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THE EXPLORATION OF THE SIACHEN OR ROSE GLACIER, EASTERN KARAKORAM.*

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Publique.

As previously stated in the *Geographical Journal*, near the end of our 1911 expedition Dr. Hunter Workman and I crossed to the Siachen or Rose glacier on August 20, making between that date and September 14 as much of a reconnaissance of its basin as the short days, variable weather, and glacial conditions of the advanced season would admit of.

In the time passed there I became fully alive to the obstacles which would beset one attempting, even with eight summer weeks at disposal, to explore its salient points and to carry out a fairly thorough survey of the main glacier and its affluents. Those who, like ourselves, have tried to investigate glaciers such as the Hispar and Baltoro, both of which may be ascended from their tongues, will appreciate the difficulty of visiting in its entirety a 46-mile-long glacier with a useless tongue. I say "useless tongue," because, as is known, the upper Nubra valley leading to that tongue is void of supplies for more than a handful of men, and, worse than this, the Siachen tongue cannot be reached at all between May and September 15, owing to the volume of water and to the presence of quick-sands in the Nubra river, which render its traverse at different fording-points absolutely dangerous to life.

Hence, the exploration of the Rose glacier resolves itself at once into solving the problem of a last base at Goma in the Saltoro valley, which is

* Royal Geographical Society, November 24, 1913. A paper by Dr. Hunter Workman read at the same meeting will be published in a later number of the *Journal*. Map, p. 232.

separated from the Rose * by the 10-mile Ghyari nala, the 13-mile-long difficult Bilaphond glacier, the passage of the 18,400-foot Bilaphond La and the descent of the 7-mile-long Lolophond glacier.

When you have performed this little feat you are there and have tapped the Siachen at about 16,000 feet, where you may next make a new receiving base for the hundreds of maunds of flour, stores, sheep, and even wood required by a large contingent of men for several weeks. "No, I won't come again," I said as I sat snowed in in my tent for two days before crossing the Bilaphond La in September, 1911. But no sooner had I turned my back to the Rose and reached the top of the pass on that brilliant September morning, than my mountain ego re-asserted itself, saying *tant pis* to the obstacles, return you must.

And thus April, 1912, again found us in Srinagar. Through the kind assistance of Mr. E. A. Reeves, F.R.A.S., I had secured the services of Mr. C. Grant Peterkin, diploma-holder of the R.G.S., as surveyor. Col. S. G. Burrard, C.S.I., R.E., Surveyor-General of India, most kindly loaned me a native plane-table, Sarjan Singh of Party I. Indian Survey, to assist Mr. Peterkin. I have also to express my thanks to Col. Burrard for the loan of theodolite, plane-tables, chronometer watch, and other instruments, and to the Royal Geographical Society for the loan of plane-table and other instruments. Major Pirrie in charge of Party I. selected Surjan Singh for the work, saw that instruments were ready, and did all in his power to further the interests of the expedition. I have to thank Mr. Stuart Fraser, C.S.I., Resident in Kashmir, for assisting the expedition in every way he could. I took again T. Byramji of Srinagar as transport agent and collector of grain and coolies at Kapalu and Goma. Two reservist orderlies from the Indian Army, Pindi Division, assisted this work by accompanying coolie-caravans to and from the Goma base. Cyprien Savoye of Pré St. Didier accompanied Dr. Hunter Workman and myself as head guide, as well as three Italian porters, and a fourth porter was attached to Mr. Peterkin's party.

We left Srिंगaar June 5, Mr. Peterkin preceding us by about two weeks, for Baltistan. Kapalu is situated on the lower Shyok river, and has for its nominal ruler a jagadar or small Raja. Raja Shere Ali Khan, an intelligent, charming man who assisted us greatly in 1911, had died, and was succeeded by his nephew, Nasir Ali Khan. The Raja gave me our old headman, Wazir Abdul Karim, a hardy, amiable little man, who hung to our camp from start to finish, always working on our side, trying his best to lead the coolies and prevent their absconding in batches, which at times they elected to do. He was certainly the best of the Raja's retainers with whom we had to do.

Four marches from Kapalu brought us to Goma, the last village of the Saltoro valley. From Goma, July 2, we ascended the Ghyari nala to the

* I use both names, Rose and Siachen, for this glacier.

maidan at the tongue of the Bilaphond glacier. This glacier was first ascended for 6 miles by Vigne, in 1835, and again by Dr. Longstaff in 1909, in his search for the Saltoro pass. It is not well to attach too much importance to native names for glaciers given by coolies, and, as Sir Martin Conway said at one of our lectures before the Royal Geographical Society, "it is difficult indeed to place much reliance upon such names." This is particularly true when making rapid journeys through a region where one is forced to accept names given by any coolie who is at hand. But when one goes, as I did, with the idea of securing data for a map that would stand, it is necessary to inquire into the traditions of a name, and, so far as the meagre opportunities offer, get at the meaning it conveys to the zemindar's mind. As the nomenclature of this glacier and of the pass at its head is of no mean importance to the future geography of this region, I must expand somewhat on the two subjects.

When, in 1911, we inquired through our polyglot Parsee agent of the zemindars or coolies what they called this glacier, one and all said Bilapho, and spelled it without the "nd." They said the word was a Balti one, meaning a small bright-coloured butterfly. Not satisfied with this explanation, I told the agent in 1912 he must go further into the question of this name and consult the mullahs and oldest inhabitants. It happened that several intelligent native settlement officers, whose business it is to get at the meaning of local names, were in the Saltoro valley, and they and the Parsee went carefully into the matter, with the following conclusion—*i.e.* that Bilaphond so spelt, but the "d" not sounded, in Balti, means butterfly; that the reason for giving the glacier the name was, not because butterflies were seen on it, as had been said by the coolies, but that in former days this name was given because of the shape the glacier assumes at Naram, 6 miles from its tongue. The main glacier running south towards Ghyari and north towards the pass forming the trunk or body of the butterfly, and the branch entering east which descends from behind Peak 8 and the one entering west forming the wings, hence completing to the Eastern eye the image of a butterfly. This definition of the meaning of the name Bilaphond presupposes an intelligence and poetic imagination not to be found among Saltoro people of to-day. Perhaps in the old time, when, according to the "legend of the Siachen," the Ghyari nala was thickly populated to the foot of the glacier, a select few lived capable of such flights of imagination. At any rate, they have handed it down to their descendants, and it is pleasant to record such a poetic and also fitting reason for the naming of the Butterfly glacier.

Regarding the Saltoro pass, which Sir Francis Younghusband sought for from Chinese Turkestan, many miles north, and which Dr. Longstaff claims to have found when he stood on the Bilaphond La, in my humble opinion, this pass, if it exists, is still undiscovered. Dr. Longstaff says "tradition and usage have given the name Saltoro to the pass," but he admits that locally it is called Bilaphond La. Now the Bilaphond La is

separated from the Saltoro valley by the Ghyari nala and the Bilaphond glacier, and bears no relation to that valley. So far as I could learn from the so-called learned men of the region, who are possessed of whatever saga connected with it that has been handed down, it is, and always has been, called by the people Bilaphond La. In the legend, of which I shall speak elsewhere, old time Baltis referred to the Yarkandis crossing the Bilaphond La when they came to "loot" in the Ghyari nala. When Vigne, in 1835, ascended the Saltoro valley in search of a route to Nubra, he was told by the natives "that he would cross a pass, and descend, after crossing a glacier, upon the northern end of the Nubra valley." This he tried and failed to do. But nowhere that I can discover in his writings does he use the name "Saltoro pass." Neither have I been able to find in the writings of Thomson, Strachey, and Moorcroft, mention of the word "Saltoro" as applied to any pass. I cannot, therefore, agree with Dr. Longstaff that "usage and tradition" have given the name "Saltoro" to the pass at the head of the Bilaphond glacier. Thus, considering the name Bilaphond to be correct, both in local usage and as designating its geographical position, I have elected to have it so called on my map. The name chosen accords with the advice given explorers by the Royal Geographical Society to select, when naming glaciers or peaks, if possible, names known to natives of the region. It is not my habit to attempt to change either spelling or names existing on previous maps, but in this case I regard myself as quite justified in not adopting the word "Saltoro" as employed on Dr. Longstaff's sketch-map.

This being a historical and geographical narrative, I will not describe this glacier, but may remark *en passant*, that, judging from the appearance of its tongue, it was in both 1911 and 1912 advancing slightly. In both years, it was found a most tiresome glacier to negotiate from the condition of its huge jumble of rickety moraines which extend from side to side of its boundary walls. Locomotion by continual "moraine hopping," aptly so called by Major the Honble. C. G. Bruce, is continued a mile beyond Naram, the first camping-ground 6 miles up the glacier. From here the ascent, by ice-bands running between median moraines, is easy to below Ali Bransa.

In 1911 we had no trouble in finding this last station before the pass, but the following July a heavy snowstorm overtook us, and it was difficult to spot the small moraine-ridge where it is situated, this being above an ascending area of crevasses which were not easy to handle in the blinding snow. It is at about 17,000 feet, and is separated enough from the high border-cliffs to be safe from falling stones. In 1911 eight native stone shelters were found there, which showed no signs of fires or of recent usage, and may have been standing in this protected place for a century. Neither Vigne nor Dr. Longstaff appear to have actually visited the place. The shelters have now been greatly demolished by the different parties of our expeditions, who constantly bivouacked here on their way to and from the

Siachen with supplies. For several reasons it clings to my memory as the most gruesome camp of my Rose glacier experiences, and, when we finally left it to cross to the Rose glacier in 1912, my mind was made up never to return thither could I find another road back. Coming directly from grass, the altitude is felt and the cold also in bad weather. We had a sixteen-hours snowstorm here, and, when it cleared, had to wait two days for a belated caravan of supplies. The minimum temperature on two nights was 16° Fahr. When the sun shines the heat is intense during the day; a black-bulb thermometer reading gave 197° Fahr. at 12.30 noon. After four nights, thinking to have shaken off Ali Bransa, we left on a cloudless day for the Bilaphond pass. An hour from camp, as the route was easy, I gave guide Savoye the order to cross the pass with the second guide and look up a route to a peak I wished to climb, and then rejoin us on the far side of the pass. Two porters remained with our caravan. Soon after, Cesare Chenoz, through his own carelessness, fell into a crevasse 80 feet deep. Although brought out alive and carried back to Ali Bransa, where every care was given him, he died the same night from the effects of cold and shock.

Three days later, after the burial of Chenoz, we again left Ali Bransa with a file of ninety coolies. The weather, as it had been for eight days, was glorious, when, for the third time in eleven months, we arrived on the summit of the Bilaphond La. This saddle was measured by Dr. Longstaff by aneroid at 18,200 feet. The mean of hypsometric readings taken by us in 1911 and 1912, and by Mr. Peterkin, give a height of 18,370 feet. The salient object of interest from the pass is the distant Rose glacier seen flowing southward, past the entrance of the large glacier which descends from the Bilaphond La and which we have named the Lolophond. Coolies coming and going from Goma arranged a camping-ground on the left moraine of this glacier which they called Lolophond. The width of the Siachen is $2\frac{3}{4}$ miles at entrance of the Lolophond, but, owing to foreshortening, such a width is not suspected from the pass. The largest Siachen east affluent is seen entering on its far side, curling gracefully around a bold rock promontory and continuing its way south-eastward with the Siachen, in tangled mazes of séracs and crevasses. To the east of the pass the Bilaphond peak rises, and to the west the summit of Peak 36, height 25,400 feet, towers above the mountains forming the Bilaphond wall. This latter peak, an object of great scenic effect elsewhere, here makes itself known only as a well-fixed survey point to aid the topographer.

A peak which I am about to mention, strikes the eye north, being one of the landmarks of the Bilaphond La. I had selected this mountain as offering a probable fine point of view in 1911, but the weather when we were in its vicinity was unfavourable for its ascent. If it were ever to be climbed this seemed to be the opportunity. The caravan was accordingly divided, the supply one continuing on to Lolophond. while we with a

smaller one, leaving the pass, descended north to a snow hollow, from which a steep, furrowed slope led us to a large plateau where camp was pitched in the snow at 19,000 feet. The next day more slopes were ascended to a rock ridge jutting out below the main peak. Here Dr. Hunter Workman set up his cameras and instruments and remained at 19,900 feet while I continued upward with three guides. It was a rather difficult climb, the middle part being decidedly precarious owing to the melting of the snow, through which we sank on to hard black ice, which necessitated constant step-cutting. On the last 200 feet the snow was deeper and more stable. The gradient was from 45° to 60° .

I saw many interesting things from this summit which aided me in the later work on the Rose glacier. Perhaps the finest was the double summited Peak 35-36, which loomed directly south-west. This mountain was formerly called Karakoram No. 3 and 4 in 'Synoptical,' vol. 7, but at present its most up-to-date survey symbol is $\frac{\text{Pk. 35}}{25A}$ and $\frac{\text{Pk. 36}}{52A}$. I substantiated one special point also in connection with it. The snow-basin on the north side, much foreshortened in the photograph, is flanked by the unscalable boundary-wall rising between the Dong-Dong glacier, which lies directly behind, and the west Siachen affluent, which we have named Peak 36 glacier. We visited the Dong-Dong wall in 1911, and there exists no passage over the watershed between the Dong-Dong and the Siachen glacier affluent.

The most interesting peak I was able to secure with my small camera was probably the high one which we later discovered from the north-east Siachen source on the Turkestan side. The only Baltoro peak I could identify was the flat-topped Bride peak west of the Rose glacier. I named my new mountain the Tawiz peak, as it overlooks the Bilaphond La, where, according to the legend, in olden days the Baltis placed the Tawiz (magic) destined to bring about their revenge on the Yarkandis of the fabled city of Tarim Shehr. Its height measured by hypsometer is 21,000 feet. That night at camp on the plateau a minimum temperature of 3° Fahr. was noted. The next-day we descended to the Rose glacier by the left Lolophond side, which we found both years to be the most feasible route.

The Siachen glacier is situated between lat. $35^{\circ} 11' 20''$ and $35^{\circ} 43' 30''$ N. and long. $76^{\circ} 45'$ and $77^{\circ} 17' 30''$ E. It was first seen by Col. Henry Strachey, when, in October, 1848, he ascended it from its tongue for 2 miles. In 1909, Dr. Longstaff first crossed the Bilaphond La and discovered that the Siachen extended further north than had been supposed. It was thought by Thomson and Strachey, I believe, to end in a mountain wall about 20 miles from its tongue, and the Survey map gives it that length approximately. Dr. Longstaff visited its basin in 1909, remaining one day taking angles with clinometer to various peaks, and the same autumn ascended it from its tongue for about 10 miles. This was all that was known of the great glacier until 1911, when, as first stated, Dr. Workman

and I made a reconnaissance of its basin and explored two of its largest affluents. In 1912 my expedition first properly explored the glacier from end to end, discovered and ascended to its north and east sources, and established the relation of the eastern Karakoram-Indus watershed to that of Chinese Turkestan at those points. All of its chief affluents were examined and these and the main stream surveyed and mapped. Most of its important mountains also were triangulated. The glacier is 46 miles long, and its width for some 25 miles varies from $2\frac{1}{2}$ to $2\frac{3}{4}$ miles. It is without question the longest and largest valley glacier in Asia, probably in the world, excepting those of the Polar regions. According to Dr. Merzbacher, the Inyltchek, the longest glacier in the Tian Shan, has a length of 65 kilom. or 40 miles and a width of 2 to 4 kilom., $2\frac{1}{2}$ miles.

