; after that we came down as quickly as possible



in another blinding snowstorm, and reached camp just after dark ; I for one very tired. I found the coolies exceedingly slow in coming down the loose blocks, I think because their balance was bad—they had to use their hands far more than I did.

I had a good view of the glacier from here : the East side is very steep and broken, with several tributary glaciers flowing down from Cho Oyu and Pk. 25,909, and from a 23,000-foot Peak (not triangulated) to the North of the latter. The West side, except for Cho Rapzang, round which the glacier flows, is a snowfield falling more or less gently from a low ridge running from the pass to the West of Cho Rapzang. The glacier itself is like many others in this region, moraine covered for 3 or 4 miles above its snout, "pinnacled" for another mile, and finally practically flat. But this flat portion gives by no means good going ; when frozen it is very irregular and trying to walk over ; and when thawed, is slushy and water soaked. There are two large water channels in the ice which are unpleasant to cross ; these are from 10 to 15 feet wide and 20 feet deep, and carry a large volume of water in the afternoon. Crossing without a rope is distinctly dangerous, for although one can find places easy enough to jump, a slip would be certain death, for once in the channel it would be quite impossible to get out, or even to stop oneself on its smooth ice floor and sides.

Cloudy weather then set in ; but on the 3rd I got a few photographs from a shoulder near by, and moved camp 2 or 3 miles farther up the glacier (at about 18,500 feet). I was in this camp for nine days and only succeeded in taking two low stations, one on either side of the glacier and each about $1\frac{1}{2}$ miles from the pass (Nangba La) to Nepāl ; but the valley on the South side, leading down to Khungphu, turns sharply to the East just below the pass, and little could be seen of the Nepalese side. Each of these stations I went up twice—to wait all day long the first time, in each case, for weather which never came. To reach the station on the East side of the glacier I had the only comparatively difficult rock climbing which I met with during the course of the Expedition ; and on the way down watched my theodolite coolie, whom I had left behind exhausted in the morning, tumble off a steep rock arête, theodolite and all ; fortunately he jammed in a crack a few feet below, and was unhurt. During the day he had started up after us on his own, and had lost his way in the clouds.

On July 12—another wet day—I moved camp some distance down the main glacier and up a tributary flowing from Pk. 25,909 and Cho Oyu, and next day ascended a shoulder whence a good view into



the cirque below these two peaks was obtained—or should have been obtained! But again I sat till dusk and saw little or nothing. Early the following day, however, it was fairly clear, so I got my photographs and then moved camp back to the base at Kyetrāk.

The next three days were spent in moving my base camp to the bridge across the Rā Chu, 6 miles below Kyetrāk; taking a light camp up to about 18,000 feet on the prominent hill immediately East of the bridge, climbing the latter, sitting through the usual storms without doing any work, and returning to the bridge. Time was getting on, and the weather was still bad, so I then decided to leave my camp at the bridge and move into Headquarters myself to get developing, etc., up to date, and have a short rest. I walked into Tingri, with two coolies, on July 18, and found Colonel Bury there alone; and the Headquarters house felt very comfortable indeed after a Meade tent, in spite of nightly pilgrimages from one dry spot to another, as the roof leaked!

Five busy days were spent at Tingri developing and printing; and as the weather showed little sign of improvement, I decided to go on with Headquarters to Chöbuk, in the Rongbuk Valley and work on that side, so as to make sure of completing the most important part, in the vicinity of Everest, and return to the Kyetrāk Valley if there should be time. So on the 24th Colonel Bury and I left Tingri and reached Chöbuk on the 25th, where we met Mallory and Bullock, just in from their reconnaissance of the North and North-west sides of Everest. A talk with them gave me some idea of the country, and the view from an 18,000-foot hill above Chöbuk enabled me to make a plan of campaign: far more extensive, as always, than the weather eventually allowed.

Colonel Bury, Mallory and Bullock had gone on to Khārta on July 26; on the 27th I moved up the right bank of the Rongbuk Valley some 10 miles, to the monastery, above which I took a 20,000-foot tation the next day. The weather was dreadful, but at 6 p.m. I got a round of photographs, which really turned out very well considering the time of day at which they were taken: it took me four and a half hours to get up this peak—fresh snow and scree—and although I had no glissades, only half an hour to come down.

On the 27th I moved camp to a grassy hollow near the snout of the glacier—Mallory and Bullock's base—and next day occupied another hill overlooking the main glacier and valley, and looking up the side valley on the East, which joins the Dzākar Chu just below the glacier snout. The next three days were spent in establishing



a light camp on the left bank of the East branch of the Rongbuk Glacier, about 3 miles from its snout, and taking a station on its left bank to overlook both the East and main glaciers.

The Rongbuk Glacier is made up of two large branches, one flowing from the snow basin immediately below the great North wall of Everest, and the other, the "West Rongbuk" which joins the main stream about 4 miles above the snout of the glacier, flowing East in the basin between the high North-west ridge of Everest and the South-east slopes of Pk. 25,990 (Gyächung Kang). At one time there was a third branch, the "East Rongbuk," which must have also joined the main stream, but this has receded until its snout is now a mile or more East of the main glacier, and only its torrent pours into a large cave in the latter. The East Rongbuk itself consists of two branches: one, the more southerly, flows from the great snow basin (which we eventually crossed to reach the North Col) between Everest, its North Peak and Col, and Pk. 23,800 (Khärtaphu); and the other, which joins the South branch about 2 miles from its snout, from between Pks. 23,800 and 23,420. The former gives a 20,000-foot pass, very steep on the South side, to the Kāma Valley; and the latter, an easy pass of about the same height to the head of one branch of the Khārta Valley.

