

The Geographical Journal.

No. 3.

SEPTEMBER, 1912.

VOL. XL.

THE MOUNTAINS OF NORTHERN SIKKIM AND GARHWAL.*

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ALONG the northern border of India stretches the most stupendous mountain barrier in the world. The main axis of the series of parallel ranges and mountain masses known collectively as the Himalaya extends for about 1500 miles from east to west, and only comparatively small sections have so far been explored. The present communication deals chiefly with the northern portion of Sikkim, and is essentially a continuation of the exploration carried out by Mr. Freshfield, and reported to this Society. The mountains of Garhwal were also visited.

I have made three journeys to Sikkim in the years 1907, 1909, and 1911. In 1907 Swiss guides were taken, but they proved unsatisfactory, and in 1909 and 1911 only natives were employed. These natives were either Nepalese, Lepchas, or Bhutias. The Sherpas, who come from Eastern Nepal, were found to be the best, and they can be safely recommended to travellers.

My main object was to explore the glaciers of Kangchenjunga, and to ascend any mountains of the region which might prove accessible. Scientific work in connection with variations in the composition of the atmosphere at high altitudes, and alterations in the relative numbers of the red and white corpuscles in blood was attempted. It was intended also to make observations with regard to the so-called mountain sickness.

About the middle of April of last year (1911) I left Darjeeling with forty-four coolies, and in eight days reached the village of Lachen, situated at an elevation of 10,000 feet, in the upper Tista valley, about 110 miles north of Darjeeling by road. The scenery of the foothills passed through on the way has been so thoroughly and interestingly described by the late

* Royal Geographical Society, April 1, 1912. Map, p. 352.

Sir Joseph Hooker and Mr. Freshfield that we may start our journey at Lachen.

Having sent on a considerable quantity of stores to Thango, about 12 miles to the north on the Tibetan road, we left Lachen on April 24 with thirty-one coolies, eight of whom were Sherpa Nepalese, who were to remain with us permanently, the remaining twenty-three being Lachen men, who were to return after four days' march to the north west.

At Zemu Samdong (Zemu Bridge), about 2 miles north of Lachen, one leaves the pony track leading to Thango and Tibet, and proceeds through forest along the side of the Zemu river, which is followed to its source about 15 miles off in the glacier of the same name. This glacier drains the east face of Kangchenjunga. Between Lachen and the end of the Zemu glacier is generally considered a three days' march on the upward journey, as the route is very rough.

Many different types of animals are met with in these upper valleys. A few miles beyond Zemu Samdong the Lachen men lassoed a mountain fox. They wished to sell me the animal, declaring that its skin would fetch a considerable sum in Calcutta, but released it on my refusal. I was glad that they did not kill the creature for its long fur, which was a beautiful brown and black. It would be better if only dangerous predaceous creatures like bears and wolves, or game which is plentiful like hares, were killed in these upper valleys for some time. The Government is fortunately restricting the number of each of the different species of animals which may be shot on one gun licence.

On the fifth day from Lachen we reached the Green lake, situated at 15,300 feet, about 12 miles up the Zemu glacier. Here we found most of the ground deep in snow, and the Green lake itself only half its summer size, the eastern portion being a muddy flat. In summer the length is about a quarter of a mile.

From this point of view the tremendous mass of Kangchenjunga, which forms a most imposing series of precipitous ridges, effectually blocks the Zemu on the west. The chief peak (28,150 feet) is 8 miles south-west of the Green lake. The Himalaya here consists of three parallel chains running east and west, cut at right angles by the main Kangchenjunga ridge, which runs north and south. The Zemu glacier lies between the southern and central ranges.

Before exploring the glaciers on the flanks of Kangchenjunga, our intention was to force a pass suitable for laden coolies across the central range to Lhonak, the name given to the district between the central and northern ranges. The central range rises to a little over 20,000 feet near the Green lake. We made five attempts, but only managed to force two passes, one of which was suitable for coolies. We began with two frontal attacks. The first attempt was made on a ridge leading up to a small snow-peak north-east of the camp, but after ascending to 18,000 feet, we found it to be unsuitable for coolies, but practicable for a roped party.

We next tried further to the west, close to Green Lake mountain, but a heavily crevassed glacier was met with, only passable with difficulty by laden coolies. Here I was partially incapacitated for some days through slipping on glazed rocks. The accident was due to an experiment with boots two sizes too large with two pairs of socks, admirable for wading in deep snow in the early morning, but quite unsuitable for rocks.

The camp was then moved round to a small plain adjacent to the Tent Peak glacier, the main northern affluent of the Zemu glacier (marked as Green Lake glacier on Prof. Garwood's map). On the following day the main icefall of this glacier was climbed. This icefall looks much more formidable than it really is, but at the same time requires care. One found the coolies inclined to sit and smoke the inevitable cigarettes right under most dangerous seracs from which tons of ice might have fallen at any moment. After pointing out the dangers a few times they became quite cautious. Two coolies named Sona and Tuny were found to be good at ice-work, especially the latter, who is by far the best all-round coolie that I have ever met with. His ice-steps were admirable. At the top of the icefall, which is about 1000 feet high, we found that although the east Tent Peak glacier was a maze of crevasses, it would be possible to advance up its true left to the top of a pass just under a buttress of the Tent peak. Prof. Garwood's map here requires correction. It shows the east Tent Peak glacier as stretching up to the Pyramid, 3 miles further to the north-west, but this ground drains to Lhonak.

An easier route than that up the Tent Peak glacier seemed to lead north-eastwards up a tributary glacier, coming down from a plateau which obviously connected with Lhonak. The Nepal gap to the west seemed so easy that we could hardly credit that there must be a rise of 5000 feet from our camp to its summit.

Perhaps a few words might be said here with regard to the nomenclature employed in this paper. The system of naming the mountains is the same as that followed by Mr. Freshfield in his book 'Round Kangchenjunga,' namely, to give them descriptive designations, either from their form or position. Glaciers are named either from the chief peak feeding them, from the pass at their head, the place at which they debouch, or from the river flowing from them. In a case where several glaciers flow from one mountain, they are named after the peak with a prefix indicating direction of flow, unless a good special name is possible.

On the following morning at 6 a.m. we started for the Nepal gap instead of attempting the pass, because I was still a semi-invalid from the accident of three days before, and had on the previous day required considerable help from the rope in ascending the icefall. The Nepal gap (21,000 feet) is the first pass in the great ridge running northwards from the highest summit of Kangchenjunga. We had to cross the main Tent Peak glacier, and proceed up its western branch, which might be distinguished as the Nepal gap glacier. In about a couple of miles we came

to an awkward icefall, which took us nearly two hours to negotiate. It was far more difficult than when visited on two previous occasions (1907 and 1909), the arrangement of the seracs having entirely altered. We went right up through the centre of it, some gymnastics being required. Deep troughs containing ice-covered lakelets constituted one of the main difficulties. Above the icefall I had expected that we would proceed rapidly, but the crevasses were far more numerous than we expected, and up to 2 p.m. the glare of the sun was very trying, the heat being terrific, until quite suddenly, on reaching about 20,000 feet, we passed into an icy-cold wind, which was pouring through the gap from the west. The sun became obscured, mists swept up rapidly, and the coolies wished to turn back. As we had been as far in 1909, I had to refuse. Progress after that was slow. The wind coming through the gap became a gale, and was piercingly cold. The snow was frozen on the surface, but soft beneath, and we sank nearly to the knees. The coolies complained of incipient frost-bite, and we had to stop until they had rubbed their feet, and put dried grass, of which they carried a small supply, into their boots. About 3.15 we reached the base of the small rock wall at an elevation of 20,850 feet, which formed the summit of the pass (21,000 feet). This ridge was not difficult on the right, and although we were all extraordinarily tired (probably because we had done too much in the preceding week), I was strongly averse to turning back without climbing it, but Sona showed me that some of his toes looked white and numb, and to climb the wall might have taken at least half an hour in our exhausted condition. We therefore retreated as rapidly as possible, but, owing to our meeting with a second set of seracs below the icefall, we were delayed nearly three-quarters of an hour, and did not reach our camp until 6.30 p.m. I would strongly recommend any one attempting to cross the Nepal gap—and probably the other side, though steep, is not impossible—to camp above the main icefall of the Nepal gap glacier, so as to leave plenty of time for the upper portion. The map was found to be inaccurate with regard to the connection between the Sugarloaf and Twins groups. These are separate, and connected by a low, narrow col. It is also incorrect with regard to the mountain group to the west of the Nepal gap, which has no direct connection with the Twins group.

On the second day after attacking the Nepal gap, having moved the camp up about 500 feet, we proceeded to attempt the pass into Lhonak. The great icefall having been surmounted, we turned up the centre of the glacier on the east. After encountering very considerable difficulty with crevasses, we gained the dividing ridge. The view from the summit was interesting. Due north was the Chorten Nima La, practically free from snow on its south side. To the west lay the Langpo and Pyramid peaks. The pass has been named Lhonak La, and its elevation is about 19,500 feet. As it was only one o'clock, I wished to descend to Lhonak, and force our way back over the gap which lay at the head of the Tent Peak

glacier, it being at least 500 feet lower than our pass. The coolies, however, were strongly against the idea, and I thought it well to give in. Sona, who, as I learned by experience, was rather a pessimist, declared that the other side of Tent Peak pass was a sheer precipice, and that we would be benighted without food or shelter.