So far as I can learn after much inquiry, the meaning of Siachen is literally rose-bush. *Sia* is the Balti name for jungle rose, and *chen* means a collection of thorns. Such wild rose-bushes are prevalent in the *nalas*, and flourish in pink and white splendour to the tongues of the glaciers in this part of Baltistan. From Dr. Thomas, the Tibetan scholar, I learn that the Tibetan *Se-ba-can* means "having rose-bushes," so probably the Balti meaning is derived from the Tibetan. As is well known, Baltistan was subject to Tibet in the eighth century. Siachen, when correctly spoken, is guttural, and requires an effort to pronounce, and to my taste the English name Rose glacier is quite as appropriate. Its very incongruity as applied to this huge ice-sheet pleases the fancy. On many glaciers the jungle rose is found on mountain flanks well above the snouts, but on the lower Siachen flanks one is fortunate to find stunted edelweiss and other small Alpine flora, while on the route of its upper 30 miles only snow roses thrive. Ice formations resembling roses I noticed in some of its chasms.

In 1911 we made a base camp on the Tarim Shehr promontory. After the first 14 miles from the Siachen tongue, this is the only place in 33 miles where grass and burtsa for fuel are found. On Dr. Longstaff's sketch-map it is indicated as a nunatak, which perhaps it once was, but on near approach it is found to be a large granite and shale promontory descending from the slate peaks forming the barrier between the Rose and the east or Tarim Shehr affluent. The lowest point where it touches the Rose glacier is 15,670 feet, and directly overtopping it here is a slate peak, height 20,840 feet, which we climbed in 1911, and named Junction Peak. At the point where Junction Peak shades off into a gentle slope a good-sized offshoot of the Tarim Shehr glacier bears down upon the promontory in a tongue of white séracs. Below this are several acres of grass hillocks watered by glacier streams. Here any number of grass camps can be made in July and August, and here we found a stone circle 12 feet in diameter made at one time by natives. The stones, which were covered with lichens, had evidently lain untouched for years. No shelters such as were seen at Ali Bransa were found. Inside

the circle, large ibex horns attached to the skulls were piled up, certainly by human hands, and these were decayed and old, falling apart in shreds when touched. No carcasses were seen outside the circle, but the place was strewn with ibex horns, apparently from animals that had died or been killed by wolves or snow leopards. In other places the footprints of foxes and of some other animal which we failed to recognize, were observed. Large ram chikor flew out from the rocks when disturbed by footsteps, and there were a fair number of very small grey birds about in early September, which the guides called snow birds, being exactly like those found in the Italian Alps. Examples of bird-life are scarce on the high Siachen, and those existing seem to make their home here at the last grass.

From the above-mentioned hillock-area a large torrent may be crossed and half a mile of slopes ascended to another rolling, much larger, grass-area, nestling in the hollows of which in 1911 we found two good-sized lakes. Here we made another camp in 1911 at 16,300 feet. Large ibex were seen daily here grazing. This part of the Tarim Shehr promontory is bounded on the north and south sides by bare shale and granite headlands which rise abruptly from the glacier. Even on these rocky eminences rising to 800 feet above the second grass-area, tiny maidans for tents may be found now and again. This is a unique spot in the heart of this ice world, surrounded on all sides by miles of glaciers and ice-girt peaks, and may well be named Tarim Shehr, or "last oasis." Thus spelled Shehr in Persian means "city," and in the legend furnished me by the "learned men," there was supposed to be an ancient city here inhabited by Yarkandis. Here also the Baltis are said to have played polo with the Yarkandis, who from here went to the Ghyari nala to loot the cattle of the Balti villagers. Further, the legend explains why the ancient city was reduced to its present desolate and rock-strewn state.

On one occasion the Yarkandis kidnapped a Balti woman working in a field of a Ghyari village. An important Mullah, Hazrat Ameer, was in the village at the time, and he gave the enraged Baltis a Tawiz amulet, telling them to put it on the top of the Bilaphond pass, and to return to their village *via* Yarkand. The Baltis having done the first part, disobeyed the priest, and returned the same way, by the pass, home. However, soon after a great storm visited Tarim Shehr, "and the snow from the mountains slipped and fell upon the city," destroying it and its people, including those who had stolen the woman. Curiously, when first on the Rose glacier, the coolies never mentioned the place to us, and it was only when I spoke to my cook about going to the promontory that he said, "Oh yes; the coolies call that 'Teram Shehr,' and say it is a nice home with much grass." How they knew of it is one of those native mysteries one cannot solve. Dr. Longstaff did not visit the place, and, under all circumstances, it is hard to reach, owing to the broken condition of the Siachen for a



VIEW TAKEN FROM THE SILVER THRONE PLATEAU AT 20,600 FEET, SHOWING QUEEN MARY PEAK, MOUNT HARDINGE, AND THE PRECIPITOUS WALLS ENCLOSING HEAD OF NORTH-EAST KONDUS GLACIER.



THE SOURCE OF THE NORTH-EAST KONDUS GLACIER, THE GUSHERBRUMS, PEAK 23, AND ARÊTE OF QUEEN MARY PEAK IN BACKGROUND.



THE TERAM KANGRI FROM THE WEST SIDE OF THE ROSE GLACIER.



PEAKS 35 AND 36 AND RIDGE SEPARATING DONG DONG GLACIER FROM
PEAK 36 GLACIER.



SUMMIT OF TAWIZ PEAK, 21,000 FEET, FIRST ASCENDED BY F. BULLOCK WORKMAN
AND GUIDES IN 1912.

mile this side of it, and because of the numberless glacier-rivers to be forded. None of our coolies allowed that they had seen the place, and none certainly had been there before we led them to it, yet they had a name for it and said it was a good camping-ground. Beyond this, not a suggestion of a name for a spot above or below on the glacier was obtainable from our Baltis.

Regarding the term "Tarim," which I have adopted, I would say that neither experts in Tibetan, Persian, or Arabic, have been able to tell me of the existence of the word "Teram." The best informed persons of the Kapalu and Saltoro districts had no knowledge of such a word in the Balti language. As Tarim is used in Chinese Turkestan for cultivated area or oasis it is possible, as Sir Aurel Stein suggests, that the Baltis may have heard of it in connection with the Tarim basin or Yarkand as applied to the country beyond their frontier, and by usage easily have perverted it into Teram which they applied to Tarim Shehr. Anyhow, it seems best to adopt a term the meaning of which applies in a general way to the Tarim Shehr promontory, for that and the large east affluent, rather than to coin one for which no authority appears to exist. At Tarim Shehr three solid cairns marked B.W. in black were placed at different points, and one at our camp at 18,400 feet on Junction mountain.

On September 8, 1911, temperature 22° Fahr., we left the promontory to examine the Tarim Shehr glacier, striking it above the entrance into the Rose glacier. After five hours of easy slate and shale moraines came badly broken up granite ones, which so slackened the caravan's progress that camp had to be made on moraine at 17,500 feet. After a very cold night we continued up the glacier-surface, which in one hour became soft from the sun's heat. The whole route was dotted with snow-covered water-pools, into which to the knees one was constantly breaking. This zone ended, the gradient became much steeper. Seen from the Rose this glacier appears to rise gradually for miles, but in reality its higher part in 1911 was composed of three slopes broken by short snow terraces, and the whole area was distorted by transverse crevasses of a size and depth not met with on the Rose or its other large branches. A wide plateau was finally reached lying at over 18,000 feet. This white sea is riven with crevasses running in all directions. Leading the caravan cautiously in and out of this maze, we advanced until the guide said the risk was too great, as the caravan might at any moment become engulfed in this vortex of great bottomless chasms. From where we stood at 18,500 feet, the plateau imperceptibly rises to what looks like a snow depression on the north side of the east end. The passage, if there is one, would be by this narrow yoke. Should a descent on the further side be practicable, the head of one of the glaciers of the Remo system might be reached, and a route to the Shyok valley be found. We considered well before turning back here, but at last decided the risk was too great, of camping the caravan at 18,500 feet for two nights in the September cold, that year

very severe at night, particularly as the chance of our overcoming with the guide the 6 miles of crevasses leading to the col the next day was an uncertain quantity. The Tarim Shehr glacier is 17 miles long from its entrance into the Rose, and averages a width of $1\frac{1}{2}$ to 2 miles before emerging into its reservoir basin. Peaks from 21,000 to 23,000 feet form its north and south boundary walls, and two of about 22,000 feet rise as isolated points from its reservoir-plateau.

In 1912 the Siachen sources first claimed our attention. When recalled from the lower Siachen my intention was to make a second attempt to reach the Tarim Shehr glacier source, but several reasons interfered. That glacier looked quite as impossible in its upper trend, as in the previous September. Provisions and coolie patience were at a low ebb, and ten days of fog came to hold us captive on the higher Rose. Finally, events worked together to make it a question of forcing a new passage at the Rose glacier west source-head or of attempting to reach the Tarim Shehr col, which, if reached, might be found to be a passage to some other glacier. Both could not be accomplished by my expedition that season. I had just the force of men and provisions necessary for returning by unknown ground to Baltistan, but not that needed to descend a new glacier east of Tarim Shehr, which it would be desirable to do if one existed, and wander down to somewhere in the Shyok valley, where most likely my caravan would find no supplies; and, as things turned out, I chose, wisely, I think, to do the former. If Dr. de Filippi's expedition explores the Remo glaciers to their heads, it will doubtless ascertain whether or not a pass leads from any of them to the Rose glacier.

I will next mention the Teram Kangri. This massif-like ridge culminating in several peaks rising from the Siachen basin and forming part of the east boundary wall, 18 miles from the north water-parting, was first seen by Dr. Longstaff from the Bilaphond La in 1909. During his day's visit to the Siachen he measured by clinometer three summits of the group, giving on his sketch-map later the height of 27,610 feet to the highest, called by him Teram Kangri. The apparent discovery of a very high peak in the eastern Karakoram created considerable interest in the geographical and Alpine world. In 1911 the Indian Survey sent Mr. Collins of the Survey to the Nubra valley, and from several high stations he triangulated the highest and lowest of the three summits with altitude results of 24,489 feet and 24,218 feet. That same season our topographer, Dr. C. Calciati, during a short visit to the Siachen triangulated the peak east of the one measured by the Indian Survey as the highest, for which he obtained a value of 24,793 feet, or 7559 metres. This he regarded as the highest summit.

In 1912 Mr. Grant Peterkin triangulated all three peaks of this group with results of 24,510 feet, 24,300 feet, and 24,240 feet being obtained for altitude. His observations show the middle peak to be the highest, corresponding thus with the result obtained by the Indian Survey, although

the value obtained for its height is somewhat greater. This ridge of peaks when seen from the Bilaphond La makes no extraordinary impression upon the observer, and I wonder that Dr. Longstaff should have selected these summits as being of unusual height. While prominent, the peaks of this ridge in their relation to the Rose glacier, are of quite secondary importance to the King George V. group at the source of this glacier and to Peaks 35 and 36 to the south-west. With the work done by the Survey and by my 1912 expedition, they may now be said to be triangulated fairly accurately for height.

Our visit to the Peak 36 glacier and ascent on Peak 36 itself to 20,000 feet, as well as some other points investigated, are on account of space omitted from this paper. As crossing the Rose to Tarim Shehr necessitated the fording of many glacier-rivers and finding a way through several intricate belts of séracs which might prove hazardous to coolies going and coming under native leaders, we gave it up in 1912 as a grain-base, using it only to procure burtsa for fuel and to harbour sheep. A higher base for collecting supplies was made on a Siachen moraine at 16,400 feet, and placed in care of a Srinagar babu. The gradient of the Siachen in a distance of 12 miles upward from Tarim Shehr is easy, showing a rise of 1442 feet, or one foot in 43. The best route is along the east side by bands of shaly median moraines. The camping is not much better than upon snow, for where the moraines do not rise in high, undulating hillocks, the surface-covering is sparse, and tents stand practically on thinly covered ice. These miles of moraines, strewn with blocks of marble and other *débris*, are very interesting, but do not come into the scope of this paper, and will be described elsewhere.

On July 18 we left one of these moraine camps at 17,000 feet for an attempt to reach the Siachen north source. Passing the last west affluent, which enters above the Peak 36 glacier, we continued up the Rose, which here takes on a sharper gradient and narrows somewhat. By 3 p.m. crevasses and soft snow made advance so slow that camp had to be pitched in the middle of the glacier, 18,050 feet. The weather seemed uncertain at evening, and the next morning we found the tents laden with snow and a heavy storm in progress. When escape is possible there is no use waiting about under such conditions, so we packed up and descended in a dense mist for three hours with snow cutting our faces like a knife. Camp was made on snow-covered moraine at 17,200 feet. Luck was not yet ours, and that night the elements raged again and continued to do so for two days more. When the clouds broke a little the third day, but with a bad wind holding and four feet of new snow now lying on the higher glacier, as provisions were low we marched down to a mountain-*arête* to await favourable skies. From this perch at 16,770 feet for one day before the snow melted, the Siachen stretched above and below us like a great snow-sea, not a crevasse or rock being visible. Then the magic sea vanished and out cropped the crevasses, rocks, and

normal glacier-features, and with them came a change of wind which set us to hoping. Lastly, our three mascots appeared on the scene and began to caw loudly. I would mention that three crows had followed the camp from Ali Bransa, and continued to accompany us to the sources and to all camps to the Kondus tongue. They were not even distinguished by red beaks as are mountain choughs, but were well-nourished crows of good size, which took care to find a living off the camp, and did not suffer for five minutes from mountain lassitude even at over 20,000 feet.

After this delay, on July 25, a second start was made and we camped again on the end of a moraine at 17,200 feet. The next day we pushed on a good distance above the previous glacier-camp to a high shale ridge which juts into the glacier from the east side. About 200 feet above the glacier near the base of this ridge a small rocky spur was discovered for camp. Circling the base of the spur on all but one side was a deep blue lakelet encased in white ice-walls. Tent terraces were constructed amid the rock-chaos, and we thought ourselves fortunate to find such good quarters on soil near the Siachen head at 18,400 feet. A highly interesting find was made here—the lower layers or remains of two native stone cairns. They were nearly demolished, but it was quite plain that only human hands could have placed the rocks as we found them.