I camped, at about 19,500 feet, on the moraine-covered glacier opposite the junction of the northerly branch from Pks. 23,800 and 23,420. On the way up I followed the watercourse between the ice of the Main Rongbuk Glacier and the scree and conglomerate slopes to the East of it, as far as the mouth of the East Rongbuk stream (3 miles), which gave good though boulder-strewn going. Thence a short scramble up "cut-bank" on the right bank of the East Rongbuk stream to the shelf of an old lateral moraine of that glacier, and along the latter—excellent going—to near its snout. The stream is pretty big in the evening; but quite easy to cross—except for iced rocks—in the early morning; and from there I followed up a series of lateral moraines on the left bank, to my camp. It was not till I was coming down that I discovered that the moraine-covered glacier itself—here covered with shale instead of boulders and scree as in the case of the main glacier—gave comfortable walking.

A little distance below my camp site, the moraine-covered snout gives place to pinnacled ice, divided into three sections by two broad, shaly medial moraines. Either of the latter would be very suitable for a camp, and would give an excellent route to our 21,500-foot camp below the Chang La. The latter might, I think, be reached



by this route in three days from the base camp at the snout of the main glacier, camping the first night at 19,000 feet at the start of the medial moraine, the second at 20,000 feet on the medial moraine some 2 miles above the junction of the Northern and Southern branches of the East Rongbuk, and the third night on snow at 21,500 feet below the North Col. The better moraine to ascend would require reconnaissance; for the pinnacles between them are difficult and slow to cross. The valley sides are steep in the lower reaches of the glacier, but more shaly and gentle on both branches, above their junction.

August 3 broke clear; and I started up a likely looking peak behind (South of) camp, which appeared to be on the ridge between the East and main glaciers. I afterwards found that this was not the case; at the time I had to stop on a lower point as the clouds settled down. From here I had a glimpse of a big peak—Makālu, I thought—over the pass at the head of the southerly branch of the glacier: and this gave me the idea that there must be a comparatively low pass from here to the Kāma Valley. But clouds prevented me seeing more and studying the topography more carefully. There were heavy snowstorms on August 4 and 5, but the 6th looked better, and after four hours' most strenuous step-cutting up and slithering down pinnacles, I crossed the glacier and ascended a 21,000-foot station on the other side, from which I obtained good, if cloudy, views of the East Rongbuk Glacier. Snow in the night and a dull morning made me decide to abandon this area—I could get my camp no farther up owing to having insufficient warm clothes to camp all my coolies at this height—and I returned to the base camp, preparatory to tackling the West side of the Rongbuk Valley. Six hours' easy going took me to my base camp.

After two days' rest and office work, I crossed the glacier and put a light camp at about 19,000 feet in a small hanging valley below the "Finger," a black rock gendarme which is a very prominent landmark on the left bank of the Rongbuk Valley. On August 11 it snowed heavily, and I found my bed, in which I spent the day, very hard indeed—the camp being pitched on large boulders on top of the moraine. On the 12th, 13th, and 14th, I started for the "Finger," the first time by the ridge immediately above camp, which gave some nice climbing with the rocks partly snow covered as they were, and the other two days, by a much quicker but less interesting route up soft snow and scree. Each day the clouds came down, and although I waited till nearly dark at about 20,500 feet on the ridge, it was not till the third day that I got a round of indifferent photographs.



Time was getting on, so on the 15th I called my "Finger" station "good enough" and moved camp up the left bank of the main glacier to a point on the old lateral moraine, opposite the entrance of the stream from the East Rongbuk; and the next day round the corner to the West, some distance up the West Rongbuk Glacier, and about 1,000 feet above it. *En route*, I tried to get some photographs from the high moraine at the junction of the West with the main glacier; but again the weather defeated me, and I got into camp—another uncomfortable one—soaked to the skin.

I was in this camp for five days; most of them spent huddled under rocks waiting for the clouds to lift. I had one beautiful day, my only one in six weeks, and got some very nice photographs of Mount Everest and its West ridge. It is surprising how a little good weather and the feeling of having really done some work affects one's spirits!

On August 21 I moved back to my base camp at the glacier snout, again trying for a station at the corner—and failing. I had not done nearly as much as I wanted to do; but there seemed to be no end to the bad weather, and only a month or a bit more remained in which to map the whole of the East side of the mountain: and I had heard from Colonel Bury that there would be a considerable amount of work on that side. Originally, I had hoped not only to return to the bridge over the Rā Chu to complete the work in the Kyetrāk Valley, but also to take several stations in the valleys running North from the 23,000-foot group North of Everest. But again apart from shortage of time, the weather made it out of the question, and I went through to Khārta, via the Doya La, arriving there on August 27.

The change in scenery immediately one crosses the Doya La is most marked, both as regards rock and vegetation. The former—mostly gneiss—is far more rugged and interesting, and there is infinitely more of the latter. The Headquarters camp at Khārta, in a little poplar grove, was pleasant indeed after the bleak, uninteresting Rongbuk Valley; and I thoroughly enjoyed my five days there, developing and printing; busy days, but very different from lying on one's back on the sharp boulders of the Rongbuk moraines. Mallory, Bullock and Morshead were in Khārta when I arrived; Colonel Bury and Wollaston returned from their excursion to the Popti La soon after, and Raeburn arrived on September 1. It was a great treat to me to be able to "swap lies" with so many people, after two months almost wholly alone!

On September 3 Morshead and I started up the Khārta Chu in



the wake of Mallory and Bullock, who had gone up to get the "bundobust" for the final fling going. As usual, bad weather dogged my footsteps, and although the weather while I was in Khārta had been glorious, Morshead and I spent seven days in taking two very indifferent stations in the lower part of the Khārta Valley, before joining the remainder of the expedition at the "Advanced Base" on September 11. A further eight days were spent there, waiting for the weather; but in that time I was able to get two very useful stations, one on either side of the valley.

On September 19 I moved up to "No. 1 Camp" with Mallory, Bullock and Morshead; and shared the fortunes of the rest of the Expedition as far as Kampa Dzong on the way back to Darjeeling, where Raeburn, Heron and I left Headquarters to return to Darjeeling via Lachen and the Teesta Valley. I was delighted to get into the "final push," and enjoyed the few days' change from surveying to climbing, enormously; except that I felt the cold very much in my feet, and had it not been for Mallory's good offices—he rubbed my feet for a solid hour after we came down from Chang La—I feel sure that the result might have been much more serious than the slight discomfort I afterwards experienced.