On investigation next day it was found that Tent Peak pass was an easy snow slope on the north side, and exclamations of "Achchha" (good) were heard in the camp throughout the evening. The coolies were delighted, because if we could not have managed the Tent Peak pass, they might have had to carry the baggage over the Tang-chung and Thé passes about 12 miles to the east. There are here two ridges between the Zemu glen and Lhonak, the central range forking a few miles east of the Green lake. As it would have taken between two and three weeks by that route, since there were more than three loads to each coolie, the saving of time and trouble was considerable. Four coolies were told off to move the baggage under Tandook's direction over Tent Peak pass, while the other three, including Sona and Tuny, came with me to attempt the Zemu gap and Simvu saddle.

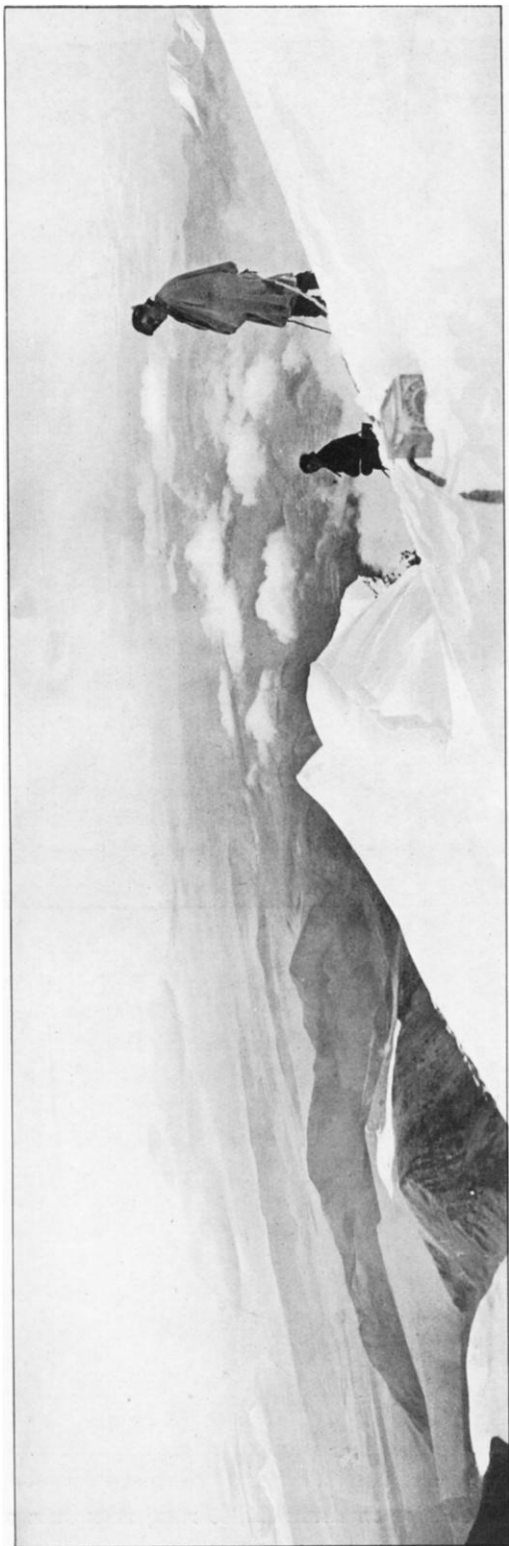
These are two possible passes over the southern range already mentioned. The Zemu gap, the more westerly of the two, lies between Kangchenjunga and Simvu (22,360 feet), and the Simvu saddle between the latter mountain and Siniolchum (22,200 feet). Our plan was to ascend to the Zemu gap, descend to near the Guicha La on the south flank of Kangchenjunga, force a pass to the Passanram glacier, and return to the Green lake over the Simvu saddle. This would make a most interesting circular tour, and is probably not impracticable.

Crossing the Zemu glacier, which looks like a chaotic muddle of moraine heaps rather than a glacier, we camped for the night on a sheltered bank partly covered with dwarf juniper, about 2 miles west of the North Simvu glacier. This was the only place of its kind for many miles, the last outpost of plant life in that wilderness of rock and snow. Next day we proceeded to an altitude of about 18,200 feet in the Zemu gap. Our route at first lay up the east side of the Zemu gap glacier. Towards three o'clock we found ourselves forced on to the side of Simvu by crevasses, and others barred further progress in front. A traverse to the right and short ascent showed us that all the crevasses had been turned, and that the remaining 1100 feet should present no difficulty. The night was bitterly cold, with wind and drifting snow. At 5 a.m. I roused the coolies, but the cold was so intense that they soon rushed back into their tent and cowered together. On my protesting, they declared it impossible to do anything in such cold, and that we would have to wait until the sun reached the tents. This would not occur until between 9 and 10 o'clock, as the sun would have to rise above a lofty buttress of Simvu. The manoeuvre of retreating to their tent was repeated a second and third time, and I began to lose patience. It should be explained that they had

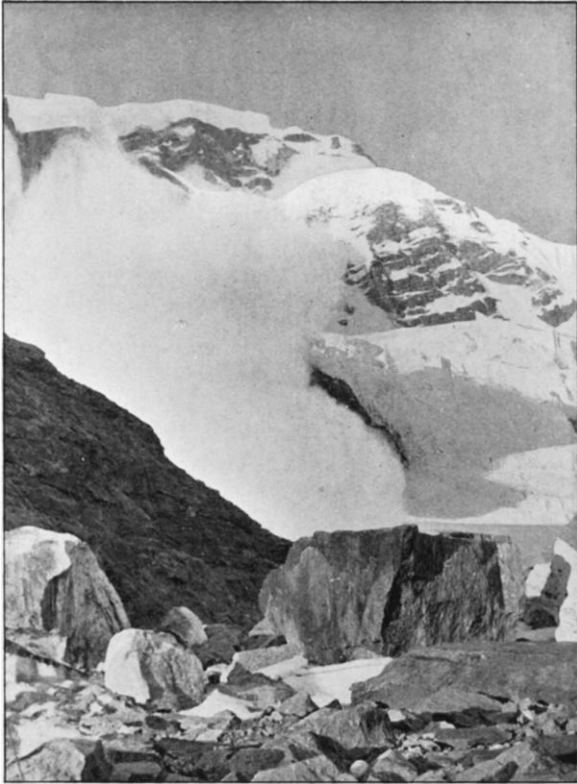
been given on the preceding night two large down quilts, so that they were as well protected as myself—I did not use a sleeping-bag—and they were wearing quite as much clothing. Eventually we got away about 8.30 a.m. just as banks of mist began to sail up the Zemu glacier. Going at full speed, and halting only once for a few minutes, we reached the top of the gap (19,300 feet) about 9.30 a.m., our pace being considerably over 1000 feet per hour. The going would have been very easy had it not been for 6 inches of snow which had fallen in the night, and in places blown into wreaths. Half an hour before we reached the top, however, grey mists were sweeping through it, and from the summit, which was only a few yards across, the view was spoilt. An icy wind blew through the gap, and it snowed intermittently. The slope fell away steeply in front, and a few yards down there was a crevasse which stretched right across the gully.

After waiting for an hour in the usual freezing blast which comes through such gaps—only rewarded by a glimpse of a great white peak (presumably Pandim) through a rent in the clouds—as it seemed too hazardous to attempt a descent with heavily-laden coolies through mist, we retreated and proceeded to our old camping-place near the Simvu glacier. On the way the view of the crags of Kangchenjunga was very imposing, and we noted that the north-east buttress seemed almost inaccessible, and would, in fact, require difficult climbing to get properly on to it, as it degenerates into a narrow rock ridge which rises at the end into a small peak. On the following day we ascended to the summit of the Simvu saddle (17,700 feet). The climb was merely a walk along the west side of the Simvu glacier, and could have been made the whole way unroped. At the bottom of the glacier, about $1\frac{1}{2}$ hours from our previous camping-place, the coolies wanted to halt for the night, promising to start at 4 a.m. next morning. Referring to their behaviour on the previous day at the Zemu gap, I jokingly suggested that it was not 4 a.m. they meant, but 10 a.m., whereupon they laughed good naturedly, and we went on to the summit. This incident indicates one secret of how to deal successfully with coolies, who have a weakness for wanting to camp about an hour after starting in the morning. Mist was sweeping up from the south when we reached the top at 3 p.m. The descent was much steeper in that direction than to the north, and was blocked by an icefall about 250 yards down. We camped about 100 yards from the icefall. Towards evening the mists cleared except to the south, and there was a magnificent sunset over Simvu and the crest of Siniolchum. The west side of the latter mountain is very precipitous, but may not be quite impossible.

