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THE SHAKSGAM VALLEY AND AGHIL RANGE

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Read at the Meeting of the Society, 24 January 1927. Map follows page 384.

I SHALL commence to-night by two quotations from a native report, written some fifty years ago. The first is :

> " A road from Askardu across the Mastagh Mountain joins at Ak Masjid the road from Kokyar, thus : Shagar, Kashmal, Baha, Baldaldu, Ististi, Dawan Mastagh, Jangal, Dawasu, Shakhs Kambo, the Khaltan Darya flowing on to Khargalik, Ak Kuram, Ak Masjid, Kokyar." *

The second runs :

> " Another stream called the Yarma or Nobra flows from above the Changlung, which was anciently traversed by a route to Khapulung. This route was closed by the people of Nobra, who, by throwing in of charcoal, helped the formation of iceblocks, which obstructed the passage altogether."

Neither of these descriptions is quite correct, but both contain some elements of truth. The first has the earliest mention of the place " Shakhs Kambo," or Shaksgam, that I have been able to find, and gives very vaguely the alignment of the route taken by Sir Francis Younghusband in 1887 ; the second introduces more vaguely still an ancient route, about which I shall have more to say presently.

A few days after I was born, in mid-September 1887, Lieutenant Younghusband, as he then was, stood on the Aghil pass, after having crossed the greater part of Asia. He looked southwards, across a broad valley, at one of the most wonderful panoramas of ice that it is conceivable to imagine. He descended into this unexplored valley—the Shaksgam—and crossed the great Karakoram mountain wall of ice by the difficult Muztagh pass, to India.

Almost exactly two years afterwards Captain Younghusband again stood on the Aghil pass. On this occasion he explored the Shaksgam

* Probably: Shigar, Askole, Biaho, Baltoro, Ordokas, Muztagh pass, Suget Jangal, —— (?), Shaksgam, the Yarkand river, Ak-kuram, Ak Masjid, Kokyar.

more thoroughly. Before going down it to search for the Shingshal pass he ascended it from the foot of the Aghil pass, passed the snout of the Gasherbrum glacier, discovered the Urdok glacier and explored this to its head, below a col over which his guide informed him there had once been a route to India.

The details were published in his report and in his book ' The Heart of a Continent.' With his permission, I will now quote from his journal for 13 September 1889. He records that the Shaksgam valley continues beyond the Urdok glacier " level and open with a direction 150°, while about 15 miles beyond, another valley branches off to the east with a direction of 120°, and the latter must probably run very nearly up to the Karakoram pass."

Sir Francis was in an intensely glaciated region, and possibly because it is very difficult to judge distances in that country this description that I have quoted was never published in his account, and as a result mapmakers have rather naturally assumed that when he turned up the Urdok glacier he was in the neighbourhood of the Shaksgam source. This assumption was the beginning of much subsequent trouble.

It must be remembered that the map in those days showed tributaries to the left bank of the Yarkand river flowing all the way from the Karakoram range, and that the watershed of the latter was not shown correctly till Dr. Longstaff's exploration of the Siachen glacier in 1909. The faulty alignment of the range led mapmakers to stretch the Shaksgam valley too far south, and also led Sir Francis to doubt the correctness of his identification of a great peak which he saw from Durbin Jangal, a spot 12,300 feet above sea-level in the Shaksgam valley. This misidentification was suggested to him by the Duke of the Abruzzi, and his longitudes, which were dependent on it, were still in doubt up to this year. I may say at once that a comparison of the sketch made by Sir Francis from Durbin Jangal with my photographs from the Tatar La, leaves no doubt that the great peak he saw was the " Staircase Peak " of the Duke of the Abruzzi.

Since 1889 no European, and most probably no human being, had been in that part of the Shaksgam which Sir Francis discovered and explored. Nor did any of my party actually set foot upon his route. In my description of our expedition, I shall show how we came from the east; how we explored down the valley, which must be the one up which Sir Francis looked; how we were held up and forced over the mountains to the north; and how we were prevented from regaining the Shaksgam lower down. The head basin of the Shaksgam, its sources and upper tributaries, and its first big feeder glacier have now been discovered, explored, and surveyed; photographs beyond have been taken down the valley, and a planetable map, which will be improved by those photographs, has been made; a large portion of the Aghil range has been reconnoitred and surveyed; and a very large

tributary to the Shaksgam river, whose existence was unsuspected, has been discovered. But there is still a gap of about 6 miles between two surveyed ridges, within which the middle Shaksgam must lie, and Sir Francis remains the only white man who has been here, though the position of his river is now very closely determined in longitude as well as in latitude.

Sir Filippo De Filippi in 1914 intended to explore the Shaksgam, but he was prevented from doing so by the amount of water in the Yarkand river. Colonel Wood, however, who was attached by the Survey of India to the expedition, from near the head of the Yarkand river, discovered an easy pass—Pass " G "—leading to a broad open valley unencumbered by glaciers—Valley " H "—which he thought afterwards must be the source of the Shaksgam, though at the time he did not know of the paragraph I have quoted from the journal above. Sir Filippo De Filippi suggested that Valley " H " might break northwards and join the Yarkand river.

After the war De Filippi and Wood planned more than one expedition to clear up the situation, but for one reason or another—mostly political and financial—the projects fell through. I was made spiritual heir to the Shaksgam in 1923, and after two years of negotiation my plans were finally sanctioned by the Government of India in November 1925. During those two years I received an immense amount of help and encouragement, particularly from the present Surveyor-General of India, Colonel Commandant E. A. Tandy, from Mr. R. Ewbank of the Government of India, from Colonel Wood, from General Sir Alexander Cobbe and Mr. Monteath of the India Office, and from the Council of the Royal Geographical Society. Without the moral support and very material assistance which you gave me the expedition would not have come off. As soon as sanction was given, I again received the greatest assistance from every one, including the various departments of the Government of India, and most especially from Mr. Hinks, who pushed out to us from England all our private supplies and much of our equipment.

The expedition was directed by my own department, the Survey of India, at Dehra Dun. The other members of my party were Major Minchinton, M.C., of the 1st Gurkhas; Major Clifford, D.S.O., M.C., Indian Medical Service; Captain Cave, M.C., the Rifle Brigade; Khan Sahib Afraz Gul Khan, Survey of India; one Pathan orderly from the Survey; and three Gurkha sepoys. We took three cooks for this party, but no other servants.

The main object of the expedition was to survey the unexplored mountains and valleys west of pass " G," especially the following:

(1) Valley " H."

(2) The sources and course of the Shaksgam.

(3) The northern glaciers of the Karakoram range.

(4) The Aghil range and mountains north of the Shaksgam.

We were also to explore for traces of any human occupation or passage, ancient or modern, in this area. Subsidiary points requiring investigation cropped up during the preliminary arrangements, and were undertaken. Some of these do not closely concern geography, but I must mention that Clifford and I took up field geology, Cave the collection of birds and meteorological study, while Minchinton and Clifford decided to collect butterflies and plants respectively. The various results are now being worked out by experts.

On the Pamirs in 1913, I had used the pioneer apparatus for stereographic survey devised by the late Captain Vivian Thompson, R.E. about 1904, and I was anxious to try in 1926 the latest developments by this method, which in the meanwhile had been much improved. After exhaustive inquiries, the Council of the Royal Geographical Society resolved to purchase for my use the photo-theodolite made by Mr. Henry Wild of Heerbrugg, Switzerland. The material which I have brought back will be worked up during the coming year, but you will be able to judge the fine definition of his camera from many of the slides which I shall put on the screen to-night. I had with me also a Zeiss theodolite, whose design is also, I believe, due to Mr. Wild, and the usual planetable equipment for the Khan Sahib.

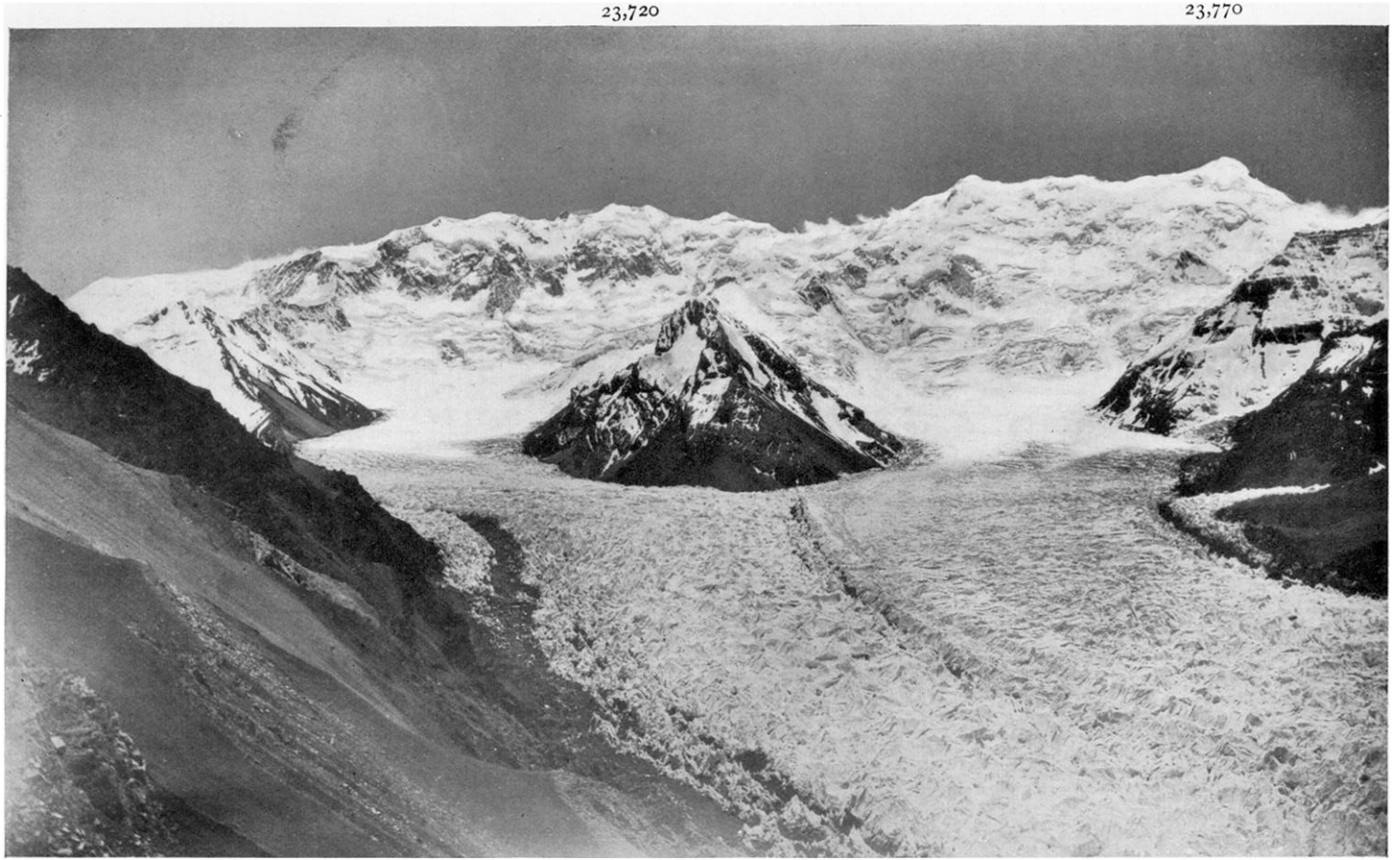
Following the advice of Colonel Wood, we decided to attempt the exploration during the months of July, August, and September. We expected difficulties with summer floods, but hoped these would not be insuperable; the great advantage of summer was the possible use of animal transport, for at that time of year, from the experience of the De Filippi expedition in the Yarkand river-basin, we could hope for a fair amount of grass, while in winter there would be none, the *burtsa* fuel would be covered with snow, and the depth of soft snow on the passes would render pack transport out of the question. As it turned out, owing to the difficulties of the country and the unexpected lack of grass, our permanent animals were practically useless, and a larger complement of porters would have been far more valuable.

The winter of 1925–26 was unusually mild in Northern India, but just as we were beginning to give thanks, the spring produced a still more unusual series of late storms, which deposited a large quantity of snow on the Himalaya, blocking the passes. Weather reports wired to us from Simla, however, indicated a fine break, and during this we crossed the Zoji La by candlelight on the night of May 15. Two days later some natives, trying to cross the pass in the early morning, were swept away by an avalanche and killed.

We reached Leh without difficulty on May 27. Our purchase of supplies and ponies was already well advanced, thanks to Major Hinde, the British Joint Commissioner, and to Khan Bahadur Ghulam Mahomed, his representative at Leh. But owing to the late season, and a minor

1. *Looking down the Upper Shaksgam from above the Depôt. Lungpa Marpo opening on right From Station W3*

[*All photographs by Major Mason with the Wild Photo-theodolite*



2. *Apsarasas Group, Karakoram Range, and Head of the Kyagar Glacier from the north*
From Station W7

official's obstruction, we had some trouble with the Khardong pass. Our first attempt to cross it on the morning of June 7 was a failure, for the yaks—there were about sixty of them—stuck in the soft snow, shed their loads, and the owners then drove them off to their own valleys, saying the pass would not be passable for twenty days. However, after much persuasion, we collected thirty fresh animals and made a second attempt to reach the pass, on the morning of the 10th. We reached the summit with nine unladen yaks while the snow was still hard, and after improving the pass with coolies, drove the yaks down again on the Leh side in the soft snow. Yet even now it was not easy to persuade the naib-tahsildar of Leh to give us the necessary transport, though the men themselves were willing to come. At last, at 2 a.m. on June 13, we started once more for the pass with our whole caravan—21 unladen ponies, 24 permanent Ladakhi porters, 100 yaks, and about 100 coolies to assist. By midday we had about half the kit on the summit, together with all the coolies and half the animals. The rest of the baggage was strewn over the snow, and many of the animals, including ten of our ponies, had been sent back. All members of the party, including the cooks, worked throughout the morning with great energy; at one place we had five animals almost buried in 6 feet of soft drift snow, and we only defeated this difficulty by laying canvas tent bags down on the snow, putting poles under the animals' bellies, and heaving them up with a dozen men. We were not fully concentrated at the first village on the north side until May 15, nine days after our first departure from Leh.

At Panamik, in the Nubra valley, we had to halt for two days, in order to draw the greater part of the fodder and to make final arrangements for our caravan. Panamik is the last village in Ladakh, and we could expect no more supplies until we returned here in October; we also engaged four men for our postal arrangements. Two of these were accustomed to ford the Nubra and two were from the Shyok valley; by working in pairs to a pre-arranged programme they kept us in touch with human habitations.

The Wazir of Ladakh had sent my proposals ahead, and the caravan was more or less ready. I considered however that his suggested terms were not quite fair to the pony-men, and therefore gave them the same rates they would get for normal caravan traffic, plus a little extra on condition they obeyed all my orders implicitly. At this early time of the year they obviously feared the Saser pass, and this fear, much more than the pass itself, was nearly the cause of their undoing. We arrived at Skyangpo-chhe,* on the near side of the Saser pass, on June 22, with about 180 laden ponies, 10 unladen yaks, and 24 porters. The next morning Minchinton and I went forward with porters, pony-men, and unladen yaks to clear a track on to the glaciers, which descend from the hills on both sides of the pass. While so engaged the men suddenly

* See Note on Names at the end of the paper.

gave a shout, and we saw descending one of the glaciers, a man leading a pony, followed by two more men. A trader and his followers, overcome by snow-blindness and exhaustion, had abandoned their merchandise and ponies and were descending the pass. Minchinton cut a track up to the stranded animals, while I revived the trader, and by evening we were able to send the caravan down to Skyangpo-chhe. The man, Torabaz Khan, took the trouble to look me up after our return from the expedition, and we found that he received all his merchandise which we sent back to him, and all his ponies survived. He told us that our dates had been forwarded from Leh to Yarkand, and that he had expected to find the pass opened by us.

The next day, June 24, we crossed the Saser pass and reached Saser Brangsa. Although we had already made a track for most of the way, we had to man-handle all the animals over two bad stretches, and before we reached the final glacier the whole caravan went on strike. A lucky snowstorm came to our assistance, and as we disappeared over the pass with our own men and animals, we saw the hired caravan reload and follow us.

After this incident we had no further trouble. We left behind us a granite land and entered one of limestone. The Depsang was unpleasant, but, from the accounts of others, not so unpleasant as it can be. We passed a night at the spot where De Filippi had his depôt, and leaving the Karakoram pass on our right hand, reached the Amphitheatre near the head of the Yarkand river, discovered by Wood in 1914, on June 29. Here we had a day's rest, for the animals were very exhausted, having had practically no grass for five days. I am not going to describe the litter of bones that point the way to Central Asia; considering the time of year, we were perhaps lucky in not increasing this litter more than we did. We were now off the caravan route, and Wood's party was our only predecessor.

On July 2 we crossed Pass "G," and entered the unknown. Wood says of the valley beyond in his report:

> "The valley was fairly open but of no great width, and was bounded on both sides by high hills, only snow-covered on their summits, and no glacier of any sort could be seen to enter it."

The following morning we continued down this valley "H." It is bounded on the north by rounded disintegrating hills, off which the snow had only recently cleared. The glacier astride the pass was only yielding a small amount of water in the early morning, but this increased during the day, and the water in the stream was augmented by the melting of small hanging glaciers of the "clotted cream" variety, perched between lofty mountains. Not more than 6 miles from the pass the stream entered a gorge—our first surprise of many. This presented no difficulty, but later in the year a way would have to be found over the

top of it. It was of limestone, split in every direction by frost. Some 14 miles from the pass we halted the caravan, and formed a depôt half a mile from the junction of our valley with a large valley flowing from east to west. Before going any further, I must mention that though I have spent much of my life among high mountains, and have done six seasons' survey work in the Himalaya and beyond, I have never seen a country the topography of which is so difficult to appreciate from a distance; until we actually reached the junction mentioned above, we could not say for certain which way the new valley led.

On July 4, two days after the date I had laid down a year before in Simla, we paid off the hired caravan and gave them their rewards. There had been no casualties or sickness among the men, but of our own twenty-one ponies three had died, and there were in addition sixteen deaths among the hired ponies and yaks.

The next morning, leaving the Khan Sahib to climb a ridge near the depôt to get a theodolite resection, and giving our animals a rest, we explored down the valley. Stream " H " enters the main valley through a narrow cleft of rock, about 10 yards long and 10 feet wide. The junction beyond is a broad stony amphitheatre, varying from 300 to 600 yards wide. The combined streams take a direction a little north of west, and flow in a large number of channels. A mile and a half below the junction, a level line becomes noticeable on the slopes on each side of the valley. Starting at the level of the flood plain, it gradually mounts the hillside, as the valley floor sinks. After another small gorge, the valley again widens out, more parallel lines become visible on the slopes, and at a distance of 4 miles from the junction a large valley enters from the south, and forms an amphitheatre more than half a mile wide. This tributary valley leads from a glacier, which was afterwards surveyed and found to descend from a saddle at the head of the Rimo glacier. The combined valleys change direction to a little more north of west, and a most wonderful sight meets the eye.

The hills on either side slope up at an angle of 30°, framing the broad flood plain. Beyond, and at a distance of some 2 miles or more, can be seen the blue waters of a considerable lake, and at the far end of this stretched a glacier, a mass of huge seracs and contorted ice, athwart the whole breadth of the valley. Beyond this again the higher slopes of the valley could be seen continuing, and far away—most wonderful of all—the giant summit of Gasherbrum, wreathed in cloud, stood sentinel.

