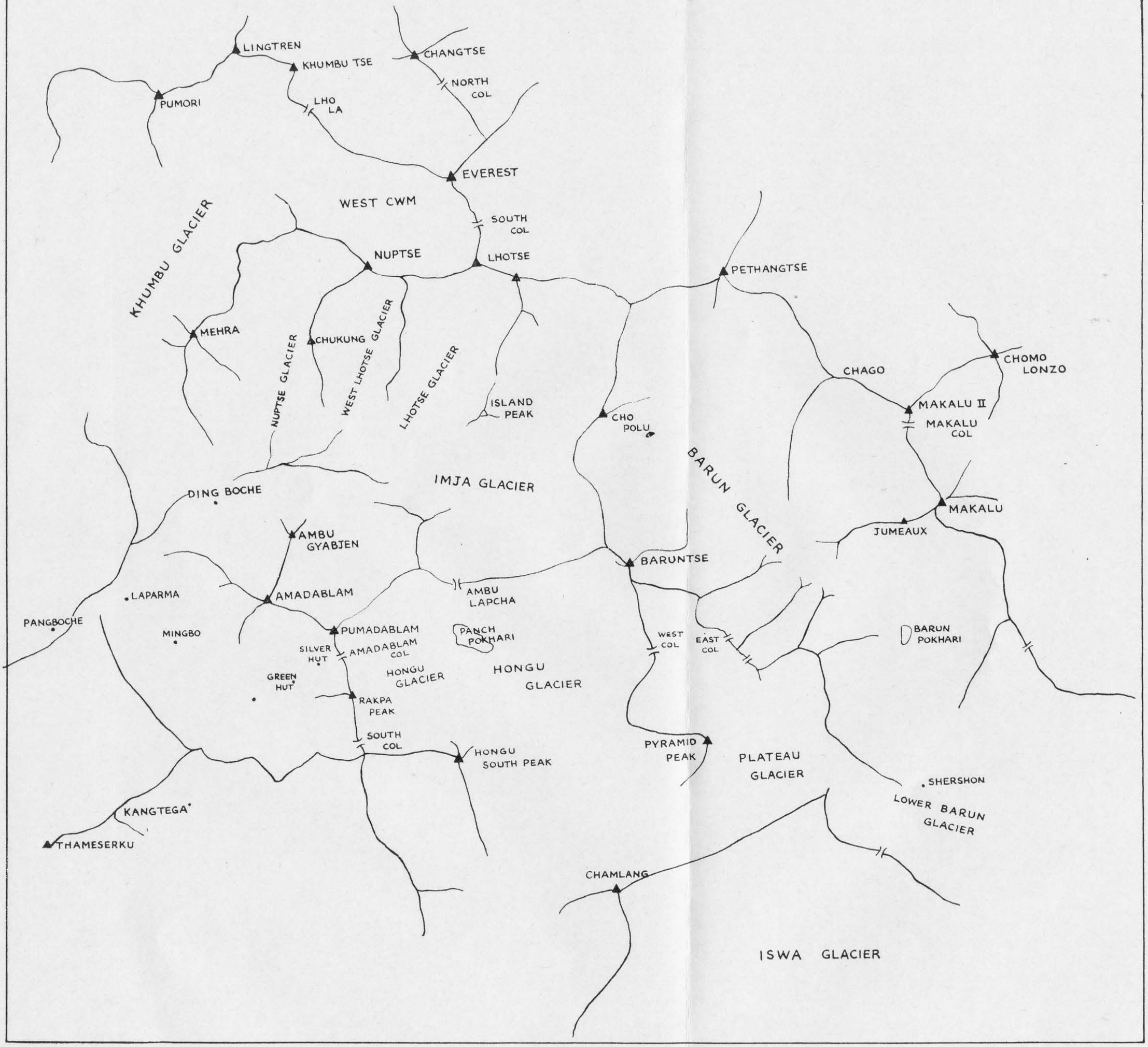
HIMALAYAN SCIENTIFIC EXPEDITION 1960–61

(A Himalayan Winter, Rakpa Peak, Ama Dablam, Makalu)

By MICHAEL WARD

The Himalayan Scientific and Mountaineering Expedition led by Sir Edmund Hillary and sponsored by Field Enterprises Educational Corpn. had three main objects. First, a thorough investigation into the legend of the Abominable Snowman; second, an investigation of the long-term effects of high altitude on man and, third, the ascent of Makalu without the use of oxygen. During the winter, too, a programme in physical geography would be carried out, including glaciology, metereology, and solar radiation studies. The second and third stages of this expedition were complementary to one another, as a number of physiological observations were going to be made on the upper slopes of Makalu. It was hoped, too, that members of the wintering party would be so acclimatised that the ascent without oxygen would be not too big a burden.

The quest for the Abominable Snowman was carried out in and around the Rolwaling Valley. The party consisted of: Sir Edmund Hillary; Dr. Larry Swan, an ecologist from Chicago; Martin Perkins, Zoo Director from Chicago; John Dienhart, also from Chicago; Dr. Tom Nevison; Desmond Doig of the *Statesman*, Calcutta; George Lowe; Peter Mulgrew; Pat Barcham and Michael Gill. To the north of the Rolwaling Valley lies a group of mountains dominated by Menlungtse and Gaurisankar. It was in this region that Eric Shipton and I in 1951 saw some footprints that could be attributed to the 'Yeti'. No evidence of the Yeti was found in the Rolwaling, although many legends and footprints were encountered. In addition, a skin of the very rare blue bear was discovered and two pandas were captured alive. These investigations took from the end of the monsoon until October. The party then traversed the Tesi Lapcha into Sola Khumbu, where they looked at the Yeti scalps kept at Dingboche Monastery and also at Khumjung. Thanks to the efforts of Desmond Doig, the elders of Khumjung were persuaded to part with their scalp for a limited period. An elder of the village went with the scalp as its guardian and the trio, Sir Edmund Hillary, Desmond Doig and Kumbo Chumbi, plus scalp, duly left Khumjung for a round-the-world trip.



SKETCH MAP: AMA DABLAM, MAKALU, EVEREST.

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Whilst these negotiations had been carried out a further party had been erecting two huts in the upper reaches of the Mingbo Valley. This party consisted of Norman Hardie, Jim Milledge, Wally Romanes and Barry Bishop. These huts were to be used by the wintering party for their physiological research programme.

The highest known permanent habitation in the world is at Aconguilcha, a mining village in the Andes. This is at a height of 17,500 ft. For any study of the long term effect of residence at very high altitudes a hut must be put higher than this. A number of sites in the Khumbu region were considered and finally the choice fell on a col just south of Ama Dablam. This col was crossed for the first time in 1951 and appeared relatively easy of access. An attempt was made to put our prefabricated hut on this col in October. Unfortunately, although the site at the head of the Hongu Glacier was good, access to the hut was not as easy as we thought, the last 500 feet being up a steep snow slope. The proposed site was also very exposed to the prevailing wind. The Silver Hut, as it was called, was therefore placed on the upper part of what became known as the Rakpa Glacier. Its height was 19,000 ft. —high enough for our physiological programme.

About 1,200 ft. lower down a wooden hut was built by Wally Romanes, the wood carried up by Sherpas from Thyangboche. This remarkable building had four bunks, a stove and enough space for a bench. Because of the green canvas covering the roof and walls, this was known, unimaginatively, as the Green Hut. The huts were finished by the middle of November and the Silver Hut was occupied continuously from the beginning of December until the end of April. As we found that the members of the wintering team were acclimatising and working very well for long periods at 19,000 ft. (rather to our surprise) we used the Green Hut mainly as a staging point.

Sir Edmund Hillary and his party left Sola Khumbu at the end of November and did not return to the field until nearly four months later towards the end of March. Sir Edmund made a flying visit of one day in January, the Yeti scalp having by then proved to be a piece of goat skin, and deposited this and its guardian Kumbo Chumbi at Khumjung. He then returned by helicopter to Katmandu and thence to New Zealand.

The wintering party was led by Dr. Griffith Pugh of the Medical Research Council. The other members were Dr. J. Milledge, a registrar in Thoracic Medicine at Southampton Chest Hospital; Dr. John West of the M.R.C. Respiratory Unit at the Post-Graduate Medical School, Hammersmith; Prof. S. Lahiri, a research physiologist at the Presidency College, Calcutta; Michael Gill, a student at the Medical College, Dunedin; Barry Bishop, a glaciologist, carried out a physical geography programme; Capt. S. B. Motwani, I.A.M.C.; Wally Romanes,

a builder and electrician from New Zealand; and myself, a senior surgical registrar at the London Hospital. Capt. Tom Nevison, U.S.A.F., from Brooks Air Force Base in Texas, stayed until the middle of January and then returned in the Spring for the attempt on Makalu.