I took three stations in the neighbourhood of No. 1 Camp—one on either side of the Kharta Glacier, and one at 22,300 feet on the "Lhakpa La." This was on snow, with my instrument resting on, and steadied by, bags of "tsampa"; which proved to be a most excellent substitute for rock!

On September 26 I crossed with Colonel Bury and Wollaston to the Kāma Valley; unfortunately, we only had two clear days there, and I had to leave it without covering as much ground as I should have liked, though—as usual—I spent my days in snowstorms, hoping for breaks in the clouds.

The return to Darjeeling via the Serpo La, Lāchen, and the Teesta Valley, made a pleasant change from the Phāri route; but again bad weather spoiled our views, and we saw nothing at all of Kangchenjunga and its neighbours. Raeburn went in by the usual road via Gangtok; Heron and I followed the river—an excellent route in spite of the prevalence of leeches—and reached Pashok on October 19. Heron went on to Darjeeling, a further 18 miles, the same day. I followed on the 20th.

I enjoyed the Expedition and my work with it, thoroughly; but in my opinion, Tibet, at any rate that portion of it in which we were, is a place to have *been*, rather than one to go to!



APPENDIX III

A NOTE ON THE GEOLOGICAL RESULTS OF THE EXPEDITION

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

The area geologically examined is somewhat over 8,000 square miles, comprising the Tibetan portion of the Arun drainage area, with, in the West, the headwaters of the Bhotia Kosi and its tributaries.

The circumstances of the Expedition were not favourable for work in any detail, but an endeavour was made to traverse and map as large an area as possible on a scale of $\frac{1}{4}$ -inch to the mile, on skeleton maps very kindly furnished by Major Morshead and his surveyors as their plane-tabling proceeded; my work must therefore be considered as a geological reconnaissance pure and simple.

If I am accorded the privilege of accompanying the second Expedition, by which time Major Wheeler's map on a scale of 1-inch to the mile will be available, I hope to be able to make a detailed survey of the vicinity of Mount Everest and investigate the complicated inter-relationships of the metamorphosed sedimentaries and the associated gneisses and granites.

My survey continues to the Westward Sir Henry Hayden's work during the Tibet Expedition in 1903-4.

Geologically this area is divided into two broad divisions: (a) Tibetan and sedimentary, (b) Himalayan and crystalline, a distinction which is clearly displayed in the topography resulting from the underlying geological structure, for to the North we have the somewhat tame and lumpy mountains of Tibet contrasting with the higher, steeper and more rugged Himalayas on the South.

The Tibetan zone consists of an intensely folded succession of shales and limestones, with subordinate sandstone quartzites, the folds striking East-West and mainly lying over towards the South, showing that the movements which produced them came from the North.

The uppermost rocks consist of the Kampa system of Hayden, a great thickness of limestones, which, where the rocks have escaped



alteration, yield an assemblage of fossils which determine their age as Cretaceous and Eocene.

Below these is a monotonous succession of shales, practically unfossiliferous, with occasional quartzites and limestones representing the Upper and Middle Jurassic with at the base beds probably belonging to the Lias.

These Jurassic shales are by far the most conspicuous formation in this part of Tibet, being repeated many times in complicated folds.

The Cretaceous-Eocene limestones form comparatively narrow bands, occurring as compressed synclines caught up in the folded complex of Jurassic shales.

Along the Southern border of the Tibetan zone, below the base of the Jurassic shales, is a great thickness (2,000 feet-3,000 feet) of thinly bedded limestones in which the fossils have been destroyed and the rocks themselves converted over considerable areas into crystalline limestones and calc-gneisses containing tremolite, epidote, tourmaline, etc., but still retaining their original bedded structure in the banding of the altered rock.

The absence of determinable fossils makes it impossible to determine the age of these with certainty, but from their lithological character and position in the sequence, it is possible that they correspond with the Tso Lhamo limestone in Sikkim (Lias) and the Kioto limestone of the Zangskar range (Lower Jurassic and Upper Trias).

The Himalayan and crystalline zone is essentially composed of foliated and banded biotite-gneiss, usually garnetiferous, on which lie, at comparatively low angles and with a general Northerly dip, the above-mentioned calc-gneisses.

These occur most abundantly to the North and West of Everest, in the Keprak, Rongbu, Hlalung and Rebu Valleys. The group of high peaks to the North-west of Everest (overlooking the Khumbu Pass) is made up of these and intrusive schorl granite, and it would seem that the precipitous North-western face and spurs of Everest are the same.

The Eastern and North-eastern valleys, Chongphu, Kharta and Kama, which are in general at a lower level than the North-western valleys, are excavated in the biotite-gneiss. On the North-eastern face of Everest fresh snow was too abundant at the time of my visit to make out what the rocks were.

Associated with the limestones and calc-gneisses are quartzites and tourmaline-biotite schists which probably represent the lowest portions of the shales immediately overlying the limestones.



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It is probable that the biotite-gneiss is an igneous rock intrusive in the calc-gneisses and schists, but this and many other puzzling features of the crystallines require more detailed study than I was able to give this year.

Both biotite-gneiss and metamorphosed sedimentaries are crowded with dykes and sills, of all dimensions, of schorl granite or pegmatite to such an extent that this granite is frequently the predominant rock. It is highly resistant to weathering and it is doubtless due to its presence in large amount that such comparatively soft rocks as the calc-gneisses take part in forming some of the highest summits.

In the same way the scattered peaks of over 20,000 feet on the watershed between the Arun and the Tsangpo owe their prominence to their being groups of veins of a very similar granite, differing in that it contains biotite in place of schorl. Around these separate centres of intrusion are areoles of metamorphism in which the Jurassic shales have been converted into slates and phyllites.