We hurried on to the edge of the lake, passing first great blocks of ice, and then mud flats. We had with us two canvas collapsible boats, and after launching these we made our way round to the glacier snout, a distance of about 2½ miles, in the hope of finding a way past the obstacle below the northern cliffs. We found only a chaotic mass of floating icefloes, and the snout of the glacier, white ice and black ice, tossed against

the red marble cliffs to a height of 300 feet. Minchinton climbed on to the snout, but found the surface too much torn asunder to proceed beyond the edge.

We recognized at once that this glacier was going to be a very serious obstacle, and one which would take some days to circumvent; so, after returning to the depôt, it was decided that the Khan Sahib and I should commence the survey, while Minchinton and Cave should reconnoitre for some way across the glacier. Meanwhile Clifford was to reconnoitre up the valley.

Our Ladakhi porters had named the lake the "Kyagar Thso," * and the glacier naturally became the Kyagar glacier. Minchinton and Cave went off to explore it on July 6, and returned on the 9th. They had, after a preliminary reconnaissance from their camp, crossed a shale col over the mountains bordering the Kyagar glacier on the east side, and got on to the glacier some 4 miles from its snout, at about 9 a.m. Several times they attempted to cross it, but were always forced back by high seracs, deep crevasses, or glacier lakes. Some of the ice pinnacles were 200 feet high, and the whole surface was so cut up that they were eventually forced back on to the lateral moraine on the east. Following this up, they found that it led to a promontory descending from the main range.

Minchinton's opinion was—and Minchinton is a fine climber, who has had experience of mountaineering since he was fifteen years of age—that a difficult way could be found across the glacier, after a good deal of "trial and error," for lightly laden porters; that at least one camp, and probably two, would have to be placed on the glacier; that no amount of labour would make a route practicable for animals; and that, if possible, it would be better to attempt a turning movement to the north. He was more impressed with this notion after receiving a note from me, giving my views after his first reconnaissance, and from the fact that a second glacier, which he believed would also block the valley, could be seen stretched across the valley lower down.

Having started the triangulation, based on resection from uncairned points of Wood and Alessio, and leaving the Khan Sahib to carry on the detail survey, I took a camp to the lake, and with Cave made four stations for the photo-theodolite on the mountains east of the glacier. From these we had a very fine view down the main valley and across the Kyagar glacier. The latter takes its rise from the northern wall of the Karakoram range, which here attains an altitude of 23,000 feet, directly under the "Apsarasas group" of the Workmans, which fall very steeply to the glacier head, in a series of broken icefalls and bergschrunds. The head was divided by two long promontory spurs into three head feeder glaciers, that from the east being subdivided into three subsidiary heads, that on the west swinging round from the northern face of Teram

* See Note on Names at the end of the paper.

Kangri, which from this side shows a great rounded snow-cap, seamed with bergschrunds, and impossible to climb.

At the foot of the ridge we were on flowed, rolled, jumped, and tossed the chaotic stream of the glacier. For 5 or 6 miles from its snout it is an amazing jumble of ice pinnacles, rising to 200 feet in height. Occasional pools of clear sapphire-coloured water, and rare patches of longitudinal gravel moraine lay almost hidden among the seracs, but the whole surface presented an icy chaos, and every "lead" that I examined ended in impassability. The snout was hard pressed against and had cut into the marble wall across the valley, and occasionally great masses of ice would break from it and fall into the Kyagar lake. Beyond the snout of the glacier the valley opened out once more. Then a second glacier, probably from Teram Kangri, thrusts forward its snout, though I personally do not think the valley is entirely blocked by it. Beyond this the valley again opens out—I will not guess the range, but the Wild photographs will give its distance—and the surface of another glacier across the valley, but not its snout, could be seen. This possibly is the Urdok glacier of Sir Francis, but the Wild photographs must again decide this point.

Now I come to the sight that riveted our attention and made it hard to record the rest. The wonder of all rose at the far end of the valley—four great giants, clothed in ice. Gasherbrum I., 26,470 feet, the "Hidden Peak" of Sir Martin Conway; Gasherbrum II., 26,360 feet; the "Broad Peak," whose height was fixed by the Duke of the Abruzzi at 27,130 feet; and lastly, the perfect cone of the second highest mountain of our Earth, K_2, 28,250 feet. Even the Ladakhi porters stared in silent wonder. It was a sight quite beyond my power to describe.

I saw the four great mountains first by sunset, and on my last visit by sunrise. I was forced to halt by the way to watch the changing colours. From a steely grey against a dark night sky, the "Hidden Peak" was revealed in all the shades of grey through gold to crimson. It was almost a sin to have to take scientific observations to such a mountain.

Owing to bad weather, I had to climb these stations four times before I could get the photographs with the Wild camera. But every visit was worth the effort, and in spite of the high wind—several times I had to pack up the Wild instrument, and once my plane-table was blown bodily off the hill—it was always difficult to wrench one's eyes from the end of the valley.

The several visits, however, showed us a gap in the wall of red marble that enclosed the valley on the north, and through this gap there streamed a flood of sunlight in the early morning. This gave us the hope that a *détour* over the "Red Wall" might give access to this gap and lead us back to the Shaksgam below the block. In any case, as we were so

dependent on pony-transport, it did not seem worth while to force the glacier with a small party; for after many days we should only have traversed the country which we could well see from our stations, and the rest of our party would have been rendered immobile with useless pony transport. We all were, and still are, absolutely convinced—I cannot put it stronger—that this valley is the same that Sir Francis Younghusband saw from the Urdok glacier snout, a description of which view I have already quoted from his journal.

While we were engaged on the work that I have described above Minchinton and Clifford were looking for ways over the mountains to the north. Colonel Wood had marked on his map, which I had with me, certain red crosses at the end of tributary streams of his "I" valley. These crosses indicated the points where he thought an entry could be effected to the valley, if necessity arose. But he was only in "I" valley for two or three days, and the side stream which gives most promise of a route when seen from that side, was found to be blocked by a glacier low down on the Shaksgam side. The small tributary entering the Kyagar Thso from the north was also found to be very confined, and led to a gorge and glacier, whose ugly snout blocked the way. Both these routes were reconnoitred and discarded. Almost opposite the junction of Valley "H," however, a narrow tributary came in from the north-west, called afterwards the "Lungpa Marpo," descending from a group of peaks over 21,000 feet high. This had seemed to me from one of my stations to offer the most practicable route, and reconnaissance by Minchinton and Clifford proved this to be the case.

It was now July 17; we had crossed Pass "G" a fortnight before. I had made several triangulation stations, and the Khan Sahib had practically completed the survey by planetable of all the ground within view. All the branch tributaries had been examined. The river was beginning to rise considerably, and the lake had extended 500 yards and increased some 15 feet in depth. The amount of grass had not come up to our expectations, and though the ponies were on very light work they were in very sore straits. A fourth had died, and two others were very thin and weak. The weather, though fine on the whole, had given us two samples of what it could do if it liked. After fully considering all aspects, and after full agreement between us all, we decided to transfer our depôt gradually to the head of Wood's valley "I," partly by porters by the Lungpa Marpo and Marpo La, and partly by the fittest of the ponies, which would go round by Pass "G," Wood's Amphitheatre, and the Yarkand valley. When reassembled in the head of "I" valley, we would cross the head, reported by Wood to be similar to Pass "G," and therefore, as we then hoped, presenting no difficulty, attempt to force a way back to the Shaksgam by "the gap in the Red Wall," and failing this, strike the alignment of "the ancient route between Nubra and Khapulung." Though things turned out very differently from what we then

expected, we are still convinced that we pursued the right course. We feel sure that, had we tried to descend the Shaksgam, or even sent a small party down it, the amount of water would have prevented any useful work, and possibly might have led to disaster. At the very best the party must have been cut off from its dumps, and would have arrived in Hunza in a very desperate condition; and the remainder would have spent their time in fruitless search parties.

On July 20, leaving supplies at the depôt to be collected for the return journey, Minchinton and I left with the porters for the Lungpa Marpo, and Clifford and Cave started back with the ponies with light loads for the Yarkand river. Our route led up the steep ravine, which contained a glacier with a more or less dead end. This glacier lay in a north-west to south-east direction, and had a total length of some 7 miles, of which the upper four were level and led to a col, which Minchinton had already reconnoitred and pronounced impracticable for laden porters. But at the point where the level névé began, a second branch glacier was thrown over the watershed, forming, as it were, the on-side saddle-flap to the glacier saddle on the watershed, and this drained into the head of "I" valley. Our route led up the right side of the glacier—the off-side saddle-flap—past some rather treacherous overhanging seracs, and along the right moraine, as far as the level portion. We camped near the top of the pass on the night of the 22nd. Our tents were pitched on the glacier, which was thinly covered with moraine, at about 18,000 feet.

The following day was a long one. The pass itself was easy, and after concentrating our porters on the far side and sending them down to "I" valley, Minchinton, the Khan Sahib and I, keeping to the 18,000-feet contour, explored the other head of "I" valley. Wood in 1914 did not explore this northern head himself, and his report is from hearsay. From no fault of his, it is somewhat misleading, for it is incomplete. There are two large glaciers, not one, which send down long streams of broken ice to the watershed. We climbed on to the first glacier at about 18,200 feet by a lateral moraine, and crossing to its centre, discovered the second. We could see that they joined some distance below us, and that the combined snouts were hard pressed against the hillside opposite; but we saw enough to give us hope that we should be able to cross both of them high up if necessary. There was still about three feet of winter snow on the glacier, and we had to feel for crevasses. This glacier takes its rise from a very grand group of red marble peaks, clotted with ice, rising to 22,000 feet. The valley draining the second glacier could not be properly seen, and we were unable to determine which way it lay; we hoped that it would pierce the "Red Wall."

We still had time to examine the snout of the first glacier. Wood writes, from what he was told: "Like the glacier at the source of the other branch" (*i.e.* that on the Marpo La), "this too sends tongues into the valleys on either side of the pass. This latter is quite practicable

for animals, as the glacier blocks neither it nor the valley, but rests on the southern slopes, leaving an easy passage. It is very similar to the Pass ' G ' near the Remo snout of the Yarkand river."

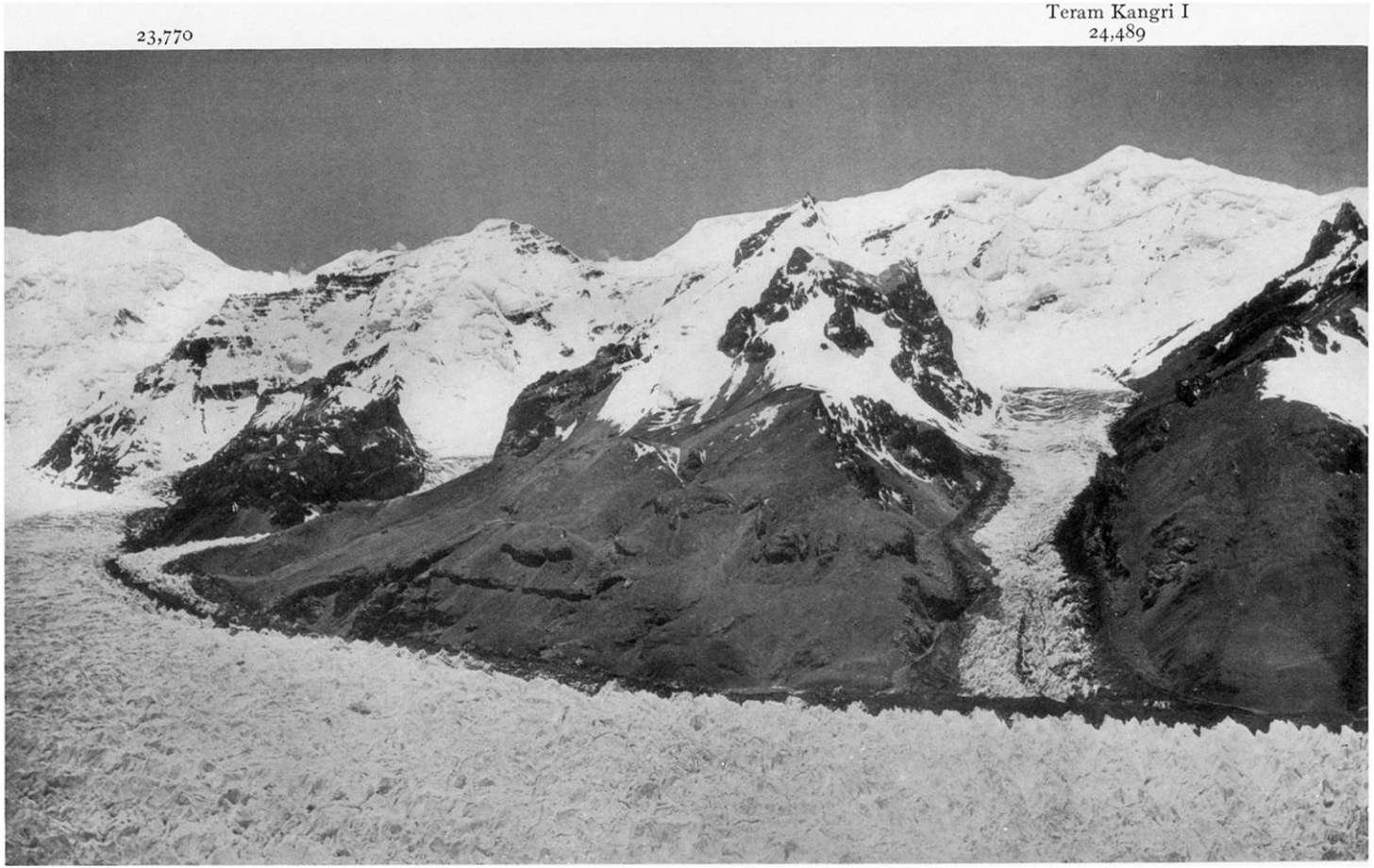
A close view of the snout and the hills unfortunately proved that this was altogether too rosy a view. From the stream below the glacier we looked up at a snout of towering seracs, at the north side of which was a narrow passage over fallen blocks of ice. The ice at the extreme end was perched on a rocky outcrop, which had been cut through by the glacier stream. We made our way up this defile, which was quite impracticable for animals, under tottering ice pinnacles, for about 100 yards, and then the ravine came to an end. We were faced by a wall of rock 60 or 70 feet high, over which the stream poured in a waterfall. Climbing the hillside to the north of this fall, we came to two small cairns, which must have been built by Wood's men, and showed us that they must have taken a higher level. We therefore kept now to this level, crossed a shale spur, and were brought to a halt by a considerable lake filling a gap between the glacier snout and a bay in the hills. After reconnoitring a short way beyond, and not being yet quite certain whether there was a way after all, we returned to camp by a higher route, which we decided could be made practicable for animals, even though it could hardly be likened to Pass " G."

The next few days were spent in further reconnaissances, both down the valley, to make certain it was practicable for Clifford and Cave with the ponies, and over the glaciers at the head. Meanwhile the porters were sent back for further supplies from the dump beyond the Marpo La ; in fact, from now onwards until the end of the expedition, porters, whenever available, were employed for this purpose, and it remained a difficulty throughout to keep the supply of food and fodder sufficient, and still to retain enough men to carry out the work in the forward areas.

The reconnaissances showed no difficulty down " I " valley, or the Lungmo-chhe, as our men named it.* The gorge was easy and the valley was, in fact, as Wood had already reported, fertile with grass and burtsa. At some period of the year, probably in the winter, animals must congregate here for shelter, for in many places the dung of wolves, burrhel, yak, and kyang lies together in the same sheltered but sunny spots. The valley is crossed by game tracks in all directions, and butterflies were common. The Tibetan snow-cock and many smaller birds were now in the valley with their broods. It was indeed an ideal spot for a new depôt.

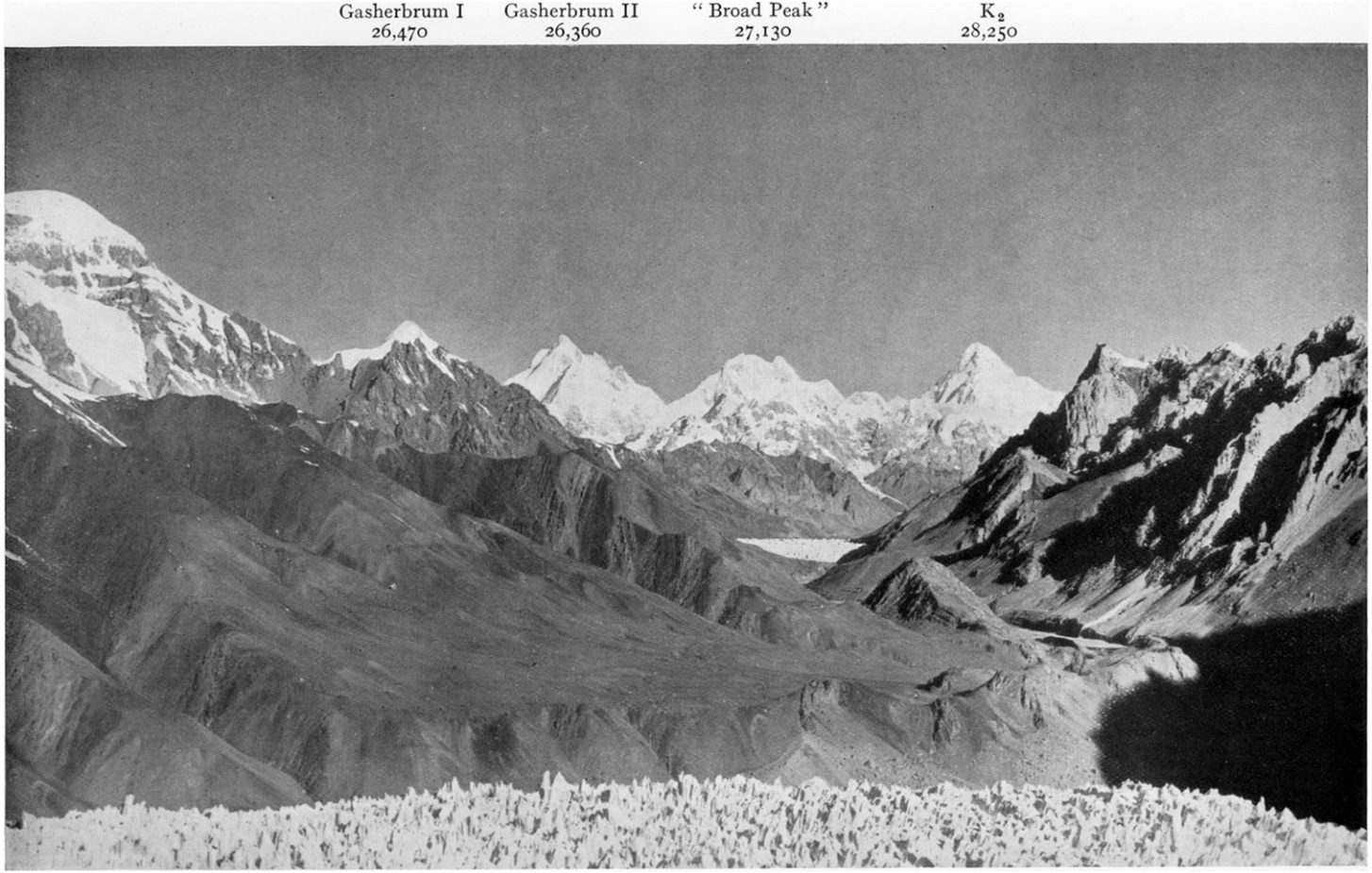
Further reconnaissance up the valley showed that this plenty ceased at the gorge below the junction mentioned by Wood. Beyond, there were no tracks, no fuel, and very little bird or insect life. We found, however, a number of fossils. The second glacier was found to block the valley completely, and had torn out the hillside opposite, forming

* See Note on Names at the end of the paper.