The programme that we carried out was divided between us, with each member responsible for a portion. For instance, John West carried out experiments on the diffusing capacity of the lung, Griff Pugh worked on blood volume and cardiac output, Dr. Lahiri on blood biochemistry, Michael Gill on psychometric tests, Jim Milledge on the sensitivity of the respiratory centre to oxygen lack and myself on blood and urine analysis. In addition we carried out a number of experiments which needed three or more people and had to fit in our own work accordingly.

Winter

At the end of November the remaining four members of the wintering party, Dr. John West, Capt. Motwani, Dr. Lahiri and myself gathered in Katmandu. We spent a frustrating ten days trying to find and gather equipment held up in the octopus-like tentacles of the Indian Customs at Calcutta. Finally these long fingers of red tape were cut and we set out on an 18-day march to Namche Bazaar. The weather was perfect and for the first time I saw the full beauty of the approaches to Sola Khumbu and the peaks South of Namche Bazar. Numbur, Karyolung, and Kangtega were majestic against the blue sky.

We reached Mingbo (15,000 ft.) during the second week in December. This is the uppermost yak grazing pasture of the Mingbo Valley and it served as our Base Camp for the winter. When we arrived, the small pasture, about 2 acres in extent, was covered in a patchwork quilt of tents. The Silver Hut had been occupied for about ten days and the physiological programme was starting. One of the many difficulties of working in tents under these field conditions was the cold; all solutions froze solid at night and this often meant a considerable delay at the start of the day. In addition small flurries of wind drove sand into instruments unless the tents were closely sealed. We quickly learnt to deal with these minor difficulties and soon all the members of the party were carrying out experiments on themselves and each other. A number of observations had already been made on three or four members at the M.R.C. Laboratories at Hampstead. We would repeat the experiments at Mingbo (15,000 ft.), the Silver Hut, 19,000 ft., and on Makalu, if possible on the Makalu Col at 24,500 ft. This would give comparable values at four different altitudes and enable some sort of comparison to be made of any adaptive changes and show evidence of deterioration at high altitude.

A number of Sherpas were used during the winter to act as cooks and to carry loads and stores to the upper two huts.

As work got under way we reverted to the normal week, taking Sunday as a day off. We found that at Mingbo we could, after a few days, do a normal sea level day's work—although our time was limited by the sun which gave us about a nine hour day.

We had really magnificent and startling views of two mountains, Taweche and Ama Dablam. A walk half mile down the valley revealed Everest and the whole of the huge Lhotse-Nuptse wall. On many evenings the pink glow of the setting sun shone on the summits of these great peaks with an iridescent and unearthly light.

At the beginning of January we had our first visit from the helicopter. This caused tremendous excitement amongst our Sherpas and those of the surrounding villages. I heard it, a strange sewing-machine-like noise early one morning and rushed out of my sleeping bag to see this gnat-like contraption approaching us from the Dudh Kosi. It looked minute and fragile against the massive lower buttresses of Taweche. Soon it came overhead and, after making a circuit, settled neatly and without fuss on a small patch of level but rough ground outside one of our tents. Out climbed an imperturbable Swede; Nils. He was on a proving flight for the firm who had hired the helicopter.

This American firm, Cook Electric, had hired the helicopter to help them put in radio stations throughout Nepal. The use of these machines is bound to revolutionise communications in such a mountainous and rugged country. The helicopter, based on Katmandu, was hired by the expedition on various occasions. Its ceiling was 19 to 20,000 ft.

We also had a flying visit from the helicopter in January when Sir Edmund Hillary brought back the Yeti scalp to Khumjung.

About ten days after our arrival at Mingbo, we all went up to the Silver Hut for Christmas Day. As we trudged up the last hundred feet to the hut we were welcomed by carols—sung without much puffing by the hut party stationed on a small ridge just below the hut. The occupants of the Silver Hut, Jim Milledge, Mike Gill, Tom Nevison and Wally Romanes had provided a magnificent lunch. Although we had no turkey, a fine tender steak of yak with potatoes was a worthy substitute.

After this feast, those who were capable skied for an hour or so and then we all went back to spend the night at the Green Hut.

In the middle of January John West and I moved up to the Silver Hut to make a complement of six people living and working at 19,000 ft.

The Silver Hut was prefabricated, circular in cross section and about 22 ft. in length. Its diameter was 12 ft. and within this structure were bunks for eight people, a table and stove. Double doors with a small

porch in between were placed at one end. At the other, almost entirely taken up by windows, were benches for use as a laboratory. The whole structure was placed on two longitudinal beams, and the beams were on adjustable legs. The hut had been designed at the Timber Research Centre with the help of Dr. Pugh.

Inside it resembled the fuselage of an aircraft, a similarity heightened by the strange, almost air-borne, feeling when the wind blew at gale force.

Next to the hut was a 12-man dome tent which was used as a store and in which the Sherpas, who were cooking for us, lived. To start with the cooking was done within the hut, but in January space became very limited and the cooking was transferred to the dome tent. One or two smaller tents were also put up; in one of these John West had most of his apparatus and the rest were used for sleeping and storage. In addition we had two ice-caves, one of which was used as a lavatory and the other for stores.

The site of this little colony was quite magnificent; we were set on the edge of a smallish glacier within a formidable cirque of peaks, dominated on the one hand by Ama Dablam with its tremendous 3,500 ft. E. face, and on the other by a jumble of spectacular ice peaks overlooking the Mingbo glacier. Behind us were the slopes of the Col leading over into the Hongu and 3–4 yards in front a drop over the edge of the glacier. In the distance the many peaks south of Namche Bazar stood out clearly against the sky, the double headed Numbur being the most noticeable. Behind these great peaks the sun would set touching them with all the many colours of the spectrum. On stormy evenings it was as if an immense smith's furnace had been lit and great flames appeared to shoot upwards colouring the mountain slopes black, orange, red and gold. These great shafts of colour appeared to pierce the clouds before fading into a cold, greenish-blue sky.

From my bunk in the morning I could see the pink glow of the rising sun touching the summits of the surrounding peaks to be replaced by a more golden colour which faded to leave the silver and black of the snow and rocks against the intense blue of the Himalayan sky.

During the weeks spent at this hut, we had a fairly set routine and observed the usual week. Towards the end of our time we ignored this rotation of the days as we had our work to finish; nevertheless its observance helped us to remain fit and fresh, rather than becoming stale with every day the same.

Although we had electric light and were able to work after dark, and often did so, we tried to work during the daylight and whilst it was warm.

As always, the first few nights at this height were troubled and broken, but gradually most of us slept normally.

The day began with breakfast at around 8–9 o'clock. Often before this meteorology readings had been taken at 7 o'clock or earlier.

Breakfast was invariably porridge made from oats or rice; luckily I did not grow to hate this as did some of the others. Following the porridge, we had eggs if there were any. The whole washed down by either the Sherpa brand of tea or coffee. Work then started under cramped conditions, which became more so when the stationary bicycle ergometer was installed.

On the days that the bicycle was used the whole laboratory space, 12 ft. wide by about 8 ft. long, became horribly congested.

Barry Bishop, during the winter, made an accurate survey of the Mingbo valley and when he was up at the Silver Hut, acted as a subject for many of the experiments.

In the afternoon we continued work until about 4 o'clock when everyone was usually tired physically and sick of the small cramped space. We then used to go out and ski. The fact that we were able to ski at 19,000 ft. and had a fine long run made life immeasurably easier for all of us. It enabled us to get away from the hut, from each other, and to take some outdoor exercise.

In addition, with the exception of Griff Pugh who skied in the 1936 Olympics, we were all much the same standard. John West and Jim Milledge had done about three winters skiing in Austria, whilst I had spent a winter in Montreal. Mike Gill and Wally Romanes were more or less beginners, but having a fine balance they learned quickly. The natural urge to get better at skiing made us all take a great deal of exercise during this short period of the day and, as falling made one so breathless, we were the more careful to stay upright. The thought, too, of a sprained or broken ankle made us fairly cautious.

The gentle slopes outside the hut were ideal for our purpose; the surface was hard névé for a great deal of the winter.

Our metal Head skis bit into this with great effect and were excellent for the conditions. On one of the steeper slopes just below our hut, we had our practice piste to which, as we got better, we added a small slalom course of about eight bamboo poles. Towards the end of the winter we timed ourselves down this course.

The lower part of the glacier became broken up into ridges and crevasses and we plotted a fine route amongst these. The run from the top of the glacier above the hut and beneath the col along the gently sloping névé into the jumbled lower glacier, provided us with varied skiing. The only trouble was that a run of between eight and ten minutes, took us thirty minutes to ascend. What we lacked was a ski tow.