On the following morning we carefully surveyed the icefall, and came to the conclusion that it was practicable for a roped party of loaded coolies, but that great care would be required, especially on the descent. The pass leads to the Talung Chu, one of the westerly affluents of the Tista. It would be possible by means of this pass to reach Jongri, the



PANORAMA (140°) LOOKING INTO TIBET FROM THE SUMMIT ABËTE OF CHUMIUMO (22,480 FEET).



AN AVALANCHE FROM THE OUTLIER (22,500 FEET).



THE EASTERN FACE OF CHUMIUOMO (22,490 FEET) FROM NEAR GIAGONG.

Kang La, and Phallut on the eastern border of Nepal, or, proceeding down the Talung Chu, Gangtok, the capital of Sikkim. Fine views were obtained from the summit both to the north and south, but the latter direction was quickly obscured by mist. We unfortunately had not enough provisions to descend the icefall, cross a ridge, and attack the Zemu gap from the south, as one would have liked. The weather, too, was stormy, and we therefore decided to cross the Tent Peak pass, and join our other party in Lhonak. The afternoon of the following day found us camped on the summit of Tent Peak pass. The route is quite easy. On the final ascent to the pass there are several large crevasses, so that coolies must be roped. We had intended to join Tandook that night, but the weather being bad we camped on the summit (19,000 feet), so as to get photographs on the following morning. Snow fell at intervals during the night and continued next morning. While we waited patiently for the mists to lift, three coolies of Tandook's section came up to remove some baggage we found on the pass. They informed us that Tandook was camped 2 miles to the north.

After waiting till the afternoon, as snow continued to fall under the influence of the southerly wind, while sunshine prevailed to the north, we descended the easy snow slope, crossed a glacier and the ridge beyond, and joined Tandook near a small lake. On the way we had to cross a glacier, and in trying to find a passage over a rapid icy stream on this glacier I slipped in up to the waist, owing to the bank giving way. Fortunately, I managed to scramble out unaided. Another couple of feet would have taken me into water at least 10 feet deep, running like a mill race. The incident is only worth mentioning because there were delays afterwards with other streams, so that an attack of mountain lassitude from which I suffered for the following two days may have been due to waiting about in wet and freezing clothes. The lassitude showed itself in a disinclination to strenuous exertion, and breathlessness in ascending the small hills round the camp, although the height was only about 17,700 feet. The gaps leading into Nepal were examined, as our original intention had been to cross the Langpo gap south of the Langpo peak and investigate the south side of the Jonsong peak. This gap, although practicable for a roped party, was not suitable for coolies. At least that was our conclusion at the time, but from later experience, as detailed below, I believe coolies could cross it with some difficulty.

On the afternoon of May 18 the camp was moved down beyond the end of the north-east Langpo glacier, which stretches further to the north-east than represented in Prof. Garwood's map, and on the following day, after crossing a ridge and passing a small lake, we camped in the afternoon by the Langpo Chu, just at the bottom of the descent from the Chorten Nima La. As the day was early, coolies were sent back to near Tent Peak pass to bring up the rest of our baggage, and with three coolies we ascended the great glacier bank on to the plateau which leads to the south ascent of the pass. This bank presumably formed the left boundary of a huge

glacier which in old times covered western Lhonak. Next day we crossed the pass (18,500 feet), getting a magnificent view from the summit. Our intention was to ascend the fine peak which guards the pass on the east, and which I have provisionally named "Sentinel peak."

About 7.30 a.m. on May 21, we started on the ascent. Our route lay chiefly up toilsome scree slopes for about 1500 feet, when we reached a crevassed snow slope. From the moment we reached snow we had to cut steps, although it was only *névé*. Very soon we were stopped by a wide crevasse, but on traversing horizontally for about 200 yards, we found a narrow bridge, and after that there was little difficulty. First we proceeded south towards what looked like the summit, but near this another higher summit appeared on the left. On reaching this, however, we found it to be merely the heavily corniced edge of a precipice which plunged down to a large glacier on the east, and a third summit appeared as a sharp snow-peak right in front. It was now about 1.30 p.m., and the coolies were discouraged. Tuny, who had cut steps the whole way, confessed to being exhausted, and Sona was pessimistic as usual, but after a rest they agreed to come up to the top. Unfortunately, a small portion of the *arête* was green ice, and necessitated careful step-cutting, so that it was past three before we reached the summit (about 22,000 feet), which has probably not been triangulated, but may be the peak named as 22,060 feet, and misplaced on map. The last portion was soft new snow, the slopes on each side being steep. It was misty and snowing when we reached the top, and after a halt of only a few minutes we began to descend, when the mist was blown aside and we got a fine view. It appeared that we had been at the end of a nearly horizontal narrow crest, but whether the other end was a few feet higher or lower I was unable to make out. It was obvious that glaciers occupied the defiles to both east and west instead of rivers as marked on the map. Mr. Freshfield has already pointed out how inadequately the Himalayan glaciers have been treated in the survey maps, and from what we saw here and in other places near the southern boundary of Tibet, the area under glaciers as represented in the latest map of Sikkim (1906), showing adjacent parts of Nepal and Tibet, should be nearly doubled.

After a rapid descent we arrived at our camp about 5.30 p.m. On the following morning we recrossed the Chorten Nima La and joined the main camp.

Next day found us on our way to the Jonsong La (20,300 feet, traversed by Mr. Freshfield's party in 1899), which was crossed on the following day, and our camp pitched at about 19,000 feet near the south Langpo glacier. From this position we had in 1909 ascended the Langpo gap and also the Langpo peak. Our present intention was to repeat the ascent of the Langpo peak, which was particularly easy in 1909, and from the top decide on a route up the Jonsong peak (24,400 feet), and more especially to investigate the summit *arête* of that mountain.

In August, 1909, the ascent of the Langpo peak was similar as regards difficulty to that of the Zermatt Breithorn from the Leichenbratter hut, with the exception that the last 600 feet was steeper than anything on the Breithorn. From the denuded appearance of the mountain, as seen from the Jonsong La—there is more snow below and less snow above 19,000 feet in May as compared with August—we were afraid that the final 1000 feet might be icy and difficult. This proved to be the case. The mountain at this early season of the year was considerably more difficult than the Finsteraarhorn *via* the Hugi Sattel, and we failed to reach the top.

During and after our attack on the Langpo peak the weather continued bad for several days, mist enveloping our camp a great portion of the time. Our next step was to descend the south Jonsong glacier, and turn north-west up a glacier provisionally named Long Ridge glacier from the mountain on the west. A pass at the north end of this mountain looked easy, but, on investigation on the following day, was found to be of the writing-desk type—an easy slope to the east and a fairly sharp precipice to the west. When we were on the summit of the pass the coolies pronounced the descent impossible, but on the following morning, after a little persuasion, three coolies agreed to come with me and attempt it.

Our intention was to cross Long Ridge pass (19,520 feet) and proceed west until we could find a way over the Chabuk La or some other pass to the north-west, and then return into Lhonak by the Chorten Nima La. We would by so doing get a proper estimate of the Jonsong massif, and ascertain whether any attack on the Jonsong peak was possible from the south-west. Our main object, however, was to find out the relationship of the lofty range which we felt convinced prevented the Mount Everest, Chomokankar, or Chomo Langmo group from being clearly seen from this portion of the range.

The ascent of the pass was not difficult, although there were several awkward crevasses. The descent was, however, very steep, probably at least an angle of 60° to 70° , and was made unroped, the coolies greatly preferring that arrangement; the rope would have been cut to pieces on the sharp rocks, so that I was quite agreeable. A stone tossed from the summit would have fallen on snow 500 feet below. A few small gullies filled with glassy ice were troublesome, requiring careful step cutting. After descending we crossed a glacier and camped on rocks about a mile to the west, under the precipices of a sharp isolated peak of the Jonsong group which we have provisionally named "the Outlier." It is probably about 22,500 feet high. From our camp we had a magnificent view of the north-west face of the redoubtable Jannu (25,310 feet), which looked like a great cathedral with twin towers.

Next morning we proceeded along the glacier, which ended abruptly in the most peculiar way at a corniced edge to a precipitous descent leading down to a glacier about 1500 feet below us. It was a regular "cut-off," and a discussion and delay followed. We had not expected anything of

the kind. The route seemed impassable for laden coolies in front, and the head of the glacier below us was barred by cliffs. Beyond the great trench in front was an array of peaks and passes. The coolies asked me point blank which was the Chabuk La, and I had to confess that I did not know. We had only two days' provisions, and were probably at least four days from the Chorten Nima La by that route. The map was hopelessly wrong, showing the unknown marvel of a river flowing in at the head of a glacier as being in front of us. The person who mapped this portion of the range seems to have been mentally related to the "scientist" mentioned in Mr. Freshfield's 'Caucasus,' who undertook to prove that there were no glaciers at all in the Himalaya.* To advance further with heavily laden coolies seemed unfair to them, but I regret now that we did not seek another route of descent and make the attempt. We could have hidden some of our baggage and sent back for it if necessary, but the idea did not occur to me until it was too late. As usual the weather gave the casting vote, so to speak. The clouds which had been massing round Jannu all the morning blew up with astonishing rapidity, and it began to snow. Reluctantly the order to retreat was given, and we returned to our old camp. In the afternoon a fine avalanche fell from "the Outlier," which I was fortunately able to photograph. The clouds of snow dust look like mist.