3. *Teram Kangri from the north-east across the Kyagar Glacier*

From Station W7



4. *Across the Kyagar Glacier and down the Shaksgam Valley*

From Station W4

cliffs. Laden porters could still find a way with some difficulty by climbing over them high up, but we were still hoping for a way for ponies. This way we found by crossing the glaciers at about 19,000 feet, well above the serac'ed lower portion, but the long day's reconnaissance, which took us into the valley beyond, told us nothing of this valley. We could not see where it led, and in such a country it was futile to guess; nor could we say whether it contained grass or fuel, though we could see no signs of life.

Clifford and Cave arrived at the head of the Lungmo-chhe on July 26, just as we were beginning to get anxious. They had very wisely taken their marches leisurely, owing to the condition of the animals. Two more of these had died, but the remainder had benefited by the young grass which was now springing up in the Yarkand valley and Lungmo-chhe. They reported the interesting discovery of the corpse of a man in the latter. There were two rupees on him, one of which was dated 1918, and a string of turquoises, so he had evidently died unattended. A little way from the body were six tins of aniline dyes, unopened, and bearing the device of a lion and shield. The man was huddled up, and Clifford was of the opinion that he had died of starvation and exposure about the year 1924. We afterwards came to the conclusion he was probably a Balti, and from discussion with traders, he had probably straggled from the caravan route some five marches to his east, lost his way, and starved to death.

Clifford and Cave had considerably increased their collections of plants and birds, and brought specimens of rock which contained metallic ore. They had come across a large number of burrhel and antelope, and brought us fresh meat, of which we were much in need.

When we were reassembled we again reviewed the situation, and concluded that it would be better for Minchinton, the Khan Sahib, and me to reconnoitre and survey ahead, owing to the doubt concerning grass, while Clifford and Cave supported us from our new depôt in the head of the Lungmo-chhe. I think we made the mistake at this juncture of pushing on at once, before getting more supplies over the Marpo La; but the weather was fine and we were very impatient to get back to the Shaksgam. We should have built up a new base here before pushing on; but we did not know then that the Marpo La route would become difficult owing to the fall of seracs on the Lungpa Marpo glacier, and so curtail supplies.

As it was, we crossed the pass—called by the men the Sa-Kang La—with four ponies and all available porters by the high-level route over both glaciers on July 30, camped in the valley beyond, the Sa Lungpa, and sent back every man that could be spared for work on the Marpo La.

The Sa Lungpa was the most desolate valley I have ever seen. There was not a blade of grass or of any green thing, nor was there any sign of life, not even of an insect. We had been accustomed to limestone hills

and disintegrated limestone slopes. Here the slopes were covered with a hard dry mud. After snow, thaw, or rain the hillsides must be liquid. Near the valley bottom the slopes were seamed by countless scorings of streams, and on the flat the mud was baked and cracked by the sun. We had found fossils in the head of the Lungmo-chhe; here we did not find even these.

Our next day was disappointing, and saw the end of our hopes of piercing the "Red Wall." We found that the river broke suddenly to the south-west, but only when we reached the point where the gorge began. We pitched camp, the Khan Sahib climbed one hill with his planetable, Minchinton climbed another to reconnoitre, and I tried to force the gorge with one man. I shall not forget that gorge. We started with ponies, but soon had to abandon them. There was a lot of water coming down the stream, turbulent clayey water surging round huge boulders. We had to jump the stream by means of these boulders several times, or climb the gorge walls to avoid them. They were either washed by the torrent or covered with ice, but we reached a point about a mile and a half down where the gorge opened out somewhat, and I felt that as the river had risen considerably it would be foolish to go on. We had more difficulty getting back than I had expected, and were disappointed to learn from Minchinton that the gorge continued for another 4 miles.

We now had definitely to abandon the hope of using pony transport any further, and sent our four animals back. They reached the glaciers of the Sa-Kang La, whence Clifford had them practically carried down to grass. We also sent back all our coolies during the next day or two to bring up supplies and fuel from the Lungmo-chhe, for there was literally nothing here. The weather also turned bad, and we were within an ace of retreat ourselves.

The trough of the Sa Lungpa continued beyond the point where the river pierced the mountain barrier on the south-west of it, and this trough, still in a north-west to south-east direction, contained another branch of the Sa Lungpa, which flowed towards us in a gorge and joined the river I had tried to descend just below the point I had reached. After making some photo-theodolite stations on the spur at the head of the gorge, and after getting up from the depôts more supplies and fuel, we moved camp over the mountains to this branch, and pitched it at the junction of two tributaries, near its source. At the head of these we had seen cols which we determined to explore, in the hope of striking "the ancient route." These cols were less than 20 miles from K_2, and we felt that the views from the summit of one of them must tell us much, though we had little hope of having enough supplies and fuel to cross them. The whole Sa Lungpa was as devoid of burtsa or any other form of fuel as before, though again we found a number of marine fossils among the limestone *débris*.

On August 6 we divided, Minchinton with one of the Gurkhas exploring the southern of the two branches, while the Khan Sahib and I ascended the northern one. Minchinton had a very hard day, and reached the head of the glacier which drained into his tributary. He climbed a ridge a little below 20,000 feet, and had a view of K_2 between the serrated peaks of the Aghil range. But at the other side of his col there was no way down for porters.

Our own reconnaissance was much more promising. A quarter of a mile from camp the stream issued from a gorge, and as we had started very early there was not much water coming down it. But it was icy cold, and we had to ford it a number of times. The depth in one place was up to our chests. Quite suddenly we came to the end, and found ourselves on an elevated plateau, 17,500 feet above sea-level. It was almost a replica of the Depsang, and ponies could have been ridden at full gallop across it. It was about 7 miles from north to south, and 5 from east to west, and we felt that if any route had ever existed in these parts it must have crossed this plateau. There was even scanty grass springing up, and a few female antelope with their young gazed at us and slowly trotted off.

Minchinton came back from his reconnaissance rather a sick man, but though he was not well for some days, he gamely came along to the "Aghil Depsang." For the next few days we were exploring the plateau, using all available men for bringing up supplies and fuel. We shot a few Tibetan sandgrouse which passed over, and some female antelope, which seem to seek the higher and more remote ground when they have young. We cooked them on their own droppings mixed with a kind of moss dried in the sun. We searched for any signs of human travel, but though we explored the plateau fairly thoroughly we found none.

Practically the whole of the drainage of the Aghil Depsang is eastwards into "J" valley. Several glaciers push their snouts forward on to the plain, and give the impression of being the remains of a *protective* ice-cap. They are now retreating, without any doubt, and the streams which issue from them are cutting young ravines and gorges across the otherwise level surface. We were now certain that the whole area north of the northern watershed of the Sa Lungpa must also drain into "J," and that therefore any ancient route, such as Wood suspected up "J" valley, must cross the plateau. The western watershed of this "Depsang" rises in places to over 20,000 feet; between the highest points the old ice-cap seems to have *depresssed*, though not *eroded* it, and from these depressions come the "crawling" glaciers. There was one depression lower than the rest: the glacier had retreated farther, and the "young" gorge was older and deeper. We determined to explore this, believing that, if Hayward was right in saying that the Kalmuk Tatars had been here, they must have passed over a col at its

head. On August 10 we camped by the snout of the glacier in the "Tatar Lungpa," and the following morning explored the pass.

The glacier was of the saddle type, coming in from the south; it is mostly situated on the east side of the watershed, and therefore drains mostly by means of a long tongue into the Tatar Lungpa. For some distance we kept below the tongue on the slopes opposite, but before reaching the pass took to the ice and found the going quite easy.

Our view from the summit must have been slightly different from that which Sir Francis Younghusband had from the Aghil pass thirty-eight years ago, but it must have been no less wonderful than his, for our altitude was greater. Before us stretched a panorama of mountains and ice, so grand and so vast that it took the mind long to grasp its immensity.

From a little under 19,000 feet we looked across a deep valley—we called it the "Kalmuk Lungpa"—draining a little north of west. At a distance of about 4 or 5 miles this valley turned either to the north or south, or joined the trough of a larger valley lying across it. The Kalmuk Lungpa was enclosed on the south by a rocky crest, draped with glaciers, of a dazzling whiteness. Beyond this crest was a second and a third, carrying some fine peaks, over 22,000 feet. To the left of these rose Gasherbrum I., 26,470 feet, the "Hidden Peak" of Sir Martin Conway, once more revealed in indescribable beauty. And to the west, a serrated line of jagged peaks of 22,000 feet was dwarfed by the mighty pyramid of the second mountain of our Earth, the stainless virgin summit of which played with tiny wisps of drifting cloud.

Altogether we saw this view from the pass on four occasions, and I am going to describe it on our farewell visit some time later. We had decided to pitch our camp on the pass itself, in order to see the sun set and rise. We faced our tents to the west, where was situated K_2. In the very early morning long before it was light, we opened up the tent and waited for the transformation. It was so dark that there was for some time no difference between the darkened sky and the sleeping mountains. Their presence was felt rather than seen. But gradually dawn came up out of the east behind us, and the west grew blacker. Then over our zenith it seemed as though the deep blue-black curtain of the night was drawn down towards the western horizon, till the shadow of the Earth reached the summit of K_2. Quite suddenly the topmost ice was flushed a rosy pink. Light seemed to creep down the mountain's side and gradually to suffuse the whole with life. For a few minutes the giant pyramid was resplendent against the blackness, faintly tinted near the base, crimson at the summit. Then to the south of us, we watched Gasherbrum reveal her morning splendour. Mountains near the two peaks now reflected the living ice with a pale glow; and slowly, one by one, they lifted their heads to the dawn.

I must turn to my narrative. From this pass a practicable route led down to the valley below, and we decided that we must, at all costs,

5. *Looking south at sunset from north flank of Shaksgam Valley, on the way to Lungpa Marpo From Station W8*

6. *The barren Sa Lungpa looking south-east*

From Station W12

descend and see in which direction the big river at the end of it turned. As we had been expecting an outlet to the Shaksgam southwards or westwards since leaving the Sa-Kang La, it seemed that this must flow south. But would it turn into a gorge? And if so, would the gorge be passable?

When we had left our depôt we had not expected to be away more than a week, and we had not built up sufficient supplies for a longer period. Nor had there been any indication that the route over the Marpo La would become blocked by the fall of seracs on the Lungpa Marpo glacier. Clifford and Cave were now having difficulty in keeping us supplied, partly from this cause, partly owing to the fact that the ponies were practically useless, and partly owing to our demands upon the coolies and the swollen state of the rivers. We were therefore delayed till August 19 on very short rations. The time was not wasted, however, and was mostly spent in working on the survey and photography. Bad weather also came on, so that actually little time was lost.

While delayed here two of our Ladakhi porters, Tashi and "Munshi," went down to explore for fuel. They brought us the totally unexpected news that the big river flowed north instead of south. They reported that it was "as broad as the Shyok at Saser." We therefore crossed the Tatar La in a state of high excitement, cairning the route, and believing that at last we might be re-entering the Shaksgam. The descent was down very steep shale to the Kalmuk Lungpa, which we reached at about 15,500 feet. The bottom of this valley was enclosed, but for the first time for many a day we found plenty of grass and fuel and flowers. Our porters were very tired, and though the junction was only 5 miles away in a direct line, the route led over a series of tiring spurs separated by deep ravines, and they did not succeed in reaching the big river that night.

On August 20 we moved on to the junction. The Khan Sahib surveyed from a hill to the south, and Minchinton and I explored on farther down the main valley. We had left the greater part of our warm kit and tents behind on the Tatar La, but instruments and supplies fully employed the men.

The main river—I shall anticipate a little, and call it now the "Zug-Shaksgam"—was, as our men had reported, flowing north, or rather a little east of north, and before long we became almost certain that it was the Shaksgam itself, and that our camp was at the spot that Sir Francis Younghusband had named "Durbin Jangal." We were, in fact, so certain that we were again in the Shaksgam that I actually wrote a letter to Mr. Hinks and told him so, giving the odds at a bottle of champagne to a glass of water.

This valley agreed in almost every particular with that of Sir Francis Younghusband. Just below our camp the stream-bed widened to nearly half a mile; above, it was about 300 yards wide. There were a

certain number of small bushes and plants. The valley was broad and its slopes ended in conglomerate or alluvial cliffs, which appeared to have been cut through by the river rejuvenated. The latitude of the junction was within a minute of that of Durbin Jangal. The water in the river continued to rise until 11 p.m., and then covered a bed 300 yards wide, thereby showing that it had a distant source. There were however three points which made us a little doubtful. The height of our "Durbin Jangal" was about 13,350 feet by aneroid; Sir Francis gave the height of his as 12,329. We explained this to our satisfaction by remembering the vagaries of the aneroid. Our "Durbin Jangal" was a good deal east of the other; owing to the possible misidentification of the peak by Sir Francis at Durbin Jangal, we had been led to expect this. Lastly, our river was flowing a little east of north; that of Sir Francis was shown flowing north-west. But even this fitted in when we turned to his account in the *Proceedings* for April 1892. For the passage here recording the view from the Aghil pass runs: "To the *south-west* you look up the valley"—not to the *south-east.* This, we believe now, was a misprint; but when everything else fitted in, or could be made to do so, the chance of a misprint did not enter our thoughts. Remember that the western watershed of our valley surveyed by us was only about 6 miles from the ridge north of K_2, surveyed by the Duke of the Abruzzi from "Windy Gap;" that no large tributary had been recorded as entering the right bank of the Shaksgam between Durbin Jangal and Kulan Jilga; and that our river was already too low to flow into the Surukwat, or Yarkand river upstream of Bazar-dara.

On August 21 our men were so tired that we decided to give them a day's rest, prior to moving up to the snout of the Gasherbrum glacier. Minchinton, the Khan Sahib, and I started up the valley to look for the best line. We already knew that there was much more water here than there could have been when Sir Francis brought ponies; for he was able to keep to the valley bed, while now this was impassable. The Khan Sahib and I kept as low to the river as possible, and succeeded in getting farther than did Minchinton, who took a higher route. But we came to a spot where we were forced down to the bed, where the river was unfordable, and as the river was rising rapidly, we were forced to turn back. We now discussed the situation, and hoping that the water would subside in the next day or two, decided to explore down the valley and determine, if possible, the position of the Aghil pass. The weather at this time was not good for surveying, for though it was hot and fine, there was a thick haze filling the valley and obscuring the hills; triangulation was quite out of the question.

On August 22 we took a light camp down the valley for some 5 miles, when we came to a point where the hills on the east closed in and the river began to turn westwards. The other side of the valley now opened out, but the river was a foaming torrent, filling the greater part of its

bed, and we were unable to cross. The going at the foot of the hillsides was intensely tiring, for there were great dry streams of granite boulders to cross. These boulders lay in lines, formed fan-shape from side ravines; some were huge, and the troughs between them were often 10 feet deep. We spent two nights here, surveying as much as we could and hoping that the river would subside. But instead, on the second night the water rose 10 feet, and had not fully gone down to normal in the morning. It was still about 5 feet deep, and with a current of about 8 miles an hour, while the most hopeful line to take would be about half a mile long. It would not have been fair to ask loaded men to cross.

Our porters were now showing signs of wearing out, and so were we. One man had already nearly been drowned on his way back to the depôt, and now another was badly bruised by a rolling boulder in a stream. A third had to be left behind today with fever, and fetched in later. They had done splendid work, and I had already raised their wages as some compensation. But now this had no more effect, and when we told them they would soon be on their way home, they merely remarked, "It does not matter; we shall still carry loads." They had lost their old enthusiasm.

If we had now been satisfied, we should have come back with the story that we had regained the Shaksgam at Durbin Jangal. We should have left the valley on August 26, after a wild windy night on which snow fell, and I believe we could have persuaded you, as we had persuaded ourselves, that this was the Shaksgam. But we could not feel absolutely convinced of this without actually reaching the snout of the Gasherbrum glacier, and we felt bound to make one more effort to reach this spot. We persuaded the men to make this effort, and on August 26 the Khan Sahib started up the valley. Owing to lack of men and an attack of rheumatism, from which I had been suffering for some days, I decided to follow the next day, after a quiet one with the photo-theodolite.

The river had not subsided in the least since the 21st, but it had changed its course in its bed. The way was difficult in places, but passable beyond the spot we had reached before. About $3\frac{1}{2}$ miles above camp a side stream enters the right bank of the Zug-Shaksgam. The tributary carried thick red water, similar to that which we had so often seen on the north of the red marble wall. It was just beyond this point that I met the Khan Sahib returning with his men. For about three-quarters of a mile above the "Red Stream" the main valley remained quite wide, and the river flows in a broad flood plain, the slopes above on either side being easy. The bed then becomes more enclosed by steep cliffs for half a mile, beyond which the river issues from a narrow cutting between them, 20 yards wide at the top and only 5 yards wide at the river-level. The water must be very deep, and the cliffs were about 150 feet high above the water. Beyond this gorge the river-bed again opened out for a distance of about $1\frac{1}{4}$ miles, but the way over the cliffs was none too

easy. Again the river issues from a gorge, a veritable cleft, through which the water poured. The cliffs here were only 10 feet above the surface, 3 feet apart at the top, and about 5 feet at water-level. They almost touch in places, so that the river practically flows underground. This extraordinary formation continues for about 400 yards, and then widens to a few yards. Two miles farther there is a sharp bend, and the greater part of the river comes from the south-east, being fed by glaciers ; a smaller tributary joins here from the north-west.

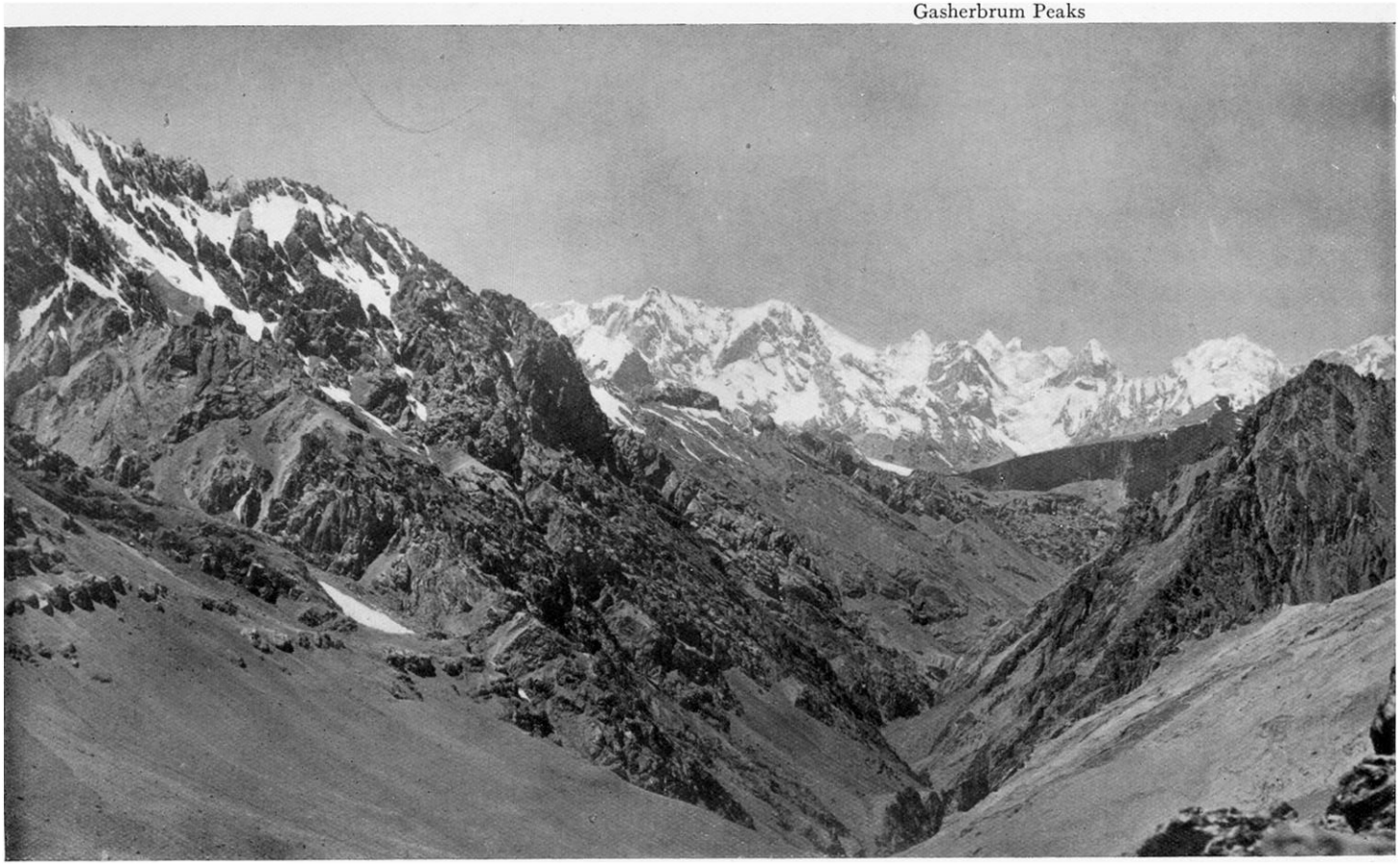
Unfortunately it was quite impossible to reach the bend, owing to a tributary gorge.