After skiing, often until the sun got off the slopes, we went in and had supper. The evenings were spent reading, writing up our results and often working out the day's calculations. We also played bridge when a four could be gathered. Chess games and problems (from the *Times Weekly Supplement*) were played and solved.

During the winter we made one ski-mountaineering excursion. This took us a whole day as most of us were inexpert skiers and we found it most tiring, although very interesting.

Above the hut a col, first crossed by Eric Shipton and Sir Edmund Hillary on the Everest Reconnaissance in 1951, led to the Hongu glacier. The upper part of this was gradually sloping and very sparsely crevassed, ideal for skiing. Mike Gill, Wally Romanes, Jim Milledge, John West and myself carried our skis up to the col and then skied, some less and some more skilfully, down the Hongu. We then made a long horizontal traverse towards a glacier which came down from the South Col. We decided, unwisely, to traverse across to this glacier and having taken off our skis were soon involved in descending some rotten rock bluffs. Eventually we reached the glacier and stopped to have a meal. We then strapped on skis and started up towards the South Col. We took two and a half hours to reach this. The glacier was well crevassed, but we found an easy route which was steep in parts. The snow in places was very deep and soft, with which I for one had great difficulty in dealing. Some animal, possibly a fox, had made its way over this pass and had left tracks; we followed these as they followed the best snow and the best route to the upper slopes of the glacier. The weather now turned bad and at the South Col we were greeted by wind and snow. The far side was very steep and although Jim, the most experienced skier in the party, started down the top slopes—he soon came to an impassable crevasse. Luckily we had an ice-axe in the party, so as soon as I got down to him I cut steps over the crevasse and we descended on foot for a few hundred feet. We then strapped on our skis and continued down the glacier to the Green Hut. By now most of us were very tired and fell fairly often. However, it was easier to ski than to walk. Finally we reached the lower end of the glacier and removed our skis. Some Sherpas met us here and took these. A further two hours stumbling over snow-covered boulders plus a final few hundred feet uphill brought us tired out to the haven of our hut. We all stayed here for the night except for Wally who found enough energy to climb up to the Silver Hut for the night in order to continue met. observations the next day.

Rakpa Peak

All the peaks which rose from the cirque behind the Silver Hut were steep and each had some notable feature. Pumadablam (21,000 ft.) looked like a smaller edition of its bigger mother Ama Dablam—hence its name, Daughter peak. This peak was climbed in November by Jim Milledge with a Sherpa, and a few days later by Pat Bartram. Next to it was a smaller hump and then the ridge curved back to include

another glacier. From here a very fine, fluted snowpeak rose. It was difficult to estimate the angle of its upper slopes—they were certainly steeper than those on the upper thousand feet of Ama Dablam. Already we were toying with the idea of an attempt on this magnificent and impossible-looking peak. From some angles these slopes on Rakpa Peak, as we were to call it, looked very nearly vertical, from others they looked a little less forbidding.

One Sunday in February Mike Gill and I set out, together with Jim Milledge, at the ridiculously late hour of 9 o'clock. We carried skis, hoping to be able to ski down the glacier from which Rakpa Peak sprung, Jim was going to leave us at the foot of the peak and ski down whilst we climbed it. The snow on the glacier was packed hard in its lower section, but on the upper part we had to make a long traverse on powder snow with a breakable crust. At 12 o'clock Mike and I started up a steep little snow slope in order to get to a ridge. Up this we were able to use crampons without much step cutting. Soon we traversed right on to some reasonably stable rock and then reached a horizontal arête before the final snow ridge. Here the ridge was guarded by a series of tottering snow and ice gendarmes. Some of these weighed a ton or more and we detached one which bounded sickeningly down the flutings; more often we skirted them gingerly. On the left, a northward facing slope, the snow was in very poor condition and not to be trusted. On the right the snow, packed to an ice-like consistency, was better. On it were stuck blobs of snow, good, bad and indifferent in quality. We used many of these to quicken our progress. On the very steep upper portion Mike Gill led and cut steps for a rope's length at a time. I followed as quickly as possible, arriving very out of breath. At 4 o'clock we reached the crest of the ridge and decided to turn back. We were about twenty minutes from the summit of the mountain—which was a few easy rope lengths away.

The descent was uneventful and we regained our skis at 6.0 p.m. The tension which had been exceedingly high during the last six hours went slack like cutting a taut elastic. For my own part I was very glad to be off the peak, as was Mike, for we had been climbing nearly at an Alpine pace on very steep and exposed ice. The sun was gradually sinking behind Numbur, Menlungtse and the peaks to the West when we put on our skis and started down, following Jim's tracks. The snow was now in poor condition and we were too tired to ski safely, so after a number of falls we unstrapped them and continued slowly on foot. It was dark before we reached the foot of the glacier. However, we were encouraged by the arrival of some Sherpas to take our skis. The few hundred feet up to the Silver Hut were interminable; many times we stopped and reflected that exhaustion at high altitudes is of a different category to that encountered at lower levels.

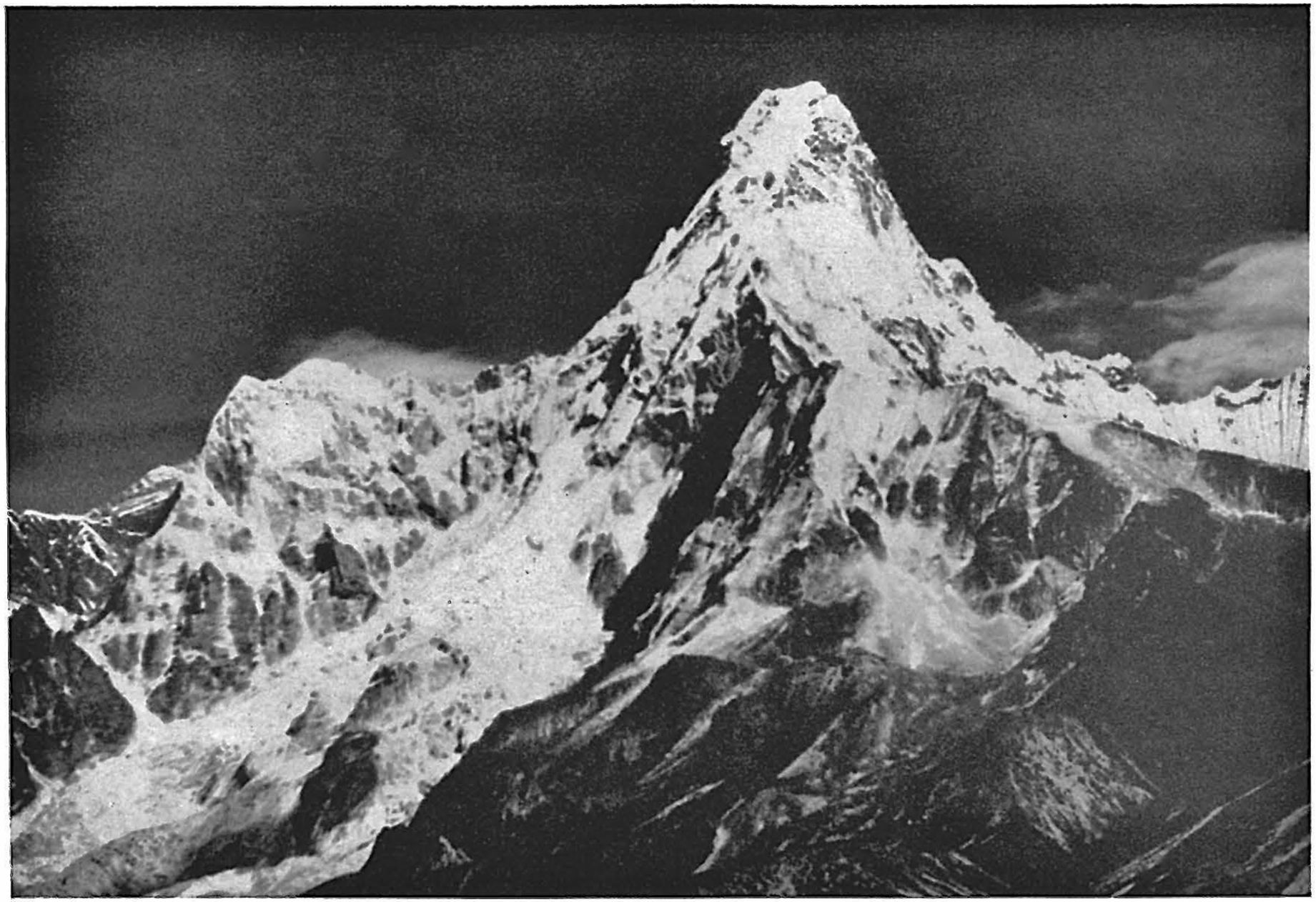

Photo by courtesy of Field Enterprises, Chicago]

AMA DABLAM FROM THE SOUTH.