On the following morning we recrossed Long Ridge pass and reached our old camp by the Langpo glacier, and next day, crossing the Jonsong La, we reached Tandook's camp, at the foot of the slope leading to the Chorten Nima La. Taking two fresh coolies, two days afterwards we were at Thango, having crossed the Lungnak La (17,300 feet).

It must be pointed out that what we saw from Long Ridge pass conclusively proves that the Pandit Chandra Das must have crossed the Jonsong La, although he describes it under the name of the Chatang La. Prof. Garwood's adverse criticism of the Pandit's description of the route is probably due to his having passed over the ground in the reverse direction under different conditions. The pandit's description of his route from Ramthang northwards is correct, except as regards compass directions. The portion of the path mentioned as being among boulders is about 2 miles north of Pangperma, and the seracs referred to are those at the confluence of the south Langpo and Jonsong glaciers.

At Thango the party divided. Coolies were sent to Darjeeling and into Tibet for supplies, and four coolies with two yaks to carry wood came with me to attempt Pawhunri, a mountain on the north-east frontier of Sikkim.

Proceeding to Giagong and the Tso Lhamo (Lake of the Goddess), we reached the snow-level at 18,000 feet on the third day. Here one of the

* Presumably this portion of the chain was sketched from the indications of one of the native Pandits, whose drawing has been shown me by Mr. Freshfield.

yaks—aided and abetted by its owner—refused, like a sensible animal, to come further, so that we had perforce to camp early. On the following day an ascent to 20,700 feet was made, but we were driven back by a high wind which whirled the fine surface snow into dense clouds. The camp was next moved up to 20,000 feet, and on the following day we reached the summit, 23,180 feet. The view was unfortunately spoiled by clouds beneath us, but was nevertheless interesting. West and south nearly everything was obscured by a rolling sea of mist, above which some of the great peaks, Kangchenjunga, Chumiumo, and the Kangchenjhau, showed their crests like rocky islands. About 4 miles to the east was an accessible snow peak, about 23,000 feet high, and between us and it there flowed northwards a fine glacier, and not a river as marked on the map. On the way up we had glimpses of the north end of the Chomolari range, but the most interesting view of all was two lofty snow peaks bearing east-north-east about 100 miles off, which towered up above the horizon in a most imposing manner. Only snow was visible and must have represented about 6000 feet, which would make the mountains at least about 25,000 feet high. They seemed to be distinctly north of the main chain. Mist covered them before we reached the top. We took nearly six hours to ascend, but did not hurry. Keeping close to the edge of the western cliffs until about 1000 feet from the top, we then made a bee line for the summit through snow nearly a foot deep.

The summit was corniced to the east, and was some distance from and much higher than the tops of the western cliffs. We remained on the top about 35 minutes. We felt quite comfortable except for the cold wind, and I am confident that there would have been no difficulty in carrying out moderately complicated experiments, such as estimating the number of the red and white corpuscles in the blood. This is specifically mentioned because authorities have stated that such estimations would probably be impossible above 17,000 feet. Samples of air were taken, and estimations of carbon dioxide started.

Had we brought a spade with us, we might have dug a big hole on the top and brought up a tent next day to carry out some experiments, and get photographs. It was quite hopeless to think of pitching a tent unless we had some protection from the wind. The descent took us about two hours and a half, but we did not descend nearly so quickly as in 1909, when we only took about two hours between 23,000 feet and a camp at 18,500 feet.

During the ascent I carefully compared the climbing capacity of the two coolies with me—Sona and Tuny's brother—with my own, and found that they climbed much better, especially above 22,500 feet. Above that elevation they could have given me at least 300 feet in 1000 feet; that is to say, they were at least 30 per cent. better although they were lightly loaded. In 1909 (when 23,000 feet was reached) the two coolies with me seemed only slightly better than myself, but they were weaker than Sona or Tuny's brother.

This comparison of the white man with the native has some interest, and perhaps one might take this opportunity of succinctly stating the results of our experience in three visits to these mountains.

At any height up to 15,000 to 17,000 feet one could hold one's own with the unloaded coolie and easily beat the loaded man. Above 17,000 feet, however, their superiority was marked, an unloaded coolie climbing much quicker than myself, and even a moderately loaded coolie going up as fast as one cared to go, up to 21,000 to 22,000 feet. Above that elevation a moderately loaded coolie could run away from me, and with an unloaded coolie one had not the slightest chance.

Why should there be this distinct difference in acclimatization to high levels between white men and Indian mountaineers, and is the difference universal? I venture to think that Mr. Freshfield, Prof. Collie, Dr. Longstaff, and Mr. Mumm would agree with me so far as their experience goes. The Brocherels might, however, be taken as exceptions to the rule according to Dr. Longstaff's narrative of their behaviour on Gurla Mandhata and Trisul.

I have only had experience of two professional guides (Swiss) in the Himalaya, and they were more adversely affected by elevation than myself. It is not impossible that people accustomed from childhood to pressures of three-quarter atmosphere or less may either require less oxygen, or may have greater lung capacity. A little more will be said about this interesting subject—the effect of elevation—later.

It might be mentioned that at the camp, at 20,000 feet, estimations of blood-corpuscles (blood counts) were made without difficulty, but I confess that it required a considerable mental effort to bring oneself to carry out the experiments. One felt as if there was an extraordinary inertia to be overcome. There was also a peculiar tired feeling which increased in intensity with altitude. As we toiled up the last 1000 feet of Pawhuni, I recollect that it occurred to me that at last I probably understood in some measure the feelings of that mysterious class of people who are "born tired." I remember, too, that it afforded me some amusement to reason by analogy that as my tired feeling was due to altitude, and a descent of a few thousand feet would render me nearly normal, probably people who are born tired might possibly feel inclined to work at the bottom of a particularly deep mine, or in a caisson under high pressure. It occurred to me, also, that they should be examined medically to see whether they did not require instruction in respiration.

On descending to the desolate sandy flats at the base of the mountain, one is struck by the remarkable variety of wild life which may be met with. A herd of eight kiang passed quite close to us. Several types of wild birds were met with about the Tso Lhamo, including eagles, pheasants, and two pairs of handsome brown geese with black and white wings. Later on, we saw on the way to Chumiumo another half-dozen pairs of these geese, but we only saw one young one, of which the parent



PANORAMA (142°) OF THE NO



PANORAMA (142°) OF THE NORTH-EAST JONSONG GLACIER (LHONAK GLACIER), SHOWING THE JONSONG PEAK (24,400).

Jonsong Peak.



THE JONSONG PEAK (24,400).

birds seemed very careful. It made one annoyed to think that a certain type of gunner—one does not mean sportsman—could easily have exterminated all these geese, for they were quite easily accessible.

There was an extraordinary number of small birds, of which the commonest was a species of lark (*Melano-corypha maxima*), which must have been there in hundreds. We found four nests without looking for them, one with three young ones, two with two, and the fourth with two brownish eggs. The young ones differed in many respects from the older birds, which had a peculiar black collar. These larks began to sing before 4 a.m., apparently quite irrespective of sunrise, for there was no trace of the sun until at least an hour later. When one went near their nests their pleasant warbling was changed to a characteristic plaintive note, which no one could fail to recognize. Quite unwittingly we erected our tents about 3 yards from a nest. From the plaintive notes heard after we had settled down, I was sure that we must be trespassing, and, on looking, found the nest with two young ones. I was inclined to move the tents, as I was afraid they would starve, but in a short time one of the birds came to feed them, and continued to do so at intervals of a few minutes during the afternoon and next morning. Deer, hares, and little creatures like marmots were also seen.

We found the whole of this trans-Himalayan portion of Sikkim in the hands of Tibetans. There were four large black tents and many smaller ones, the number of Tibetans being about 50. The people were friendly, and men, women, and children were quite pleased to be photographed. These Tibetans were well off, and owned at least 2000 sheep and 150 to 200 yaks. It seemed somewhat an anomaly that while these people were given free entry into Sikkim, no white man was allowed to set foot in Tibet.

On the way back to Thango we met Mr. Bell, the British resident from Gangtok, who was most kind and hospitable. He was much interested in the report of the existence of lofty snow-peaks to the east-north-east, which he suggested were part of the Kuhla Kangri mountains. He had seen the south of Kuhla Kangri from Bhutan, but his account did not agree with the two peaks seen, which were probably about 12 miles apart and different in appearance. On asking Mr. Bell whether it would be possible to investigate the peaks from Bhutan, he stated that that country was quite closed to white men at present.

The weather continued so broken towards the end of June that we had to give up our intentions of attacking the Jongsong peak, and turn our attention to Kangchenjau (22,700 feet) and Chumiumo (22,430 feet). On the way back from Pawhunri we had examined the north face of the former mountain as far as mist would permit, but could see no good way leading to the summit. The mountain had never been clear, however, even in the early morning. In order to investigate the south side we determined to ascend the Sebu La (17,600 feet), and started on June 22.