On July 27, temperature 15° Fahr., we left Spur camp and descended to the glacier. The ridge of the east wall, before spoken of, upon which the camp was located, projects into the glacier for some distance, thus causing a narrowing in of the Rose before it reaches its upper basin. After contouring this we ascended sharp, crevassed slopes for 1½ hours before reaching a large plateau. From this basin west rises a low snow mountain, and beyond it the high precipitous walls of the King George V. group which close the Rose glacier in an impenetrable barrier. Although high enough in themselves, these are really only lower walls of the group, which dominates in four high peaks the north-west head of the Rose glacier. Neither Peak 23 nor its satellites are seen from this point. From the east side of the plateau gentle slopes rose toward an apparent, but from here invisible, col. But this was not in that day's work, so we continued north over rising hillocks and slants which became most wearisome as the snow softened, letting us in to the knees at about every step. There was nothing to guide us, but after consultation we headed toward a snow peak of probably 22,000 feet, which apparently stood at the end of everything. On the west or left we passed the snow gap with a bergschrund at its base, that is seen for 30 miles down the glacier, which Dr. Longstaff noticed when he reached the Siachen, and which he says "he connected at once with the sketch of Younghusband's Saltoro pass," which he had seen in his report. This gap is what I suppose Dr. Longstaff refers to as Younghusband's saddle and designates by that name on his sketch-map. The gap is, however, no pass, and bears no relation to the real water-

parting ridge, which latter is not seen at all from any point of the Rose glacier. It is a narrow connecting link between some peaks of the intricate Siachen reservoir, merely an idiosyncrasy of nature, thrown in to mislead any one casually looking up from the middle Siachen. Beyond this false col is a deep snow-basin.

Leaving this point a mile or so behind, we came to a peak the east shoulder of which gave us a sharp bit of climbing. By this time we were well out of sight of the main Siachen reservoir, and after a descent continued along a previously unseen high snow-field. The whole *trajet* in the deep soft snow was exhausting, and we were relieved when upon contouring a reach of gaping crevasses the ridge was at last approached and distant peaks, rising from beyond a void, came into view. The guide, stepping ahead, called out, "Slowly, we must rope; it is a line of huge cornices." And so it was, not one, but rows of them, extending right across the ridge to the base of a sharp peak which forms the east boundary of this water-parting. We went as near the edge as possible, and saw these monsters curling over in great white hoods, fringed with massive pendants of ice. Below these fell a perpendicular snow-wall 5000 to 6000 feet to a basin. Bounding this basin was a long splintered rock-ridge which, as could be seen, formed a wall near one head of a large glacier flowing down north-north-east into the verdureless barren region of Chinese Turkestan. Besides the source above which we stood, this glacier had another, plainly seen, to the west on the flanks of the Gusherbrum range. From the latter, the glacier at first descends in chaotic ice-falls.

At the moment of arrival on the ridge we saw three tremendous rock-peaks piercing the clouds to the north-west, beyond doubt from position and appearance the Gusherbrums, but before the camera could be used their tips were lost in cloud. The continuing walls of the Gusherbrums, of which we saw all except a small corner, joins that of Peak 23. The rounded snow elevations seen at the west of the watershed col, running in intricate lines east and west, form a part of the very long but continuous east *arête* of Peak 23. Hence, the Rose glacier may be said to find its main source in the King George V. group, while the east *arête* of Peak 23 itself descends to the col and builds this part of the water-parting between the Indus and Chinese Turkestan. From here the watershed turns south-east and follows the north-east Siachen wall for 14 miles, beyond which we could not with certainty trace it, but it apparently is formed by the remainder of the wall extending to the head of the Tarim Shehr glacier.

A triangular mountain massif, the beginning of which is seen in the illustration, runs south-east from this Turkestan glacier and forms, from what we saw from the east col, the barrier wall between the glacier here spoken of and another large glacier which we discovered from the east col. The glacier here seen is different from those I have met with on the Karakoram side. As may be observed, grey moraines, and they are high ones,

descend through its middle, and they run thus a long way toward the tongue. The ice encasing the moraines on either side was composed of lines of tall pyramid and wedge-shaped white pinnacles, and nowhere were crevassed ice-bands to be detected. My impression was that the glacier could be ascended nearly to its source by a moraine route. From my own observations and after consultation with Sir Francis Younghusband, I judge this to be the Gusherbrum glacier, the tongue of which he visited in 1889. I am glad that we have been privileged to see and photograph it from above one of its sources, and to have aided Indian geography by definitely fixing this important Eastern Karakoram water-parting. The watershed-ridge measured by us with hypsometer works out for height at 20,860 feet after comparison with lower station readings taken three times daily at Skardu. I have named this ridge the Indira col. The only other explorers met with here were a dainty brown butterfly and a large sluggish wasp. The latter greeted us amicably and seemed content to sit for five minutes at a time on the point of my ice axe. There was a high wind blowing, which had perhaps wafted them up to meet us from Kashgar. The thermometer registered 50° Fahr. when we left to descend to our distant camp.

We next day investigated the east Rose source, returning first to the high plateau and then, turning east, ascended by easy slopes in two and a half hours to a snow saddle. This col lies at the base of a long shale mountain-*arête* upon which, if necessary, tents could be placed on rock. It was of interest to note that, on this most forbidding of glaciers for tent-nomads, at one of its heads a dry camping spot may be found. The saddle measured by hypsometer is 19,210 feet. The first thing that impresses the visitor here is the grand group of high peaks looming up as in the photograph, a little to the south behind the east Siachen wall, on the Turkestan side. They are lofty, wild, and complex, rising from intricate snow valleys and elevated plateaux. They have not been placed on any previous map, and were evidently here seen for the first time. The col we stood on, seen in the view, forms a semicircle and ends in the bergschrund-festooned wall visible in foreground of the peaks. Directly below the col a sharp drop occurs, of say 2000 feet. Below, this wall shades off into a short crevassed glacier, which, as an affluent, joins a wide trunk-glacier flowing north-west towards its tongue. We saw well only the upper part rising south-east towards its source behind the group of peaks above mentioned. From the edge of the col the end of the triangular mountain-mass discovered from the Indira col was seen, and the main glacier appeared to take its downward direction along the base of these mountains.

It is probable that this large glacier flowing north-west joins the Gusherbrum stream seen from the Indira col beyond the triangular mountain range, or that both end in the same valley near together. The lat. 35° 41' 20" of the point reached by Sir F. Younghusband on the

Urdok glacier would about correspond with that of this col. After consultation with him there appears to be but one conclusion possible—that this is the glacier he ascended in 1889 in search of the Saltoro pass and named the Urdok. The col he saw culminating the Urdok is probably a ridge of the mountain group seen by us from the east Siachen col. This “Young-husband saddle” at head of the Urdok glacier could not lead to the Siachen, as on the east Siachen wall above Tarim Shehr there is no break or possible pass. This east col, therefore, is another and more easterly point on the watershed-ridge towards the Turkestan side, which, with the north one, makes two, which I think I may, with my *confrère* in exploration, justly claim to have discovered and first visited. I have called it the Turkestan La on the map, because under proper European leadership it could be crossed with difficulty by coolies up to August 1 in ordinary seasons. But, in my opinion, it could never have been employed as a passage by Kashgar people to Baltistan or Nubra for two reasons. First, it would be fraught by too many mountaineering obstacles to be used as a caravan route by natives of Turkestan. Second, not being the culmination of a main artery, it would be observed by them only as a ridge at the top of a branch of the Urdok, which it would not occur to them to explore. Here, there is no obvious route such as exists from Nagar over the Hispar pass to Baltistan, for example. In some isolated case a party may have been driven by circumstances from Baltistan or Nubra to seek a way out to Turkestan, and on ascending to the Siachen reservoir found an exit here. This, if accomplished only once, would account for the cairn remains found at Spur camp.

Another explanation of the Spur camp cairns may be sought in the possibility of Nubra or Goma people having penetrated that far up glacier in search of a pass, and, not liking the appearance of the snow-wastes above, having returned down the Siachen. This might also account for the stone circle at Tarim Shehr. But I fear no light can be shed on the matter, certainly not in the Saltoro valley, and, from what I have heard from persons who have inquired in Nubra, the people there appear to have no knowledge of the Rose glacier.

One may weave what romance one will about the cairn-remains near the Rose glacier source, but I think what we saw at the north and east points of the water-parting demonstrates pretty conclusively that no caravan route for either laden animals or men has ever existed there. Sir F. Younghusband tells me that a sportsman with a few natives of Kashgar thinks he crossed the water-parting somewhere in this region ten years ago. He could not, however, remember being on a large glacier during his journey, nor give any details pointing to the route traversed, and only recalled Kiris in the Shyok valley as the first village he reached. At any rate, it is quite certain that he did not cross by the north, north-east, or west Siachen sources.

During these days a white mist hung over the mountains and about

the Siachen, which proved disastrous to photography. It was cold at night and very hot after 11 a.m. On the col described, the glass stood at 32° Fahr. at 9 a.m., and at noon a black-bulb thermometer reading of 200° Fahr. was noted. The weather still holding fair, we at once started for the west Siachen head lying above the last west affluent. Before leaving Spur camp a large cairn was built and marked B.W. in black with the date. Descending the Rose glacier by the same route for a time, we crossed later to the west side just above the entrance of the upper west affluent. Here the glacier from melting was turned into a series of slush-covered lakes which were best crossed on hands and knees. The broad west branch enters the Rose at over 17,000 feet. It is a snow expanse from one containing wall to the other. Crevasses, which are legion in the lower part, remain mostly snow-covered, and therefore doubly dangerous, until August. After the first quarter-mile the gradient is a steadily-ascending one, to where in its upper portion it assumes the appearance of a slowly rising plateau. From here its source, still distant, may be seen, backed by two beautiful snow cones, which we called the Silver Throne, probably about 23,000 feet high, and Lower Silver Throne. We climbed beyond the crevassed zone and camped near the centre of the glacier at 18,700 feet. This camp, where we passed three nights, was a source of many lamentations from the coolies, because of the absence of rocks and of lakelets so abundant on the Rose glacier.

The next day in a strong wind, temperature 14° Fahr., we continued on due west toward a depression between the Lower Silver Throne and the north border-peaks of the glacier. On near approach a reach of large open crevasses was found to stretch across the glacier, and to get around these we should have to traverse the glacier and climb up the mountain flanks to look over the dip now seen to exist beyond. As geographical information from a high point was our object, it was clear that that was not the place to find it. The guide insisted that, did we go, we should see only a precipice instead of a pass. I decided that the depression must, however, later be examined, as it might prove to be a real west source passage to another region. A high col connected the higher and lower Silver Throne peaks, so we climbed the slopes a little south leading over the lower peak flanks, and in two and a half hours reached the snow yoke.

Here an interesting scene lay before us. A large glacier, the visible source of which was walled in by high rock-cliffs, lay 4000 feet below. Long moraines extended nearly to its reservoir, evidencing that this lay at not much over 16,000 feet. It seemed probable that the Kondus glacier backed against the Siachen west tributaries, further east near the Sherpigang wall, and so we put aside the thought of its being the Kondus. It did not appear wide enough or far enough north to be the Baltoro. Awaiting further developments, photographs were taken of a peak facing the Silver Throne on the opposite side of the new glacier. This proved to be a



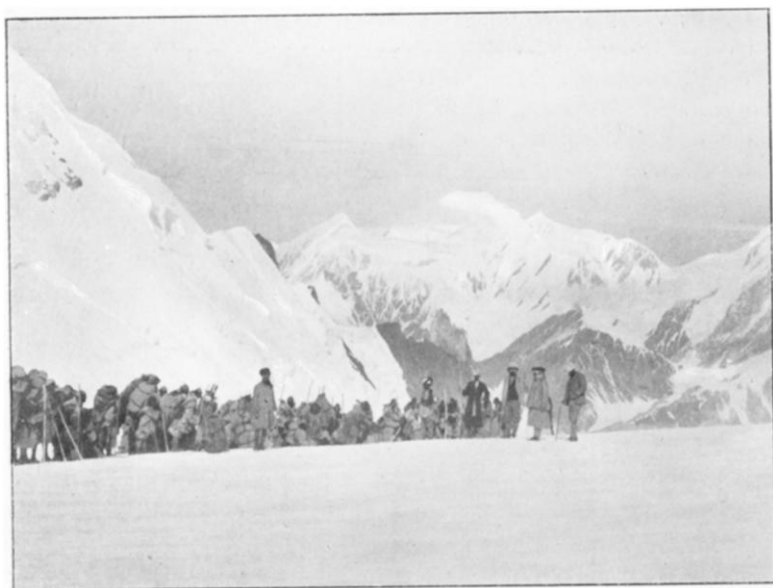
TARIM SHEHR PROMONTORY TAKEN FROM 18,400 FEET, SHOWING JUNCTION OF
TARIM SHEHR BRANCH WITH THE UPPER ROSE GLACIER.



ON THE TURKESTAN LA OR NORTH-EAST SIACHEN WATER-PARTING, 19,610 FEET.
GROUP OF PEAKS TO THE SOUTH FIRST SEEN FROM THIS POINT.



PEAK 8, PHOTOGRAPHED FROM JUNCTION PEAK AT 18,400 FEET.



ON THE SIA LA, 18,000 FEET. BRIDE PEAK IN BACKGROUND.

lower peak of the Golden Throne, the highest being behind further north. We faced an unknown, unmapped area, being confronted by four or five first-order Himalayan giants, the tortuous ridges, intricate valleys, and lesser peaks of which were hurled into a stupendous mountain ensemble, not to be accounted for with precision at first glance. I shall return to these peaks, which are seen to greater advantage from the high Silver Throne plateau. This saddle, 19,600 feet, can be crossed by mountaineers, but is not feasible for a coolie caravan.

With weather still fine the next day, facing a still more glacial wind than on the previous one, we retraced our steps toward the source. This time, by ascending on the flank of the north containing glacier-ridge, a view over the gap was obtained. Here, as I had surmised, the real outlet to the west Rose source was seen. From the ridge connecting the lower Silver Throne with the opposite mountain *arête* a long snow defile ran downward to the new glacier, a bit of which could be detected in the distance. Being satisfied on that point, we turned south again, and, climbing beyond the col previously visited, over rising schrund-gashed hillocks, headed toward what appeared to be a still higher ridge south of the main Silver Throne peak. Finally surmounting a snow wall, we reached a large plateau not before supposed to exist, stretching south. A ridge at its end was climbed which overhung the glacier discovered the day before. The plateau at its lowest point is at 20,450 feet, and at its highest 21,000 feet altitude. From here the lower Silver Throne was overlooked, and a grand view of the Gusherbrums and the King George V. group obtained.