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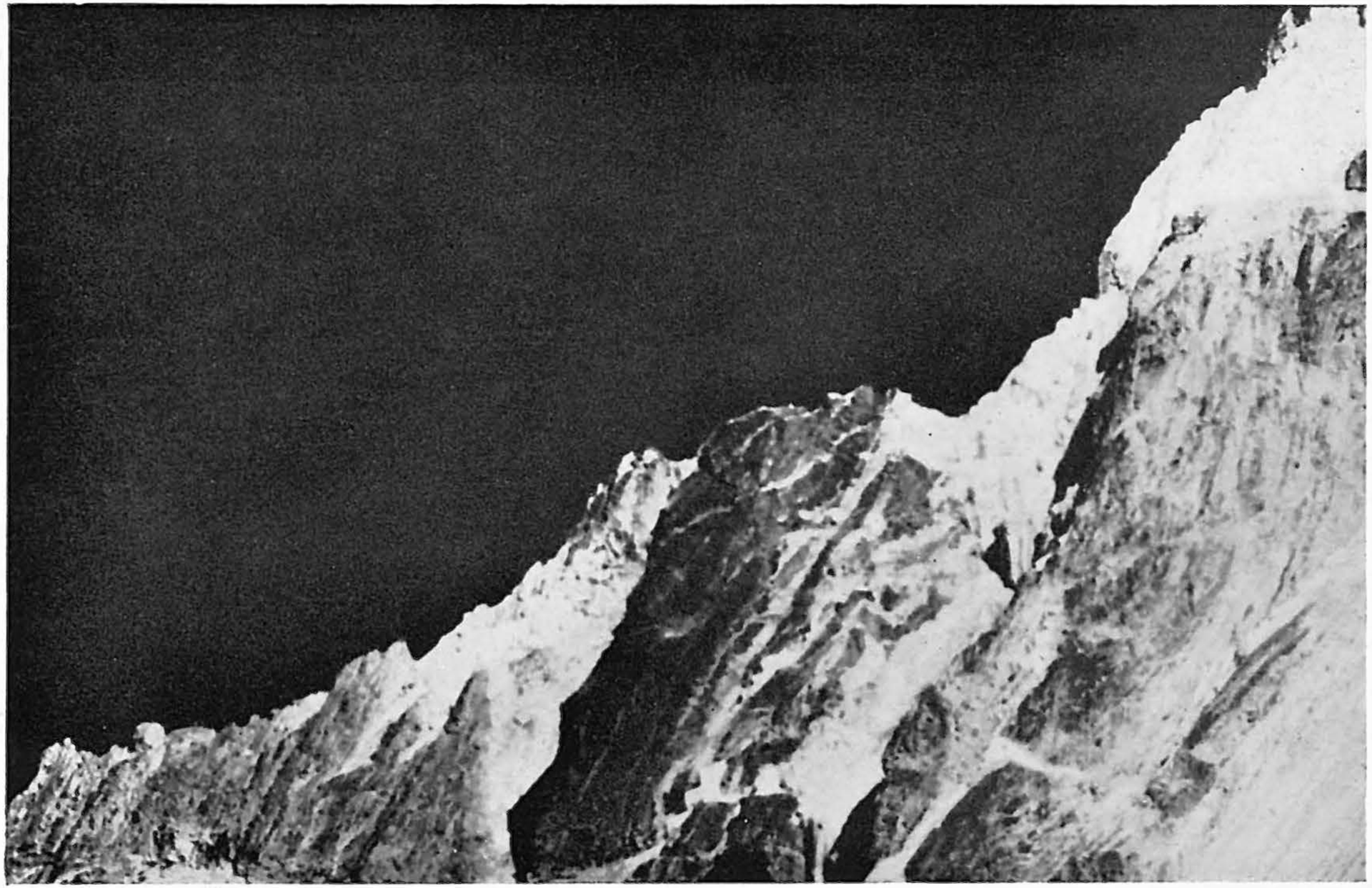


Photo by courtesy of Field Enterprises, Chicago]

THE SOUTH RIDGE OF AMA DABLAM SEEN FROM SILVER HUT.

Ama Dablam

When Tilman left Thyangboche in 1950 he is reported to have said that he thought it was one of the most beautiful places in the world—ringed as it was by steep and inaccessible-looking mountains. Of these mountains the most outstanding and the most beautiful was Ama Dablam. The name is, I believe, a combination of Sherpa words meaning Mother—as typified by the great outstretched arms of the South-west and South-east ridges, embracing the lower valleys and reaching out protectively towards Thyangboche. A *dablam* is a heavy locket of charms that Sherpa women wear around their necks. On the mountain these are represented by a series of hanging glaciers like shelves on the South-western face.

My first view of Ama Dablam was on the Everest reconnaissance in 1951, and my reactions then and in 1953 were of admiration for its beauty and air of inaccessibility; the beautiful flutings below its summit; its incredibly steep faces of rock, snow and ice, and its sharp, serrated ridges knifing into the clear sky. Although part of a ridge, it stands out alone; all its ridges narrow, all its faces steep. There are no obvious weaknesses, such as the shallow angle of the West face of the Matterhorn, to which Ama Dablam has been likened. In any case, the Matterhorn seems to be brutal and aggressive, though beautiful. Ama Dablam has more female characteristics—a certain remoteness, and is clothed in a sheath of glittering ice.

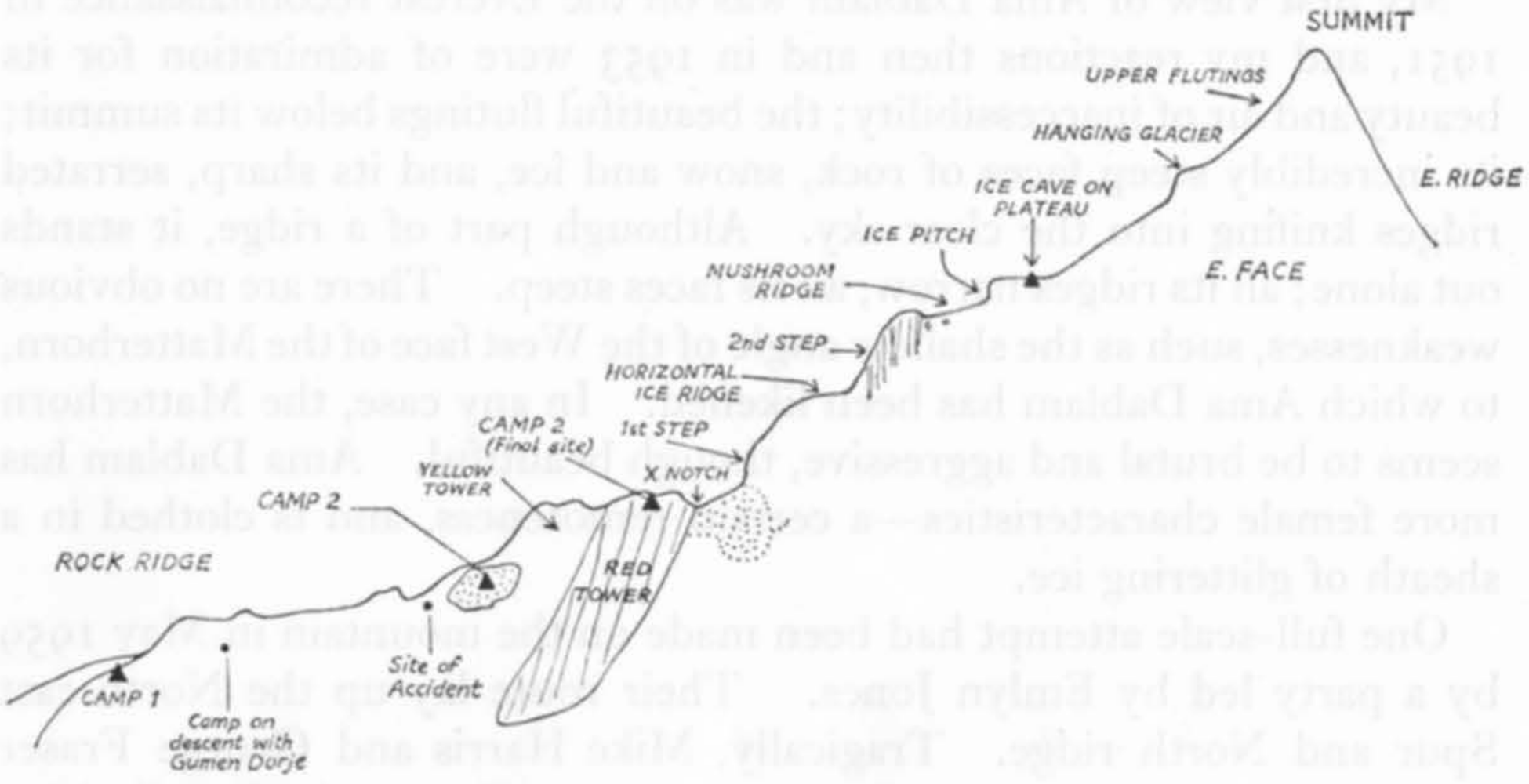
One full-scale attempt had been made on the mountain in May 1959 by a party led by Emlyn Jones. Their route lay up the North-east Spur and North ridge. Tragically, Mike Harris and George Fraser were lost on the upper part of the mountain. The standard of climbing was high—certainly one artificial pitch and sections up to VI in difficulty.