We had the pleasure of Mr. Bell's company for part of the way. The whole of Kangchenjau was never visible at one time, but enough was seen to show that the mountain was practicable by a long icefall which started east of the main peak and curved round towards the south-west. It was impossible, however, to climb the mountain in the circumstances, because the relationships of the crevasses were complicated, and the possible route was only visible for a few minutes in the morning. It was therefore decided to cross the Sebu La and attempt Tsen Gui Kang, a fine peak 21,000 feet high which we had admired from Mome Samdong in 1909.

On June 23 we crossed the pass, and camped at about 17,000 feet, not far from a small ice-covered lakelet. On the ascent we met with large numbers of plants of the mountain rhubarb. The coolies seemed to appreciate them greatly, and gathered large quantities. I tried them, but found them somewhat insipid, and with none of the sourness of the cultivated plant. As, however, fresh vegetables had been very scarce, I asked Sona to cook some and serve with tapioca at dinner. In this form it was more palatable, but I am inclined to think contributed somewhat to insomnia and a peculiar intermittent throbbing in the cerebellar region, which occurred every few minutes for some hours.

It was about two o'clock when we reached the snow on the pass, and to my surprise the coolies were most unwilling to cross. They declared the snow far too soft, and I had to ascend alone nearly three-fourths of the entire distance to the summit before they started to follow. Having a rather hazy idea of the proper route, I went quite close to a few small crevasses which might easily cause trouble to an unroped party. I found later that these small crevasses are specially mentioned by Mr. Claude White in his book on 'Sikkim and Bhutan.' It snowed or rained nearly the whole of the day and two nights spent near Sebu lake, and as the crests of Tsen Gui Kang and Kangchenjau remained obstinately in the mist we moved back to Thango. Here followed an awkward delay, because a portion of our party had not returned.

As our defaulters did not come in, and the weather continued bad, it was determined to make a serious attack on Chumiumo, the only mountain which might now and again be out of the mists. The coolies were somewhat discouraged on starting, as they declared that the Lachen men said that Chumiumo was impossible. They brightened up on being assured that there was no intention of clambering up the precipices which form the east and south sides of the mountain which they had already seen, and that the west side, when examined from a distance, seemed not at all difficult. Coolies have a very keen sense of the value of their lives, and dislike being taken into places even approximately dangerous.

Crossing the Lungnak La in heavy rain, we proceeded along by the Naku Chu, passing the ruins of an old Tibetan fort (Dzong) on the way. There were some fine herds of yaks in this valley. The evening of the

fourth day found us encamped on the south-west escarpment of Chumiumo under towering precipices. We found that Chumiumo was certainly possible from the south-west, but that the north-west *arête* looked much easier. Mist was almost continuous, and snow fell at intervals. This incessant moisture seemed to affect the rocks, and falls were more frequent than I have ever known them. Some tremendous rock avalanches fell from the precipices of the south face.

As our tents on the rocks were more exposed to the dangers of falling stones than is allowable for moderately orthodox climbers, and as the weather seemed much better a couple of miles to the north, we moved our camp round to the north-west face of the mountain. We camped near a beautiful clear stream of water flowing from a small glacier at 18,500 feet, and next day moved our camp up to 19,500 feet, camping on rocks which obviously contained a large quantity of copper. Although only about 2 miles in a direct line from our old camp at the end of the south-west *arête*, and in a similar position—namely, on rocks near precipices—the weather was quite different. Rockfalls were very rare, and the mist never came down to our level. As indicating the height to which the waves of the sea of animal life may reach, it is worth mentioning that a few delightful little rock warblers had built their nests at nearly 20,000 feet, on the rocks above our camp. They seemed quite fearless of man.

The south end of the mountain remained obstinately in mist, while the north end was fairly clear, and we looked over a large portion of Tibet. Tuny arrived from Thango on the evening before we made our attempt, along with Anderkyow, who had been sent for provisions. He reported that Tandook had returned with supplies.

On July 12 we started at 6.30 a.m. The morning was doubtful. Ascending to near the head of the glacier, we crossed, and went up to the right of some seracs which nearly touch the north-west rock *arête*. At a height of a little over 20,000 feet, near the base of the final ascent, were a few awkward crevasses, but after passing these the mountain was surprisingly easy. Tuny and Sona wished to try the north-west rock *arête*, but I insisted on trying the snow, which, although steep, was in excellent order, and probably took not more than a third of the time that the rocks would have taken. I mention this because the coolies always balked from steep snow, being under the impression that it was dangerous. We arrived on the summit *arête* in mist, and had to wait for some time before the north top loomed up about 200 yards off. Ascending to this top, which is only a couple of yards broad, and appears as a sharp snow peak, we halted until the mist lifted somewhat, and then proceeded along the *arête* to the south summit, which is about 300 feet higher. It was a beautiful walk without the slightest difficulty, although in places the way was narrow and we were quite close to the edge of the formidable eastern precipices. The snow was never more than a foot deep. The south top is bounded on the south and east by precipices, but is several yards broad

and quite safe. We remained for about half an hour on the summit (22,430 feet), and then proceeded back by the way we had come. Mist had interfered greatly with our views from the top, but fortunately we managed to get some photographs, and we took others while proceeding along the *arête*. We were back in camp about four o'clock, after a day which impressed us all by its easiness. On the return journey the snow on the steep slopes was in good condition, but near the crevasses at the bottom was so soft that we sank repeatedly nearly to the waist. We frequently stuck, and had to extricate each other with ice-axes, the snow freezing suddenly just above the knee, so as to render movement of the leg impossible.

Sona and Tuny did not seem to be much affected by the elevation, while I felt that I could have climbed considerably higher. Whether this was due to a rest the day before, or to my becoming acclimatized to high altitudes, is somewhat difficult to decide. Probably both factors contributed, especially the latter. One of the main difficulties at high altitudes depends on the fact that one does not breathe rapidly enough to oxygenate one's blood sufficiently, and it is only after some weeks that one seems to be able to accustom oneself to breathing faster, which makes a great difference to one's comfort in climbing.

Next day we proceeded to Thango, a fairly long day's march. We crossed the north Chumiumo glacier, and, ascending the ridge to the east, descended to the pony track which proceeds north from Lachen to Kamba Dzong. From the summit of the ridge (about 20,000 feet), a superb view was obtained of the mountains stretching away to the west. What we had suspected before became clearly evident, namely, that on the east side of the Arun river there are several lofty peaks, which would almost certainly hide the Mount Everest group from any traveller on the mountains of North Sikkim, unless from view points over 21,000 feet high. The highest of the range, which is called Kanglingen, appears as a massive snow peak, and must be over 23,000 feet high. Near it a route leads from Saar over an easy pass called the Tok Tok La to the Arun river. We are, therefore, nearly sure that Mr. Claude White and others are in error when they state that they had good views of the Mount Everest group from positions on or near the mountains of North Sikkim. It is probable that on very clear days the loftier peaks may show over the Kanglingen group, but they could hardly be very conspicuous. Observers may have confused the two groups.

As we would have had to wait at Thango for at least a fortnight before the weather was good enough to guarantee a satisfactory view from the summit of the Jongsong peak, we decided to go round to the other side of Nepal and make an attempt upon Kamet (25,400 feet). This was not a judicious decision, as our time was too limited. Darjeeling was reached on July 25, and here we bade farewell to the faithful coolies who had accompanied us for about three months. In order to prevent misunderstanding, I must state that all of these men were in the best of health and

spirits. They were thoroughly satisfied with food and pay and the amount of work expected of them, and when asked at Thango whether they would remain for another month if we decided to attempt the Jonsong peak and the Kangchenjau, every one of them volunteered to stay without hesitation. These Sherpa Nepalese coolies are, in fact, most agreeable to work with, and if treated kindly, will do anything reasonable.

Taking Tuny and Sona with us, we left Darjeeling on July 27, and three days afterwards arrived at the railway terminus of Katgodam, where our route joins that taken by Messrs. Mumm, Longstaff, and Bruce in 1905. Any one wishing to get a good idea of Kumaon and Garhwal cannot do better than read Mr. Mumm's book. On the third day from Katgodam we reached Almora, the capital of Kumaon. The deputy commissioner was absent, but the assistant deputy commissioner was most obliging and gave me a note to the Tashildhar, who threw himself into the business of getting coolies with a most praiseworthy energy. Within half an hour two sets of seven coolies each were paraded for inspection. I wished to select a few from each batch, but was informed that no one of the first batch shown would travel with any of the second because of caste prejudice. The men selected were quite different in physique from the Sherpa Nepalese coolies, being tall and slim, and their stamina was found to be inferior. They would only carry about two-thirds of the loads taken by the Sherpas, but they agreed to come through to Badrinath, about ten days' journey by the Kuari La. This was the first time that any arrangement of the kind had been entered into, and it worked well. The coolies required more encouragement than the Nepalese coolies, and being Hindoos, preferred to be paid cash for food. Any white man or Buddhist like Sona and Tuny touching their food would spoil it. I therefore left them entirely to themselves when at meals. The unconscionable time they took to breakfast—about three hours—during the first few days caused me to make inquiries. I found that they had only one small griddle pan between the seven of them, and that each of them used it for cooking ten to twelve chupatties in rotation.