Economically the area traversed by the Expedition is devoid of interest. Barring a little copper staining on a few boulders on moraines no traces of ore were seen.



APPENDIX IV

THE SCIENTIFIC EQUIPMENT

By A. R. HINKS, F.R.S., Secretary of the Royal Geographical Society,

The most important scientific work of the first year's expedition should have been the study of the physiological effects of high altitude that Dr. Kellas had undertaken, with the support of Professor Haldane, F.R.S., and of the Oxygen Research Committee of the Department of Scientific and Industrial Research. In his work on Kamet in 1920, Dr. Kellas had tried, and provisionally decided against, the use of oxygen compressed in cylinders : but he laboured under the grave disadvantage that the light cylinders he hoped to obtain had been, after his departure for India, pronounced unsafe ; and the cylinders sent out were clearly too heavy for effective use in climbing. Dr. Kellas had therefore fallen back on the use of oxygen prepared from the reaction between water and oxylith in an apparatus which included a kind of gas mask. He was prepared also to make several difficult researches into the physiological processes of adaptation to low oxygen pressure ; and some delicate apparatus was prepared and sent out to him by the Oxygen Research Committee. Unhappily these interesting and important enquiries came to nought, for there was no one competent to carry them on after his lamented death at Kampa Dzong ; and the Expedition of 1922 was thereby deprived of much information that should have been at its disposal in studying the use of oxygen for the grand assault.

The scientific equipment for which the Mount Everest Committee were directly responsible was not ambitious : the Survey of India were responsible for the whole of the survey and brought their own equipment, which is described elsewhere in this book. It was necessary to provide the climbing party only with aneroids, compasses, reserve field-glasses, thermometers and cameras, with subsidiary apparatus for checking the aneroids at the base camps, and heavier cameras for work at lower levels.

The aneroids by Cary, Porter & Co. and by Short & Mason were



constructed in pairs, to operate from 15,000 to 23,000, and 22,000 to 30,000 feet respectively. They seem to have performed well on the whole, and tests made at the National Physical Laboratory since their return show that they have changed very little; but it cannot be said that their performances were very effectively controlled in the field, for until late in the season there were no trigonometrical heights available, and the climbers had little opportunity in their rather isolated circumstances of employing their aneroids to the best advantage, for purely differential work. Nor is there much to be said as yet on the value of the shortened form of George mercurial barometer, to come into action only at 15,000 feet (Cary, Porter & Co.). These instruments will find effective use only in the second season, when the reference points of the trigonometrical survey will be available as fundamental data.

The climbers carried "Magnapole" compasses with luminous points, and sometimes a Mark VIII prismatic; these all worked well. The simpler compass is the more convenient for use on snow when goggles must be worn. A luminous liquid compass (Short & Mason) was found very useful on long reconnaissance rides.

For the record of temperatures in camps Messrs. Negretti & Zambra had made three small pairs of maximum and minimum thermometers in leather travelling cases. These suffered some casualties, by theft, or being accidentally left out in the sun; and the pattern has been repeated for the second year's work.

The heavier photographic equipment included an old and well-seasoned $7\frac{1}{2} \times 5$ Hare Camera, lent to the Expedition, but newly fitted by Messrs. Dallmeyer with a Stigmatic lens of 9 inches focal length, a negative telephoto lens of 4 inches focal length giving enlargement up to 6 times, and a set of Wratten filters. With this camera Mr. Wollaston secured some of the finest pictures taken on the Expedition.

There were also two quarter-plate cameras for glass plates: a Sinclair Una camera fitted by Messrs. Dallmeyer with a Stigmatic lens of 5.3 inches focal length, and Adon telephoto lens; and a second Sinclair camera lent by Captain Noel.

One or the other of these two was used by Mr. Mallory at many of the high camps, and both the Hare $7\frac{1}{2} \times 5$ and the Sinclair quarter-plate went to the 22,500-foot camp at the Lhakpa La: doubtless the greatest height yet attained by so large a camera as the former. The principal difficulty with these cameras was unsteadiness in a heavy wind when the telephoto lens was in use: and the tripods



have been strengthened and the lens supports stiffened before they go out again.

The plates were of two kinds : Imperial Special Rapid and Fine Grain slow. The latter were generally preferred, and could hardly have been better. The Imperial Dry Plate Company, who generously made and presented these plates to the Expedition, deserve special thanks for their skill and for their generosity.

The cameras which used films were a Panoram Kodak of 5 inches focal length, with films 12×4 inches ; a No. 1 Autograph Kodak, and two Vest Pocket Kodaks, all three fitted with Cooke lenses by Messrs. Taylor, Taylor & Hobson. The Panoram Kodak was used very successfully by Colonel Howard-Bury, and the splendid series of panoramas is the most useful, if not quite the most beautiful, set of photographs brought home. The smaller cameras were used by the climbing party with many good results.

Finally it must be said that a large part of the best photographs were taken by Colonel Howard-Bury with his own 7×5 Kodak, and the results very generously placed at the disposal of the Committee.

All the instruments were examined and tested at the National Physical Laboratory, and the thanks of the Committee are due to the Director and his staff, who gave most valuable advice and assistance.