The South side of the mountain and the South ridge had been reconnoitred to a height of 20,000 ft. by Cunningham, a member of Gregory's party. He got to the foot of a yellow tower about 100 ft. high and climbed this to a ledge between one-half and one-third the way up, where he was stopped by an overhang.

During the walk from Mingbo to the Green Hut and from there up to the Silver Hut one makes a quarter circle around the South and East sides of Ama Dablam. We often jokingly said that we had better climb it before the spring party came along. As the winter went by Mike and I had climbed Rakpa peak and found that we could do climbing of a high degree of difficulty and exposure at that altitude. The final slopes of Ama Dablam, that is from where the South ridge adjoins the mountain proper, were at an average angle of 45°. A ledge, or really a hanging glacier—at about 21,000 ft.—seemed a suitable site for the first camp. Unfortunately, above this another hanging glacier barred the way to the upper flutings and appeared to overhang our proposed

camp site. Below this a steep rock step was obvious. As a route, therefore, the South ridge and the continuation presented a considerable number of difficulties. Perversely, I felt that if only we reached the upper slopes, which from a distance look so steep and uninviting, we should be able to get to the top.

Towards the middle of February the weather, which all winter had been good with calm days, clear nights and continuous sun, and with temperatures no lower than −27°F, became a little warmer and a west to south-west wind started. Dr. Pugh and Dr. Lahiri joined us at the Silver Hut and this became very crowded, in fact almost impossible for seven people to work in. A series of experiments to determine



the cardiac output were being carried out and we decided to relieve the congestion by having a look at the South ridge of Ama Dablam. In any case it was the only route that we could tackle, and as we were a scientific party, mountaineering had to take second place. Wally Romanes, who throughout the winter was invaluable (there seemed to be nothing that he could not repair or make), started off on February 19th with Gumen Dorje and put a camp at about 18,500 ft. just before the serious climbing on the South ridge. They were somewhat disturbed by the booming wind on the ridge above them. Next day they traversed the ridge to the foot of the yellow tower and climbed up to the ledge where Cunningham stopped. From there two alternative routes seemed possible; either straight up over an overhang to the ridge or a long difficult traverse to the right across the exposed face of the tower. Wally thought that this would be a good and difficult route at more normal altitudes. As he is not given to over-statement, I was not at all optimistic. Barry Bishop and I, with Pemba Tensing and Gumen

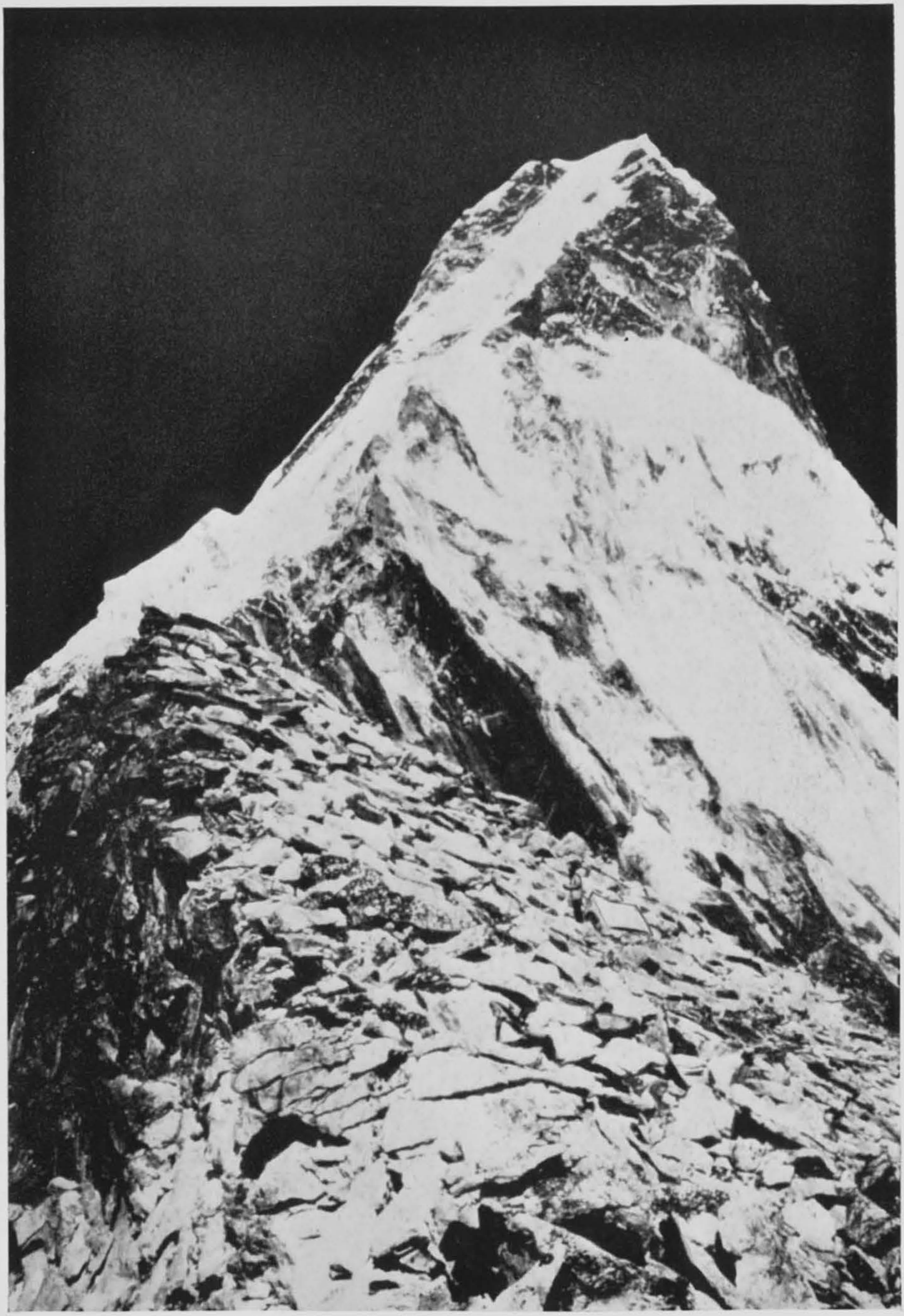


Photo by courtesy of Field Enterprises, Chicago]

THE SOUTH RIDGE OF AMA DABLAM WITH CAMP I IN THE FOREGROUND.

Dorje, set off from the Green Hut on February 23rd and after being blown over several times by a very fierce wind we reached Camp I, on a sheltered though restricted site. Here we spent a comfortable night with the wind booming a few feet over our heads. Next day Barry and I set out for the Yellow Tower. Wally had said very little about this ridge and we were surprised to find that instead of being a relatively easy scramble it was very exposed, jagged and narrow, in fact, a good Alpine ridge. The route was obvious and inescapable the whole way with no alternatives. We came across a nylon rope left by Cunningham on one of the towers—it appeared quite strong, so we left it. Further on there were several pitches that had to have fixed ropes. Just before the Yellow Tower the ridge narrowed and we had to progress *à cheval* for 15 ft. and under the Yellow Tower a small hanging glacier was to prove an ideal camp site. At the ledge on the tower we belayed and I started off to have a look at the long right-hand traverse. The first 20 ft. or so were out on the face and after putting in some pitons I somewhat shakily landed on the top of a diamond-shaped block. It was then necessary to make a very exposed right traverse to what looked like easier ground. Once across this 10 ft. we thought the way ahead was easier. I funked the traverse and stepped back left into a right-angled corner and went up to the overhang that stopped Cunningham. After a few tries I came down and Barry went up to the overhang and managed to climb it. He was relatively optimistic about the next few feet. Next day we put a camp on the hanging glacier at the foot of the Yellow Tower and on the 26th returned to the attack. This time I went up and over the overhang using *étriers*. We were about 6 ft. from the edge of the ridge and this looked almost impassable, the rock too was very loose and overhanging. I came down to the ledge on top of the diamond-shaped rock and managed to put in two pitons; I hung an *étrier* on the far one and went across the right-hand traverse. I belayed and Barry went on to do the so-called easy bit. In fact, the final crack on to the ridge was surprisingly difficult. I followed and we landed a few minutes later on top of the Yellow Tower. Some more scrambling brought us to the top of the adjacent Red Tower and we could look into the notch. This separated the South ridge from the mountain proper. From the notch a vertical step, seamed by a crack, led on to a steep ridge. This rock step was obviously going to be difficult and we returned to the top of the Yellow Tower and fixed a wire ladder to a convenient pinnacle on the ridge. This stretched as far as the ledge and we used it from then on. That afternoon, Wally, Pemba Tensing and Gumen Dorje arrived at Camp II.