Anything more unexpected or more unlike the valley that Sir Francis Younghusband ascended with ponies past the snout of the Gasherbrum glacier could not have been conceived. To my mind there is only one explanation, namely, that this Zug-Shaksgam is the lower course of the Sa Lungpa, whose upper branches we had already explored. There is still room for the river of Sir Francis between our watershed and the mountains north and east of K_2, though there certainly is not room for *two* more valleys of this size.

The question is, Where does this river flow? We had already followed it down to a level which precluded any possibility of it breaking northwards to the Surukwat or Yarkand river. It must enter the Shaksgam therefore between Durbin Jangal and the foot of the Aghil pass. But there is no mention of a large tributary here in the account of Sir Francis. I have since my return had the opportunity of examining his journal, and this throws no light on the point. His rough chalk sketch, however, does show a tributary entering the right bank of the Shaksgam between Kulan Jilga and Durbin Jangal ; and I believe that this must be our Zug-Shaksgam. But it must be very nearly as large as the river he explored.

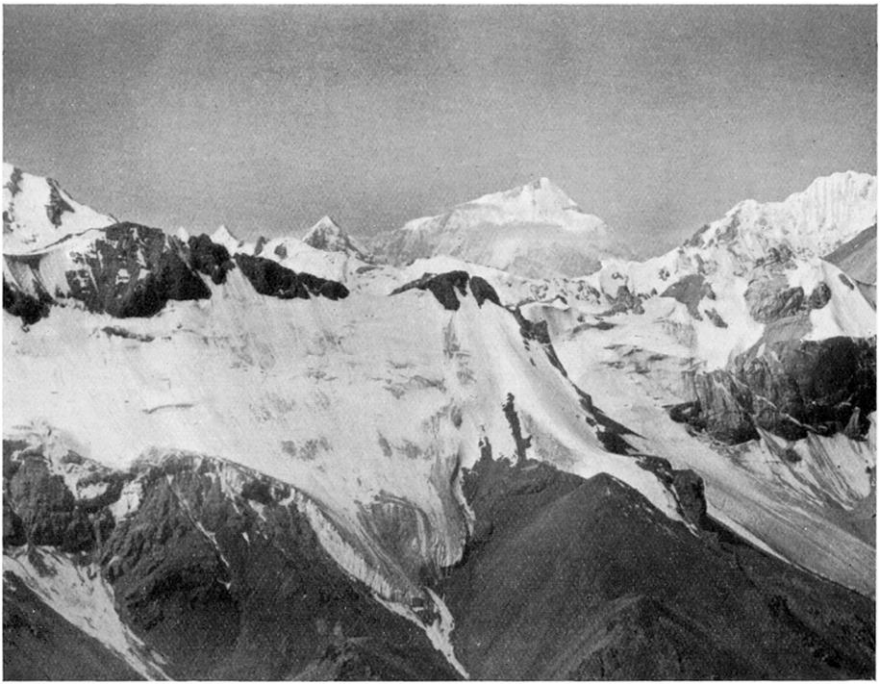
We had to be content that we had discovered this river, and to leave its further exploration to some future expedition. Our men were now far too exhausted to be asked for further efforts, and the river showed no signs of subsiding and allowing us to cross. The most we could now hope to do was to return to the upper Sa Lungpa, and if the gorge there had become passable, to force a way down it and confirm its identity with the Zug-Shaksgam. We moved in easy stages, for the men had much to carry, and the outcoming supplies to pick up. Also we wished to give the Sa Lungpa waters time to subside. We found however that this river had not become passable, and so returned to our depôt, reaching it on September 1.

While we had been away Clifford and Cave had studied the conditions of the Lungmo-chhe, and had explored the area between it and the " J " valley of Wood. This area was found to drain through narrow gorges into " J," and not as Wood had surmised. Clifford and Cave followed the gorges for some distance and reached the junction with

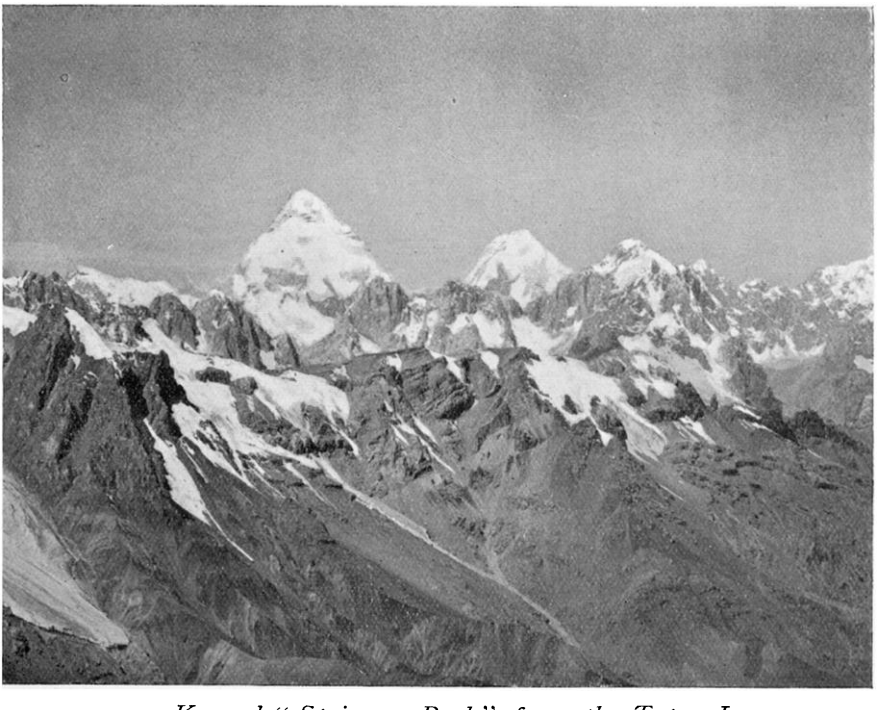


7. The break in the Aghil Ridges above the Sa Lungpa Gorge

*From Station W*10



8. *Gasherbrum I from the Tatar La*
*From Station W*15



9. *K_2 and "Staircase Peak" from the Tatar La*
*From Station W*15

" J " valley, thereby much lightening the task of surveying the area on our return.

The Khan Sahib was now able to survey the whole of the Lungmo-chhe and the area to the north of it, and this gave him opportunities of making some slight corrections to the existing map of the glaciers and watershed on the south of the valley. The tributary containing two lakes, mentioned by Wood, was also surveyed, and, as I have said above, the valley beyond the saddle was found to be blocked by a glacier.

Cave had gone almost back to the Shaksgam by this way, and reported that the Kyagar Thso had extended to a length of over 5 miles.

While we were engaged on these surveys, the porters brought over the last of the dump from the Lungpa Marpo. On September 12, after a spell of bad weather, we sent off the ponies by the Amphitheatre to the head of the Shaksgam to collect the supplies left there for the return journey. The men had orders to meet us in the Yarkand river on the 21st. We ourselves followed with the porters by short marches, for they had to do each journey twice, and sometimes three times. In the Yarkand valley we had our only serious accident. After arrival in camp, Tilak Bahadur, one of the Gurkhas, had climbed the rocks bordering the river-bed, when the hillside gave way and crashed down on him. His skull was fractured, but thanks to Clifford's skill he recovered, though he had to be carried for many days on an improvised stretcher by four men, whom we could ill spare. Our transport difficulties were accentuated by the loss of three more ponies during a snow blizzard, which delayed the rest on their journey to the Shaksgam. Two more ate through their ropes and strayed on the night of the 22nd. We were therefore somewhat thankful to reach the Amphitheatre on September 23, and to find that Ali of Hondar, a pony-man who had accompanied us to the Shaksgam in June, had arrived back at the Amphitheatre the day before, with thirty more ponies, according to programme. After one more day of foul weather, we quitted the Amphitheatre for good and started back for Panamik. The return journey was of course a very simple matter compared to the outward one ; caravans were passing along the route in both directions, and the weather was very kind to us during the crossing of all the passes.

We reached Panamik in the Nubra valley on October 3, after having been almost continuously above an altitude of 16,000 feet since we had left it in June. We did not take any maximum or minimum temperatures, but in the Shaksgam and Aghil areas it was not excessively cold, and I do not think we ever had more than 25° of frost at the most, and very rarely as much as this. Fine weather was far more usual than bad, and I should say that 70 per cent. were fine ; though on these fine days, many of which were hot, there was always a very high wind, which was always bitterly cold, blowing from the regions of snow and ice to those that were warming up. Some of these winds must have attained a great

velocity, and it is satisfactory to report that the tents which Messrs. Benjamin Edgington supplied, and which you gave us, withstood all these gales. Occasionally on fine days, particularly in the Yarkand valley and in the Zug-Shaksgam, survey work was made impossible by haze, but I cannot say whether this was caused by the heat on the rocks or from the loess of Central Asia. Spells of bad weather were generally heralded by a few days with cloudy skies; the actual spell, however, usually did not last for more than two or three days. Were it not for these spells, it would be possible without excessive discomfort to bivouac without tents; in fact, our men sometimes preferred to do so, rather than carry them; but in these cases, when the weather turned bad, we gave them shelter in our own. At the same time, if there is survey work to be done in the daytime, and computations to be done at night, I consider that as much comfort as possible is essential during sleep.

Cave, in his meteorological notes, reports that in his regular observation of cirrus between May and September, there was no single record with an easterly direction. The high currents almost universally came from the west or south-west. Among other points of interest, he made notes on winds, sun-halos, haze, and the succession of colours at sunrise and sunset.

Clifford was the only one who had some difficulty in sleeping over 17,000 feet, but he is not a good sleeper at sea-level. Both the Khan Sahib and I found that altitude had a distinct tendency to make us inaccurate, and the worry of computing on more than one occasion gave us headaches over 17,000 feet.

The health of the whole party was good, except for a few minor troubles, and except for the accidents I have mentioned. But towards the end several of the men developed coughs, and Clifford's opinion was that they would not have been fit for much more work. I am sorry to have to record so much mortality among our animals. Of the twenty-one animals which I bought, ten died; of these, four died from lack of grass and altitude, three from exposure during a snowstorm, one from colic, one from pneumonia, and one dropped down dead with a heart attack. Four yaks died during or after the crossing of the Khardong pass in June, and sixteen of the hired animals died from various causes.

Before closing, I wish to thank Minchinton, Clifford, Cave, and the Khan Sahib for all their help during the expedition. Minchinton's knowledge of mountaineering was a very great asset, and even when he was unwell and could hardly walk, he refused to be left behind. He was indispensable. I was very sorry to have to leave Clifford and Cave at the depôt when we went over the Sa Kang La. Cave had practised with the photo-theodolite and would have been invaluable. Both he and Clifford, however, turned their energies to collecting, and I believe their collections of birds and flowers are as complete as possible. Clifford's skill as a surgeon was happily not often required, but it is due to him

that we all came back. Of the Khan Sahib I cannot speak too highly. He was always ready to turn his hand and his mind to any job that was going, and his beautiful and accurate survey has been much admired. He has asked me to thank you personally for the award of the Back Grant last year.

From preliminary investigations of the butterflies and birds, examined by Colonel W. H. Evans and Mr. Hugh Whistler, there appears to be no new species of either. About two-thirds of the species of butterflies are identical with those secured by Capt. Hingston on my survey expedition to the Pamirs in 1913. I understand from Mr. Whistler that the main interest of the bird collection lies in the high altitude at which some of the migrants were secured.

I am not going to finish without a word of praise to the Ladakhi porters. They were absolutely splendid; they came of their own free will, and once they had put their trust in us they never gave us a moment's real worry. It is quite impossible for me to overestimate their services, but you must have realized to some extent their pluck and loyalty.

GEOGRAPHICAL OBSERVATIONS AND CONCLUSIONS

The Muztagh, or Karakoram Range.—The great range of snowy peaks which number among them K_2, the Gasherbrums, and Teram Kangri, has for some years been known to European geographers as the Karakoram. This name, as Wood rightly remarks (Wood, p. 7), is given by the Central Asian traders to the pass alone, and not to the mountains. Wood surmises that it was Hayward who first suggested applying the name to the mountains. Hayward certainly used it,* but he also employed the other—Muztagh—as well, as did Sir Francis Younghusband; and it seems to me a little doubtful whether he intended to apply the name "Karakoram" to the line of the great peaks. Both names are Turki, so cannot be considered alternative, especially when it is remembered that the one means "Black gravel" and the other "Ice mountain." My own belief, after studying Hayward's account, is that he meant to use the name "Karakoram" only for the unexplored system of mountains west of the Karakoram pass (see *Geogr. Journ.*, 1869). To this day traders allude in a vague way to the snowy mountains which they know exist to their west, but which they can barely see, as the "Muztagh." I believe it a misunderstanding of Hayward's account, and of the observations of Montgomerie, of the Survey of India, that has led European geographers to use the term "Karakoram range" as it is at present applied. Montgomerie used the symbol "K" for all the peaks he measured which appeared in the direction of the distant range, and at the station of Haramukh, near the Wular lake in Kashmir, he first observed "K_2," entering it as such in his angle book.†

* Burrard states that Moorcroft was the *first* Western geographer to apply the name "Karakoram" to the great range which separates the Indus and Tarim basins (Burrard, p. 97). The objection to the name Muztagh which Burrard cites, viz. that there are other "Muztaghs" not on this range, applies equally to the name "Karakoram." There are several Karakorams, or Karakurams, in Turkistan and on the Pamirs; and the Karakoram pass itself is on a subsidiary fold of the Aghil range.

† It may be of interest to state that Montgomerie's entries of the Karakoram

I do not think that Montgomerie believed for a moment that K_2 should be considered on any particular range, for certain of the "Ks" are on a southern alignment. But I certainly believe that the naming of K_2 has influenced geographers in retaining the name for the range.

One of the direct results, I am sure, of denoting the line of the great peaks by this name has been to insist that the Karakoram pass itself must lie on it. The Karakoram range has on some maps been made to bend out of its normal alignment, to almost due east, in order to include this pass. The great divide between the Nubra and the upper Shyok, which is even yet only very imperfectly surveyed—barely reconnoitred, I should say—has been allowed to sink into geographical insignificance, though it carries four triangulated peaks of over 24,000 feet, one of which attains 25,000.*

I feel certain now that, as I hope to prove later in this paper, the true axis of the Karakoram range follows the alignment of the Upper Shyok–Nubra divide.

The Source of the Shaksgam.—Prior to the De Filippi expedition of 1913–14, the map of the region west of the Karakoram pass, with the exception of the pioneer sketches of Hayward and the rougher ones of Johnson, was almost a blank. Farther west we had the results of the explorations of Sir Francis Younghusband; but the trough of the Shaksgam east of the meridian of Teram Kangri was purely conjectural, and from the maps its main source might have been the Urdok glacier.

Wood's explorations during that expedition led him to surmise that the source of the Shaksgam river was very much farther east than had been supposed, and to publish his conviction that the Yarkand tributaries, "I" and "J," had their sources in a range north of the Shaksgam. Wood also traced the alignment of a "Red Range" north of "J" valley, and showed it with a north-west to south-east alignment. Nevertheless, he did not consider that the country as a whole was sufficiently well surveyed for him to state his opinion that the accepted alignment of the Karakoram range was wrong; and it was not till I reached Panamik on the way back, that I received a letter from

peaks in his angle-book for the station of Haramukh, together with their present heights and names, accepted by the Survey of India, are as follows:

K_1 (west)	.. ..	Masherbrum west	.. .. 25,610 feet
K_1 (east)	.. ..	Masherbrum east	.. .. 25,660 ,,
K_2	.. ..	K_2	.. .. 28,250 ,,
K_3	.. ..	Gasherbrum IV.	.. .. 26,000 ,,
K_{3a}	.. ..	Gasherbrum III.	.. .. 26,090 ,,
K_4	.. ..	Gasherbrum II.	.. .. 26,360 ,,
K_5	.. ..	Gasherbrum I.	.. .. 26,470 ,,
K_6	.. ..	Karakoram No. 8	.. .. 25,110 ,,

The "Broad Peak," 27,130 feet, as far as I can remember, is hidden behind the Gasherbrums in the view from Haramukh; it was not observed by Montgomerie. Gasherbrum I. is the "Hidden Peak," and Karakoram No. 8 is the "Bride Peak" of subsequent travellers.

* Burrard implies that the Nubra and Upper Shyok *both* drain from the north of the Karakoram range (Burrard, p. 98). But he was uncertain owing to lack of data, and the name of the range has not been shown on maps according to Burrard's views, which were written prior to Longstaff's discovery of Teram Kangri, and the correct alignment of the main watershed.

Wauhope tentatively showed the Karakoram along the whole of the Nubra–Shyok divide; the watershed south of the Saser pass is as yet insufficiently surveyed to say whether he was correct (see below).

him stating that he agreed with the conclusions in my Journal, and that he himself had formed a similar opinion some years previously.

The work of the present expedition has confirmed Wood's surmise concerning the source of the Shaksgam, and Pass " G " may be considered as lying at its most distant head. The high massif carrying several peaks of 22,000 feet and some large glaciers, draining into " I," " D," and to the Shaksgam itself, may be considered another equally important source. But neither the glacier by Pass " G " nor this massif contributes as much water as the great ice-streams of the Karakoram, such as the Kyagar, the Urdok, and the Gasherbrum. Although no vast amount of water reaches the upper Shaksgam from the northern wall of its valley, the majority of the drainage of these mountains finding its way into the Shaksgam lower down, by the large tributary which we discovered, yet the combined effect of the whole basin must be far greater than that of the Yarkand river above Khufelang. I feel convinced, therefore, that Sir Francis was right in suggesting that the Shaksgam is the true geographical source of the whole Yarkand river; at any rate, its basin supplies by far the greatest volume of water.