APPENDIX V

MAMMALS, BIRDS AND PLANTS COLLECTED BY THE
EXPEDITION

By A. F. R. WOLLASTON

A.—LIST OF MAMMALS COLLECTED

- Stoat. *Mustela temon*
Stoat. *Mustela longstaffi*
Marmot. *Marmota himalayana*
Hamster. *Cricetulus alticola tibetanus*, subsp. n.
Vole. *Phaiomys leucurus*
Vole. *Phaiomys everesti*
Vole. *Microtus (Alticola)*, sp.
Pika. *Ochotona roylei nepalensis*
Pika. *Ochotona wollastoni*, sp. n.
Pika. *Ochotona curzonice*

B.—LIST OF BIRDS COLLECTED

- Central Asian blackbird. *Turdus maxima*
Solitary thrush. *Monticola solitarius*
White-breasted Asiatic dipper. *Cinclus cashmirensis*
Indian stone-chat. *Saxicola torquata indica*
Gould's desert chat. *Saxicola montana*
Bush chat. *Pratincola prjevalskii*
Indian redstart. *Ruticilla rufiventris*
Guldenstadt's Afghan redstart. *Ruticilla grandis*
White-capped redstart. *Chimarrhornis leucocephalus*
Hodgson's grandala. *Grandala caelicolor*
Tickell's willow-warbler. *Phylloscopus affinis*
Mandelli's willow-warbler. *Phylloscopus mandellii*
Smoky willow-warbler. *Phylloscopus fulviventris*
Spotted bush-warbler. *Luscinola thoracica*
Prince Henry's laughing thrush. *Trochalopteron henrici*



- Eastern alpine accentor. *Accentor rufiliatus*
Red-breasted accentor. *Accentor rubeculoides*
Rufous-breasted accentor. *Accentor strophiatius*
Brown accentor. *Accentor fulvescens*
Sikkim black tit. *Parus beavani*
Wren. *Troglodytes*, sp.
Hodgson's pied wagtail. *Motacilla hodgsoni*
White-faced wagtail. *Motacilla leucopsis*
Yellow-headed wagtail. *Motacilla citreola*
Blyth's pipit. *Anthus citreola*
Indian tree-pipit. *Anthus maculatus*
Hodgson's pipit. *Anthus rosaceus*
Grey-backed shrike. *Lanius tephronotus*
Slaty-blue flycatcher. *Cyornis leucomelanurus*
Himalayan greenfinch. *Hypacanthis spinoides*
Tree-sparrow. *Passer montanus*
Cinnamon tree-sparrow. *Passer cinnamomeus*
Blanford's snow-finch. *Montifringilla blanfordi*
Adams' snow-finch. *Montifringilla adamsi*
Hodgson's ground-finch. *Fringilauda nemoricola*
Brandt's ground-linnet. *Leucosticte brandti*
Walton's twite. *Linota rufostrigata*
Red-breasted rose-finch. *Pyrrhospiza punicea*
Scarlet rose-finch. *Carpodacus erythrinus*
Hodgson's rose-finch. *Carpodacus pulcherrimus*
Severtzoff's rose-finch. *Carpodacus severtzoi*
Prejewalk's rose-finch. *Carpodacus rubicilloides*
Red-headed bullfinch. *Pyrrhula erythrocephala*
Godlevski's meadow bunting. *Emberiza godlevskii*
Elwes' shore-lark. *Otocorys elwesi*
Long-billed calandra lark. *Melanocorpha maxima*
Tibetan skylark. *Alauda inopinata*
Short-toed lark. *Calandrella brachydactyla*
Brook's short-toed lark. *Calandrella acutirostris tibitana*
Chough. *Pyrrhocorax graculus*
Brown ground-chough. *Podoces humilis*
Common hoopoe. *Upupa epops*
Pied crested cuckoo. *Coccytes jacobinus*
Eastern little owl. *Athene bactriana*
White-backed dove. *Columba leuconota*
Snow partridge. *Lerwa lerwa*



- Temminck's stint. *Tringa temmincki*
- Redshank. *Totanus calidris*
- Dusky redshank. *Totanus fuscus*
- Greater sand plover. *Aegialitis mongola*
- Common tern. *Sterna fluviatilis*

In addition to the above the following birds were identified, but specimens of them were not obtained :—

- | | |
|-------------------|------------------------|
| Wall-creeper | Ruddy sheldrake |
| House martin | Garganey |
| Sand martin | Wigeon |
| Rock martin | Pochard |
| Alpine chough | Gadwall |
| Magpie | Hill rock-dove |
| Black crow | Chinese turtle dove |
| Raven | Tibetan partridge |
| Swift | Tibetan snow partridge |
| Siberian swift | Blood pheasant |
| Cuckoo | Black-necked crane |
| Himalayan vulture | White stork |
| Lammergeier | Ibis-bill |
| Sea eagle | Painted snipe |
| Pallas' sea eagle | Pin-tailed snipe |
| Black-eared kite | Brown-headed gull |
| Barheaded goose | |

C.—LIST OF PLANTS COLLECTED BETWEEN JUNE AND SEPTEMBER, 1921, 12,000-20,400 ft.

- | | |
|---|---|
| Clematis orientalis, L. | Aconitum ochrochryseum, Stapf, sp. nov. |
| Ranunculus pulchellus, C. A. Mey., var. sericeus, Hk. f. & T. | Delphinium Pylzowii, Maxim. |
| Ranunculus pulchellus, C. A. Mey. | Halenia elliptica, Don |
| Anemone obtusiloba, Don | Delphinium grandiflorum, L. |
| Anemone polyanthes, Don | Hypecoum leptocarpum, Hk. f. & T. |
| Anemone rivularis, Ham. | Meconopsis horridula, Hk. f. & T. |
| Geranium Grevilleanum, Wall. | Meconopsis grandis, Prain ? |
| Caltha scaposa, Hk. f. & T. | Meconopsis, sp. |
| Delphinium Brunonianum, Royle | Corydalis, sp. |
| Aconitum gymnantrum, Max. | Corydalis juncea, Wall. |