The first three days' march from Almora to Gwaldam was very hot, and we were told the monsoon had failed, but at Gwaldam we entered what seemed to be a region of continual rain. For the next six days we pushed on through torrents of rain and dank and dripping forests to Joshimath. We generally camped on the path and trenced our tents thoroughly. At Joshimath we met with a surprise and disappointment. The patwari, or local magistrate, called with a letter from Mr. Stowell, the Deputy Commissioner, prohibiting further advance, and threatening legal action if we proceeded. After telegraphing twice, and losing a day, we were allowed to advance to Badrinath.

After two days' holiday for the benefit of the Almora men, we proceeded northwards with fifteen coolies, and the second afternoon found us encamped at the end of the Khaiam valley. The coolies here quite misled

me, insisting that this valley afforded the best way to Kamet, whereas we should have taken the Khati (or Gastoli) valley to the south. We found these Mana men most unreliable as regards information, and would never again trust them. The geographical sense of many coolies is somewhat feebly developed. We pushed a camp up to 18,500 feet, and on the following morning were fortunate enough to get a magnificent view of Kamet and attendant peaks. Kamet looked impossible from the west, but it might be practicable to ascend a steep slope of snow to the south of the peak, and bend round on to the north-east face, which looks the most probable direction for a successful ascent. We climbed a small snow peak about 20,200 feet high to the north of the pass, but the mists had covered Kamet before we got to the top, and little further was learned. It was obvious that we had not time to attack Kamet seriously, so that Tuny and the Almora men were despatched homewards, while Sona and I, with three coolies, proceeded north towards the Mana pass leading into Tibet. On the morning of the third day Dhoneran peak, a long easy mountain about 19,000 feet high, was climbed.

From the summit we had a fine view of the north-west face of Kamet. This face looks practicable if one could get on to it. The arrangement of the gorges to the north-west of Kamet is probably incorrectly given on the map, and would repay investigation. If we had only had another fortnight! It was, however, imperative that we started for Bombay. Our Almora men were already three days' march ahead of us. A strenuous effort was therefore necessary, and we moved rapidly southwards by double marches, covering over 40 miles in the first two days.

Before concluding, perhaps a small contribution might be made here to the already voluminous literature on that debateable subject, the so-called mountain sickness. From our experience the alternative term "mountain lassitude," first introduced by Major Bruce and subsequently endorsed by Dr. Longstaff, is a much more satisfactory term. None of our party were in the slightest degree sick at high altitudes, and the climbing powers of the strongest coolies seemed to be only slightly affected even at 23,000 feet. Elevation in the case of a normal individual simply reduces their vitality and strength, and therefore capacity for resistance to the onset of sickness, which, when met with, is chiefly due to other more active factors. Elevation is essentially a predisposing factor rather than an active one, its effect probably depending upon diminished formation of oxyhæmoglobin during respiration.

The other factors, which, when aided by elevation, tend to upset one's capacity for keeping all the organs in the proper co-ordination which we call health, might be summarized as follows: 1. Inadequate training. 2. Indigestion due to unsuitable food. 3. Over-strenuous exertion. 4. Want of acclimatization to high altitudes. 5. Exhaustion. 6. Psychic effects. 7. High temperature. 8. Chill. 9. Snow glare. 10. Advancing age.

1. *Inadequate Training.*—This is serious in the Alps, but much more potent in the Himalaya.

2. *Indigestion due to Unsuitable Food.*—The best possible diets for high altitudes have yet to be devised. There is probably no doubt that the appetite is lessened. After long and careful experiment, we found that the best mainstay of both morning and evening meal was a large bowl of soup, thickened with rice and with added butter. The three ingredients were served separately. One could then add tongue, boneless sardines, etc., as wanted; but it was found that the entire elimination of meat by substitution of four or five freshly made chupatties (unleavened pancakes) with jam and butter was occasionally a good plan. Of course, different men require different diets, so that one must not be dogmatic.

We carried several tins of plasmon with us for use on an ascent of the Jonsong peak or Kamet, if opportunity offered, but unfortunately had no opportunity of testing them.

Perhaps peptonized foods and prepared substances containing glycerophosphates like sanatogen might be useful for protracted camps at heights over 23,000 feet. Hot tea in thermos flasks we found excellent at high altitudes, but the two flasks taken were broken within a month. Failing tea Prof Collie informs me that citrate of caffeine is an excellent substitute.

3. *Overstrain.*—Over-strenuous exertion is a frequent cause of real sickness, because the co-ordination of the different organs is rendered far more difficult to maintain. It is, therefore, probably better to go slowly, so that in this respect I would venture to disagree with Dr. Longstaff and to follow Mr. Mumm, who says, "Camp high and start late." I would prefer to read this, "Camp high and start as early as you safely can."

4. *Want of Acclimatization to High Altitudes.*—In attacking very lofty peaks it would probably be found advisable above 20,000 feet high to push camps up only from 1000 to 3000 feet per day, depending upon difficulties met with.*

5. *Exhaustion.*—When one is near the limit of one's powers, especially when fasting, the waste products thrown into the blood are beyond the possibility of natural elimination, and toxic effects are produced.

6. *Psychic Effects.*—These might be important, especially in the case of a beginner finding a place more dangerous than anticipated. Probably local blood congestion supervenes—perhaps splanchnic dilatation or constriction—which has a deleterious effect.

7. *High Temperature*, 8. *Chill*, and 9. *Snow Glare* vary greatly in their effects. They are indefinite factors which tend to upset the co-ordinating balance.

* The idea that the bad effects of high altitude are cumulative is, we think, completely negated by the ease with which, at the end of the expedition, we climbed Dhonerau peak (19,000 feet), marched about 20 miles, and then made 22 miles next day. In 1909 we also made about 40 miles in the first two days' marches when retreating from the mountains, after prolonged residence above 15,000 feet.

10. *Advancing age* is, like elevation itself, a general depressant of one's powers, but when I consider that one of the Vice-Presidents of the Society, when getting towards threescore, led a large party over a pass more than 20,000 feet high into an unknown country, the effect of age is obviously a variable one, and must be greatly discounted in certain cases.

It must not be supposed that the natives are never afflicted with what looks like mountain sickness. I have met with several cases, but usually, at comparatively low levels, and in nearly every case the diet was to blame.

Perhaps three facts might be emphasized in conclusion.

1. The ordinary mountaineering rules regarding use of ropes, etc., should be carefully followed in the Himalaya, even in the case of snow passes used by natives, unless the position of crevasses is known. This is especially important before the summer snows begin, as numberless crevasses are then thinly covered. Exceptions are made in the case of moraine-covered ice streams like the Zemu and Kangehenjunga glaciers.

2. Men with cloth boots should not be taken on dangerous ice slopes, and especially ice traverses. This follows from what has been related above, and is confirmed by the experience of Prof. Collie in Kashmir.

3. Many of the Sherpa Nepalese are first-rate climbers as well as coolies, and could be used for serious climbing of the big peaks like Kangehenjunga, after proper training. Serious climbing in the Himalaya can hardly be said to have begun, but I might venture to express agreement with Mr. Freshfield's dictum, that all the great peaks can and will be climbed.