The Kyagar Glacier.—From the junction of the two highest tributary sources, near which junction was placed our first depôt, the valley of the Shaksgam trends only a little north of west. At latitude 35° 40′, longitude 77° 10′, the valley is blocked by the Kyagar glacier, draining from the snowy cirque of the " Apsarasas group " of the Workmans.* The Kyagar glacier has a large open névé basin lying under the wall of the Karakoram, divided by two large spurs into three heads. From the junction of these heads, the combined ice-stream becomes a tumbled mass of pinnacles which continue for 6 miles thence to the snout, which is crushed and contorted against the marble cliffs opposite. It is difficult to describe these pinnacles. Some rise to a height of 200 feet and are of the most beautiful transparent blue ice, while others are opaque. Between them there are occasional short moraine bands, but in the lower reaches of the glacier these are by no means continuous and afford no passage either up, down, or across the glacier without a very great deal of step-cutting. Many of the " leads " that I examined through my glasses ended in glacier lakes of considerable size, and of the most beautiful turquoise and sapphire colouring imaginable. Near the " snout spread " these pinnacles are distinctly dangerous, and I saw more than one fall into the Kyagar lake.

The Kyagar Lake.—The Kyagar lake, formed by the damming of the valley by the glacier, is a very remarkable feature. When first discovered it still carried the remains of its winter ice. During the early part of the year very little water enters it, and the percolation drainage through the glacier dam more than counterbalances the supply. The winter ice is thus left unsupported and breaks, falling in great blocks to the hillsides and valley bottom. We were in time to see many of these lying along the slopes, giving a very good indication of the winter surface of the lake. But the level was rising even early in July, showing that the percolation is really not great. Towards the end of the month the lake had increased 500 yards in length and probably about 15 feet in depth. Clifford and Cave saw it again about a month afterwards, when it had extended a further 2½ miles, giving a total length of somewhat over 5 miles. Along the hillsides and for several miles up the valley there is a series of parallel beach lines, scoured by the lap of waves at each high level

* I should here like to pay a tribute to the triangulation of Mr. Grant Peterkin, of the Workman expedition. His points were easily recognizable from the north.

of the lake, and which appear as though some one has been scratching contours on the slopes. These lines must give the high-water marks of the lake in different years, and are therefore a measure of the height of the glacier dam and to some extent of the fluctuation of the snout. There is no doubt that the dam has been considerably higher than it is at present, as can be seen from the beach-lines, and when it was so the snout must have turned down the valley. It has certainly worn down the cliffs opposite, carried away the *débris* from the mountains above, and is still polishing the marble. It is, however, impossible to say definitely whether the glacier is advancing or retreating.*

The Shaksgam below the Kyagar Glacier.—The cliff against which the Kyagar snout impinges is the visible termination of a long range of red marble, extending in a north-west direction, and carrying peaks some of which exceed a height of 22,000 feet. The Shaksgam, continuing on approximately the same course as before, therefore deserts this wall, which at a distance of 6 miles from the Kyagar snout is replaced by another enclosing ridge bounding the valley on the north. This appears as an "island ridge" from the hills east of the Kyagar glacier, and rises in one place to 23,000 feet. It also has a north-west to south-east trend, and between it and the red marble range, which we used to refer to as the "Red Wall," a new north-west to south-east valley is disclosed. The Shaksgam river, however, now begins to bend to take a parallel alignment, and must eventually cut across the line of the "island ridge."

The course of the Shaksgam from the source by Pass "G" was accurately surveyed as far as the beginning of the island ridge. From here the planetable fixings were not sufficiently far apart to give good intersections, and the work cannot be considered of the same standard of accuracy, though it is hoped that the Wild photographs will improve it in this respect.

Beyond the bend north-westwards the river must lie between the ground surveyed by the Duke of the Abruzzi in 1909 and that surveyed by us. The gap between the two surveys is only 6 miles wide, and as the latitudes of Sir Francis Younghusband have never been questioned, the position of the river can be placed on the map with very little margin for error. It is now possible, therefore, to insert the snouts of the Urdok and Gasherbrum glaciers.

The south boundary of the Shaksgam valley may be considered as the line of the great peaks—K_2, the Gasherbrums, Teram Kangri—but this watershed is more distant than the "Red Wall" on the north. The spurs projecting from the northern rim of the Rimo and from Teram Kangri have a north-west trend, and I believe that it will be found that the glaciers farther west, *i.e.* the Urdok and the one from the Teram Kangri, have a similar course.

A glance at the survey will show at once this curious north-west to south-east trend of the main features. Even the smaller tributaries on the north bank of the Shaksgam, east of the Kyagar snout, flow south-east and then bend right round to join the Shaksgam in a westerly direction. It appears at once as though the Shaksgam river is cutting a course diagonally across these ridges.

* An interesting parallel to this lake occurred in 1926 in the upper Shyok behind the Kumdan glacier. The glacier burst early in November, and the pent-up waters swept down the Shyok, damaging the valley for a distance of 300 miles and destroying the suspension bridge of Tirit and the village of Deskit, near the Nubra junction. The waters must have been confined in the Shyok gorge below the junction, for they flooded *up* the Nubra valley to beyond Panamik, where some caravans were destroyed. Dr. Longstaff gives the results of his investigations concerning previous blocking of the upper Shyok valley by the Kumdan and Aktash glaciers in the *Geographical Journal*, vol. 35, 1910, p. 649.

The Aghil Range.—When the party transferred its base to the head of the Lungmo-chhe, the watershed was crossed at the Marpo La. To the north-west stretched a group of peaks over 21,000 feet in altitude, and these were again seen later and surveyed from the head of the Sa-Kang La glaciers. This group, also of red marble, with some red boulder conglomerate, extends north-west and borders the Sa Lungpa valley on its south-west side. The axis is parallel to that of the Shaksgam "Red Wall," but separated from the latter by at least one subsidiary glacial trough. The two branches of the Sa Lungpa, from south-east and north-west, meet in the north-east boundary of the range, cut through it in a south-westerly direction, collecting the drainage of the glacial troughs, and, as far as we could see from hills at the head of the gorge, the whole appears to be thrust against the "Red Wall" and forced north-west. It seems highly probable that it is only separated from the Shaksgam by the "Red Wall," and eventually becomes the Zug-Shaksgam, which we explored from the Kalmuk Lungpa.

To sum up: The range bordering the Shaksgam on the north—part of the Aghil range of Sir Francis Younghusband—may therefore be described briefly as a chain comprising three and possibly four axes of crystalline limestone, parallel to each other and with a north-west to south-east trend. It carries a number of peaks above 22,000 feet and one at least above 23,000 feet.

The Head of the Lungmo-chhe and the Sa Lungpa.—The trough of the Sa-Lungpa and of the northern source of the Lungmo-chhe also lies parallel to the prevailing trend, and this trend is now seen to conform to the strike of the rocks, which are stratified and which yielded fossils. But the drainage is far less regular, for the Lungmo-chhe drains into the Yarkand river, and thence past Khufelang, while the Sa Lungpa cuts a gorge into the Aghil range, and must eventually join the Shaksgam river. The Sa Lungpa trough is also very different from that of the Lungmo-chhe in other respects. The latter is conspicuously fertile for this part of the world, and contains plenty of grass and burtsa, while the Sa Lungpa goes to the other extreme and is the acme of desolation.

The north-western of the two saddle glaciers of the Sa-Kang La extends right across the valley, definitely blocking it and forming the south-east source of the Sa Lungpa. The north-west branch of the Sa Lungpa has two sources: one from a glacier lying on a ridge of the Aghil range, and the other draining through a gorge from the Aghil Depsang. The trough is continued beyond the glacier source by the deep valley of the Kalmuk Lungpa.

I have said above that the Sa Lungpa must find an outlet eventually into the Shaksgam. I believe that the Zug-Shaksgam is actually the lower course of the Sa Lungpa; and to my mind there is no doubt that this river must join the Shaksgam somewhere below Durbin Jangal, owing to the altitude to which we followed it. Yet it is curious that Sir Francis did not record any tributary, and I can only suggest that the Zug-Shaksgam becomes confined in a gorge before reaching the main river.*

The Country north of the Lungmo-chhe and Sa Lungpa.—The country north

* Sir Francis Younghusband has very kindly allowed me to examine his original journal written on 12 September 1889. He writes: "... Nothing particular to note on march, and I have been very busy fixing my position accurately with regard to the main range, and have no time to write."

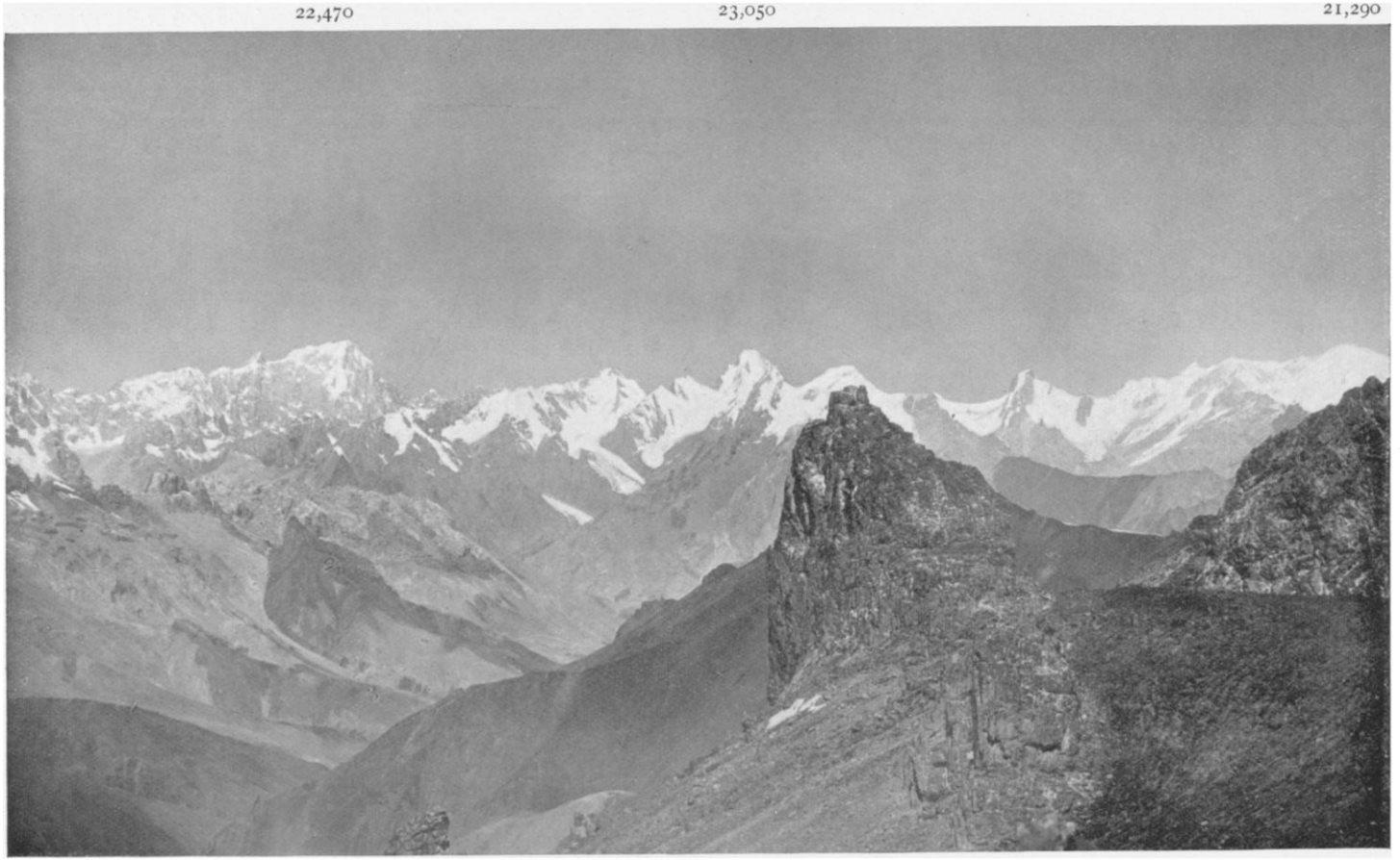
His rough chalk sketch-map, however, does show a tributary entering the right bank of the Shaksgam between Kulan Jilga and Durbin Jangal; I believe this will be found to be Zug-Shaksgam.

of the Lungmo-chhe is much more worn than that to the south, being of a softer limestone and very much crushed shale. But here too there are traces of the same north-west to south-east trend. The ranges are not so continuous, and are frequently cut by gorges. The barren country between Wood's "I" valley (Lungmo-chhe) and his "J" was, contrary to expectations, found to drain into "J" valley. Wood's party was only in this valley for a very short time, throughout which it experienced continuous bad weather. It is therefore hardly to be wondered at that the surveyor did not get the drainage of this basin quite correctly. The five points ascended on the watershed north of the Lungmo-chhe by members of my party, together with the reconnaissances of Major Clifford and Captain Cave down the gorges to "J" valley, leave no doubt that Khan Sahib Afraz Gul Khan has drawn this area correctly, though, as he did not actually see the valley bottoms owing to the gorges, the contours have been shown by broken lines. This country is almost as barren as the Sa Lungpa, and probably more so than "J" valley, for burtsa was found in a side valley close to the latter.

The Aghil Depsang.—It has been recorded with what surprise my party discovered the Aghil Depsang. After toiling along the barren Sa Lungpa, trying to find an outlet to the Shaksgam, being saturated with ideas of the general trend of the country, nothing was more unexpected than a high open plateau. The greater part of this plateau drains into "J" valley, giving it a very large basin. The strike of all outcrops of rock which were measured followed a south-east to north-west trend, but today the ranges across the plateau, if they ever existed, have been completely worn down, and it seems to me that they were never of any great significance.

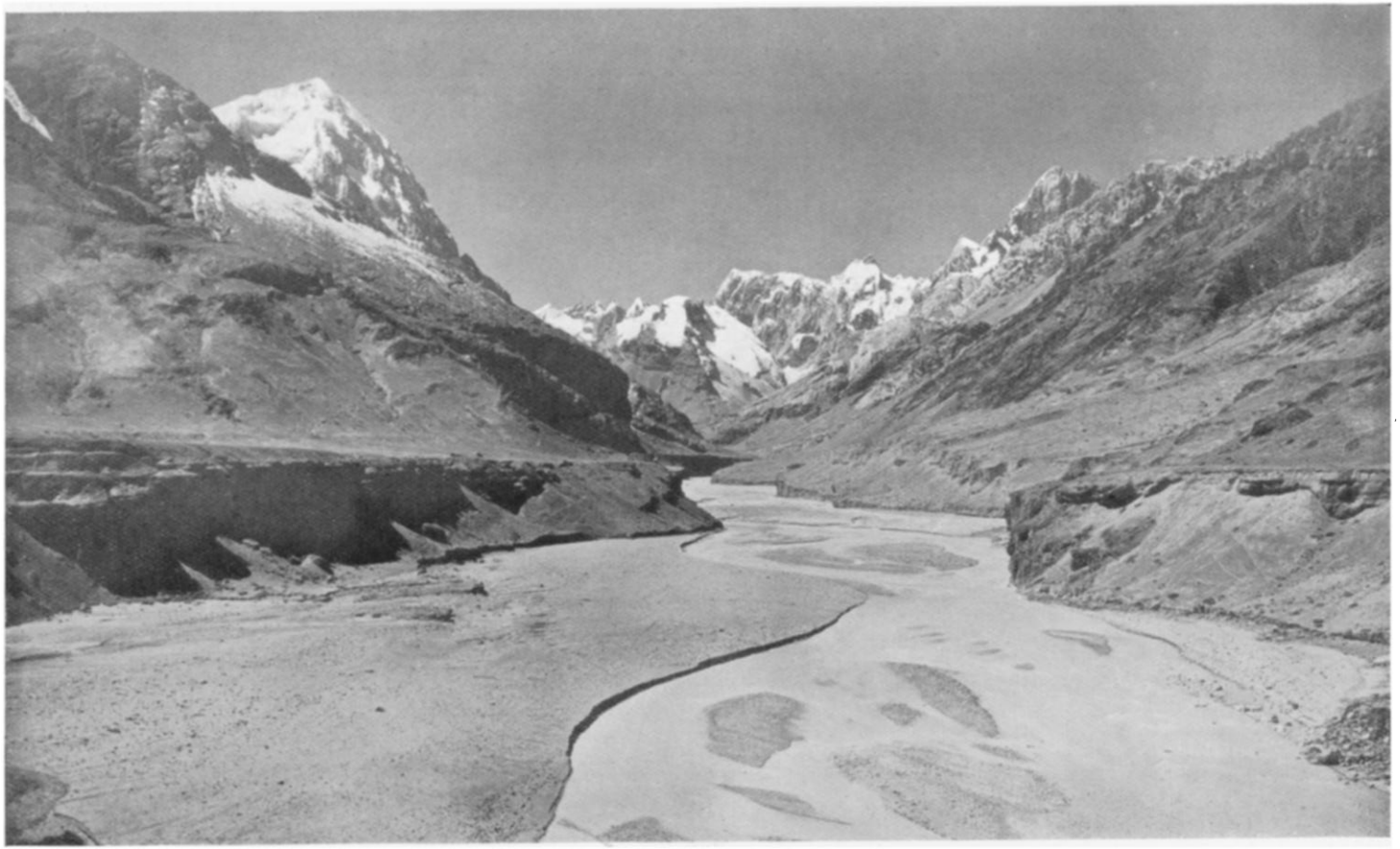
The Aghil Depsang is about 7 miles from north to south, and about 5 miles from east to west; it is therefore somewhat smaller than the Depsang south of the Karakoram pass. But the similarity between the two is very remarkable. Both have the same broken stony surface, with "squelchy" river-beds; both have isolated hills of *débris* and disintegrating limestone; the drainage of both is from their west margins across the plains, and not from a central watershed. Both give a scanty grass, apparently identical, but no burtsa; for both are at the same altitude, 17,500 feet above sea-level. Both can be very hot in summer sunshine, or perishing cold with bitter winds drawn to the warming area from regions of ice; and to both the female antelope brings her young, away from wolves and other molestation. To the west of each there is a range, the features of which are remarkably alike. But there is one difference: in the region of the Depsang, the Kizil Lunga has captured the drainage of the glaciers; while at present, the Sa Lungpa has not yet cut back far enough to take much of the waters of the Aghil Depsang. This difference is, I believe, due to the later retention of the icecap on the latter, remains of which are to be seen in the form of great "crawler" glaciers stretching on to the plateau. Yet these last appeared to me to be retreating, for young gorges are now being cut in the soft rock by the glacier waters, and it may not be long, geologically speaking, when the last dissimilarity vanishes.

The "Red Range."—Before passing to a consideration of the ranges as a whole, it appears desirable to mention the "Red Range." Colonel Wood records its existence north of "J" valley, and states that he observed it extending for some distance on both sides of the Yarkand river. For some distance of its length he surveyed it. We never had an opportunity of visiting it, but it was a conspicuous feature from many of our stations. It appeared to us to extend as far as Bazar-dara, and in a south-westerly direction we observed it on



10 *The Shaksgam–Zug-Shaksgam divide from the Tatar La*

*From Station W*15



11. *Looking up the Zug-Shaksgam towards its Gorge*
From lat. 36° 00′ 56″, *long.* 76° 52′ 47″

both sides of the Yarkand river, making roughly in the direction of Balti Brangsa. This is of interest, for I received a letter from Colonel Wood during my journey back, in which he writes :

> " The Red Range is, I feel pretty sure, a watershed, and I think that it and the range just west of the Yarkand river and continuing south-east are one. The Yarkand cuts through it, just north of " J," and the other branch of the Yarkand river, which starts from the Karakoram pass and along which runs the trade-route, cuts through it between Balti Brangsa and Baksam Bulak. . . ."