Peak 23, or Hidden peak, elusive and well named, no doubt, by Conway so far as its relation to the Baltoro glacier goes, assumes another aspect in connection with the Rose glacier. It is seen 30 miles down the glacier as its *motif majeur*. As I said before, its great east *arête* forms the north water-parting ridge, and its east and south flanks throw off the snows that produce the reservoir and upper *névé* of this glacier. Its high satellite-peaks again drain to and form much of the snow supply of the upper west Rose affluent, so that this group may truly be called the originator and large supplier of the Rose glacier. Peak 23 is also called by the Indian Survey Gusherbrum I., but it is a higher, more impressive peak than the others of that name, and stands at some distance removed from them. This mountain, with the three high peaks south-east of it on the same ridge, builds a group of its own 11 miles long distinct from the peaks to the north, and I have the honour, with the gracious permission of His Majesty, to call it on my map the King George V. group. Particularly impressive from the Silver Throne plateau were the two second highest mountains of the group which were first discovered and triangulated by this expedition. The highest of these, seen in the photograph taken at 21,000 feet, I have with the permission of Her Majesty named Queen Mary peak. Its height is 24,350 feet. The second peak,

23,270 feet, I have pleasure in naming Mount Hardinge, after H.E. the Viceroy of India.

It may be noted I have named no peaks already triangulated and numbered by the Indian Survey, and I entirely agree with the policy of the Survey in keeping Government maps of Asia free from personal names. *Re Himalayan nomenclature*, I quote the greatest authority. Col. Burrard says, "The numerous peaks which have no native names, have been numbered in a scientific way, after the astronomical system." As the present system of nomenclature has extended throughout Southern Asia, the new Survey symbols placed on my map seem likely to become permanent ones. This in no way affects the nomenclature adopted by explorers for new peaks shown on their private maps, and it seems to me appropriate that illustrious British names should adorn the first detailed and fairly accurate map made of Asia's greatest glacier.

Our high plateau was of particular geographical interest, as from it could conclusively be proved that the King George V. group with its formidable precipices prohibits both at the north and west Siachen sources all passage from the Siachen to the Baltoro glacier, which is not a complement of, nor has it any relation to, the Siachen. Behind the sheer snow-painted ridge seen in the foreground of the King George V. group in illustration a snow valley runs to a col climbed by Mr. Peterkin, who saw a distant snow ridge below the Golden Throne probably lying above the Baltoro glacier, in which direction he was looking, but near the col the snow expanse he overlooked ends in a rock precipice falling to the main Kondus source that we examined later and found to be an impassable wall. The mountain ridge alluded to in the view separates the valley and col visited by Mr. Peterkin from the pass crossed by us to the Kondus and runs nearly parallel to it in direction.

While on the Silver Throne plateau clouds rising from the south swirled over our heads, dropping occasional snow-flakes as a warning for us to depart. We had gleaned most of the secrets of the Siachen, and could not complain if the weather-god now turned his attention to fulfilling the prayers for storm contained in the Tawiz of the coolies. Contouring chasms and plunging to above the knees over the sodden snow-hillocks, we returned to camp, and, after a night of blustering wind and snow, descended to the Siachen in a blinding storm. I was, however, convinced that in order to complete the exploration of the Siachen basin and sources, a return must be made to the icy west head, and our exit carried out by the lately-found passage there. We next descended the Rose glacier to the great bend, a short distance above the point reached by Dr. Longstaff from Nubra. Here, owing to delinquencies on the part of a headman, we were forced to return to the high Rose.

Mr. Peterkin thoroughly carried out the mapwork on the lowest Siachen to the Nubra river. In spite of careful observation, nothing was seen of

Dr. Longstaff's cairn at the point indicated on his sketch-map. In some unknown way it has doubtless been demolished.

Above Tarim Shehr on the return, a camp was pitched at 16,600 feet on moraine-strewn ice, where supply and transport exigencies, abetted by continual fog and storm, kept us prisoners for ten days. The minimum temperatures at this camp were 10° and 15° Fahr. only, but with no sun by day and high winds at night we felt the cold more than at dry, cold, higher camps where the thermometer fell to near zero. Tinned provisions disappeared slowly, for even the guides had long since arrived at caring for little beyond soup and light food. They attributed this to *ennui* at the long detention, but I think it was the effect of altitude. We had been four weeks, with the exception of three days, always above 16,600 feet, and most of that time above 17,000 feet, and I noticed that all our Europeans ate steadily less as time elapsed. I have often observed this effect upon the appetites of our Europeans, after any stay above 16,000 feet. I still maintain, H.R.H. the Duke of the Abruzzi's experiences to the contrary, that Europeans do suffer from insomnia at camps above 20,000 feet, for I have seen these facts borne out, not only upon ourselves, but very decidedly upon our numerous hardy young guides and porters during seven different Himalayan expeditions.

On August 20, our caravan of sixty-six left Boulder camp and marched up to the end of the east latero-median moraine. Here the final preparations of coolie food for twelve days were made, although the weather was uncertain and the sky leaden. The next day, under a threatening sky, we crossed the Rose, the three crows gaily leading, and ascended toward the old snow camp. The snow was at its worst and the coolies lagged badly, notwithstanding half of them wore nailed boots. We camped not far from the col in a freezing temperature and snowstorm at 3 p.m. It cleared about six, and after a cold, still night, minimum temperature 3° Fahr., we continued on to the ridge, Nature for the first time in many days smiling radiantly upon us. A somewhat long descent occurring before the final climb to the col places the actual saddle measured by boiling-point at the same height as the camp, 18,700 feet. This Siachen-Kondus water-parting-col I have named the Sia-La. Here the caravan was photographed against a background of the lower Silver Throne *arêtes*, with Bride peak looming grandly into the deep blue vault above.

The descent to the Kondus glacier is of about 2600 feet. The gradient of the upper third was sharp. At about the halfway point the surface became greatly broken by huge chasms and fissured by wide crevasses running from side to side, which necessitated long *détours*. Fortunately, a good route on the right side was chosen, for by August 20 the left side is so riven it cannot be traversed at all. A moraine ridge below was reached by noon, where we lunched in full view of the large glacier streaked by black and grey moraines and of the precipitous grim walls at

its head. These walls were thoroughly examined, as we were now quite certain that we were on the upper Kaberi,* or Kondus glacier. The Sia La descends to the Kondus not at its head, but from the east, and its existence would not be suspected by persons ascending even the upper part of the glacier. Near the source, behind the Silver Throne *arêtes* and on the true left side, the glacier leading up to the pass is first seen. Hence the topography is as follows: Bride peak, seen apparently nearly over the Kondus from the pass, really lies some miles west—so far west that it is actually beyond and west of the second Kondus north-west branch seen on the map, and of which I shall soon speak.

A lower peak of the Golden Throne rises above the Kondus source north, and the King George V. group lies behind the Kondus head also north. Peak 23 itself lies some 8 miles north of the Kondus reservoir, and its snows on this side do not drain to that source. Those of a part of Queen Mary peak do fall to the shelf above the Kondus precipices. The deductions made by the Abruzzi expedition, that a probable pass exists from the Kondus head to the Oprang basin and Urdok valley, are quite awry, but the opinion of Signor Novarese that the westernmost extremity of the Siachen communicates with the Kondus exact, so far as it goes. But he is wrong in his supposition that the Kondus head intervenes between the Siachen and the Urdok glacier. The Kondus head lies further west and south than he supposes, and between that head and the north Siachen water-parting, which overlooks the Gusherbrum glacier, the broad 11-mile-long King George V. group intervenes.

Overtopping the Kondus reservoir is a high granite and shale wall broken at one point by a projecting *arête*, between which and the main glacier a short glacier descends to the reservoir. The *arête* of the lower Golden Throne builds a part of the Kondus wall, and above, far behind, lies what on Conway's map is called "Probable Saddle." Here may be a col overlooking the Baltoro, but there is no pass from it to the Kondus glacier.

South-west of the Golden Throne massif, at point on Conway's map marked "Kondus Saddle," is in reality a sheer snow wall, which does away with that saddle altogether. Thus these two saddles as passes are non-existent. The Kondus basin is entirely closed so far as any communication with the Baltoro glacier is concerned, and has but one outlet, which is to the Rose glacier west affluent. The mountain topography here is complicated, and can only be unravelled by overlooking the Kondus source and its outlying great mountains from elevated points and by visiting the source itself. We were fortunate to do this in clear weather, and I think my report of the connection, geographical position, and

* To natives of the Kondus valley the Kondus glacier is known only by the name Kaberi.

conditions here will be found in the main to be correct by future explorers.

Following the Kondus down southward, numerous affluents are seen entering from the right side, descending from the precipitous narrow ridge which divides the main north-east from the second north-west branch. At about 10 miles down, the chief stream, with which we are dealing, makes a distinct bend south-west, and below the bend the north-west affluent enters, the two streams uniting and forming one, which continues south to its tongue in the Kaberi nala. Any one ascending the Kondus from the tongue, in 10 miles would see nothing of the main north-east branch, and even where the bend occurs, nothing is seen of it until an opening is discovered between gigantic border-cliffs. It is the most hidden of hidden glaciers. No Survey man nor any one else having gone more than a mile above the tongue before our 1911 expedition, accounts for the mistake on the Survey map, which shows one main glacier running to the base of Peak 23.

To return to the north-west affluent. This is shorter than the north-east, and is separated from it by a narrow barrier-ridge, which in its upper part we overlooked from the Silver Throne col. We saw also from there a part of the sharp wall rising above the north-west Kondus head. We ascended this branch far enough to see that Bride peak lay west of its source, and that the reservoir was like the main north-east Kondus, walled in by high cliffs, which afford no pass to the so-called Chogolisa saddle existing on Conway's and the Abruzzi maps. In 'Karakoram and Western Himalaya,' Dr. de Filippi says that "The southern wall of Chogolisa is very steep, and that the Kondus was not visible from the Duke's point of observation." This I can believe, and it serves only to confirm my own observations. Had H.R.H. the Duke of the Abruzzi been aware that there are two upper Kondus glaciers, when he stood on "Chogolisa," he would have realized that the "large valley running between two parallel chains of high mountains on the other side of the Kondus basin" was not the Siachen, but probably the north-east Kondus glacier. He was above the north-west Kondus basin, and doubtless could not see the reservoir of the north-east Kondus. Further, there is no pass from the north-west Kondus to the Chogolisa glacier next west of the Kondus, for we found on examination in 1911 an impenetrable mountain chain on that side of the Chogolisa glacier head. Dr. Calciati states that he thinks one of his older coolies said that he in his youth had crossed from the Kondus to Hushe. It is not likely that such a passage was ever made by natives from anywhere on the Kondus, but at any rate no passage exists at the north-west Kondus head to the Hushe glaciers.

As obviously no pass exists from the Kondus to the Baltoro or the Chogolisa glaciers, the name Chogolisa saddle in the sense of pass should not be inserted on future maps. As a euphonious native name there is

no objection to it, but, as the glacier bearing the same name does exist and claims no relation to the so-called saddle, it is, to say the least, an irrelevant and misleading term.

As stated in my preliminary report the Kondus is the most tiresome glacier we have met with in the Karakoram to travel upon. After three miles from its source, it descends in hillock-moraines in places 200 to 300 feet high. These extend from one containing wall to the other, and I recall only two small stretches of a quarter-mile, where it was safe to proceed in a narrow sand-ravine existing between these hillocks and the cliffs of the perpendicular rock-peaks which border the glacier. At a point 6 miles from the tongue, on the left orographical border cliffs we painted the letters F.B.W. with date, in black, and built a cairn on a ridge under the rock face.

As to climatology, I have a few facts to add. In 1911, between August 20 and September 15, and in 1912, during July and August, we found, as a whole, better weather-conditions on the Rose glacier than we have ever noted in the Western Karakoram. The south-west wind brought mist or storms, and there were plenty of them, but the north and north-east winds brought fine weather which lasted for longer periods than we have experienced on the Biafo, Chogo Lugma, or Hispar glaciers. Dr. Longstaff thinks June the best month for high climbing in the Eastern Karakoram, but in 1912, July was a better month for high work than June. In both these years the south-west monsoon was light in India, and the whole vale of Kashmir suffered much from drought. In the Kapalu district almost no rain fell in July and August of either years. These facts doubtless counted much in our favour on the glaciers. Certainly 1911 and 1912 were favourable weather years for snow work in the Eastern Karakoram, but they offer no basis for claiming better or worse climatic conditions in general for the Eastern over the Western Karakoram.

No Tawiz amulet was worn to bring us luck, and fair skies were needed to carry out the work planned. Certainly what measure of accomplishment in that line was ours came through persistent endeavour and the aid of the weather-god, who on special and critical occasions favoured us, and to him are due my deep salaams.

APPENDIX.

NOTES OF THE ROSE GLACIER HAVING BEEN AN OLD TIME ROUTE TO NUBRA OR CHINESE TURKESTAN.

REGARDING the eight stone shelters, one stone circle, and two cairns, found by my expedition at Ali Bransa, Tarim Shehr and the North Spur camp, and their bearings on the question of the Bilaphond and Rose glacier having been once used by natives as routes to Turkestan and Nubra, I have a few words to say.

In the *Geographical Journal* of June, 1910, Col. Godwin-Austen says that "after looking at the map," it appears to him that this pass, referring to the "Saltoro," "was in all probability a way by which the people of Baltistan got into Yarkand." This remark was made after Dr. Longstaff's short visit to the Rose glacier, when nothing was really known as to the water-partings on that glacier, and when all that could be said was mere supposition.

From what I have seen of them, I do not hesitate to negative the idea of either the Bilaphond La or the Rose glacier having been at one time a route from Baltistan to Chinese Turkestan.

The two remaining points of exit are those by the east Tarim Shehr affluent and by the Lower Siachen to the Nubra valley.

The passage, should it exist, from the head of the Tarim Shehr glacier, could only lead to the Remo or an adjacent glacier draining to the Shyok valley, and that would be, apart from the prohibitive ice-conditions, a circuitous route. No shelter-huts were found on any part of the promontory at entrance of the Tarim Shehr glacier into the Rose, only one stone circle, and on the 17 miles of glacier to the source no vestiges were seen. It has been said, I know, that, when driven by stress of circumstances, natives will find a way out over most arduous routes, yet even allowing for this, it is most unlikely that people either from Nubra or from Baltistan would attempt passing by the east Siachen affluent.

The suggestion by Dr. Longstaff that the Bilaphond La was once "used as a short cut from Baltistan to Nubra," appears fairly plausible, although no records of this passage having been employed are available. No signs of former human birds of passage were found by my expedition between Tarim Shehr and the Siachen tongue, but the fact remains that Ali Bransa was by previous generations occupied as a bivouac and most likely more than once.

What tells most against the idea of this having been a usual route to Nubra, are the very difficult physical conditions of the Rose glacier the whole 23 miles to its tongue, the unfordability from May to September 15 of the Nubra river, and the sparsely inhabited and supplyless area encountered in the Nubra valley before Pananik village is reached.

Whether like serious obstacles were less in evidence in former times, must be answered by one competent to solve these problems, which I confess I am not. So far as the present-day Baltis are concerned, I feel sure they would proceed by the Chorbat, or any other remote road, rather than thread the mazes of the Rose glacier and face the Nubra water-crossings.