- Corydalis Moorcroftiana*, Wall.
Arabis tibetica, Hk. f. & T.
Lepidium ruderales, L.
Arenaria ciliolata, Edgew.
Dilophia salsa, Hk. f. & T.
Cardamine macrophylla, Willd.
Arenaria Stracheyi, Edgew.
Silene Waltoni, F. N. Williams
Silene Moorcroftiana, Wall.
Arenaria musciformis, Wall.
Arenaria melandrioides, Edgew.
Polygonum islandicum, Hk. f.
Geranium collinum, A. DC.
Impatiens sulcatus, Wall.
Thermopsis barbata, Royle
Thermopsis lanceolata, R. Br.
Sophora Moorcroftiana, Benth.
Stracheya tibetica, Benth.
Astragalus strictus, Grah.
Oxytropis microphylla, DC
Gueldenstædtia uniflora, Benth.
Desmodium nutans, Wall.
Potentilla coriandrifolia, Hk. f.
Potentilla multifida, L.
Potentilla sericea, L.
Potentilla microphylla, Don
Potentilla peduncularis, Don
Potentilla Griffithii, Hk. f.
Spiræa arcuata, Hk. f.
Saxifraga Lychnitis, Hk. f. & T.
Saxifraga nutans, Hk. f. & T.
Saxifraga aristulata, Hk. f.
Saxifraga near *S. saginoides*, Hk. f. & T.
Saxifraga flagellaris, Willd.
Saxifraga Hirculus, L.
Saxifraga Lychnitis, Hk. f. & T.
Saxifraga fimbriata, Wall.
Saxifraga pilifera, Hk. f. & T.
Saxifraga Caveana, W. W. Sm.
Saxifraga microphylla, Royle
Saxifraga pallida, Wall.
Saxifraga umbellulata, Hk. f. & T.
Parnassia ovata, Ledeb.
Parnassia pusilla, Wall.
Eutrema Prewalskii, Hk. f. & T.
Sedum fastigiatum, Hk. f. & T.
Sedum trifidum, Wall.
Sedum orenulatum, Hk. f. & T.
Sedum himalense, Don
Epilobium palustre, L.
Epilobium reticulatum, C. B. Cl.
Pleurospermum Hookeri, C. B. Cl.
Scabiosa Hookeri, C. B. Cl.
Valeriana Hardwickii, Wall.
Aster, sp.
Aster heterochaetus, C. B. Cl.
Allardia glabra, Dene.
Aster tibeticus, Hk. f.
Cremanthodium Decaisnei, C. B. Cl.
Aster diplostephioides, C. B. Cl.
Erigeron, sp.
Leontopodium fimbriigerum, J. R. Drum. ?
Leontopodium monocephalum, Edgew.
Leontopodium Stracheyi, C. B. Cl.
Anaphalis xylorhiza, Sch. Bip.
Anaphalis cuneifolia, Hook. f.
Tanacetum tibeticum, Hk. f. & T.
Senecio arnicoides, Wall. var. *frigida*, Hk. f.
Cremanthodium pinnatifidum, Benth.
Chrysanthemum Atkinsoni, C. B. Cl. ?
Artemisia Moorcroftiana, Wall.
Sonchus sp.
Senecio glomerata, Decne.
Senecio (§ *Ligularia*) sp.



- Senecio chrysanthemoides*, DC.
Tanacetum khartense, Dunn, sp. nov.
Aster sp.
Lactuca macrantha, C. B. Cl.
Senecio sorocephala, Hemsl.
Saussurea gossypina, Wall.
Saussurea tridactyla, Sch. Bip.
Tanacetum gossypinum, Hk. f. & T.
Saussurea wernerioides, Sch. Bip.
Crepis glomerata, Hk. f. ?
Saussurea graminifolia, Wall.
Senecio arnicoides, Wall.
Saussurea uniflora, Wall.
Morina polyphylla, Wall.
Saussurea glandulifera, Sch. Bip.
Lactuca Dubyæa, C. B. Cl.
Lactuca Lessertiana, C. B. Cl.
Cassiope fastigiata, D. Don
Daphne retusa, Hemsl.
Rhododendron lepidotum, Wall.
Rhododendron setosum, Don
Rhododendron near *R. lepidotum*, Wall.
Rhododendron campylocarpum, Hk. f.
Rhododendron cinnabarinum, Hk. f.
Rhododendron lanatum, Hk. f.
Rhododendron arboreum, Sm.
Rhododendron Thomsoni, Hk. f.
Cyananthus incanus, Hk. f. & T.
Glossocomia tenera, DC.
Cyananthus pedunculatus, C. B. Cl.
Campanula modesta, Hk. f. & T.
Campanula colorata, Wall.
Campanula aristata, Wall.
Androsace chamæjasme, Hort., var. *coronata*, Wall.
- Androsace villosa*, L. var. ?
Androsace strigillosa, Franch.
Primula minutissima, Jacq.
Primula Buryana, Balf. f. sp. nov.
Primula Wollastonii, Balf. f. sp. nov.
Primula pusilla, Wall.
Primula sikkimensis, Hook. microform
Primula capitata, Hook.
Primula capitata, microform.
Primula uniflora, Klatt
Primula Dickieana, Watt.
Primula obliqua, W. W. Sm.
Primula indobella, Balf. f.
Primula minutissima, Jacq.
Primula glabra, Klatt
Primula Younghusbandii, sp. nov.
Primula tibetica, Watt.
Primula denticulata, Sm.
Primula sikkimensis, Hook.
Primula nivalis, Pallas, var. *macrocarpa*, Pax.
Gentiana amœna, C. B. Cl.
Gentiana ornata, Wall.
Gentiana sp. Probably new but the material is too imperfect to decide this.
Gentiana Elwesii, C. B. Cl.
Gentiana robusta, King
Gentiana micantiformis, Burkill
Gentiana nubigena, Edgew.
Gentiana tubiflora, Wall., var. *longiflora*, Turrill, var. nov.
Gentiana stellata, Turrill, sp. nov.
Gentiana tenella, Fries
Swertia cuneata, Wall.
Arenaria Stracheyi, Edgew.