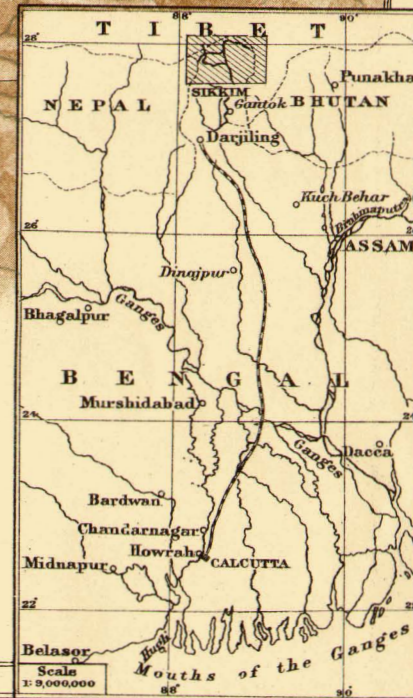
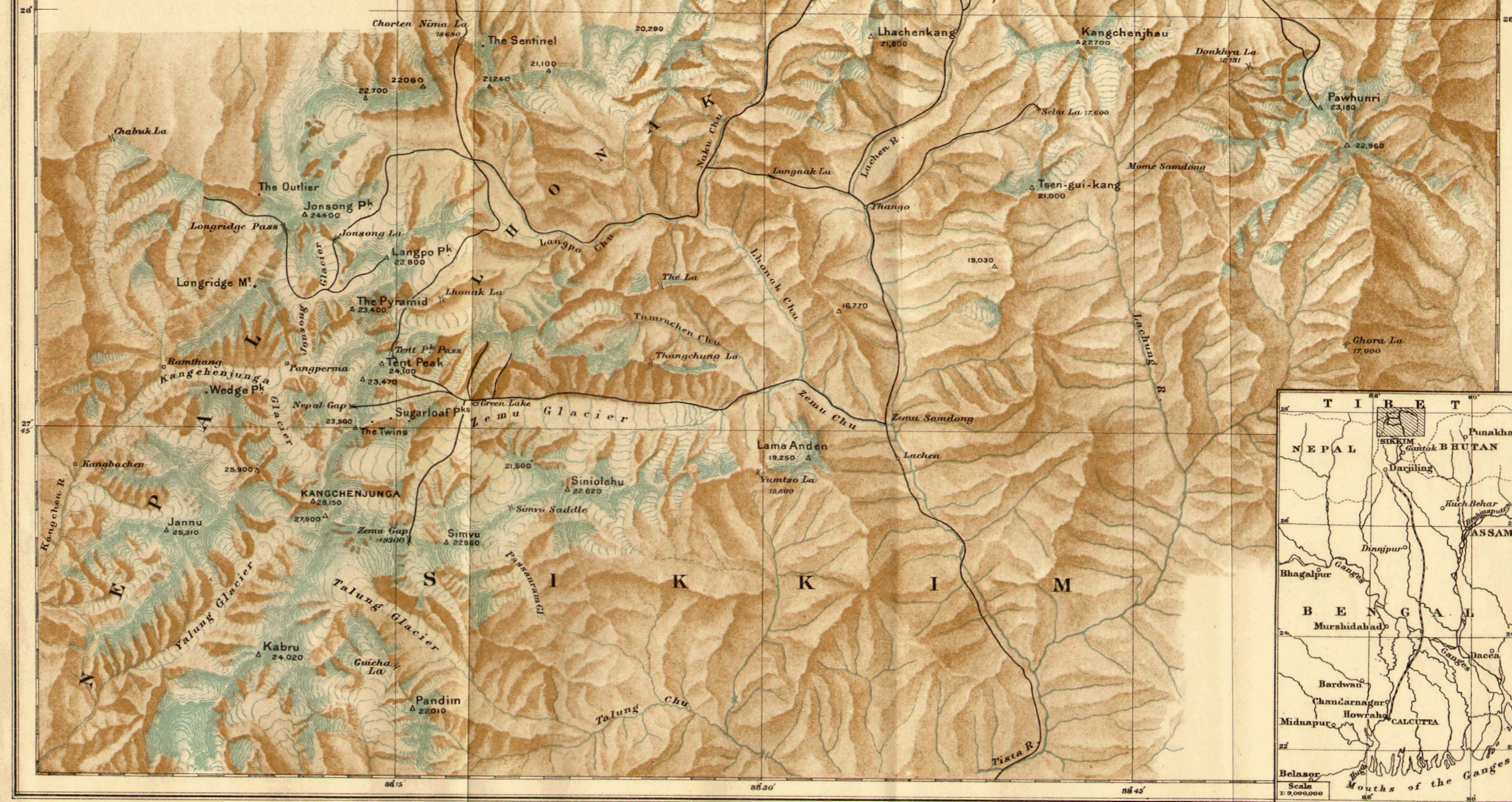
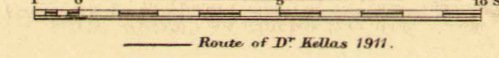
I must take this opportunity of thanking Mr. Claude White for kind help given in 1907 during my first visit to Sikkim, and also Mr. Bell, the present Resident at Gangtok.

Mr. DOUGLAS FRESHFIELD, Vice-President (before the paper): I must express the regret which I feel myself, and which you will all share, that our President is not able to be here to-night. We feel this regret the more on account of the nature of the paper before us—one on Himalayan exploration. Lord Curzon has always taken the deepest interest in Himalayan exploration, and when in office in India, he did all he could to further it, as far as the limited powers of a Viceroy extend. I qualify the phrase because the energies of a Viceroy are liable to be hampered by political considerations, and by the scruples of native states. The paper we are going to hear to-night is on that part of the Himalaya which is comprised in the native state of Sikkim, lying some 400 miles almost directly north of Calcutta. It was first brought before the notice of the English public by Sir Joseph Hooker, in his charming work, 'Himalayan Journals,' published some sixty years ago. Twenty-five years ago a young Oxonian, Mr. Graham, described some remarkable climbs in this region. His story was largely discredited, partly through his own fault, for he was a very careless writer, but mainly because at that time many people could not conceive it possible that even trained mountaineers could climb at the pace he described—that is, at about 650 vertical feet an hour above 22,000 feet. It has interested me, in looking over Dr. Kellas's paper, to find that the height he was able to climb at that elevation was 600 vertical feet in the hour, while his native porters

NORTHERN SIKKIM

To illustrate the paper by
D^r A. M. KELLAS

Scale 1: 300,000 or 1 Inch = 4.7 Stat. Miles.



NOTE.

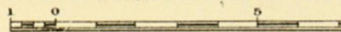
This map has been constructed from the "Sketch Map of the Glaciers of Kangchenjunga," by Prof. J. Garwood; scale 1:125,000; published in the "Geographical Journal," July, 1902. Map of Sikkim, prepared for the Bengal Government, from an original based on Sheet No. 7 N.W., N.E. Trans-Frontier, 3rd edition; scale 1:253,444; published under the direction of the Surveyor-General of India, May, 1906; and from a MS. drawing, giving corrections to Prof. Garwood's map, prepared chiefly from photographs taken by Dr. A. M. Kellas. The heights are from the Survey of India map of Sikkim.

NORTHERN SIKKIM

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DR. A. M. KELLAS

Scale 1: 300,000 or 1 Inch = 4.7 Miles



Route of Dr. Kellas

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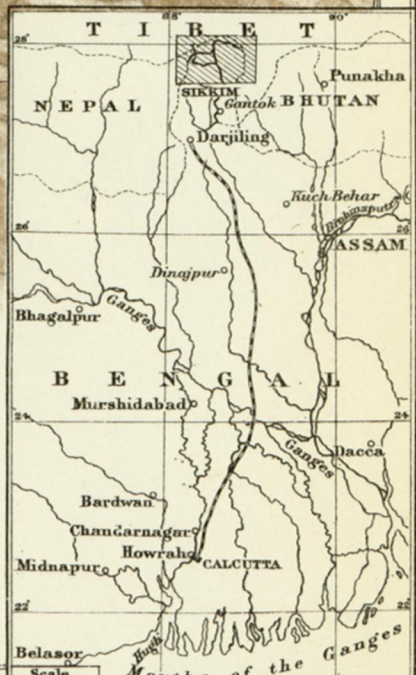
Route of Dr. Kellas 1911.





TIBET

K I M



TIBET

NEPAL SIKKIM BHUTAN

BENGAL

Mouths of the Ganges

88° 45'

28°

88° 45'

22°

22°

0°

Lava 8166

Chumiuma 22,430

Lhachenkang 21,600

Kangchenjau 22,700

Lhamo Tao

Donkhya La 16,131

Pawhunri 23,150

Sebu La 17,600

22,960

Tsen-gui-kang 21,000

Mome Samdong

19,030

16,770

Ghora La 17,000

ma Anden 9,250

Lachen

misso La 5,800

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Scale

NORTHERN SIKKIM

To illustrate the paper
D^R A. M. KELLAS

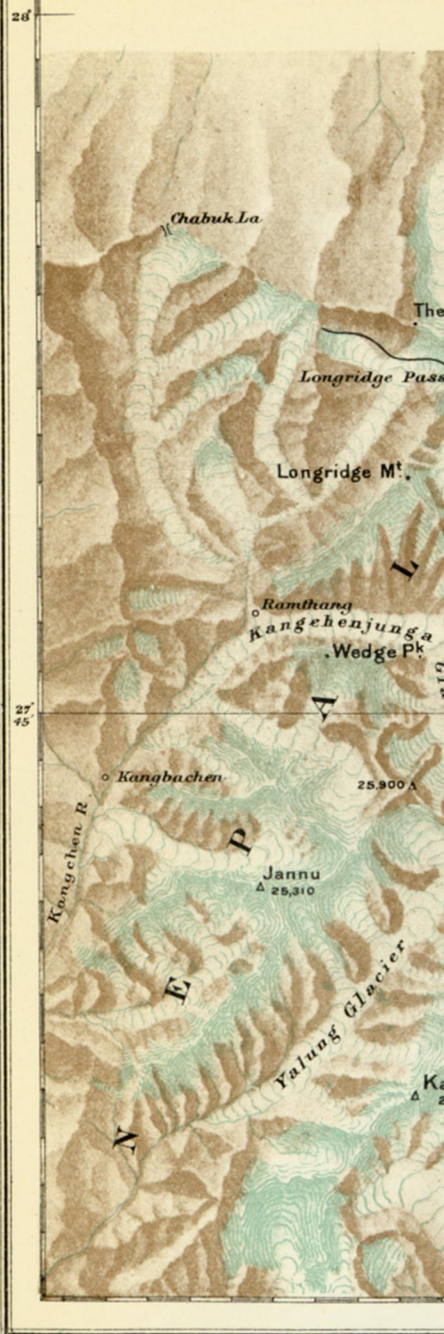
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Route of D^R Kellas

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NORTHERN SIKKIM

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DR A. M. KELLAS

Scale 300,000 or 1 Inch = 4.7 Stat. Miles.

0 5 10 Stat. Mls.