A route to Nubra by the Rgyong La, since on its summit Dr. Longstaff found a cairn, would, it seems to me, have been chosen by natives, rather than the one over the Bilaphond La, but that does not bear upon the point here at issue, which hinges on the presence of the shelters at Ali Bransa. Again, perhaps the Baltis previously said to inhabit the Ghyari valley, on occasion climbed to the Rose glacier, carrying their investigations as far as the opposite Tarim Shehr grass-area and then returned over the pass home.

This suggestion credits the old-time Baltis with exploring proclivities which certainly those of to-day are not guilty of possessing.

These questions in human geography, if I may so call them, are interesting, pertaining as they do to the Rose glacier, a vast intricate snow expanse, stretching its long snowy affluents, ice-bound water-parting ridges, and formidable crevasse-riven tongue, as defiant bulwarks toward Baltistan, Chinese Turkestan, and Nubra. But, like those queries arising daily in other sciences, they must, I fear, abide their time and await a solution that may or may not be forthcoming.

NOTE ON THE CONSTRUCTION OF THE MAP OF THE SIACHEN GLACIER,
BY C. GRANT PETERKIN.

The map is an extension from, and is based on the fixed points of, the G.T.S. of India. During the survey five of these fixed points were observed to, namely, $\frac{\text{Pk. 8}}{52 \text{ E}}$ $\frac{\text{Pk. 36}}{52 \text{ A}}$ $\frac{\text{Pk. 35}}{52 \text{ A}}$ $\frac{\text{Pk. 33}}{52 \text{ A}}$, and $\frac{\text{Pk. 23}}{52 \text{ A}}$. The area covered by this survey, about 600 square miles, is given on the G.T.S. atlas sheets 44A S.W. and S.E. The topography there shown had been altered by the explorations of Dr. T. G. Longstaff's expedition (*Geographical Journal*, vol. 35, p. 622). An outline map, on the scale of 4 miles to 1 inch, was issued at Dehra Dun, showing alterations made by that expedition, and this was embodied in the R.G.S. map published as above. These were the existing maps at the time of this expedition.

The Survey of India now publish degree sheets, which are to supersede the old atlas sheets. The nomenclature of fixed points according to these sheets is shown.

The survey party was working on the glacier about nine weeks, having crossed the Bilaphond La on June 24, and recrossed on August 27. The season was an excellent one, at least 80 per cent. of the days being suitable for observation to high peaks. As is already known, the peculiarity of this glacier is its inaccessibility from the region of the tongue, except for a few weeks in the late season. This makes little or no difference for survey work, as in the central area good views are generally to be obtained of the fixed points which are available for interpolation, while the upper Nubra valley is narrow and much enclosed by high mountain walls, which would make the extension of triangles from any base measured there very inconvenient.

Surveyor Surjan Singh, of No. 1 party, Survey of India, made a very good plane-table sketch on the scale of 2 miles to 1 inch. All plane-table accessories were lent by the Survey of India. I also had one of Reeves's telescopic alidades with parallel bar attachment, a useful instrument in such country. I took with me a tacheometer of the form usually known as the Indian Survey subtense instrument; but with large distances and the difficulty of access to points it did not prove useful, and I relied on the plane-table for whatever detail was required.

My initial plans were dependent on the possibility of measuring a suitable base. On getting on to the surface of the glacier, I decided that no base of sufficient length, even for extension, could be measured without spending a great deal of time, and even then its accuracy would be doubtful owing to the peculiar unevenness of such a surface and its liability to quick change. I therefore crossed the glacier at once to the Terim Shehr promontory, being a central position from where to make a rough reconnaissance.

The triangulation was carried out with a 5-inch transit theodolite fitted with verniers reading to 30", which was lent by the Survey of India. In countries where transport is a consideration, surveyors will probably find one of the light and compact 4-inch instruments, now so well made, to be as useful as the larger ones.

The first station was made on a low spur of Junction peak, from which position there was an excellent view of several high peaks to the west, two of which were the survey points, $\frac{\text{Pk. 8}}{52 \text{ E}}$ and the twin peak, $\frac{\text{Pk. 35 and 36}}{52 \text{ A}}$

A base was deduced from the two known sides, $\frac{\text{Pk. 8}}{52 \text{ E}}$ $\frac{\text{Pk. 36}}{52 \text{ A}}$, and $\frac{\text{Pk. 8}}{52 \text{ E}}$,

$\frac{\text{Pk. 35}}{52 \text{ A}}$. Colonel Renny Tailyour's solution from two fixed points was used ('Auxiliary Tables' (4th edit.), p. 85). The two values obtained for the side AB were 7400.8 and 7405.1 feet. After leaving Tarim Shehr the survey was carried northward up the main stream of the glacier. From stations P and Q observations were again taken to the fixed points $\frac{\text{Pk. 8}}{52 \text{ E}}$ and $\frac{\text{Pk. 36}}{52 \text{ A}}$. The

value obtained for the side PQ, when working from the base AB, was 12,098 feet, while the direct reduction from the fixed points gave a value of 12,118 feet.

In the brief season on these high glaciers no preliminary reconnaissance survey can be done by a small party such as we were, if it is proposed to cover any considerable area. The constant moving of camp and keeping up the necessary supply of ata kept our few coolies always busy. The building up of firm platforms for observing was a constant difficulty, which, in the case of stations on the moraine, was added to by the rapid melting which takes place in the middle of the day. At the head of the glacier there was no possibility of building stations, and the theodolite had to be set up on the snow-field. It was hoped that the triangulation could be carried to some station in the Nubra valley; however, owing to time and the untoward failure of the commissariat arrangements for the coolies, most of the southern part had to be abandoned. Owing to bad weather at the end of the season, triangulation was not carried up the Lolophond glacier to the pass.

The heights obtained from theodolite vertical angles are dependent on those of the G.T.S. fixed points from which they were initially deduced. From stations A and B the heights were carried up the glacier, being checked at stations where fixed points were observed to, and from station I. the height of Hidden peak was deduced. This gave a value of 26,491 feet. The G.T.S. value is 26,470 feet. The coefficient of refraction used was 0.055; this was tested by the observation of reciprocal angles. Hypsometrical readings were also taken. Arrangements were made by Mrs. Bullock Workman for lower station readings to be taken at Skardu three times daily while the expedition was in the field. Three hypsometrical readings were taken on different dates at the Bilaphond La, giving heights of 18,328, 18,365, and 18,428 feet. The mean value was taken. Hypsometrical readings at D station gave a height of 16,666 feet. The trigonometrical height, which at this station was deduced from direct rays to G.T.S. points, was 16,395 feet.

The Survey of India report, that hypsometrical heights taken by them have been found to be as much as 600 feet in excess at trig. stations (*Geographical Journal*, vol. 41, p. 155).

The survey party carried two aneroids graduated to 25,000 feet, which had been made for Mrs. Bullock Workman by Hicks. One was fitted with Watkin's patent; both gave steady readings up to 16,000 feet, but above that the Watkin became erratic. The patent action was not used at all. Photographs were taken at several theodolite stations, and were used in plotting detail.

A sketch of the Kondus glacier basin is shown on this map. The details of its construction are given in the note with the map. There has been a little difficulty in getting a satisfactory junction, especially in the lower part.

SIACHEN GLACIER SURVEY.

THEODOLITE STATIONS.

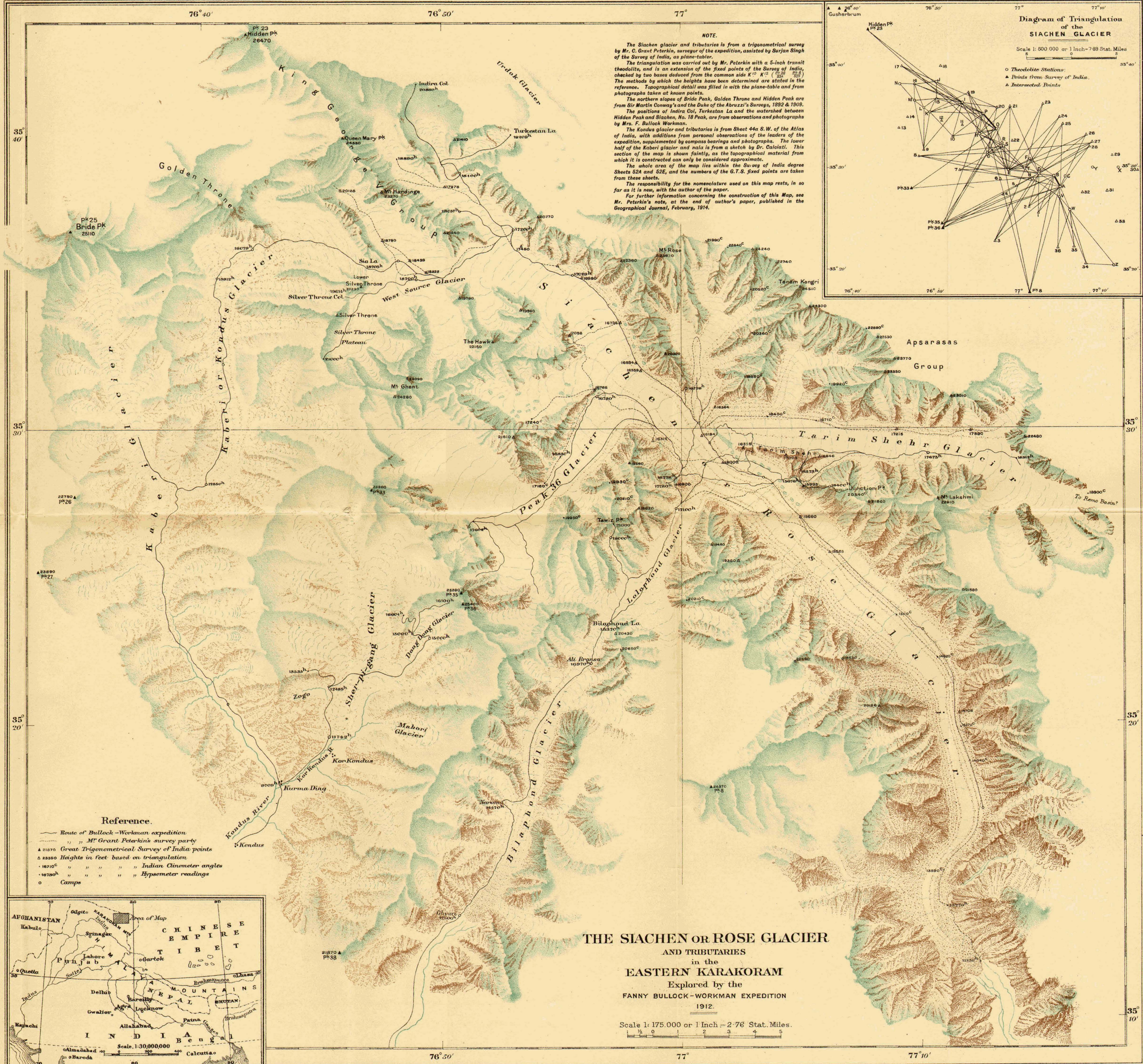
Station.	Latitude N.	Longitude E.	Height.
A	35 28 02	77 05 08	15993
B	35 29 07	77 04 26	17003
C	35 29 01	77 05 48	16946
D	35 29 21	77 02 37	16314
E	35 29 41	76 58 56	16395
F	35 30 45	77 01 27	16364
G	35 31 20	76 56 25	16765
H	35 33 13	76 55 22	17058
I	35 36 17	76 53 22	17450
J	35 38 17	76 50 05	17978
K	35 35 20	76 49 22	18222
L	35 35 43	76 48 43	18439
M	35 36 26	76 47 33	18780
N	35 38 06	76 45 43	20128
O	35 35 37	76 54 54	—
P	35 35 11	76 55 52	16980
Q	35 33 38	76 57 26	16736
R	35 32 19	76 58 09	16594
S	35 32 01	76 58 22	16559
T	35 29 51	77 00 57	16194
U	35 28 50	77 01 49	16002
V	35 26 59	77 05 01	15660
W	35 25 46	77 06 13	15503
X	35 29 57	77 12 13	17590
Y	35 29 58	77 09 05	17215
Z	35 20 20	77 11 38	14706

INTERSECTED POINTS.

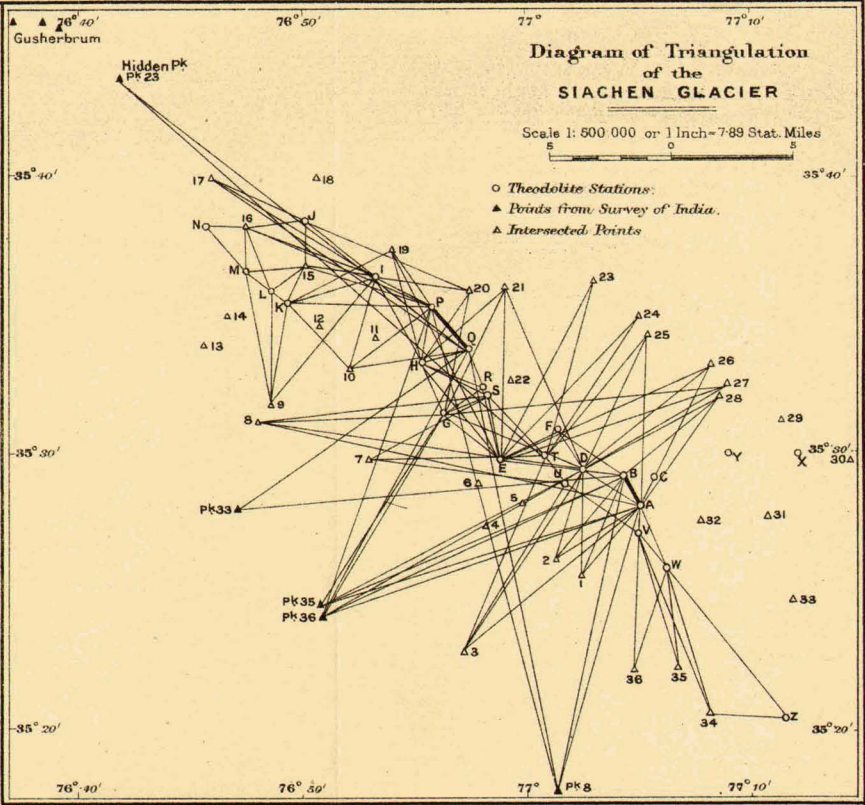
SIACHEN No. 1	Latitude N.	Longitude E.	Height.
2	35 25 32	77 02 26	19360
3	35 26 05	77 01 18	19460
4	35 25 04	76 57 26	20430
5	35 27 19	76 58 14	19620
6	35 28 08	76 59 43	16900
7	35 28 49	76 57 49	19560
8	35 29 41	76 52 59	21610
9	35 31 06	76 48 07	24280
10	35 31 44	76 48 33	24090
11	35 32 58	76 52 10	22160
12	35 34 07	76 53 19	19960
13	35 34 31	76 50 44	19790
14	35 33 47	76 45 36	—
15	35 34 55	76 46 38	20230
16	35 36 36	76 50 08	21440
17	35 37 59	76 47 29	23270
18	35 39 51	76 45 43	24350
19	35 39 55	76 50 33	21410
20	35 37 09	76 54 04	20770
21	35 35 47	76 57 32	22360
22	35 35 56	76 59 05	23630
23	35 32 36	76 59 23	20300
24	35 36 02	77 03 00	24240
25	35 34 43	77 04 54	24510
26	35 34 11	77 05 25	24300
27	35 33 08	77 06 16	22530
28	35 32 22	77 09 01	23770
29	35 31 57	77 08 40	23550
30	35 31 05	77 11 21	23010
31	35 29 48	77 14 39	22480
32	35 27 36	77 10 49	22910
33	35 27 29	77 07 55	21860
34	35 24 39	77 11 30	21580
35	35 20 33	77 08 14	20180
36	35 22 11	77 06 45	19530
37	35 22 04	77 04 47	20460

GREAT TRIGONOMETRICAL SURVEY OF INDIA POINTS.