This was written quite independently of our observations, which are however, in entire agreement with it. I am uncertain how far to the south-east this range extends, for no modern survey has been made beyond longitude 78° 15′. Nevertheless, on our return journey across the Depsang plains I could see distinct traces of what appeared to be the same red range north-east of the Chipchap.

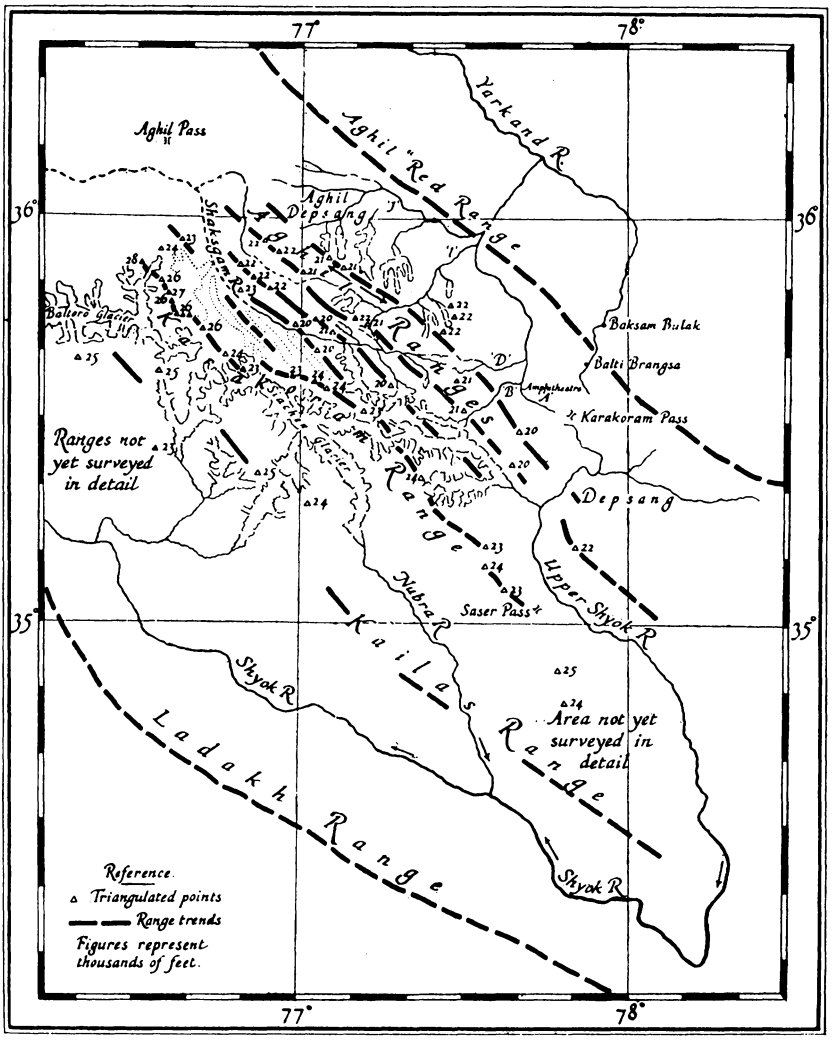
After considering this " Red Range " in connection with the " Red Wall," I am inclined to include it among the " Aghil mountains." The width of the Aghil range embraces both and comprises the several parallel ridges described above.

Extension of the Aghil Range.—Having established the general trend of the ranges and ridges in the area of our survey, it was natural to try and follow the extension in both directions. North-west of us this was not easy, for the country was cut across by the large river, the Zug-Shaksgam, which eventually held us up at the end of August. But I am of opinion—and this is rather in the nature of a guess—that either the Shaksgam " Red Wall " or the " Island Ridge," may be originally an extension of the north-west to south-east range seen by and photo-surveyed by the Duke of the Abruzzi's party from " Windy Gap." If this is the case, the main Shaksgam cuts through these outer walls. Whether it penetrates the whole of the crystalline core of the Aghil range, and passes between it and the stratified alignment further north, can only be decided by further exploration. If it does, and from the sketches of Sir Francis it appears most probable, then the course after the westward bend will be found to lie in a continuation of the Sa Lungpa–Kalmuk Lungpa trough.

It was the south-eastern prolongation of the Aghil chain that afforded the most interesting results. The Shaksgam " Red Wall " is almost certainly continued along the southern watershed of Wood's " H " valley, towards Pass " G," and I should not hesitate to place its continuation along the northern watershed of the Rimo glacier. There is a marked geographical and structural similarity between the Depsang peaks and those on the south-west border of the Sa Lungpa, and the Burtsa river cuts a gorge through the range above Murgo, remarkably similar to the gorge of the Sa Lungpa, which checked us early in August. The walls of the two gorges appeared to me to be of identically the same rock, and the towering peaks are of very much the same appearance. The Sa Lungpa gorge is certainly much narrower and more difficult, but this I think would be explained by the smaller rainfall and consequently slower rate of erosion.

I am in my own mind quite convinced that the Aghil range as a whole, and very probably its component ridges as well, can be traced south-eastwards from longitude 77°, north of the Rimo, through the Depsang peaks and plateau to the gorge above Murgo, and possibly beyond. The similarity of the two Depsangs, and the discovery of marine fossils along a line parallel to the trend, though perhaps no definite argument in themselves, strongly support this theory.

The Karakoram Range.—This conception of the Aghil range must necessarily change the old one of the Karakoram bending through the alignment of the Karakoram pass. I am unfortunately not acquainted with the southern aspects of the great peaks of this range from close quarters, but they have been amply described by Sir Martin Conway, Sir F. De Filippi, Dr. Longstaff, and



The Trend of the Aghil Ranges

the Workmans. As I have mentioned earlier, there are some very great peaks, culminating in one of 25,000 feet, on the Shyok–Nubra watershed, imperfectly surveyed it is true, but exhibiting very marked points of similarity to K_2, the "Broad Peak," and Teram Kangri. There are no peaks attaining this altitude or bearing the same visible points of similarity, perhaps the most striking of which is the association of a granite core with crystalline limestone, on the range

described above as the Aghil. Godwin Austin has suggested that this association of granite and limestone occurs in K_2; De Filippi has reported the same in the case of "Broad Peak"; and both Dr. Longstaff and the Workmans have recorded limestone near the head of the Siachen glacier. We observed the same in the neighbourhood of the Saser pass—a fundamental basis of granite, but associated with limestone.

From a glance at the map as a whole, insufficient though certain parts of the survey are from a modern aspect, it is apparent that a very high watershed between the upper Shyok and Nubra extends from the Saser pass north-westwards to the head of the Rimo glacier and thence to Teram Kangri. Major M. L. A. Gompertz, who was surveying in the neighbourhood of the Saser pass this year, also formed the same opinion independently that this watershed is the Karakoram range. One particular point of interest in connection with his work is his surmise that there is a large glacier beyond the head of the Mamostong,* draining westwards or north-westwards into the Nubra, and not towards the upper Shyok, as has been generally supposed.

There is one further argument, small in itself, but with some weight if added to the rest. The type of glacier beyond the Saser range is similar to that beyond the Karakoram. All are of the strange "pinnacled" type. But the first large glacier encountered west of the Saser pass—the Mamostong—is the usual type of cis-Karakoram glacier, blackened and flat.

How far the Nubra–Shyok watershed can be considered as an extension of the Karakoram it is impossible to say at present. My own belief is that the upper Shyok cuts through it below Kataklik; but a modern survey of this whole watershed is necessary before this point can be settled. It is however obvious that if the foregoing conception of the Karakoram be accepted, the pass of that name lies many miles from it, and some revision of nomenclature appears to be desirable.

The Ancient Route.—One of the questions we were especially anxious to investigate was that of an ancient route across the area surveyed. There are many references to this route, and I cannot do better than refer the reader to the appendix to Colonel Wood's report. Practically every traveller to these parts has heard the tradition of an ancient pass between the Nubra or Skardu and Khufelang. This pass, if it existed, must have been west of the Karakoram pass, and east of K_2. The references are now so numerous that, difficult though the country is, they can hardly be ignored. Before starting I had read all the notices of the route that I was able to find, and can add only one of any interest to the list of Colonel Wood. It is from a serious native route report of the last century:

> "Another stream called the Yarma or Nobra flows from above the Changlung, which was anciently traversed by a route to Khapulung. This route was closed by the people of Nobra, who, by throwing in of charcoal, helped the formation of iceblocks, which obstructed the passage altogether."

Although we failed to resurrect the lost art of making 45 miles of ice by means of charcoal, and although all inquiries in Leh, in Nubra, and among traders, with one exception, led to nothing tangible, I for one felt almost certain that we should find traces of an old route in continuation of the cairns dis-

* This glacier is wrongly named "Murgisthang" on maps. See Note on Names at end.

covered by Vigne, Longstaff, and the Workmans. The one exception referred to above was an old trader in Leh who had a story that "a rajah's caravan" had attempted to penetrate by that way, and had completely disappeared; but that adventurous spirits would sometimes go forth in search of his treasure. None, however, came back to tell their tale.

Actually we found no traces of treasure or travel, ancient or modern, except the body of a man. But though I believe this corpse to have been a straggler from the caravan route, at least four marches distant, and though the saddlebag discovered by Wood may have the same interpretation, I still believe that it is possible there was an ancient way by which a few people, possibly "Kalmuk Tatars," robbers or fugitives from justice, might have migrated or escaped. If they did so they must have selected October, for this would be the only month when they could get through the gorge above Khufelang, up the enclosed valleys and gorges of "J," over the Aghil Depsang and Tatar La, across the Shaksgam and its tributaries, and still be fit and ready to tackle the glaciers and passes of the Karakoram before cold and exposure would exterminate them. I do not consider there is any possibility of their having travelled up the Lungmo-chhe, for there are too many difficulties in the matter of finding a route from it, whereas "J" valley, though barren, leads directly to the Tatar La. Any party must have suffered great hardships, but it would probably be independent of cooked food, and hardships were presumably in the daily nature of things. But I am absolutely certain that the through route has not been used for a very great number of years.

It is of course possible that we missed some traces of human passage. In a country where all nature is on strike, it is possible that fireplaces may be few and far between. Nevertheless from the time we left the trade route towards the end of June until the time we struck it again towards the end of September, the sole signs of human occupation were the blackened stones of Wood's camp fires in the Yarkand valley and the Lungmo-chhe and the corpse of a single stranger.

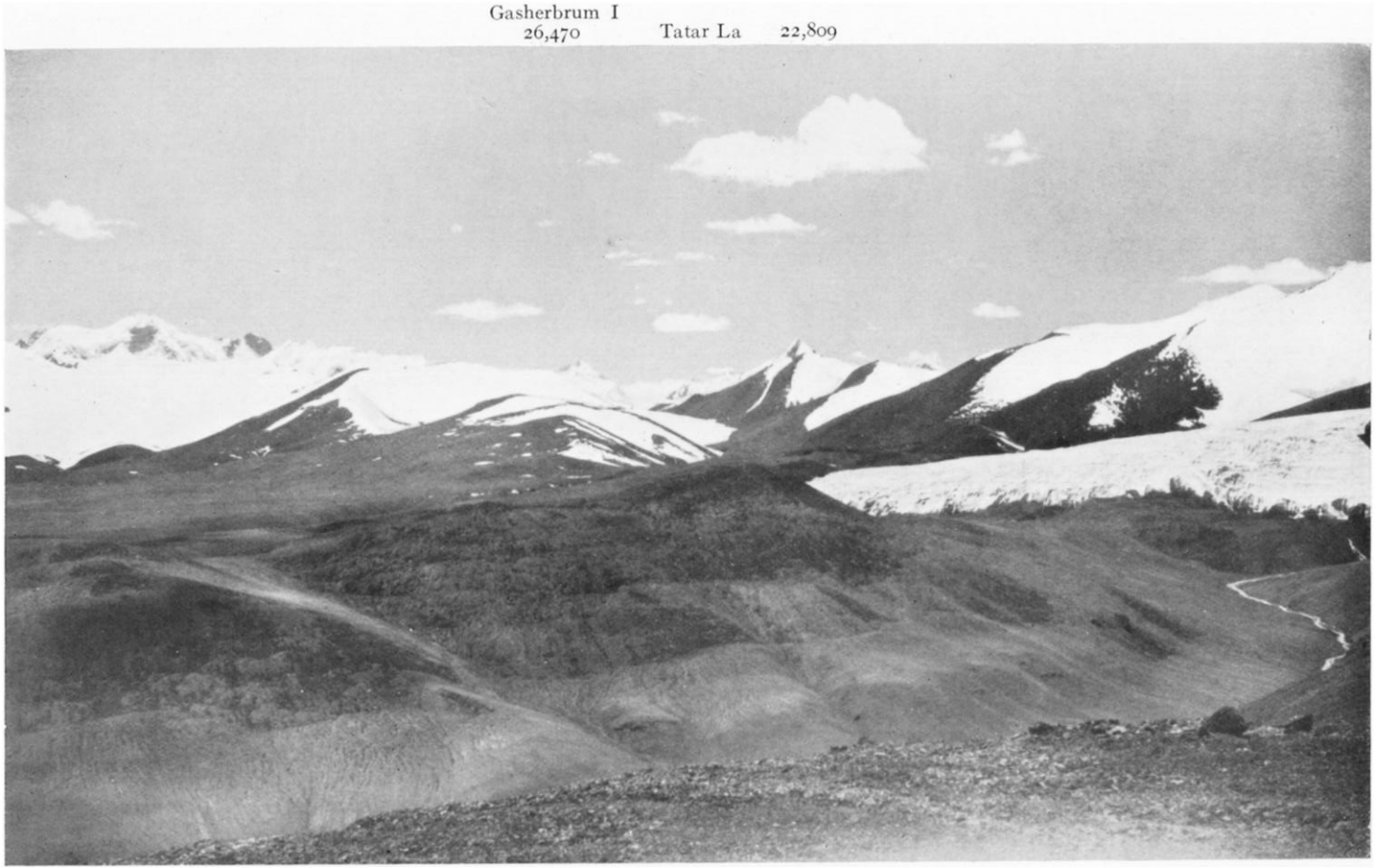
Area left to be Surveyed.—We do not claim that there is now no survey work left to be done. But I think we have accomplished all that is possible during the summer months, at any rate from this side, except perhaps in the north-west corner of "J" valley to the "Red Range" of Wood, and the high massif at the head of "D." There is also the survey to the north of the "Red Range," into which area we were not allowed to go. But the rest of the blank must be filled in by a party taking either the Aghil pass with animal transport, or the Shingshal with porters on foot. In both cases the so-called "open" season is closed, and the cold weather must be the time selected. Whether the late autumn or early spring is best for the passage into the area, I am unable to say, for it seems to me to depend entirely on the time of the finest weather. But I think, if I was to go again, I should winter in Gilgit, cross the Shingshal early in February, survey the Shaksgam valley first and the great tributary glaciers after the spring avalanches have fallen and before June; it would then be possible to get clear of the rivers before the summer floods.

NOTE ON NAMES

Colonel Burrard remarks in his 'Sketch of the Geography of the Himalaya': "The nomenclature of a mountain region should not be forced: it should grow spontaneously, and we should never invent a name until its absence has become inconvenient." In the area of our explorations there were but two names in existence, the Shaksgam valley and the Aghil range; and neither

12. *The Red Wall and the Island Ridge, Aghil Range*

From Station W6



13. *The Aghil Depsang and the Tatar La*

*From Station W*14

of these was known to any of our men. The absence of names *was* inconvenient, and something had to be done about it.

Colonel Wood's system on our east margin was to employ the alphabet: though he expressly stated that the letters he used were to be considered provisional, in all the correspondence before our expedition these letters had to be used. The tendency is therefore for provisional names, however one may wish to the contrary, to become permanent. Such is the case with K_2, the second highest mountain in the world: the symbol was used first in Colonel Montgomerie's angle book, and it has permanently remained.

Our own system was an attempt to follow Colonel Burrard's principle; and we encouraged our men to name places. It is interesting to note that they never named a single mountain, and the names they gave to passes and valleys had to be dragged out of them. I am however convinced that these names do mean something to them, which the alphabet does not. On our return to Leh, we called one of our men before Mr. Kunick and one of his native pastors of the Moravian Mission. Each name was reconsidered, and its derivation and suitability investigated. The resulting names are given below. All are in Ladakhi, which is a dialect of Tibetan. I would add that along the trade route, both Ladakhi and Turki names are used indiscriminately, and I am adding at the end some of the Ladakhi names used on the trade route, with their meanings, as far as we could ascertain.

(*a*) *Ladakhi names applied to the area of our explorations.*

Kyagar Thso, "The grey white lake." (Deriv. *Kya* or *skya*, grey; *gar* or *kar*, white.)

Kyagar Kangri, "The Kyagar Glacier." The word *Kang-ri* means "ice mountain." To the uneducated native mind, a large glacier is an ice mountain, and the peak at its head merely a protuberance at one end of the mountain. As Kang-ri is used by educated Tibetans and Europeans to denote mountains and not glaciers (*e.g.* Aling Kangri, Teram Kangri), it would lead to confusion if we were to use "Kyagar Kangri" for the glacier. I therefore use the expression "Kyagar glacier." (In this connection, the old name for the Siachen glacier is "Saichar Ghainri." I believe this is really "Siachen Kangri," which was the name given me in Panamik for this glacier.)

Marpo La, "The Red Pass." (Deriv. *Marpo*, Red.)

Lungpa Marpo, "The Red Ravine" or "valley." *Lungpa* is placed first by the men for euphony.

Lungmo-chhe, "The Big Valley." (The word "*chhe*" is a suffix, derived from "*chhenmo*," meaning "big." Strictly the valley should probably be "*Lungpa chhenmo*." But for euphony, we were told, a Ladakhi would always use the suffix, and convert the noun into its feminine form.) This is Wood's "Valley I."

Sa-Kang La, "The Earth and Ice Pass." (Deriv. *Sa*, earth; *Kang*, ice.) This pass, at the head of the Lungmo-chhe, consists of two convergent saddle glaciers whose snouts join, but whose trunks are separated by a tongue of land.

Sa Lungpa, "The Valley of Earth," or "mud." As already noted, the slopes and valley bottom were covered with a layer of mud.

Shaksgam itself appears to mean either "the Box of Pebbles," or "the Dry Pebbles." (Deriv. *Shak*(*ma*), pebbles; *Gam* or *sgam*, box, or possibly *kam* or *skam*, dry.)

Zug-Shaksgam, "The False Shaksgam."

Dizma La. *Dizma* seems to mean "many coloured." The rocks on this pass were of a mauve and violet tint.

Kadpa-ngonpo La, "The Blue Rift Pass." (Deriv. *Kadpa*, rift or quarry; *Ngonpo*, blue.) This pass lies close to the Karakoram pass and at the head of Wood's "Valley A." Near the pass there is a blue scar from a fall of the hillside. I *suggest* the word *Lungpa Ngonpo* ("the blue valley") for "Valley A."

The Aghil Depsang, the Tatar Lungpa, the Tatar La, and the Kalmuk Lungpa were named by us without reference to our men.

(*b*) *Names on the trade route.*

Pang-dang-sa, "The grassy plain." (Deriv. *Pang* or *Spang*, turf; *dang* or *thang*, plain; *sa*, earth, ground.) A camping-ground for caravans west of the Saser pass.