- Swertia Kingii*, Hk. f.
Swertia Youngusbandii, Burkill
Swertia multicaulis, D. Don
Nardostachys grandiflora, DC.
Trigonotis rotundifolia, Benth.
Eritrichium densiflorum, Duthie
Microula sikkimensis, Hemsl.
Onosma Waddellii, Duthie
Onosma Hookeri, C. B. Cl.
Verbascum Thapsus, L.
Lancea tibetica, Hk. f. & T.
Lagotis crassifolia, Prain
Pedicularis trichoglossa, Hk. f.
Pedicularis Elwesii, Hk. f.
Pedicularis megalantha, Don,
 forma
Pedicularis megalantha, Don, var.
pauciflora, Prain
Pedicularis Roylei, Maxim.
Pedicularis siphonantha, Don
Pedicularis cheilanthifolia,
 Schrank
Pedicularis tubiflora, Fischer
Pedicularis integrifolia, Hk. f.
Pedicularis globifera, Hk. f.
Incarvillea Youngusbandii,
 Sprague
Escholtzia eriostachya, Benth.
Nardostachys latamansi, DC.
Dracocephalum breviflorum, Tur-
 rill, sp. nov.
Dracocephalum tanguticum,
 Maxim.
Dracocephalum heterophyllum,
 Benth.
Dracocephalum speciosum, Benth.
Veronica lanuginosa, Benth.
Nepeta discolor, Benth.
Nepeta Thomsoni, Benth.
Atriplex rosea, L.
Polygonum vacciniifolium, Wall.
Polygonum viviparum, L.
Polygonum tortuosum, Don
Polygonum affine, Don
Polygonum amphibium, L.
Stellera chamæjasme, L.
Euphorbia Stracheyi, Boiss.
Orchis cylindrostachys, Kränzl.
Liparis sp.
Goodyera fusca, Lindl.
Dendrobium alpestre, Royle
Pleione Hookeriana, S. Moore
Orchis Chusna, Don
Roscoea purpurea, Sm.
Iris nepalensis, Don
Iris goniocarpa, Baker
Iris tenuifolia, Pallas
Lloydia tibetica, Baker
Lloydia sp.
Fritillaria Hookeri, Baker
Fritillaria near *F. Stracheyi*, Hk. f.
Fritillaria cirrhosa, Don
Allium, sp.
Allium Wallighii, Kunth
Allium Govenianum, Wall. ?
Allium cyaneum, Regel
Larix Griffithii, Hk. f.
Dryopteris Linneana, C. Chr.
Dryopteris Filix-mas, var. *ser-
 rato-dentata*, C. Chr.
Cryptogramma Brunoniana, Wall.
Calophaca crassicaulis, Benth.
Glaux maritima, L.
Androsace sessiliflora, Turrill, sp.
 nov.
Astragalus oreotrophes, W. W.
 Sm.
Thamnolia vermicularis, Schær.
Stereocaulon alpinus, Laur.
Thelochistes flavicans, Norm.



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NOTE.—The material of some of the numbers was insufficient for accurate determination; in a few cases the material necessary for comparison was on loan, and in the case of one or two genera, such as *Aster*, revision of the North Asian and Indian species will have to be undertaken before certain plants can be definitely named. The numbers in the list coming under these categories are named "—sp."

ROYAL BOTANIC GARDENS, KEW.

March 7, 1922.



MOUNT EVEREST

CSL

NOTE.—The material of some of the numbers was insufficient for accurate determination; in a few cases the material necessary for comparison was on loan, and in the case of one or two genera, most of their members of the North Asian and Indian species will have to be examined before certain plants can be definitely named. The names of the list coming under these categories are named "—sp."

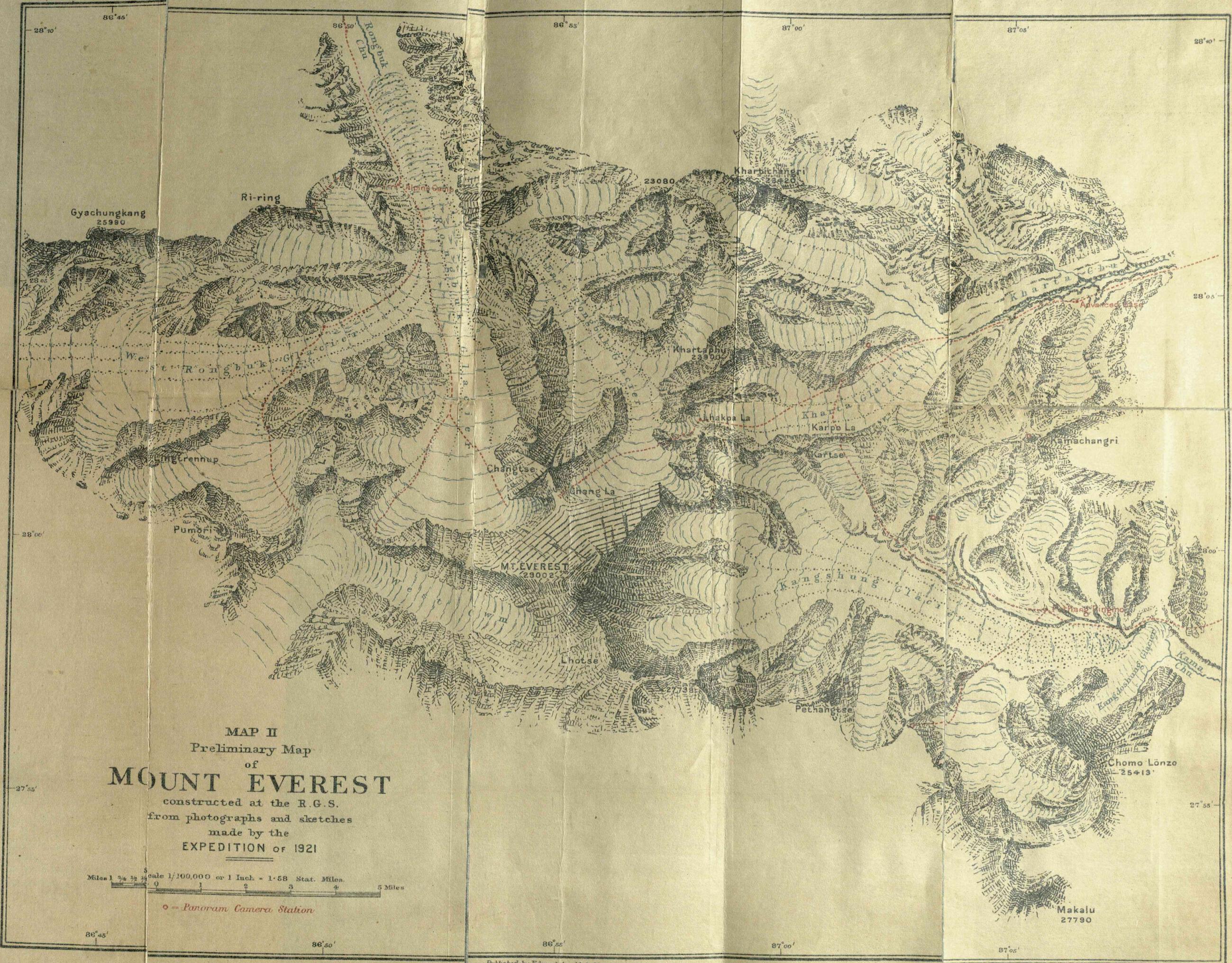
ROYAL BOTANIC GARDENS, KEW.