Point	Latitude N.	Longitude E.	Height.
Pk 23	35 43 30	76 41 48	26470
Pk 25	35 36 44	76 34 23	25110
Pk 26	35 27 45	76 34 44	22750
Pk 27	35 25 08	76 33 12	23890
Pk 33	35 27 54	76 47 07	23960
Pk 35	35 24 24	76 50 50	25280
Pk 36	35 24 01	76 50 55	25400
Pk 38	35 12 12	76 45 41	21870
Pk 8	35 17 46	77 01 23	24370

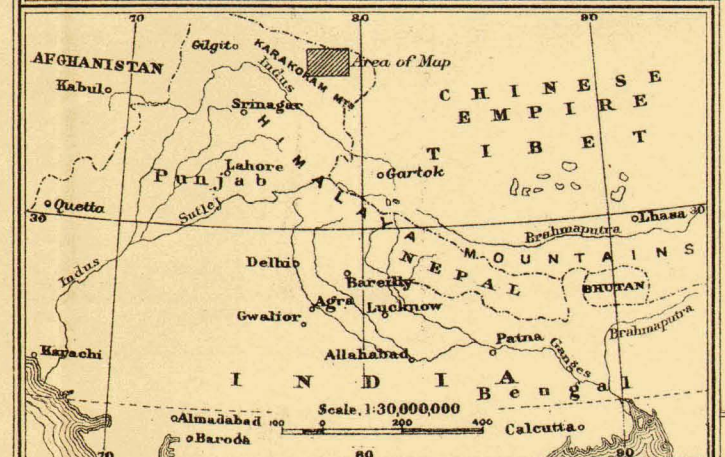


NOTE.
 The Siachen glacier and tributaries is from a trigonometrical survey by Mr. C. Grant Peterkin, surveyor of the expedition, assisted by Surjan Singh of the Survey of India, as plane-table.
 The triangulation was carried out by Mr. Peterkin with a 5-inch transit theodolite, and is an extension of the fixed points of the Survey of India, checked by two bases deduced from the common side K¹⁰ K¹¹ (1525 235). The methods by which the heights have been determined are stated in the reference. Topographical detail was filled in with the plane-table and from photographs taken at known points.
 The northern slopes of Bride Peak, Golden Throne and Hidden Peak are from Sir Martin Conway's and the Duke of the Abruzzi's Surveys, 1892 & 1909. The positions of Indra Col, Turkestan La and the watershed between Hidden Peak and Siachen, No. 18 Peak, are from observations and photographs by Mrs. F. Bullock Workman.
 The Kundus glacier and tributaries is from Sheet 44a S.W. of the Atlas of India, with additions from personal observations of the leaders of the expedition, supplemented by compass bearings and photographs. The lower half of the Kaberi glacier and also is from a sketch by Dr. Gaietani. This section of the map is shown faintly, as the topographical material from which it is constructed can only be considered approximate.
 The whole area of the map lies within the Survey of India degree Sheets 52A and 52E, and the numbers of the G.T.S. fixed points are taken from these sheets.
 The responsibility for the nomenclature used on this map rests, in so far as it is new, with the author of the paper.
 For further information concerning the construction of this Map, see Mr. Peterkin's note, at the end of author's paper, published in the Geographical Journal, February, 1914.



Reference.

- Route of Bullock-Workman expedition
- Mt Grant Peterkin's survey party
- Great Trigonometrical Survey of India points
- Heights in feet based on triangulation
- Indian Clinometer angles
- Hypsometer readings
- Camps



THE SIACHEN OR ROSE GLACIER
 AND TRIBUTARIES
 in the
EASTERN KARAKORAM
 Explored by the
FANNY BULLOCK-WORKMAN EXPEDITION
 1912.

Scale 1:175,000 or 1 Inch = 2.76 Stat. Miles.

SIACHEN GLACIER SURVEY.

THEODOLITE STATIONS.

Station.	Latitude N.	Longitude E.	Height.
			feet
A	35° 28' 02"	77° 05' 08"	15993
B	35 29 07	77 04 26	17003
C	35 29 01	77 05 48	16946
D	35 29 21	77 02 37	16395
E	35 29 41	76 58 56	16314
F	35 30 45	77 01 27	16364
G	35 31 20	76 56 25	16765
H	35 33 13	76 55 22	17058
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L	35 35 43	76 48 43	18439
M	35 36 26	76 47 33	18780
N	35 38 06	76 45 43	20128
O	35 35 37	76 54 54	—
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Q	35 33 38	76 57 26	16736
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T	35 29 51	77 00 57	16194
U	35 28 50	77 01 49	16002
V	35 26 59	77 05 01	15660
W	35 25 46	77 06 13	15503
X	35 29 57	77 12 13	17590
Y	35 29 58	77 09 05	17215
Z	35 20 20	77 11 38	14706

INTERSECTED POINTS.

SIACHEN No.	Latitude N.	Longitude E.	Height.	
			feet	
1	35° 25' 32"	77° 02' 26"	19360	
2	35 26 05	77 01 18	19460	
3	35 23 04	76 57 26	20430	
4	35 27 19	76 58 14	19620	
5	35 28 08	76 59 48	16900	
6	35 28 49	76 57 49	19560	
7	35 29 41	76 52 59	21610	
8	35 31 06	76 48 07	24280	Mt. Ghent
9	35 31 44	76 48 33	24090	
10	35 32 58	76 52 10	22160	The Hawk
11	35 34 07	76 53 19	19960	
12	35 34 31	76 50 44	19790	
13	35 33 47	76 45 36	—	Silver Throne
14	35 34 55	76 46 38	20230	Lower Silver Throne
15	35 36 36	76 50 08	21440	
16	35 37 59	76 47 29	23270	Mt. Hardinge
17	35 39 51	76 45 43	24350	Queen Mary Peak
18	35 39 55	76 50 33	21410	
19	35 37 09	76 54 04	20770	
20	35 35 47	76 57 32	22360	
21	35 35 56	76 59 05	23630	Mt. Rose
22	35 32 36	76 59 23	20300	
23	35 36 02	77 03 00	24240	
24	35 34 43	77 04 54	24510	Teram Kangri
25	35 34 11	77 05 25	24300	
26	35 33 08	77 08 16	22530	
27	35 32 22	77 09 01	23770	
28	35 31 57	77 08 40	23350	
29	35 31 05	77 11 21	23010	



76° 40'

76° 50'



NOTE.

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The triangulation was carried out by Mr. Peterkin with a 5-inch transit theodolite, and is an extension of the fixed points of the Survey of India, checked by two bases deduced from the common side K¹⁰ K¹² ($\frac{26}{526}$ $\frac{62}{526}$). The methods by which the heights have been determined are stated in the reference. Topographical detail was filled in with the plane-table and from photographs taken at known points.

The northern slopes of Bride Peak, Golden Throne and Hidden Peak are from Sir Martin Conway's and the Duke of the Abruzzi's Surveys, 1892 & 1908.

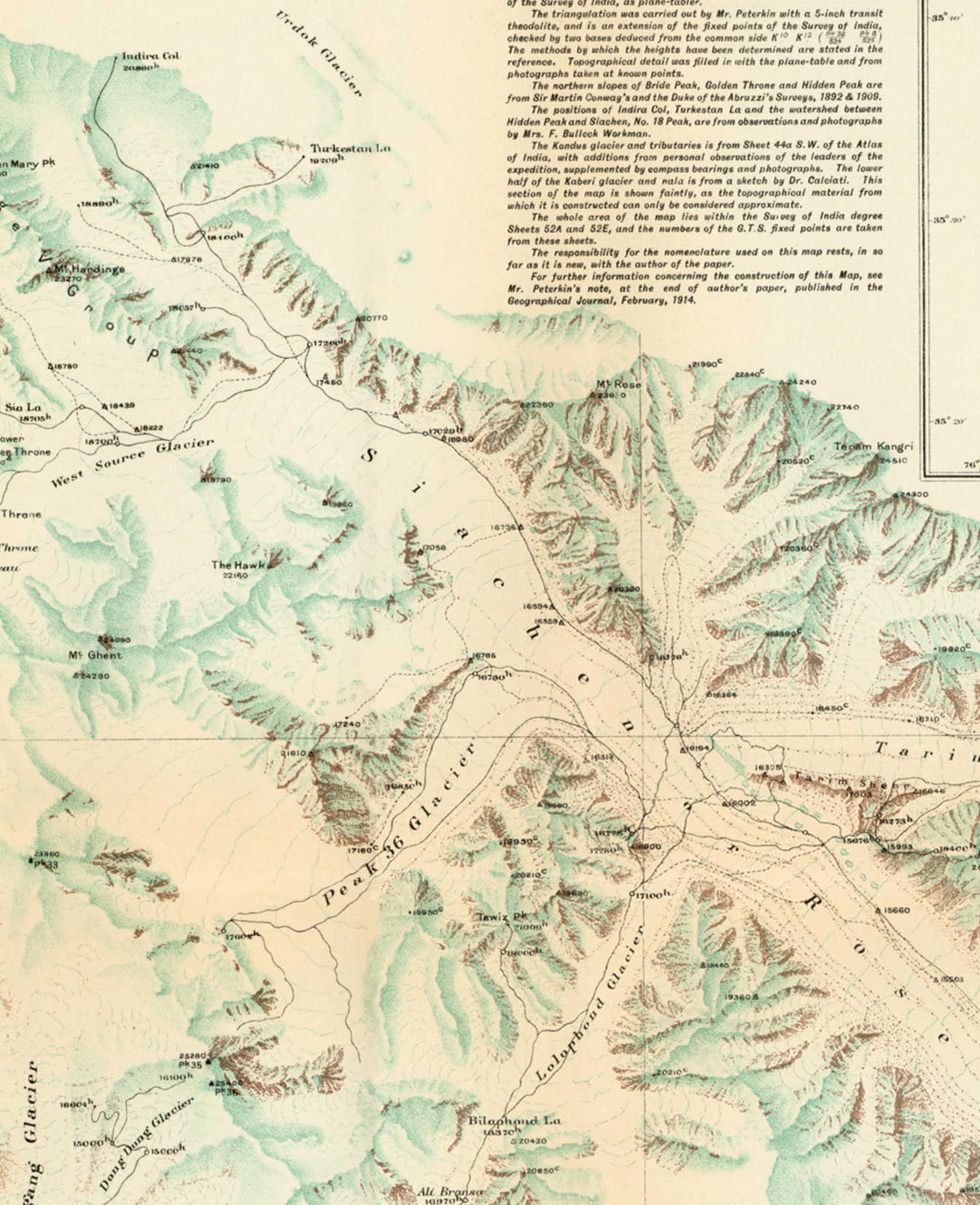
The positions of Indira Col, Turkestan La and the watershed between Hidden Peak and Siachen, No. 18 Peak, are from observations and photographs by Mrs. F. Bullock Workman.

The Kondus glacier and tributaries is from Sheet 44a S.W. of the Atlas of India, with additions from personal observations of the leaders of the expedition, supplemented by compass bearings and photographs. The lower half of the Kaberi glacier and nala is from a sketch by Dr. Calciati. This section of the map is constructed can only be considered approximate.

The whole area of the map lies within the Survey of India degree Sheets 52A and 52E, and the numbers of the G.T.S. fixed points are taken from these sheets.

The responsibility for the nomenclature used on this map rests, in so far as it is new, with the author of the paper.

For further information concerning the construction of this Map, see Mr. Peterkin's note, at the end of author's paper, published in the Geographical Journal, February, 1914.



35° 40'

35° 30'

35° 20'

76°

NOTE.

tributaries is from a trigonometrical survey or of the expedition, assisted by Surjan Singh & others.

ried out by Mr. Peterkin with a 5-inch transit of the fixed points of the Survey of India, from the common side K¹⁰ K¹² (P³⁶ P³⁷ P³⁸) heights have been determined are stated in the II was filled in with the plane-table and from