Route of Dr Kellas 1911.





could do more. Then, some five years ago, two Norwegians, Mr. Rubenson and Mr. Mourad Aas, friends of Dr. Nansen, who had never done any mountaineering out of Norway, gained the summit ridge of Kabru, 24,000 feet, the mountain Mr. Graham had ascended, without meeting with any very formidable difficulties. Lastly, twelve years ago, I described here a tour of Kangchenjunga, which was made by my friends Signor V. Sella, Prof. Garwood, and myself in 1899. So far, I have spoken only of papers read before our Society. But there have been other explorers in these mountains. Mr. Claude White, who was for many years Resident at the Native Court of Sikkim, has wandered up and down along the Tibetan frontier. Anglo-Indian surveyors have triangulated the peaks. Native pandits have traversed the passes, and written very entertaining, if not always very intelligible, accounts of them. To-night we are going to listen to a paper by Dr. Kellas, a gentleman who has paid three visits to Sikkim, and made three mountaineering campaigns among its glaciers. He has managed to combine these with his duties as a Professor of Chemistry in this city. He will give us only a very brief summary of some of the results of the last of his visits. There is a great deal too much to be told in a single lecture. But I hope he will bring before us some interesting details with regard to the topography of these ranges, and also with regard to the relations of the great storehouses of snow which feed their glaciers. He may also be able to give us information with regard to the means that should be taken to counteract the effects of altitude on the human frame, and thereby to facilitate the conquest of the highest mountains of the world. If we listen carefully to what he tells us, we shall gather incidentally that he has been to the top of two mountains of over 22,000 feet and one of 23,180 feet. I say, if we listen carefully, because Dr. Kellas's modesty leads him to treat these matters quite parenthetically, and not to dwell upon them in the way in which you would expect an average traveller to do. I am afraid, also, you will hardly gather from his narrative a full idea of the difficulties and dangers of his Himalayan explorations. If he seems to move smoothly from height to height, you must recollect that he probably leaves out sundry dangers, and that by his skill and patience and experience he found the way to avoid others. The Eastern Himalaya are a range which requires considerable skill and mountain experience for its proper exploration, and I cannot recommend it as a field to the Alpine gymnast, who has little acquaintance with the varying conditions in different climates of the upper snows. With these few remarks, I will ask Dr. Kellas to read his paper.

Mr. FRESHFIELD (after the paper): We have all enjoyed Dr. Kellas's very interesting account of a wonderful series of Himalayan experiences. I had hoped that my friend and former companion, Prof. Garwood, would have been here and been able to explain the circumstances under which his map was made. It was only described as a sketch-map, and he did not pretend to give any accurate account of all the recesses of the mountains. This was carefully explained in an accompanying note. He suffered under some exceptional difficulties—first, we had as guide a Pandit who, being very nervous himself of going into Nepal or Tibet, when he thought there was any chance of our getting into either, systematically led us astray; next, there was a premature and very heavy snowfall, which obliterated all the distinctions between glaciers and ordinary slopes. Despite, however, these difficulties, Prof. Garwood has, I believe, succeeded in providing a great advance on any previous map, and a very substantial basis which others may work to perfection. Dr. Kellas's paper, besides its interest as a description of one of the most fascinating portions of the Earth's surface, has a secondary importance. It may, I trust, prove a stepping-stone to higher things. It may be useful, as he has told us, in helping other climbers to deal with the loftier mountains which still remain unclimbed. The

poles have both been discovered, and we must confess that—at least, from the picturesque point of view—they are a disappointment. The North Pole is a speck on the shifting surface of a frozen sea; the South Pole a flat and featureless expanse of snow. Neither provides any natural sign to show the explorer he has arrived; he has to take up his instruments to prove that he is not far from the exact spot; he is unable to leave any permanent record of his visit. Now, it seems to me that the next problem to be attacked, the ascent of the highest mountains of the world, will be a more satisfactory one for those who attack it, because the adventurers who first shake hands on the top of one of the highest Himalayan peaks will have no doubt of their victory. The ascent of the highest mountains of the world is a task that will take money and time and perseverance and technical skill, but it will require less of these than has been required in the conquest of the poles, and it seems to me the reward will be as great, because, though these exploits may seem to belong not so much to science as to the adventure of travel, yet in the end science profits in one way or another. We have practically, in my lifetime, elevated the man-level from 18,000 or 19,000 feet up to nearly 25,000. How it is to be carried up higher Dr. Kellas has suggested to-night. The problem is one which may require time for its solution. But there is a general consent among climbers that it will be solved. Close attention to diet, frequent and light meals, prove the best means to prevent mountain lassitude from developing to an extent that incapacitates from climbing. An Arctic equipment, as light as it can be made, must be provided, both as to tents and clothing. A form of boots that will protect from frostbite, and yet not be dangerous in icesteps, must be evolved. The right season of year for each district must be ascertained; the local orography closely studied. Native coolies must be trained, as they were by Dr. Kellas, to glacier work. Bivouacs must be pushed higher and higher from the base until a light party can hope to climb from the last to the supreme summit. On all these matters Dr. de Filippi's sumptuous record of the Duke of the Abruzzi's recent expedition to the Karakoram supplies the most valuable information, and his conclusions agree, I think, in every respect with those independently formed by English mountaineers.

I am not going to follow Dr. Kellas by furnishing any further hints as to the best way to attack Kangchenjunga; for I am unwilling to do anything that may incite that enterprising body, the Press, to offer a large reward to some one to rush in and race a properly organized expedition. I make this remark not without foundation, for seven years ago a London newspaper sent out a person it described as its "special commissioner" to climb Kangchenjunga. The delegate took with him three Swiss, not Alpine guides, but, I understand, Swiss gentlemen. The party reached the base of the mountain; there one of the Swiss and four coolies perished in the snow! I trust whenever Kangchenjunga is attacked it will be by a properly constituted party; otherwise fresh disasters must be looked for.

Mr. CLAUDE WHITE: I have had very great pleasure in listening to Dr. Kellas's paper to-night, and, although I am no climber myself, I have been to the bottoms of most of the valleys from which Dr. Kellas made his ascents. There is one point that may be of interest, and that is, I found all my coolies and escorts got what I termed "mountain sickness" at a height of about 15,000 feet; I cannot tell you from what cause, but if I got them past that height, I could generally get them up to 19,000 or 20,000 feet. Dr. Kellas is scientific; he may be able to give you some explanation of this.

Mr. A. L. MUMM: I have listened with intense admiration to Dr. Kellas's story, and I have looked with amazement at his photographs, but I think the most amazing thing I have seen this evening is really this map with his route marked upon it.

That brings graphically before one the extraordinary amount of ground he covered in a single season at immense elevations, above ice and snow all the time, crossing passes 19,000 and 20,000 feet high, and ascending peaks of 22,000 and 23,000 feet, in a way which, I believe, has never been paralleled. The first and most obvious reason for his success was his extraordinary energy. He seemed to me to be above all human weaknesses, and I was quite relieved when towards the end of his paper he had to admit being subject to a small extent to mountain-sickness, in the reality of which I have a most profound belief. Next to his own personal energy, I think that the leading cause of his successful achievement was the great skill which he displayed in training and managing his coolies. The same skill in that respect was displayed by Mr. Rubenson, to whom Mr. Freshfield referred, a few years ago, but Dr. Kellas went one better than Mr. Rubenson, who had the support of a skilful European mountaineering companion, whereas Dr. Kellas had to rely solely on himself and the pupils of his own training.

I have no knowledge of Sikkim, and have nothing to add to what Dr. Kellas said about that region; as to Kamet, all I have seen of it was the eastern side, which was the exact opposite to the side he visited. I think two other parties besides Dr. Kellas have approached it since we were there, but none of them has made a really serious attack on it. The fact is, it is from all sides ungetatable. There is one further point with regard to the extraordinary amount of work done by Dr. Kellas. Most travellers who go to new, unexplored parts of the Earth's surface, go once and do not return, and I think all of them come back feeling how much better they could do things next time. They bring away a great deal of experience, which is unfortunately personal and largely incommunicable, and however much the next man may sit at their feet and hear all they have to say, it is impossible for him to start where the first man left off. Dr. Kellas has not said much this evening about his two earlier expeditions, and I gather that his achievements in the course of them were relatively slight compared with those of last year, but I venture to think he would not have achieved anything like the measure of success which he did in 1911 if it had not been for those two earlier trips. Everybody has to acquire his own experience for himself, and if any one light-heartedly imagines that he can follow Dr. Kellas and go out without any Himalayan training and accomplish anything like the same amount that he did, he will be very grievously disappointed.

Mr. FRESHFIELD: I think I may now terminate the proceedings by echoing, as I am sure all here will wish to echo, the sentiments that have been well expressed by Mr. Claude White and my friend Mr. Mumm with regard to Dr. Kellas's remarkable mountaineering tour—one of the most remarkable and probably one of the most fruitful that has ever been accomplished by a mountaineer in the Himalaya. We all congratulate him on the success which met him in his persistent explorations. We thank him for the excellent photographs he has shown us to-night, and we wish him many happy returns to the Himalaya. I am sure you will desire to carry by acclamation a vote of thanks to Dr. Kellas.