On the 27th we went to look at the buttress leading out of the notch, called now the First Step, as we had seen another steep buttress further up. On the slope up to the foot of the crack the wind was rather fierce

so we were glad to shelter behind the crest of the slope. Wally climbed up the first half of the crack and then spent some time putting in pitons for the overhanging upper bit. Barry then went up and put in a few more before we all descended to our tents. Next day Barry put in the final pitons and, using *étriers*, climbed the step. I then took over and we ascended steep and exposed but not too difficult rock to a convenient platform. From here to the foot of the second step the route lay up an ice ridge. We thought that we could avoid this step by a nasty loose looking gully on the left. On the way down we put in belay pitons at the most convenient sites. On our return to camp we found Mike Gill, who had now finished being a subject for the latest batch of experiments at the Silver Hut.

He and Wally next day, March 1st, tried to get beyond the second step—whilst Barry and I went up with loads to the ledge below the second step. We also placed a further 50-ft. wire ladder from the top of the crack. Mike and Wally managed to climb the rotten gully to the left of the second step and got to the foot of a snow ridge that led to our next proposed camp site on an ice ledge 1500 ft. below the summit.

Mike Gill then spent the next few days moving food and fuel up to Camp II and putting in fixed ropes as far as we had got. Barry Bishop, Wally and I went down to the Green Hut. I continued on down to Mingbo to see what I could do about our primuses which were giving a lot of trouble. Another reason was that a plane had managed to land on our air-strip, but in doing so had come in rather tail-heavy and had lost its landing wheel and rather bent the tailplane. As no-one except Captain Motwani was down there, Griff Pugh thought that I should go down to see how everything was. I arrived to find a bank of clouds obscuring our landing strip. The plane, a Swiss Pilatus Porter, was sitting at one end and around it the 'Gallant Captain' and some Sherpas were pottering. Inside the pilot sat bundled up—cold and obviously feeling unwell. The previous day, after landing, they had spent a lot of time fixing the tailplane with wire and substituting a block of wood for the tail wheel. Tony Hagen, a Swiss geologist, was with the pilot, and earlier that morning a search plane had come out from Katmandu to find them, but had been unable to see anything through the clouds. The pilot was staying with his plane and indeed spent the night there, so that he could get into wireless communication with any further searchers.

They both spent an uncomfortable night, but next morning the weather was fine and the plane took off for Katmandu without incident. I returned to the Green Hut.

Our landing strip, just above Mingbo, was the third landing ground in Nepal and, at nearly 16,000 ft., the highest. It was made for and used by the Red Cross to bring in food and equipment for the number

Photo by courtesy of Field Enterprises, Chicago]

THE SOUTH RIDGE OF AMA DABLAM FROM THE TOP OF THE RED TOWER. THE NOTCH IS IN THE FOREGROUND WITH THE FIRST STEP SEAMED BY A CRACK RISING OUT OF IT. THE BUTTRESS OF THE SECOND STEP SHOWS UP CLEARLY. BEYOND IT AND TO THE RIGHT ARE THE UPPER SLOPES OF THE MOUNTAIN MUCH FORE-SHORTENED.

of Tibetan refugees around Namche Bazar. The first few landings and take-offs appeared to be rather hair-raising, but these improved with practice and the pilots were extremely expert.

On March 6th, Wally, Barry and myself rejoined Mike Gill for a final look at the mountain. In our absence Mike and the Sherpas had moved about 100 lbs. of food and equipment to the notch. We also decided, on Mike's suggestion, to move our present camp on to the top of the Red Tower just before the notch. His reasoning was that by the time we had climbed the second rope ladder we were tired and hopes of getting to the ice shelf, a considerable way, were much diminished. Our route was very exposed throughout and, despite the two rope ladders, difficult; in addition, our two Sherpas did not like the mountain at all and found climbing rope ladders very frightening. We wanted, therefore, to carry the top camp ourselves. That night about two to three inches of snow fell making progress on the rocks extremely slow and rather dangerous. We waited until it had melted a little and then we all moved camp—hauling loads up the first tower. It took six of us all day to move our camp up 200 ft. and a quarter of a mile along the ridge.

Next day Mike and Wally set off again to try and get through to the ice shelf, whilst Barry and I fixed more ropes and took loads up to the ledge below the second step. On their return Mike and Wally were rather depressed. Beyond the Second Step a ridge led towards the ice shelf. About 100 yards before this, extraordinary mushroom towers of ice—overhanging on both sides—blocked the crest of the ridge. Below the mushrooms the ridge sides were too steep and too dangerous to climb along. In addition, the ice shelf was guarded by a small but steep ice wall about 20 ft. high which would have to be climbed by artificial means. Their opinion was that although this section would go, it would take some time. One encouraging fact, however, was that they thought that we could dig an ice cave on the shelf and use that as our last camp rather than take up tents—this would, of course, lighten our loads considerably.

On March 9th, Barry and I set off for the ice shelf whilst Mike and Wally ferried more loads. The gully by which the second step was traversed was very loose and nasty. However, we made quick progress to the top of the step and along the horizontal ridge. The mushroom area looked rather formidable. Closer inspection showed that the ridge proper on which they balanced appeared firm enough so we set off. Luckily, although portions were rotten, we could always belay in a convenient crevasse or crack and then safeguard each other over the unstable bits. We came eventually to the edge of the ice shelf. This was climbed by means of a few pitons, an *étrier* and a tight rope. The ice shelf was a beautiful site for a camp. About an acre in extent, it was gently sloping and, although overlooked by a hanging glacier

higher up on the face, a convenient ridge directed all the falling ice to one face or the other of the mountain. The best find of all was that the snow was perfect for making a cave.

As we came down, the weather, which during most of our time on the mountain had been good except for a cold and blustery wind, showed signs of breaking up. Great black cumulus clouds were boiling up and the wind grew colder. At the ledge we met Mike and Wally who had come up to get some kerosene as we were running out at Camp II.

On March 10th whilst Barry and I took some more loads up to the ledge and fixed ropes on the gully skirting the second step, Mike and Wally managed to take two full loads up to the ice shelf. We had originally bargained for them to take loads to the top of the second step and this unexpected bonus was extremely useful for the next day, when we all four carried up to our last camp on the ice shelf. We arrived here at 4.0 p.m. and immediately set to work hacking an ice cave under Wally's instructions. This was really hard work at what must have been 21,000 ft. To start with, only one person can work at the entrance until it is widened out—then a small hall is made with its floor a little below the entrance. Finally a shelf was made about three feet from the floor on which all of us could sleep. This cave took until 9.30 p.m. to make—we managed to get to sleep at midnight after a somewhat sparse meal. We were compensated by a gorgeous sunset.

On the 12th Mike and Barry stayed to make the cave more habitable —whilst Wally and I set off to reconnoitre the upper slopes of the mountain. We had first to cross a small avalanche runnel, the only dangerous place on the whole mountain. This was clear ice and, after some fancy crampon work by Wally, needed some steps. We roped this and made for a small rock buttress—which turned out to be rather rotten. Above, a 300 ft. snow slope led to the right-hand edge of the hanging glacier that guards the final upper flutings of Ama Dablam. At convenient points on this slope we put ice pitons to save time next day. The slope ended on a small horizontal ridge and then we crossed another ice runnel and were on some rocks beyond the hanging glacier. A further two pitches and we landed on the slope above the glacier. We went up there for some way and could see no definite obstacle between us and the summit. It all depended on the snow conditions. If good we should get up and down in fair time, if bad we had little hope.

Next day we started at 8.30 after a good breakfast cooked by Mike Gill. The first part we climbed easily thanks to our steps of the day before. At the flutings we were agreeably surprised to find a small ridged fluting that led from the bottom right of the face to the top without interruption. We cut the whole way up this. Wally and I who had led from the camp were getting tired by the end of the first two pitches of the flutings, so Mike and Barry took over and led to the top.