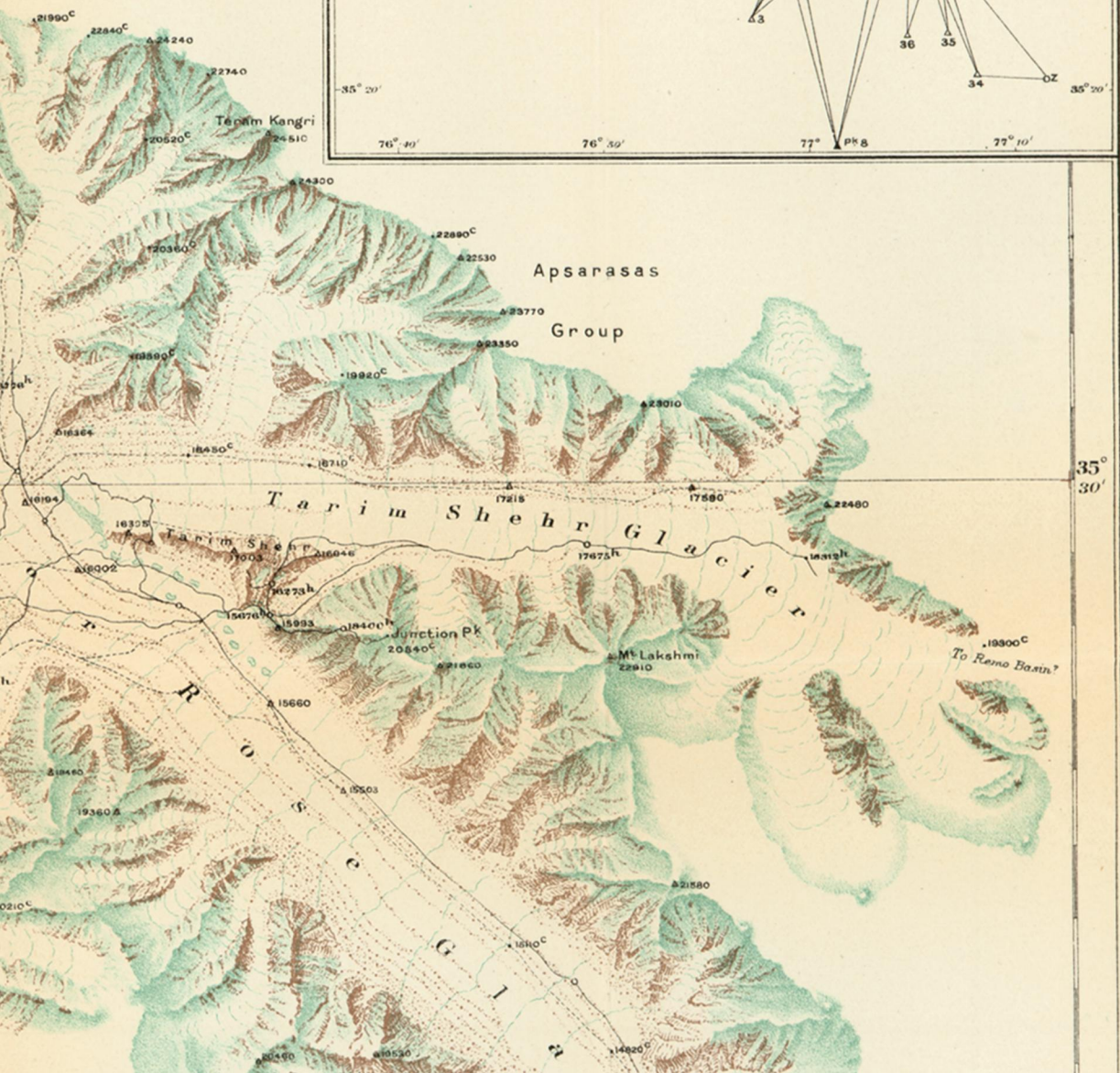
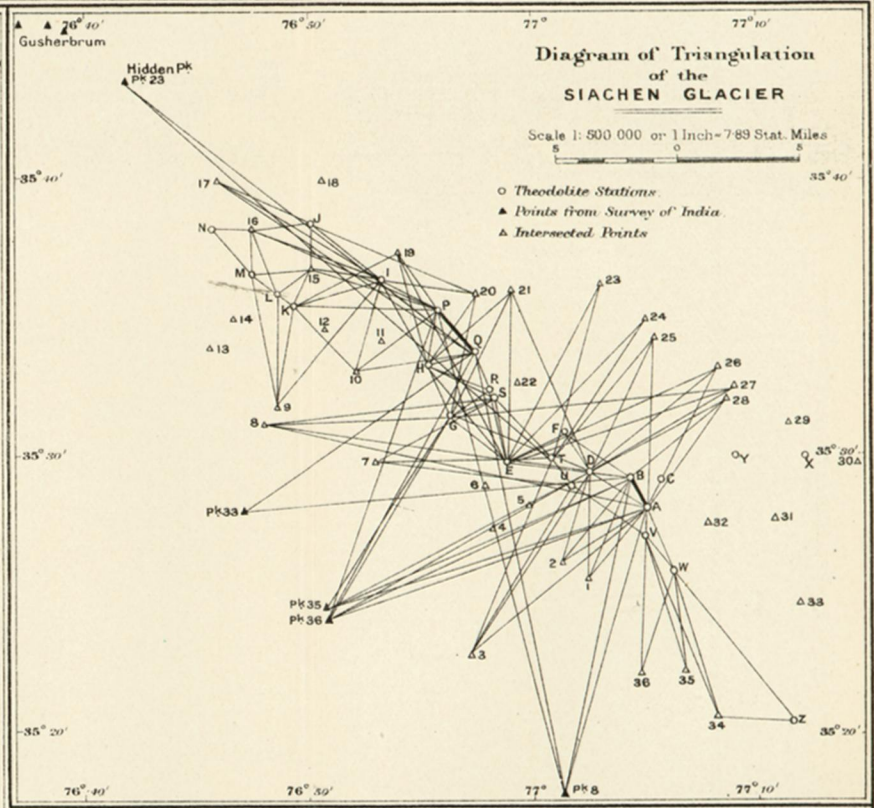
le Peak, Golden Throne and Hidden Peak are the Duke of the Abruzzi's Surveys, 1892 & 1909. I, Turkestan La and the watershed between Peak, are from observations and photographs

tributaries is from Sheet 44a S.W. of the Atlas personal observations of the leaders of the pass bearings and photographs. The lower nala is from a sketch by Dr. Calciati. This faintly, as the topographical material from be considered approximate.

ap lies within the Survey of India degree numbers of the G.T.S. fixed points are taken

nomenclature used on this map rests, in so r of the paper.

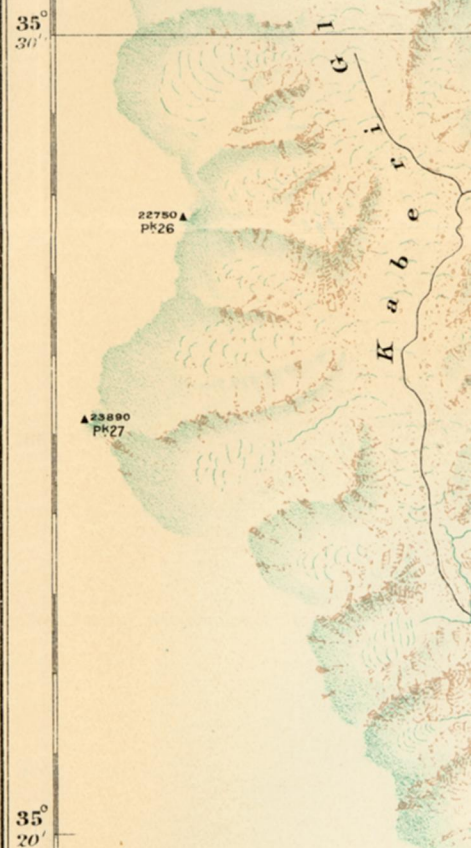
concerning the construction of this Map, see end of author's paper, published in the , 1914.



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"	4	35 27 19	76 58 14	19620	
"	5	35 28 08	76 59 48	16900	
"	6	35 28 49	76 57 49	19560	
"	7	35 29 41	76 52 59	21610	
"	8	35 31 06	76 48 07	24280	
"	9	35 31 44	76 48 33	24090	Mt. Ghent
"	10	35 32 58	76 52 10	22160	The Hawk
"	11	35 34 07	76 53 19	19960	
"	12	35 34 31	76 50 44	19790	
"	13	35 33 47	76 45 36	—	Silver Throne
"	14	35 34 55	76 46 38	20230	Lower Silver Throne
"	15	35 36 36	76 50 08	21440	
"	16	35 37 59	76 47 29	23270	Mt. Hardinge
"	17	35 39 51	76 45 43	24350	Queen Mary Peak
"	18	35 39 55	76 50 33	21410	
"	19	35 37 09	76 54 04	20770	
"	20	35 35 47	76 57 32	22360	
"	21	35 35 56	76 59 05	23630	Mt. Rose
"	22	35 32 36	76 59 23	20300	
"	23	35 36 02	77 03 00	24240	
"	24	35 34 43	77 04 54	24510	Teram Kangri
"	25	35 34 11	77 05 25	24300	
"	26	35 33 08	77 08 16	22530	
"	27	35 32 22	77 09 01	23770	
"	28	35 31 57	77 08 40	23350	
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"	31	35 27 36	77 10 49	22910	Mt. Lakshmi
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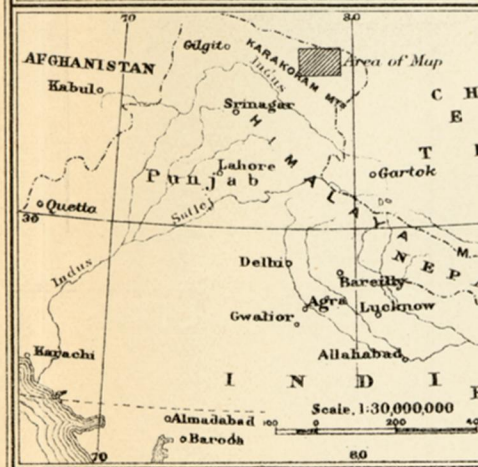
GREAT TRIGONOMETRICAL SURVEY OF INDIA POINTS.

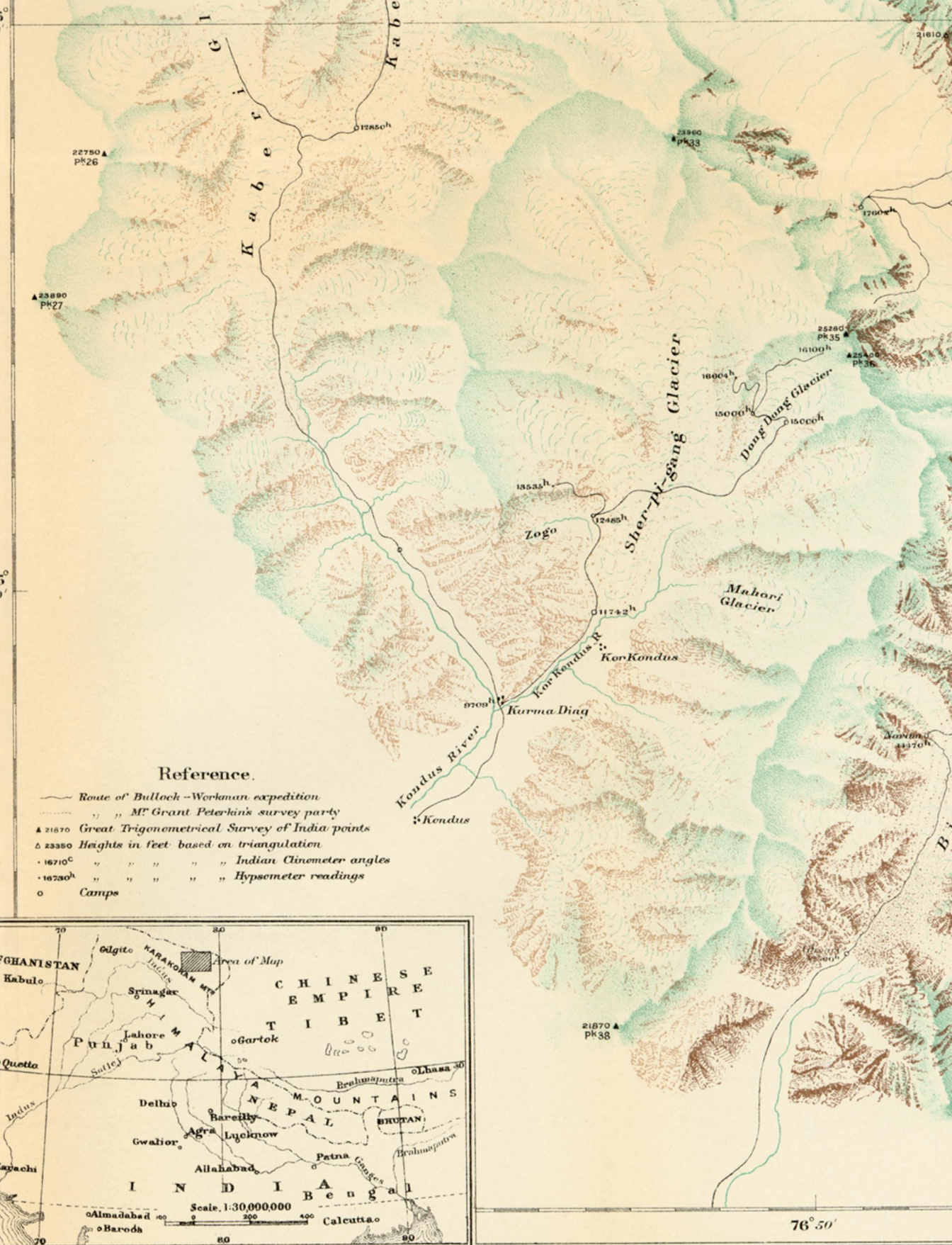
				feet
Pk. 23	...	35 43 30"	76 41 48"	26470
52A				
Pk. 25	...	35 36 44	76 34 23	25110
52A				
Pk. 26	...	35 27 45	76 34 44	22750
52A				
Pk. 27	...	35 25 08	76 33 12	23890
52A				
Pk. 33	...	35 27 54	76 47 07	23960
52A				
Pk. 35	...	35 24 24	76 50 50	25280
52A				
Pk. 36	...	35 24 01	76 50 55	25400
52A				
Pk. 38	...	35 12 12	76 45 41	21870
52A				
Pk. 8	...	35 17 46	77 01 23	24370
52E				

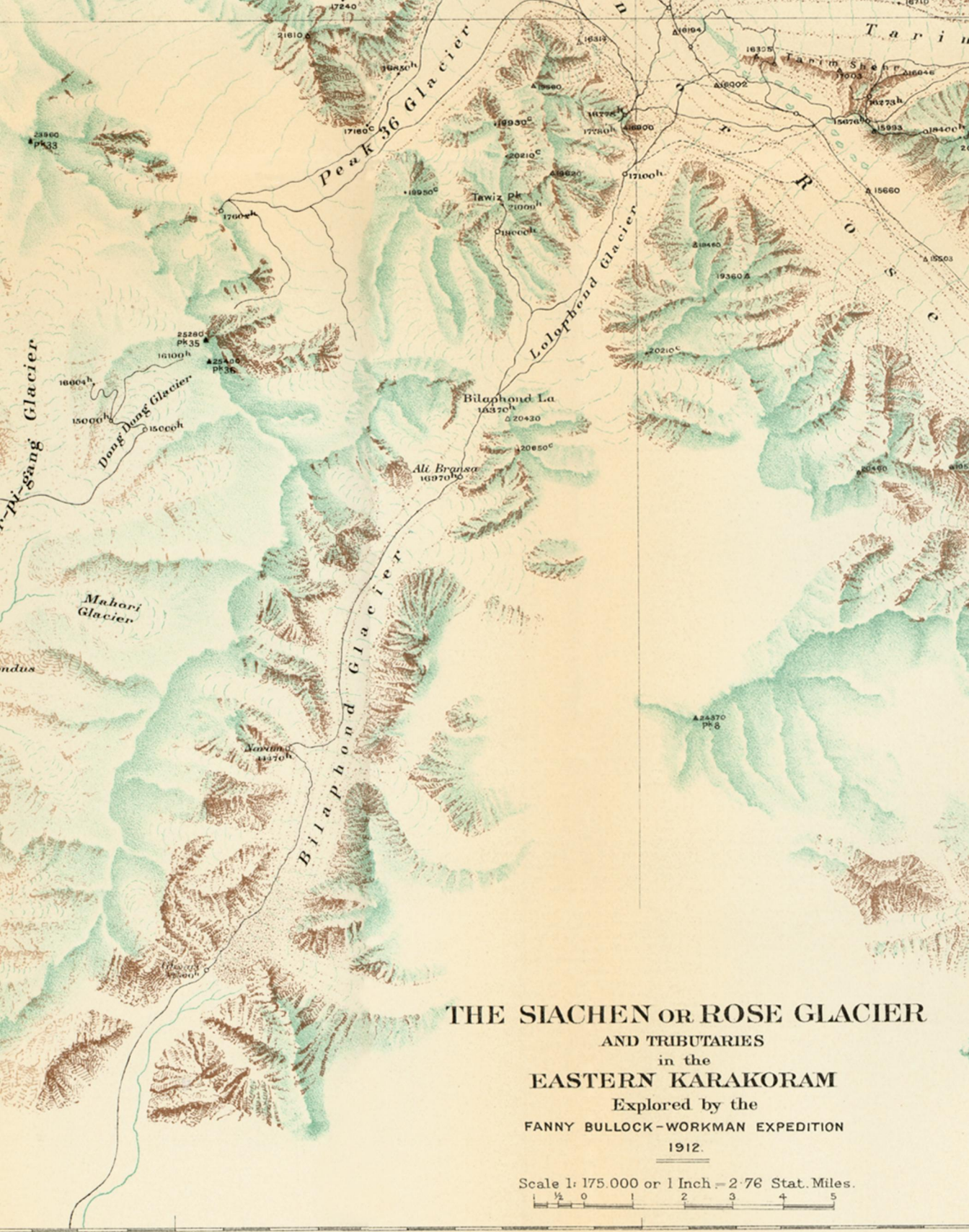


Reference.