Skyangpo-chhe, "The great wild ass." (Deriv. *Skyang* or *Kyang*, wild ass; *-po*, male; *-chhe*, big, *see above under* Lungmo-chhe.) A camping-ground west of the Saser pass.

Mamo-stong, "The thousand demons." (The spelling on old maps *Murgis-thang* seems to me to be incorrect. We were told that a legend existed that a large number of "bad men" from Central Asia were killed by an avalanche on the Mamostong glacier, and that the derivation was *Mamo*, demons; *stong*, thousand.)

Ang-gar-shak. Meaning doubtful; derivation seems to be *Ang*(*gyag*), junction of ice and the mountain side; *gar* or *kar*(*po*), white; *shak*(*ma*), pebbles. The meaning may be "a moraine," for the trade route here traverses a moraine west of the Saser pass.

Bong-ro-chan, "The Place of the Dead Ass." (Deriv. *Bong*(*bu*), a baggage ass; *ro*, a corpse; *chan*, having.) A locality just west of the Saser pass.

Sa-ser, "Yellow Ground." (Deriv. *sa*, earth, ground; *ser*, yellow.) The name is given first to a spot in the upper Shyok, and from this the pass becomes the "Saser La."

Depsang, "The Open Plateau." (Deriv. *Deps* or *Ldeps*, elevated plain; *sang* or *sangsang*, open, clear.)

The spelling for the glacier explored by the De Filippi expedition should, I think, be "Rimo," not "Remo." There appears to be no word in either Turki or Ladakhi, with the *Raymo* sound. *Rimo*, in Ladakhi means either a picture, band, or stripe. It is just possible that the word may be some derivative of the word *Ri*, a mountain; but we were told that in such a case, the word would probably be something like "*Rimo-ri*." I cannot explain why. The word *Rimo* is a very common one in Ladakhi, in the sense, "a picture." Most of the assistants in the Survey of India at the time of the Kashmir survey, 1855–1864, spelt the names exactly as they sounded in English; if this was the case with "Remo," this should now be spelt "Rimo."

The Ladakhi does not seem to have a great number of topographical terms in common use; and he does not appear to discriminate much between a ravine and an open valley. He seems more concerned with how the word appears to his sense of hearing. He may use the word *Trokpo*, which seems to mean literally a mountain brook, for quite a large side tributary; and he will use the word *Lungpa* (or its feminine form, *Lungmo*, if he chooses), which is more strictly a fairly large side valley, to denote a brook. The word *Lartsa*, which means literally "the foot of a pass," is generally used for the *camping-ground* at the foot. But *Pulo*, which actually means a "shelter hut," seems to be used just as often, regardless of whether there is a hut or not. *Brangsa*, a

" camping-ground," is also somewhat loosely used in the same connection, but more often away from the immediate vicinity of passes.

NOTE ON THE MAP

The map reproduced with this paper is a reduction of the planetable survey by Khan Sahib Afraz Gul Khan of the Survey of India on the scale of 1 inch = 2 miles. This survey was based on triangulation by Major Mason with the Wild photo-theodolite. The stations of the trigonometrical survey were resected from uncairned peaks triangulated by Colonel Montgomerie, Grant Peterkin (Workman expedition, 1912), Colonel Wood, and Commander Alessio (De Filippi expedition, 1914).

The Karakoram watershed on the south and south-west is from surveys by the Workman expedition (Siachen glacier) and the Abruzzi expedition, 1909 (Baltoro glacier head, K_2, the Gasherbrums). The Yarkand river on the east and north, and the lower part of "valley J" are from Colonel Wood's surveys with the De Filippi expedition.

The pioneer work of Sir Francis Younghusband has been shown in broken lines, with parallels showing his observed latitudes. When the Wild stereo-photographs have been worked up, more detail in the Shaksgam valley, and some of the northern spurs from the Karakoram range will be shown.

DISCUSSION

Before the Paper the PRESIDENT, after referring to the loss the Society had sustained in the death of Sir John Scott Keltie, said: To-night we are met to hear the report of the successful issue of an unusually important expedition in which this Society can claim to have had a share: it gave considerable help to that expedition and provided some of the most essential equipment. Some particular results of an instrument which this Society provided you will see upon the screen to-night, and I think that presently you will agree with me that they are among the most remarkable views of mountain scenery that have ever been taken. Major Mason, who is giving us the report, was the leader of the expedition. We have also present one other member of it, Major Clifford. We are sorry that the two other British officers are still overseas. Major Mason, who has carried this expedition through under very arduous circumstances in a country which is as remote from human habitation, apparently, as anything in the Old World—I rather fancy that he and his expedition were the only inhabitants of the particular Himalayan valleys into which they penetrated—will give us the authoritative account, necessarily curtailed by the necessity of keeping within bounds of time and also of not attempting to give too much detail by oral delivery. His full report will be published later in the pages of the *Geographical Journal*. I will now ask Major Mason to give you the report of which I speak.

Major Mason then read extracts from the paper printed above, and a discussion followed.

Sir FRANCIS YOUNGHUSBAND: In case I forget to do so later, I must commence by associating myself with all that Major Mason has said as regards the splendid work of the Ladakhi coolies he had with him. No one who has undertaken explorations in those parts can fail to understand how much he is indebted to those men upon whom, fundamentally, the whole success of the expedition depends. It is a great delight to me to know that the fine old

KARAKORAM HIMALAYA

Preliminary Map of the

SHAKSGAM VALLEY & AGHIL RANGE

1926

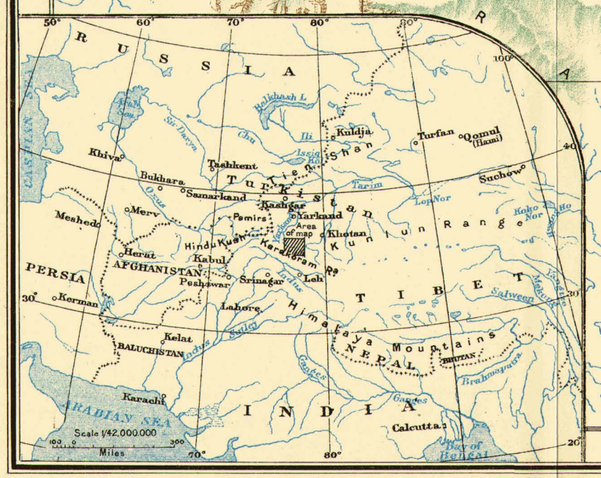
Scale 1/250,000

5 0 5 10

Miles

This map has been drawn from the half inch Surveys of Khan Sahib Afraz Gul Khan, Survey of India. For further information see Major Mason's note at the end of his paper. Approximate contours are at 500 ft. vertical interval.

△ *Triangulation Stations*
W△ *Wild Camera* „



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SHAKSGAM VALLEY - Mason

40'
50'
Bazār-dara
12550
16000
14000
20'
16000
Surukwat
16000
14000
19680
10'
Aghil Dawan
Kulan Jilga
36° 7' 22"
16000
Shaksgam
21290
23050
Durbin Jangal
36° 2' 0"
14170
36°
22470
20000
18000
16000
Gasherbrum Jilga


77°
10'
20'
YARKAND or RASKAM R.
Bazār dara
KARAKORAM HIMALAYA
Preliminary Map of the
SHAKSGAM VALLEY & AGHIL RANGE
1926
Scale 1/250,000
5 0 5 10
Miles
This map has been drawn from the half inch Surveys of Khan Sahib Afraz Gul Khan, Survey of India. For further information see Major Mason's note at the end of his paper. Approximate contours are at 500 ft. vertical interval.
Δ Triangulation Stations
WΔ Wild Camera ,,
21252
21195
20090
20467
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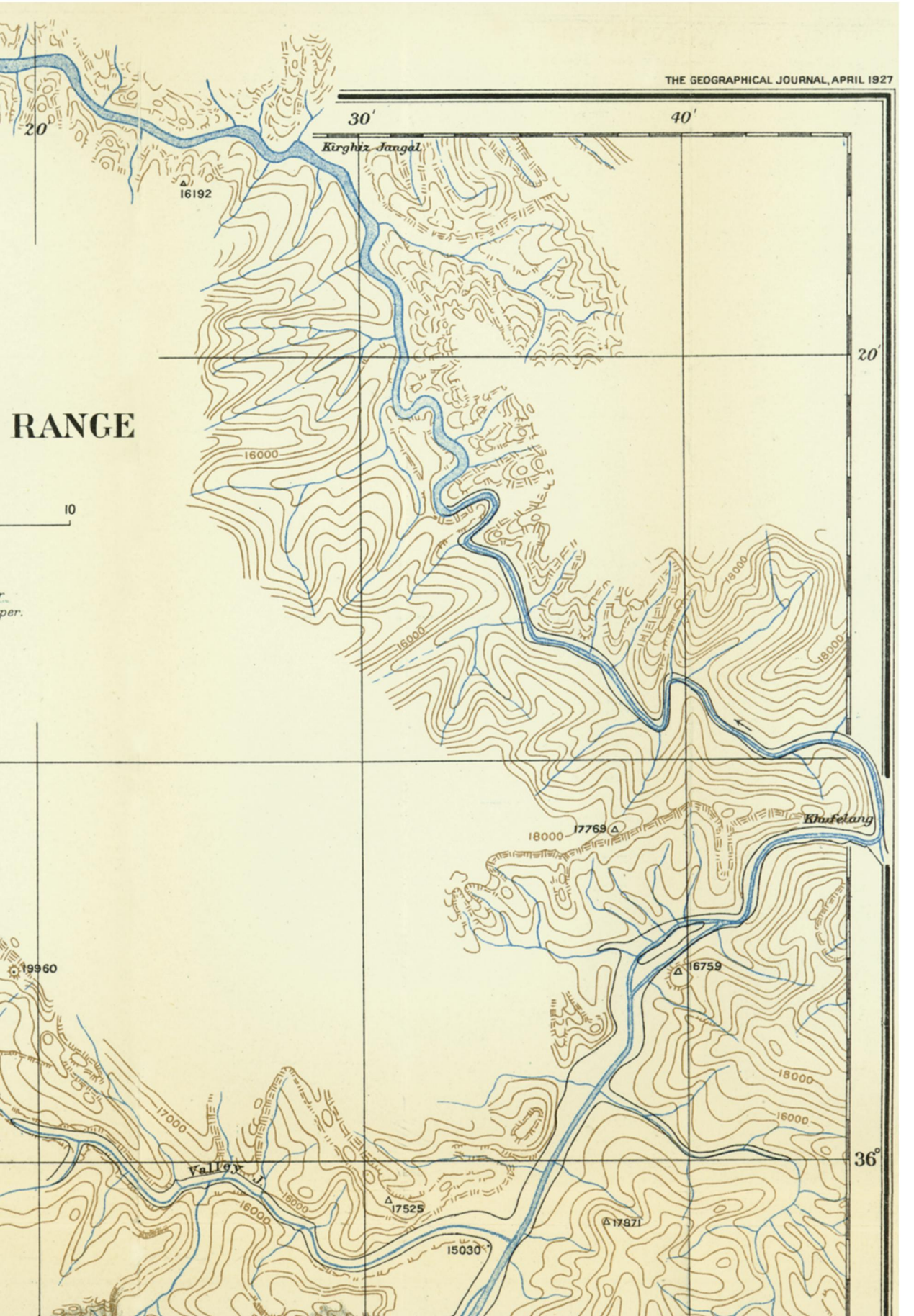
W14Δ
Aghil Depsang
W15Δ
Tatar La
Aghil Depsang La
17400
20780
18250
19960
18969
20600
18000
16000


30'
40'
20'
36°
Kirghiz Jangal
16192
RANGE
10
16000
18000
17769
Khufelang
19960
16759
17000
Valley
17525
17871
15030


36°
50'
Gasherbrum Jilga
35° 56' 5"
Staircase Peak
24080
Windy Gap
20450
K2
28250
26020
Gasherbrum Glacier
Broad Pk
27130
35° 48' 5"
26000 Gasherbrum Pks
26090
26360
35° 45' 45"
Gasherbrum I
(Hidden Pk)
26470
Baltoro Gl.
Urdok Glacier
Shaksgam R.
35° 41' 20"
Turkistan La
19210
20770
Siachen G
22470
22809
22728
22969
22802
23377.
14170
RUSSIA
CASPIAN SEA
Aral Sea
Balkhash L.
Khiva
Bukhara
Tashkent
Samarkand
Kuldja
Ili
Turfan
Qomul (Hami)
Suchow
Kashgar
Yarkand
Khotan
Merv
Meshed
Pamirs
Area of map
Hindu Kush
Kara Koram Ps.
Herat
Kabul
AFGHANISTAN
PERSIA
Peshawar
Srinagar
Leh
Kun Lun Range
Lop Nor
Koko Nor
TIBET
Kerman
Lahore
Himalaya Mountains
Salween
Kelat
BALUCHISTAN
NEPAL
BHUTAN
Karachi
ARABIAN SEA
INDIA
Calcutta
Bay of Bengal
Brahmaputra
Ganges
Scale 1/42,000,000
Miles
50°
60°
70°
80°
90°
100°
40°
30°
20°

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SHAKSGAM VALLEY - Mason

traditions of the Ladakhis, their staunchness and loyalty, are still maintained. They do not help entirely for the sake of pay, because after all what explorers are able to give them does not amount to much. The Ladakhis have a real spirit of adventure. I am quite sure that when any one comes along who is out for a big adventure the Ladakhis are ready enough to join, and it is by appealing to that spirit of adventure that one gets the best work out of them.

Next, I want to say how much this whole expedition owes to Mr. Hinks. Major Mason has alluded to that, but I should like to add my own tribute, because here at this end I have been able to see what Mr. Hinks has done, and I wish particularly to acknowledge the help that he has afforded me. As a help to Major Mason, he looked out many of my old diaries and observation note-books, together with that old map of mine that you saw on the screen, and with his topographical instinct he was able, from a phrase in my diary here, from an observation in my note-book there, and from a tributary on my map—from these various indications to make my simple and rough reconnaissance shine out with a brilliance I never imagined it could have! By such aid he has enabled Major Mason and me to join together in a most unexpected way, much to the delight of us both.

Now I come to Major Mason himself. Well, Major Mason goes back to that day when he was a fine healthy baby a week old and I stood on the Aghil pass and first saw the Shaksgam river and all that magnificent region. Lest any one here should think that I am one hundred years old, I should like to say that I was then only twenty-four—the ideal age for an explorer: for at that age he has no experience and does not know a difficulty when he sees one, the result being that when he comes to a difficulty he sails serenely through it and only when he is safe on the other side discovers that it was one. Very fortunately, I had not to encounter the same difficulties which Major Mason had, because I was only what an American lady explorer once described as a "valley thumper." I went up the valleys and when I came to a range I sneaked over it by the lowest gap I could find. But Major Mason, by the nature of his calling, had to climb the mountains to take observations of the great peaks, and you must have seen from the photographs what immense difficulties he had to contend with. Yet in spite of all those difficulties, and in spite of apparent failure at the very climax of his journey when he had reached the tributary but could not say whether it joined up with the Shaksgam river or not, he did go just far enough to be able to join up not only his accurate survey of the peaks with the surveys of the Duke of the Abruzzi and with the old Survey of India of the K_2 region, but also with that rough reconnaissance of the river valleys which I made in 1887 and 1889. Therefore he successfully accomplished the task on which he set out and which was attended with so much unexpected difficulty. As a result of the work of Major Mason himself, of his indefatigable colleague, the Khan Sahib Afraz Gul, and of the other members of the expedition, we now have an accurate map of that region which joins up with the Duke of the Abruzzi's farthest surveys and just leaves room for my rough reconnaissance of the Shaksgam river in 1889.

And now that that map work is done we can get on in future with the real business of a geographer, which I always consider to be the description of the beauty of the region which he is in. And this particular region is one of the finest in the whole world. The photographs you have seen to-night have given you some idea of it. We generally hear from travellers in such regions as this that it is not possible to describe the beauty of what they have seen, but at any rate Major Mason this evening, with the gallantry of an explorer, has

made some slight attempt to achieve the impossible, and he has given us an idea of what the beauty of K_2 at dawn can be. What I very much hope is that some time just one traveller by himself will go up into that K_2 region and then, with nothing else to think of now he has a map made for him, devote himself entirely to describing either in words or (like the great predecessor of Major Mason in the Survey of India, Colonel Tanner), in pictures what the glories of it are. I do not suppose that in the whole Himalaya, except perhaps in Nepal, where Mount Everest can be seen from the south, is there such a magnificent array of mountain majesty as may be seen in that splendid panorama of peaks—K_2, 28,250 feet; another peak of 27,000 feet; four others of 26,000 feet; and others of 24,000 feet. The distinguishing features are the ruggedness and jaggedness, the austerity and dazzling purity of those mountain summits. And not until we have a description in painting or in words of the beauty of this region will the geography of it be complete.

In conclusion, I should like to say what an immense satisfaction it is to me to feel that the means by which we have been able to join up the rough reconnaissance I made in 1889 with the entirely accurate survey made by Major Mason was by observation of the stars for latitude. I like to feel the stars joined in our minds with those highest mountains. And now, Major Mason, I should like to congratulate you and the officers with you upon the splendid results of your arduous work. I hope you will have many more opportunities of bringing before the Society the beauties and grandeurs of the Himalaya.

Major R. C. CLIFFORD (Indian Medical Service): The lecturer is essentially a geographer and a surveyor and, I think you will agree with me, a photographer. He has mentioned that the valleys through which we were surveying and exploring contained no other inhabitants, but I think he has rather forgotten the animal life which we saw there. All along the Yarkand and its tributaries we came on many herds of antelope, the same Tibetan antelope that exists to the east in the Chang-chhenmo, and in Tibet. I am told that this is interesting because it shows that these antelopes exist much farther west than was previously recorded. Also on the lower slopes of the hills in the valley which Colonel Wood called " I " valley, and which is now named the Lungmo-chhe, there were large herds of burrhel, which were undoubtedly the same species as are found nearer towards India, though heavier in the head than those found towards the Karakoram range. I do not want to start a discussion as to whether there are two kinds of burrhel or not, but we found dead heads of 36 inches, which is an enormous size compared with those which are nowadays shot on the nearer ranges. On the expedition we never saw a live head of more than 28½ inches, but I think this is possibly because we were limited in the extent of our exploration by our funds, which were provided for a special purpose and not for shooting. But should anybody want to go where he can get burrhel very easily and also some very interesting heads of antelope, I advise him to undertake the journey across the Yarkand river into the Lungmo-chhe. The road by the Yarkand river is very easy, once you get over the Saser pass and the Depsang plains. In the Lungmo-chhe valley there are a number of protected spots.

There is another interesting question which I think somebody ought to be able to work out if he can get there earlier than we did. We reached the Yarkand river towards the end of June, which is, I think, too late to see the trek of the herds of wild horses which live up in that part of the world. These animals have made for themselves a regular path along both banks of the Yarkand river, and the contouring of the hills is so level and so extraordinarily

cleverly done by these animals, that if you follow the paths you never get up against a snag; they take you round edges of most extraordinary cliffs and deep depressions which it would take hours to get in and out of, and you can walk along them without thinking for a moment that you will get lost or come up against difficulties. We were, unfortunately, just too late to see these herds of wild horses, but I am sure they come there by their markings, which were quite fresh, and they extend right up near the head of the Lungmo-chhe; but they stop short of the gorge which exists before you get right up into the glaciers which Major Mason showed in his picture at the head of the valley.