The general angle was between 40° and 50°. The snow was in almost perfect condition and we got to the top at 2.30 p.m. This was a small snow cap about 100 yards long by 30 yards wide. A crevasse ran lengthwise along it. We looked down on the Silver Hut easily and wondered if they had seen us. We also looked down the North Ridge, the upper part of which appeared very hard. We found no trace of Mike Harris or George Fraser. The high peaks, Makalu, Everest, Lhotse, and Cho Oyu, were veiled by grey cumuli so after about three-quarters of an hour we returned to our ice cave. Barry took a controlled series of photos to tie in with his map of Mingbo Valley.

Next day we packed up our kit and descended to Camp II where Pemba Tensing and Gumen Dorje were relieved to see us. We removed as many pitons and ropes as we could. In all we must have used over 1500 ft. of fixed rope.

On the 15th, the Ides of March, Mike and Wally set off early with a lot of rope to make an aerial ropeway from the top of the Yellow Tower to the small hanging glacier. This was soon fixed up whilst the rest of us struck camp. We then sent loads down the ropeway—Mike at the bottom and the rest of us at the top. Gumen Dorje and Pemba Tensing went down early, roped up and set off down the ridge. About an hour later we followed with light loads. We left some loads for more Sherpas who had come up from the Green Hut. About ten minutes from the Yellow Tower I came across a small group of Sherpas looking rather frightened. A piece of rock had broken under Gumen Dorje. With his heavy load he had been unable to save himself and his right leg was broken just below the knee. I gave him some morphia and antibiotic tablets, reduced his fracture and fixed his leg using cardboard as a splint. We now had to get him down. The Sherpas were too small to carry him so Mike and I set about doing this. First of all Wally went off with Penuri to take a note up to Griff Pugh at the Silver Hut. Barry with our Sherpas started belaying the loads down and also flashing the Silver Hut with a mirror. Luckily, our walkie-talkie set was in good condition so that communication should be good. Mike set off, Gumen on his back, and myself belaying him. He took him over a nasty toe traverse and then prepared to do the small knife-edged ridge. It was obvious by this time that one person carrying a 120–140 lb. load with a projecting leg and one person belaying him was too dangerous, so we waited until Wally came back. The system then evolved was of either Mike or I carrying Gumen with Wally belaying. The non-carrying Sahib and one Sherpa would generally steady and hold in position the feet, hands and other portions of the carrying Sahib's anatomy. He would also protect Gumen's projecting leg. In this fashion we went along the ridge. We could do about 5–10 minutes at a time without changing over. Wally's ropework was superb,

protecting and helping us all the time. As the afternoon wore on the weather began to break up and it was obvious we could not get off the ridge on to easier ground that night. We had to find, if we could, a camp site. The only possible site was just before we descended the tower down which Cunningham had put a fixed rope. Here we left Gumen tied to a rock whilst we made two rudimentary tent sites. Soon snow began to fall.

Barry came in with some of the loads, whilst Mike and I put up tents and made Gumen comfortable. Wally went down to Camp I to meet a Sherpa sent up by Griff Pugh (we had made radio contact by now) with some kerosene and food—and a Kramer wire splint. We were pretty well out of fuel and food as we expected to be down at the Green Hut that night. Wally appeared with these, having rescued a somewhat reluctant Sherpa who had been overcome by darkness some way from Camp I. He then returned looking more like a snowman than ever. All night the snow fell and next morning about six to eight inches lay on the rocks. It would have been suicidal to move so we waited until midday until the rocks were dry. As the rocks became clearer so the weather got worse, and we resigned ourselves to another fall of snow and wondered if we could abseil down the ridge anywhere. However, at 11 o'clock we set off again. The crest of the tower was still covered in snow, but the east side was freer. We decided that the only way to solve the problem was to pendulum in an arc around the east face with the rope fixed at the top. This Mike did with Wally at the top, myself holding Mike's feet on. This manoeuvre was observed through the telescope from the Silver Hut and looked fearsome. After another few hours of snail-like progress over the snow-covered rocks we got on to easier ground. Here one of the Sherpas, Da Tensing II, took over. As we had reached easier ground the pace speeded up and we quickly passed Camp I. However, the weather now broke in earnest. If it had done so an hour or two earlier we should have had tremendous difficulty in getting off. Beyond Camp I we got into a sea of great boulders, which being now snow-covered were incredibly slippery and dangerous. Da Tensing II did a magnificent carrying feat, redeeming his almost 'shock-like state' of the day before. As darkness began to fall we got to a further camp hurriedly pitched amongst the boulders. A little later, Barry came in having got everything off the mountain.

Next day some Sherpas from Dingboche came up and one of them, a big strong one, Tenzing, carried Gumen almost all the way to Mingbo.

Two days later a plane came in and Gumen went to Katmandu, his leg miraculously still in the correct position. He was put in plaster at the United Mission Hospital at Shantah Bhawam that evening.

The four of us now went down to near Thyangboche, where, by dint

of doing nothing and eating immensely, we all put on the weight we had lost. Barry Bishop unfortunately developed a bad abscess which gave him a considerable amount of pain and also necessitated his flying to Katmandu for treatment. Tom Nevison had flown in a few days before.

At this time the rest of the party had come in from Katmandu. Sir Edmund Hillary and Peter Mulgrew had been in the Rolwaling 'Yeti-hunting' in the Autumn and then come over to Mingbo to assist with the erection of the Silver and Green Huts. Leigh Ortenburger, an American who had made a number of fine climbs in the Andes and Desmond Doig, accompanied them. John Harrison, a New Zealander, brought up the rear a week later with a further large convoy.

Attempt on Makalu

We now entered the third and last stage of the expedition, the ascent of Makalu without the use of oxygen.

From Mingbo there were two possible routes to Makalu, the first over three passes, one of 19,500 ft. above the Silver Hut, followed by a descent to the Hongu Khola, then two further 20,000 ft. passes would enable us to cross the Barun plateau and descend to the Barun glacier at the foot of Makalu. The alternative route would be to descend the Dudh Kosi until it was possible to strike eastwards to the Arun Valley, then north to Sedawa where we could turn west up the Barun valley and glacier. This was the approach the French used. Either route was difficult; the more direct was by the three passes and it was on this route that Sir Edmund Hillary decided.

In the meantime, the ascent of Ama Dablam had caused a commotion in Katmandu. As we had not asked for specific permission to climb Ama Dablam, the Nepalese Government decided to cancel the permission that the expedition had to attempt Makalu. This came as a tremendous shock to all of us, especially so, as we had, in fact, permission to climb in the Mingbo area (which, of course, included Ama Dablam) and this permission had been confirmed by the Captain in charge of the check post at Namche Bazar.

Ed decided to fly to Katmandu to sort things out. This he did after a rather nerve-racking ten days. We followed these negotiations from the Silver Hut, by means of our short-wave wireless set, and in addition were able to contact friends all over the world. Pete managed to talk to people in America, Australia, New Zealand, Japan and India. From a contact in Florida, Tom Nevison learnt that his wife had given birth to a son. Our call number, 9N–3–PM, was the rarest in the world, so many people wished to work us. The Denis's and the Cook Electric staff at Katmandu had a set and were extremely good and patient—especially as our calls were often of poor strength.

Whilst the wintering party completed their work at the Silver Hut,

the spring party, plus Wally Romanes, started on route making over the three passes to the foot of Makalu. This was a major undertaking and was completed successfully within a reasonable time.

Our last three weeks at the Silver Hut were exceedingly hectic and we used to work a twelve-hour day. We managed to complete our physiological programme with a distinct sense of relief. The winter party now split up. Griff Pugh, Lahiri, Motwani and Barry Bishop, who had returned from Katmandu, stayed in the Mingbo valley, Barry to complete his glaciology and radiation programme, the others to pack up the physiological equipment. Mike Gill, John West, Jim Milledge and myself went across to Makalu.

This journey was either a two or three day trip, depending on how energetic one felt, and a very pleasant change of scenery after the months spent in the Mingbo region. On the first day we climbed to the top of the col above the hut and went easily down the gradual slope of the upper Hongu glacier. The first staging camp was placed at the grass level. It was a pleasant spot and we basked in the afternoon by a small stream. Next day Mike Gill and I decided to go up to the Barun plateau and spend the night there, so that Mike could get some good photos of the sunrise and sunset over Makalu. We followed a long and pleasant route that climbed gradually up a glacier to the foot of a rock rib, the final step before the plateau. During the day we had magnificent views of many peaks surrounding the Eastern part of the Hongu and, as we climbed up on to the Barun plateau, of Makalu, Baruntse and a host of other peaks.

The plateau was a windy spot, but Mike managed to get some pictures both at sunset and early in the morning. Next day we waited until the others came up and then we all set off down to the Makalu Camp I on the Barun glacier. With us went a cheerful party of Sherpas relaying loads from the plateau.