March 7, 1953.

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Errata.

In Maps I and III, the parallel of Latitude marked 30° should read 28° .



MAP II
 Preliminary Map
 of
MOUNT EVEREST
 constructed at the R.G.S.
 from photographs and sketches
 made by the
EXPEDITION of 1921

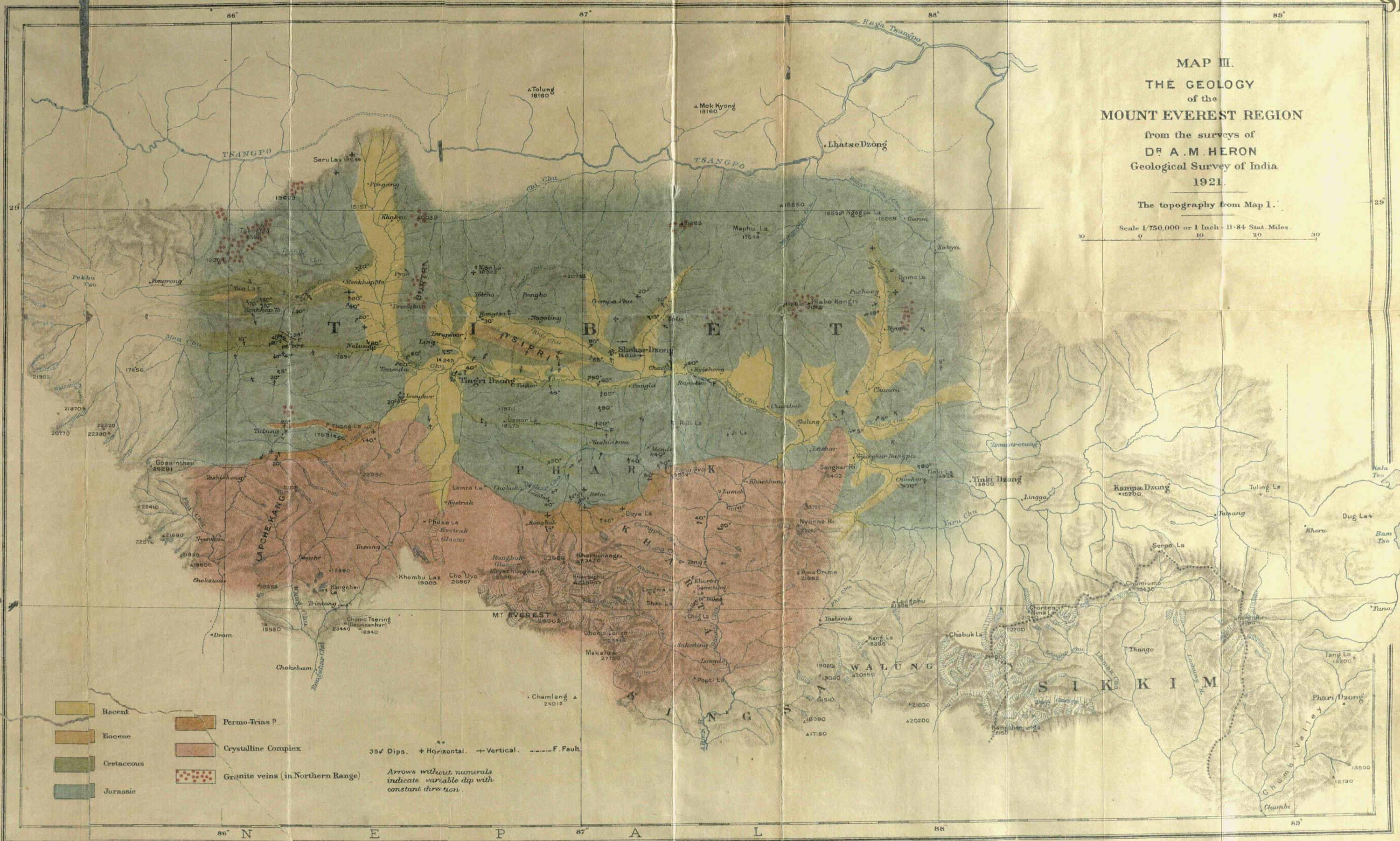
Scale 1/100,000 or 1 Inch = 1.58 Stat. Miles.
 Miles 1 1/4 3/4 0 1 2 3 4 5 Miles

o - Panoram Camera Station



MAP III.
THE GEOLOGY
of the
MOUNT EVEREST REGION
from the surveys of
DR A. M. HERON
Geological Survey of India
1921.

The topography from Map I.
Scale 1/750,000 or 1 Inch = 11.84 Stat. Miles.



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

35° Dips. + Horizontal. + Vertical. - - - F. Fault
Arrows without numerals indicate variable dip with constant direction.



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