The rest of the fauna are a sort of mouse-hare, quite common in other parts of the Himalayan regions, and a certain number of birds. We came across birds which are represented in India and in the higher Himalayas by almost identical types, such as the wagtail and finches of various kinds. These have been collected to some extent by various people in that part of the world, and I suppose it will be of interest for these bird collectors to know that Captain Cave has made a very thorough collection of one, if not two, specimens of every type of bird seen. The only bird he did not collect was the duck—much too valuable for other purposes!

So far as the insect life went, I am afraid it was very disappointing. Major Minchinton, among his other duties, chased a few butterflies up and down the hills when he saw them—the heights were somewhat extreme for such exercises—and in the earlier part of the expedition a few of the commoner butterflies were caught. Other insects there were none, except large numbers of black spiders. We tried to work out the derivation of the word Karakoram. We knew "Kara" meant black and that "koram" means gravel. But I tried to prove it meant spiders, because there are so many black spiders there.

The bird and animal life is absolutely interdependent. I saw a remarkable incident when I was sitting at a certain height to which I had followed a very fine specimen of antelope. Suddenly I saw a movement on a rock. At first I could not make out what it was, but after watching carefully I saw it was a huge eagle. Suddenly it made a dash for the base of another rock. Then I heard a squeal. The eagle tried to rise, and on going closer I saw it had rather a large specimen of a mouse-hare by the back. It had its claws into it and was trying to pick it up, but the rock was in the way, and the mouse-hare had turned on the eagle and held it by one of its outer feathers. Suddenly the feather pulled out, and up went the eagle and the mouse-hare with it. The winter brings heavy snow and the animals all take shelter. There are signs and markings of different species in the same spot. One side had sheltered wolves, the other side burrhel; it was all there for any one who cared to read.

The only living thing that appears to be unable to depend upon the other living things in those parts is man. He must go up there supplied with everything, and it is to Major Mason's everlasting credit that we were able to be quite independent of the animal life there, because he made most wonderful arrangements. We had all our food put away in boxes, and we were a self-contained party and able to divide up at a moment's notice. It was all through him. I have never enjoyed an expedition so much, thanks to the wonderful arrangements Major Mason made. Nothing could have been done more economically or efficiently, and if the expedition has in any way failed to get the ultimate results that were hoped for by Major Mason and its members, it is certainly no fault of his. I thank you very much for having given me an opportunity of congratulating him on such a fine show.

Colonel H. WOOD (Survey of India): I should like to unite with Sir Francis

Younghusband in congratulating Major Mason and his companions on the conclusion of a very fine piece of exploration, and to thank him for his very interesting lecture and also for the really extraordinarily beautiful slides of mountain scenery that he has shown us. The country which he has been describing is of peculiar interest to us in India, because it is probably the only part of the frontier of India which is still entirely unknown. Major Mason has added a great deal to our knowledge, but there remains a goodly portion about which we really know absolutely nothing. As Sir Francis has said, the district probably contains the finest group of mountains of any similar area in the world. I have had the good fortune at various times to pass along the north side of practically the whole of the Himalayas, a side which is not very often seen, but from where one gets better views than from anywhere else, and I certainly have never seen such scenery as one finds in the Karakorams. The fact that Major Mason was very much impressed by its beauty cannot therefore surprise anybody who knows that neighbourhood. It is beyond words to describe the mountains which are there. Possibly somebody may paint it, but I very much doubt whether any one can describe it really as one thinks of it and sees it in one's mind's eye. This part of the world has also particularly a peculiar interest to me, because for at least nine years it was my hope and ambition to have done this exploration myself. When I had the good fortune to be attached to the De Filippi expedition in 1914, and in October of that year we talked about the pass we had found into this country, Sir Filippo De Filippi and I said: "The war cannot last for long; it will shortly be over, and in 1916 we will go and do this exploration." During the whole of the war I thought about it, and for several years after it was over we both tried our utmost to get permission to go there. I actually did eventually receive permission in 1923, and had made all my plans and got my stores sent up to Srinagar, and ponies were being collected for me in Leh and I was on the point of starting, when a telegram was received from England in India saying I was not to go; and so, after many years of thought, the disappointment was too great, and I passed my plans on to Major Mason, who agreed to carry on. I therefore feel rather the godfather of this expedition, and I would like to congratulate Major Mason very much on the work he has done.

There is only one point I should like to mention, and that is, as I have such a personal interest in the valley I cannot refrain from expressing a wish that he had pushed a very lightly equipped party across the glacier and allowed it to take a march or two down the valley to see where it led to. You have heard how difficult it is to say where the rivers go, and until some one has actually been down this valley, I am not at all sure that some further surprise may not await anybody who goes. I do not want to dispute Major Mason's wisdom in deciding to go across the range to the north. I should certainly, in his place, have done the same thing. It is rather being wise after the event, but I cannot help feeling that I should like that some one had gone down that valley.

There is one other point, one which Major Mason did not touch on to-night, but which is given in his full report. He suggests that the name "Karakoram" should be changed to "Muz-tagh," and as he quotes a letter of mine, I am afraid this might lead you to think that I am in agreement with that suggestion. I do not like changes of names. I do not think they are advisable, and more particularly when a name has been in existence, as this one has, for about sixty or seventy years. It is quite possible that the Karakoram pass is not on the main axis of the ranges known as the Karakorams; I think when the name

was given, sixty or seventy years ago, it was intended as a regional name, very much like the Himalayas and many others of mountain regions. The mass of mountains is generally known as the " Karakorams," and not as the " Karakoram range." To apply definitely that name to one particular ridge, as has sometimes been done, is, I think, a mistake ; because I do not consider we have sufficient knowledge at the present moment to say how all the various ridges run. I therefore would like to register a protest against any change of the name. I am sorry, however, to have to disagree with Major Mason, and I hope he will forgive me, particularly after the very interesting lecture that he has given us to-night.

The PRESIDENT : As no one else wishes to address the meeting, it falls to me to claim that Major Mason's report has amply justified the expenditure to which your Society has gone and those very strenuous labours of Mr. Hinks, about which Sir Francis Younghusband spoke. I can fully endorse what the latter said. Nothing within the last year has aroused so much interest in the Secretary and, in spite of his very arduous duties, has caused him to devote so much of his off-time to the support of exploration as the preparations for the expedition of Major Mason. This has been, as you see, very successful, though it has not completed the work in the district. I hope that Major Mason may go back. There is still evidently much to be discovered there. I imagine it is practically impossible for an air-survey to pass down those valleys and for an aeroplane to fly low over the top of that extraordinarily unattractive-looking glacier ; therefore, if anything more is to be learnt about this region it must be by Major Mason going back and possibly pushing a light party across the glacier : though I am bound to say that I find it difficult, after looking at the photographs, to imagine how any party, either heavily or lightly laden, could possibly go over it. I am sure we all owe much gratitude to Major Mason for the report that he has given us, and for having so amply vindicated the Society's purchase of a Wild photo-theodolite. The lenses attached to the cameras must be of the very first class to bring out such wonderful mountain views as those which we have seen.

We also owe a considerable debt to Major Clifford, not only for what he has done, but for the very interesting sidelights which he has thrown upon other work of the expedition about which Major Mason had not time to speak. I should like to know, having looked at the photographs shown during the evening, on what antelope live. However magnificent the scenery—it is the most magnificent you can conceive upon this Earth—I failed to discover in the foreground, at any rate, of nine out of ten of the photographs, anything on which even a hare could live, much less an antelope. But I dare say that the great scale of the scenery and the distance at which many of the photographs were taken have concealed from our eyes the vegetation which animals find when the migrations take place. I am sure all of you must echo the wish of Major Clifford, that somebody should go there when these migrations are actually taking place. The only things at all comparable to them are the great bird migrations.

A vote of thanks has already been moved in substance, if not in form, to Major Mason by Sir Francis Younghusband and seconded by Colonel Wood, the " godfather " of the expedition ; and I am sure that you will accept that vote of thanks and signify your acceptance in the usual manner to Major Mason.

Dr. LONGSTAFF writes : I would like to add a note on the very interesting Geographical Conclusions printed at the end of the paper. I am very glad

that a geographer of Major Mason's authority openly proclaims that the Karakoram Pass, though it is on the Indus–Yarkand water-parting, is *not* on the range of mountains of that name but on an extension of the Aghils, while the Saser Pass is truly situated on the crestline of the Karakoram range. The main axis of elevation of this great fold can be traced through Sir George Cockerill's Malungi Dias north of the Hispar Glacier, through K_2 and the Gasherbrums, through Teram Kangri, along the crest of the Saser Pass; and on through that great group of peaks rising to over 25,000 feet between the Nubra and Shyok rivers: further, I am quite confident that Major Mason is fully justified in believing that the Shyok River cuts through the main axis of the Karakoram range below Kataklik, as I think Sir Sidney Burrard recognized. When Major D. G. Oliver and I were route-hunting in the mountains to the east of the upper Shyok River we found those same crystalline limestones which Major Mason alludes to—and an impracticable mountain barrier which must extend to the neighbourhood of the Changchhenmo (*vide Geogr. Journ.*, 35, p. 646). But while heartily agreeing with Major Mason's alignment of the main axis of the Karakorams I would insist that to the south of this and separated from it by the almost continuous trenches of the Hispar-Biafo and the Baltoro-Siachen glaciers there lies a second great mountain chain, through Rakaposhi, Mango Gusor, Masherbrum, and the Bilafond (Saltoro) peaks, so that our Karakoram system includes at least two parallel ranges (*loc. cit.*, p. 625). The north-western to south-eastern trend of the topographical features discovered by Major Mason in the Aghils is duplicated by the very remarkable topography of the upper valleys of the Nubra and Shyok rivers, indicating that the whole of this vast region has been elevated by the same pressure from the north-east. The appearance of newness and instability of these Karakoram ranges is most striking: their gorges, precipices, and avalanches are more terrific than in the Great Himalaya itself; they have not yet been smoothed and combed by denudation, not yet "shingled" for the convenience of climbers: the age of their rocks has no necessary connection with their age as mountains.

It is not easy to reconcile any precise systematic definition of what constitutes a particular mountain range with the apparent chaos presented to us by the face of Nature. Major Mason does not suggest any alteration of nomenclature, and it is rash even to approach so thorny a subject. But with a fairly intimate knowledge of both ranges I have long regretted that the name Kailas is officially attached to this southern range of the Karakoram—especially as I also know the great Tibetan mountain of that name. Though there are naturally certain differences between the northern and southern aspects of these mountains I am impressed by the essential unity of these two parallel ranges of the Karakoram system. There are most certainly *no* native names for any of these ranges as a whole, therefore our nomenclature must be admittedly arbitrary: even the separation or division between the Hindu Kush and the Karakoram seems quite arbitrary when you are looking at it. Now the Muztagh Pass lies truly on the main axis of elevation, and the application of that name to this portion of the Karakorams by Hayward and others had a good deal to recommend it. But it has been officially and definitely discarded. The accepted name Karakoram has a local application to a very ancient and important caravan route; but the pass of this name, though it is situated on the Indus–Yarkand water-parting, lies well to the north of both the ranges under discussion, as Major Mason points out. Bearing in mind the above considerations, I venture to suggest that it would be convenient to use the name

Karakoram, or Karakorams, or Karakoram-Himalaya for the entire mountain complex between the valleys of the Indus–lower Shyok and the Indus–upper Shyok, and from Gilgit to the Changchhenmo: the use of one of the latter forms of the name would help to dissociate the range from the unrelated Karakoram Pass.

That peculiar pinnacled ice formation of the glaciers on the north side of the range is, of course, not due to any inherent quality of the ice compared to that on the south side, but to the fact that the main axis of the Karakoram, and not the local water-parting, constitutes a definite boundary between two different climatic *régimes*. I am confident that the causation of these pinnacles is due to the incidence and interplay of radiation and evaporation, both of which depend very greatly on the humidity of the air. The drier zone, with pinnacled glaciers, is reached as soon as the Saser Pass is crossed, several marches before the Karakoram Pass is reached. I am very interested to learn that in the opinion of Major Gompertz there must be a large glacier draining westward beyond the head of the Mamostong (or Murgisthang) icefield, because this seems to explain a problem which has long perplexed me. I expect that this will be found to discharge into that surprisingly large ice-free valley which joins the lowest bend of the Siachen glacier on its left bank (*loc. cit.*, p. 644). When it is desired to survey this unknown corner, will the party please proceed 5 miles up the Siachen Glacier and take the first turning to their right? The finding of the Tibetan Antelope on the newly discovered Aghil Depsang, so far to the west of its known range, is a most interesting discovery: a beautiful example of suitable edaphic and ecological conditions inducing migrations on the fringe of a species-area. Similarly, we found the Shapu considerably north of its known range at Zdongpolas, on the northern bank of the lower Shyok river, because just there occurs one isolated area perfectly suited to its habits. In his delightful contribution to the discussion Major Clifford was rather unfair to humanity, reflecting on man's inability to support himself in these inhospitable regions. Man could there only support himself by the chase, and since the game is all migratory he could only exist as a seasonal nomad, like the wolf. Unfortunately, game will not arrange its migrations to suit the convenience of explorers—not even in the "friendly Arctic." I am gratified that Major Mason admits the dulling effects on the mind of long residence at high altitudes, because I have so often been contradicted about this. I *should* like to know what he *really* thinks about the beneficial effects of working for three and a half months at 16,000 feet, and how much more acclimatization would determine success upon Mount Everest? A very eminent mountaineer (*Appalachia*, December 1926) has recently advocated a whole year's acclimatization as a preliminary.

May I express my pleasure in the full recognition which is now accorded to the accuracy of Sir Francis Younghusband's observations during his pioneer explorations of forty years ago? Major Mason has somewhat stressed his own failure to reach the actual tracks of our former President, but the gap is so small that we may safely consider that the problem is solved beyond any doubt, and had his ponies or even a light foot-party been able to push straight down the main Shaksgam valley, we should not have had the survey of the extraordinarily inaccessible and interesting Aghil mazes. I wish to congratulate most sincerely Major Mason, Major Minchinton, Major Clifford, Captain Cave, and Khan Sahib Afraz Gul Khan on the accomplishment of a most difficult and arduous piece of work.

Note added by Major Mason.

I am extremely grateful to Dr. Longstaff for his valuable note. It also gives me an opportunity of removing a misapprehension from Colonel Wood's mind, and of developing more fully what I had in my own. Dr. Longstaff is right: I did not suggest altering the name "Karakoram" back to "Muztagh," and it was perhaps because nomenclature is such thorny ground that I hesitated to tread it. Now however an angel has led the way, and the fool may follow.

Dr. Longstaff alludes to the southern range, for which Sir Sidney Burrard *suggested* the name "Kailas" in 1906. At that time the alignment of the ranges was dependent on the old reconnaissance maps of Colonel Godwin Austin and his colleagues. Colonel Godwin Austin himself told me that in 1861 they were expressly instructed not to waste time over the survey of barren ranges above 15,000 feet. Since those days we have had the detailed surveys of Sir Martin Conway, the Duke of the Abruzzi, Dr. Longstaff, the Workmans, Sir Filippo De Filippi, and Colonel Wood himself. The discoveries of Dr. Longstaff concerning the Karakoram axis north of the Siachen glacier in particular, emphasize the parallelism and essential unity of the Karakoram ranges. I claim a similar unity and parallelism for the Aghil ranges beyond the Karakorams. The time has come, not for reversion to discarded nomenclature, but for considering how existing names can best be applied to avoid confusion.

Of the three alternatives which Dr. Longstaff suggests for the Karakoram mountain complex, I think the last is the best, but I would extend this name, "Karakoram-Himalaya," north beyond the Shaksgam trough, to include the Aghil ranges, and *at present* I would not define the northern boundary. This regional name would then include the "black gravel" area of the Turki traders, and an "abode of snow" well within Indian borders. It would include all the "Ks" of Montgomerie and all the Karakorams, Eastern, Western, and Central, of subsequent travellers. This employment of the word "Karakoram" also connects these ranges one with another in a lateral sense, and the essential unity that Dr. Longstaff emphasizes is made clear. The several ranges might be named for convenience, the "Kailas-Karakoram," the "Muztagh-Karakoram," and the "Aghil-Karakoram." In the first of these we have the alignment of the Tibetan Kailas range suggested; in the second—the true ice-mountains—Muztagh becomes the defining word, and the Muztagh passes now lie on a Muztagh-Karakoram range; and in the third, we have both the Aghil pass and the Karakoram pass on the Aghil-Karakoram range. These are only suggestions; and they are bound to meet with certain criticism. It is of course essential that the opinion of the Surveyor-General should be ascertained before any steps are taken to attach any of these names.

Regarding the dulling effects on the mind at high altitudes, I can speak only unscientifically. I believe that there is at first a tendency for the mind and body to become acclimatized. With good nourishment and no cares it might be possible to remain acclimatized, though I doubt it; and such conditions are practically impossible. Worries, anxiety, and preserved food all have a cumulative effect, and both body and mind are strained after long residence at high altitudes. I am quite certain of one point: though physically and mentally fit at the end of our journey, we were all suffering to various degrees from this strain; and both physically and mentally we tired much more easily than when we left Panamik on the outward journey.

May I conclude by associating myself and my colleagues with the remarks

of Dr. Longstaff concerning the accuracy of Sir Francis Younghusband's observations nearly forty years ago, and may I add that Sir Francis has been the master-pioneer by whom successive Karakoram travellers have ever since been inspired ?

EXPLORATIONS IN THE GRAND FALLS REGION OF LABRADOR

Varick Frissell

THERE is no map of Labrador showing detail approaching accuracy. The small amount of scientific knowledge we have comes almost entirely from one source : " A Report on Explorations in the Labrador Peninsula along the East Main, Koksoak, Hamilton, Manicuagan, and Portions of other Rivers in 1892–93–94–95, by A. P. Low, B. Ap. Sc." (Geological Survey of Canada, Annual Report, 1895). Indeed, it was Mr. Low who awoke Canada and Newfoundland to the fact that Labrador in general and the Grand Falls region in particular were worth having. He reported that the latter region contained vast deposits of hæmatite and magnetite rich in manganese. The mining would be facilitated by their proximity to a tremendous waterfall, estimated capable of generating nearly 5 million horse-power. Gradually it has been felt that this area would become the key to development of the entire Peninsula. From this centre would radiate power to grind forests of spruce into pulp, saw trees into lumber, and to electrify the proposed railway.

Realizing the geographical problems in the vicinity of Grand Falls, Mr. James Hellier, an undergraduate of Yale University, enthusiastically agreed to help me explore the region. Since prevailing clouds of dense vapour had prevented Messrs. Bryant and Kenaston, as well as Mr. Low and others, from obtaining suitable photographs of Grand Falls, we determined to camp on the spot until favourable conditions permitted our making not only still views but moving pictures as well. Next, we determined to discover the function of Valley River, for we had reason to doubt that it drained Lake Ossokmanuan, as Mr. Low indicates on his map. Lastly, we proposed to explore the " unknown channel " mentioned in Mr. Low's report (p. 139), but disregarded entirely on his map. This channel was evidently an important tributary of the Hamilton, and by trappers on the coast was alluded to as the " Unknown River." In 1921 Mr. J. G. Thomas had seen a high fall presumably on this same stream,* and Dr. Wilfred Grenfell had written to me about it, encouraging more thorough exploration.

In July 1925 we began the 300-mile journey up Hamilton River to

* In September 1924 we had received a letter from Mr. J. G. Thomas with an account of his discovery in May 1921 of twin falls on what he thought was the Valley River, and with photographs. After some delay in hope of obtaining prints more suitable for reproduction, a note on the discovery was published in the *Journal*, **66**, 79.—ED. *G.J.*