From the far side of the plateau and at Camp I views of Everest, Lhotse and Lhotse Shar were quite magnificent. This group of mountains towers majestically above every other peak, cold and aloof, but not inviolate. We could see the lower part of Makalu, but not the crux of the route, the final slopes up to the col. Camp I was placed in a small ablation valley by the side of the Barun glacier. On the far side a side glacier from the Makalu cirque joined the Barun. By the time we came to Camp I further camps were being established on the mountain.

We, however, immediately went down to Shershon, the first Yak pasture down the Barun. Here the four of us, Mike Gill, John West, Jim Milledge and myself, spent our time doing nothing very much. It is a delightful spot with the tremendous precipices of Peak 4 just above us. After four days of this idyllic existence we returned to Camp I.

In our absence Camp III had been established at about 21,000 ft. This served as our main basis for operations on the upper part of the mountain. From Camp II we saw Camp IV being placed on the far side of a snow gully connecting the two shelves that run across this part of Makalu. This portion of the route was pioneered by Tom Nevison, Pete Mulgrew and Leigh Ortenburger, and John Harrison.

The plan was for Mike Gill and myself to go up to Camp IV and then establish the route to the Makalu col (24,500 ft.). Once the route was made it would be consolidated by fixed ropes. A series of lifts would then be made to establish a good dump on the col, then from here a series of summit attempts would be made. In addition, two members of the physiological party, John West and Jim Milledge, would carry out a limited series of experiments and observations at this camp.

On May 3rd, Mike Gill and I set off up from Camp III and made our way slowly across the face towards the small couloir. We climbed this with the aid of the fixed ropes put in by the previous parties and finally arrived at Camp IV. The view from this camp was quite magnificent. Next day we set off up towards the col, going back again along a broad snow ledge leading towards the left. We were a little uncertain as to the best route and so when we saw a fixed rope flapping on a rock rib we followed it—only to find that it led nowhere very much. It was now getting late, so we returned to our camp and next day traversed further along—almost to the edge of a couloir which falls from a small nick in the col. A snow gully led upwards and some further zigzagging about easy rocks brought us to the col. There we were greeted by a gentle but extremely cold wind. There was, however, a magnificent view of Chomo Lonzo, climbed by the French in 1955. Mike and I now descended to Camp III, whilst the route was consolidated and the lifts to the col began.

When we got down we found that Ed Hillary, who had not been very well, was complaining of a severe headache. This, needless to say, had not stopped him from taking a full share of work. However, he decided that he, like us, should go to lower levels to recuperate, so next day we set off for Camp III. We arrived in the afternoon and later that evening Ed complained that his headache was a great deal worse. Just as daylight was fading Mike and I heard a shout from Ed's tent and I went across to find that he could not speak properly and also that his face was partially paralysed. I called Jim Milledge and we gave Ed oxygen for the rest of the night—ourselves staying the night in the tent to see that none of the oxygen tubing kinked. By next morning Ed was very much better but there was no doubt that he should no longer stay at these altitudes. After talking things over we decided, reluctantly, that Jim Milledge would have to go with him, so they both

set off for Shershon. Luckily Ed could walk and his speech, although slurred for nearly a week, returned fully. Naturally I was extremely worried by this turn of events, but there was little else that we could do for him.

I now took over the expedition and whilst keeping Ed informed as much as possible started planning the assault. The plan was to have two assault parties—Mike Gill, Wally Romanes and Leigh Ortenburger, and Pete Mulgrew, Tom Nevison and John Harrison. The first party would establish Camps VI and VII and by taking the lion's share of Sherpas would leave little to be carried by succeeding parties. John West and myself (taking Jim's place) would carry out the scientific programme on this col. This involved, amongst other things, carrying up a stationary bicycle.

In the next few days the weather, which although not actively bad was not particularly good, seemed to be improving and we set off. The route to the col, by now well roped, presented no difficulties. At Camp V John West and I set up our bicycle and in the next few days completed the physiological programme. In the meantime, Wally, Mike and Leigh had set up Camp VI on the near side of the glacier coming down from the summit of Makalu at about 26,000 ft. The main difficulties were in cutting steps across this glacier and fixing ropes. This they managed to do, but because of bad weather were unable to establish Camp VII. However, they left a dump of food on the far side of the glacier. On the way back across this glacier they slipped and slid some way without any damage. This effort had cost them a lot and Mike's nose was badly frost-bitten when they returned to the col.

On May 17th, Pete Mulgrew, Tom Nevison and Annalu managed to establish Camp VII on the far side of the glacier. One of the Sherpas, Ang Temba, on his way up to Camp VI hurt his ankle and was unable to walk. Next day the three climbers, after a dismal night, set off towards the summit. Although they were going slowly they gained height steadily until at about 27,400 ft. Pete Mulgrew experienced a tremendous pain in his chest. This completely pole-axed him and he found that he was unable to move either up or down. After some time and by a tremendous effort of will he managed to start making his way down to Camp VII, which they reached in the late afternoon.

Next day, having sent off Annalu with a message to the lower camps, Tom and Pete only managed to get a few hundred feet lower down to be met, providentially, by some Sherpas from Camp VI with a tent.

The next day Pete could not move and another night was spent in this bivouac. By now however, the situation had been sized up by Leigh and John Harrison and our main objective now became to get Pete Mulgrew off the mountain. John Harrison had in the meantime

descended to Camp III and collected as many Sherpas as he could, taking clothing and equipment from the unwilling ones, and returned to the rescue. Leigh, John and those Sherpas then climbed to help Pete down. They managed to get him, with much difficulty, to Camp V on the Col.

The situation was complicated further by my own illness which came on during my descent from Camp VI, to which I had gone to see Ang Temba, who had managed to sprain his ankle badly. He was carried down by Urkien and some Sherpas on the day that the summit attempt was being made. About half a mile from Camp V on the Col I fell off a hump of ice and had to be dragged into my tent, there to remain delirious for two days. These days of disjointed and bizarre memories, culminating in a gruelling descent to Camp III helped by John West, Leigh Ortenburger and Tom Nevison, coincided with the rescue party higher on the mountain.

Once Pete Mulgrew had been brought to the Col a home-made sledge of rucksack frames was fashioned for him, and the descent to Camp III was made in a day, with the added help of John West and Wally Romanes.

During these desperate days we owed our lives to some remarkable feats of strength and endurance and unselfishness on the part of all the members of the party. Urkien was of tremendous calibre, and it was a party consisting mainly of low altitude Sherpas who brought Pete Mulgrew down from his camp at 26,500 ft.

In the meantime, Katmandu had been contacted and it was decided to fly out, by helicopter from Shershon, the three sick members of the party. The remainder of the expedition would return over the Barun and Hongu glaciers to the Silver Hut, there to meet Sir Edmund Hillary, who by now was supervising the erection of the new school at Khumjung.

Pete Mulgrew, Ang Temba, John West and I made our way to Shershon; Pete and Ang Temba were carried. Next morning we saw the helicopter arrive and with smoke from our fire gave him the wind direction. He landed easily on some gravel flats and took first Pete and myself down the Barun Gorge to Sedawa. He then returned and came back with Ang Temba and John West who spent the night at Sedawa. Pete and I were put down in a ploughed field fifty yards from the United Mission Hospital, where we were looked after with every care and attention. John and Ang Temba arrived next day.

After a week spent in hospital recovering from pneumonia, and frost-bitten fingers and toes, I returned to England. Pete, who was very badly frost-bitten in addition to what appeared to be a clot of blood on the lungs, spent a further few weeks in Katmandu and then returned to New Zealand. The rest of the party crossed to the Silver Hut, and came out via Namche Bazar, three weeks later.

Summary

The main facts that emerge are as follows—

1. The Yeti scalp was examined in England and found to belong to a form of goat and not to any mythical animal. The tracks are as yet not fully explained—but ablation of existing fox or goat tracks may be the explanation. The Yeti, like the Loch Ness Monster, is neither explained nor disproved—long may they live!

2. A full scientific programme, with its main emphasis on the long term effects of high altitudes on men, was carried out and, what is more, completed. A large mass of most interesting physiological and medical information was obtained and will be published in the appropriate journals.

3. The ascent of Ama Dablam in March was an unscheduled climb. Technically it was a hard mountain; fortunately the weather during its ascent and indeed throughout the whole autumn and winter was better than in the pre-monsoon season, though colder.

4. The attempt on Makalu was dogged by bad luck. We climbed to within 500 ft. of the summit, which would have been reached if it had not been for the severe and unfortunate illness of Pete Mulgrew. Climbing at great heights without oxygen definitely involves a great deal more risk than climbing with oxgyen. It is doubtful if, on mountains over 26,000 ft., this risk is worth taking. In any event oxygen (and enough of it) must be taken for medicinal purposes. In fact, on Makalu climbing sets were taken to be held in reserve. Oxygen bottles were taken to the col for use in an emergency.

5. Finally, a school has been built for the Sherpas at Khumjung, and a master installed.