- Route of Bullock-Workman expedition
- " " " " " " " " " " " "
- " " " " " " " " " " " "
- ▲ 21870 Great Trigonometrical Survey of India
- △ 23890 Heights in feet based on triangulation
- 16710^c " " " " " " " " " "
- 16730^h " " " " " " " " " "
- Camps

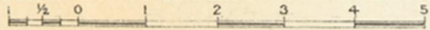






THE SIACHEN OR ROSE GLACIER
 AND TRIBUTARIES
 in the
EASTERN KARAKORAM
 Explored by the
FANNY BULLOCK-WORKMAN EXPEDITION
 1912.

Scale 1: 175,000 or 1 Inch = 2.76 Stat. Miles.



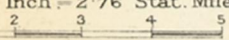
76° 50'

77°



OR ROSE GLACIER
TRIBUTARIES
 in the
KARAKORAM
 explored by the
WORKMAN EXPEDITION
 1912.

1 Inch = 2.76 Stat. Miles.



77° 10'

35° 30'

35° 20'

35° 10'

EASTERN KARAKORAM
 Bullock-Workman.

The PRESIDENT (before the paper): I am glad to see so large an audience assembled to give a welcome to our old friends, Mrs. Bullock Workman and her husband, Dr. Hunter Workman.* I say they are old friends of ours, because not merely are we familiar with their work from the written accounts of it, but they have both lectured to us on several occasions; exactly four years ago they paid us the compliment, for the first time, of lecturing together, as they are about to do to-night. It is quite fifteen years since Dr. and Mrs. Workman commenced their work in the region of the Himalayas. Since then they have carried out expedition after expedition with marked success and with scientific results of high value. It is a little more than three years since Mrs. Workman gave her last lecture before the Society on the subject of the Hispar glacier. Since then, she and her husband have been busy in a difficult and complicated region of the Eastern Karakoram, and it is with the results of these last expeditions that they are going to favour us to-night.

Sir FRANCIS YOUNGHUSBAND (after the paper): I think even those of you who have never been in those parts must have realized, from the magnificent photographs which Mrs. Bullock Workman and Dr. Hunter Workman have brought back, the terrible obstacles which they have had to overcome in order to accomplish what they did, and certainly those of us who have been there and know what the difficulties really are, can say that it is only by the greatest perseverance, pluck, and determination that such obstacles could have been overcome. I think that probably the part which I should most advantageously speak to you is in regard to this mysterious Soltoro pass, which Mrs. Workman has referred to. She was in doubt why it was called the Soltoro pass, but I think we simply called it the Soltoro pass because we did not know any other name to give it, just as mathematicians use the expression " x " to denote an unknown quantity. All that was known to us was a rumour that a pass did exist from Chinese Turkestan in the north into the Soltoro district of Baltistan on the south. There had been such reports for many years, and in 1889, when I was deputed by the Government of India to explore the passes into Hunza, I was asked on the way to try and find this mysterious Soltoro pass. I had crossed the watershed in 1887 by the Mustagh pass, and I imagined the Soltoro must be somewhere about the limit where Dr. and Mrs. Workman reached in 1912 expedition. I explored up that Urdok glacier, which is marked on the extreme north-western corner of the map, and at the top of the glacier I saw what I thought must be a pass, and ascended it about halfway when I was deterred from going any further by two avalanches very similar to that depicted in the slide which Dr. Workman has shown. I was just able to see that, at any rate, there was no practical route from Turkestan down to Baltistan by that way. But the curious thing is that this summer, quite unexpectedly, we heard of an officer from India who had come across the range by some way which he himself cannot define accurately on the map, from Turkestan down to Baltistan. He had gone up into Kashgar territory on the north by the Karakoram pass on the extreme east of these maps, and when in Turkestan, his hunter had told him that there was a more direct way down to India, by a pass to the west of the Karakoram pass, and ten years ago he came down by this same way west of the Karakoram pass, and certainly east of the Mustagh pass, and came out at Skardu in Baltistan. How he did it—whether he came over this glacier, which Mrs. Workman has so vividly described this evening, or by some other way, it is difficult to say. He assumed at the time that the route was known, and as he had no surveying instruments with

* Dr. Hunter Workman's paper will be published later.

him, for he was simply on a shooting expedition, he was unable to say exactly how he came. I hope this point will be finally cleared up by the expedition which Dr. de Filippi has organized, which is now at work in that region. Dr. Longstaff, in 1899, was, I think, the first to establish the interesting point that this Siachen glacier was really one of the great glaciers of Asia. Its mouth, as Mrs. Workman has said, was first seen by Henry Strachey many years ago, but it was then supposed to be quite an ordinary glacier—that is, ordinary for those regions, and it was reserved for Dr. Longstaff, when he crossed the Bilaphon-la, which he then thought must be the Saltoro pass, to first establish the magnitude of this glacier which Dr. and Mrs. Workman have now explored to its extremities, and mapped scientifically and accurately, so that we now have a full and detailed description of this remarkable glacier. Another point I was interested in in Mrs. Workman's account, was what she said about having seen a little brown butterfly. Some years ago I met a gentleman travelling in that region, who asked me whether, when I was crossing high passes, I had seen any butterflies? I said, "No, certainly not; high passes are not the places where you see butterflies." He said there was, some years ago, a brown butterfly caught by the Forsyth Mission of 1873 on the Karakoram pass, and he had been offered £400 to secure another specimen of the same butterfly. I hope Mrs. Bullock Workman will get £400 for her specimen. I desire to congratulate Mrs. and Dr. Hunter Workman on the very fine work they have accomplished, and on the highly valuable scientific results they have attained, and which could not have been accomplished without great care of organization before they started, without extreme persistence and pluck while on the journey, and without further elaborate working out when they came back.

Dr. T. G. LONGSTAFF: I have listened with great interest to the paper this evening. In 1909 I spent four months in this region, though only seven days and five nights were passed on the Siachen glacier. I was accompanied by Lieut. Morris Slingsby, 56th Rifles, F.F., for the first half of the trip, and Dr. Arthur Neve, of Srinagar, joined us for the Saltoro pass; his assistance was of very great value. For the last two months I had the good fortune to travel with Captain D. G. Oliver, at that time British Joint Commissioner for Ladak. My paper appeared in our *Journal* for June, 1910. I have had a series of maps, including my own sketch-map, put up in the next room. Neve wrote an account of the first part of our trip for the *Times of India*, September 2, 1909, which is of particular interest, because it was written before the identity of the upper Siachen glacier had been discovered: a *résumé* of this article appeared in our *Journal* for November, 1909. His 'Thirty Years in Kashmir,' just published, contains a great deal of valuable and most reliable information on this and the neighbouring districts. His great influence with the natives give him advantages altogether denied to the ordinary traveller.

It is satisfactory to find that the Siachen and Teram glaciers each obtain a mile more length than I credited them with, though I note with regret that the former loses one-twelfth in extreme breadth. It is also satisfactory to find that our location of Younghusband's saddle was substantially correct. We are even agreed as to the mistake I made in attributing so great a height to Teram Kangri, a mistake I endeavoured to rectify by communicating Colonel Burrard's letter to our *Journal* (vol. 39, p. 71) two years ago, and by publishing in the *Alpine Journal* (vol. 26, p. 307) an account of the remarkable mountaineering achievements of Mr. V. W. B. Collins of the Survey of India, who successfully triangulated the peak in 1911 (compare also *Geogr. Journ.*, vol. 37, pp. 28-29). In the use of those points actually visited by us in 1909 and determined barometrically

I see that on the new map there is invariably an increase of altitude shown, averaging 270 feet in the nine comparable instances.

We have to thank the lecturers for giving us, by their enterprise, Mr. Grant Peterkin's really first-rate survey of the Siachen glacier. I showed him all my photographs and data before he started, and since he returned I have seen his and have watched his map growing at our quarters. I am certain that there will be no corrections of any importance for subsequent travellers to make in it. Of course, when we get beyond the limits of his own survey on to some of the outlying snow basins and on to the Kondus, the map becomes once more a sketch-map, just as mine was. That he did not see my cairn above the great bend is only to be expected, since he passed nearly 1000 feet below it and at a distance of at least a mile away from it.

I feel that the Italian expedition has hardly been treated fairly. It is true that they believed that Younghusband's saddle would be found further west than is shown on my map and where the lecturers have now placed it. But I really must point out that apart from this—only advanced as a supposition—there is no essential difference in the geographical relations between the Baltoro and the upper Siachen, as described by the Italians and by the lecturers. The great height (21,000 feet) of their camp on Chogolisa saddle gave the Italians a most commanding view. The quotation cited by the lecturer from page 315 of de Filippi's book makes it appear that they did not see the Kondus basin. Yet they say (de Filippi, 'Karakoram,' etc., pp. 441-2) that the Kondus glacier "was seen to intervene between the Baltoro and the recently discovered upper Siachen." "The westernmost extremity of the Siachen valley will not communicate directly with the Urdok, but only with the Kondus": this has been proved by the discovery and passage of the Sia La by the lecturers. Again, "Hidden peak is not the most easterly peak of the Gusherbrum group, for eastwards of Hidden peak rises another"—evidently that named after Her Majesty by the lecturers. This is all just as the lecturers have demonstrated this evening. Undoubtedly, Dr. and Mrs. Workman are the first Europeans actually to traverse the Kondus glacier, and they have very materially increased our knowledge of it. They have also visited the Sher-pi-gang for the first time, and of course they are the first to explore the highest reaches of the Siachen glacier itself.

With regard to the suggestion that because there are no practicable passes there, the names Kondus saddle and Chogolisa saddle of Conway's and the Italian maps should be abolished for the future—this is based on a misunderstanding of the rules of mountain nomenclature by the lecturer. They are called saddles *because* they are not passes. Compare the Agassiz *Joch* and the Hugi *Sattel* on the Finsteraarhorn. The Italians themselves indicate that they are not passes, but that is no reason for the abolition of two names of historical interest.

I fear that the constant changing of geographical names will lead in the future to as much confusion as has fallen upon biologists from the same cause. The name Saltoro pass has already been accepted by the Survey of India. It was recognized by Shere Ali Khan of Khapalu when we were getting information from him in 1909. It is used in the official 'Sketch of the Geography and Geology of the Himalaya Mountains and Tibet' (Chart 20). It also appears on the official map to illustrate Younghusband's explorations.

But apart from any of these precedents it is unquestionably the most important high pass leading directly into the Saltoro valley—from anywhere. The study of these native names is fascinating, but beset with difficulties. Lolo-phond sounds rather familiar to me. It is the name of a camping-place,

apparently our second camp beyond the Saltoro pass. To such the natives not infrequently attach the name of some person who has been there. For instance, Doulatbeguldi—"the place where Doulat Beg died." Now, *Loloff* was about the nearest the Baltis could get to my name, though Ladakis and Tibetans can get much nearer to Longstaff. It is quite an unexpected compliment for which I am duly grateful. The suggested change of the name Teram (properly Term, pronounced Térram) to Tarim (pronounced Tarreem) is unfortunate. We obtained this name Term from our coolies: it was the only name connected with the upper Siachen glacier which we could extract from them. Tarim must be either Persian or Turki. It is as if we altered an English place-name into a somewhat similar-sounding French one: as, for example, Cambridge into Cambrai. And again, surely Siachen should stand unchallenged as the name of the greatest glacier in Asia. Both these names also have been accepted by the Indian Survey. The lecturer seems to infer that the Baltis supplied the name Siachen. Possibly its identity may have penetrated to the Saltoro valley in consequence of our discoveries. But I must remind you that when we stood on the Saltoro pass in 1909 and saw this great glacier before us, no one knew what glacier it was nor whither it flowed; according to all previous notions we already stood on the Turkestan water-parting. Its origin was obviously in the neighbourhood of Hidden peak (*Geogr. Journ.*, vol. 35, p. 630) and the main interest was to find out where it went to, a riddle only solved with Captain Oliver's help three months later, when it was found that we had added some 500 square miles to the Indus basin. I understand the lecturer to say further that the name Siachen is not known to the people of the Nubra. Yet it is a Ladaki name, and was obtained directly from the upper Nubra villages. Neve also obtained this form of the name some years earlier: the Nubra people further told him that three marches up the glacier was a pass to the Remo ('Thirty Years in Kashmir,' p. 293). Therefore I ventured in this one instance to change the old Survey spelling Saichar to Siachen, giving the derivation practically adopted by the lecturer. The "ch" is pronounced soft as in *chenmo*. All the names on my map, published by our Society, had been decided upon in consultation with the Indian Survey at Dehra Dun, and were actually printed by them on the outline sketch-map, which they so kindly drew from my material. I welcome the new name "The Hawk" (22,200 feet on the Workman's map) as a most appropriate one for this beautiful mountain, and should like to withdraw our temporary name "Cornice peak" (22,140 feet on my map) as not good enough. None of these temporary names were printed on my map, but were used in my text.

Now as to the historical evidence for the former existence of a direct route over the Turkestan water-parting to Yarkand, used in combination with the Saltoro pass. In my paper I hastily assumed the negative view, attributing the stone shelters which we found at Ali Bransa (*Geogr. Journ.*, vol. 35, p. 629) to a route to Nubra only. Further reading had convinced me that the historical evidence is distinctly in favour of the positive view, and now the stone circle on the Teram peninsula and the cairns at Spur camp, discovered by the lecturers, definitely prove to my mind that such a route was formerly in use. The study of glaciers is of very recent growth. Changes may occur far more rapidly than has usually been expected. Remember that the Mustagh pass was in use so late as the time of Ahmed Shah—some eighty years ago. When Younghusband forced it, it had been completely abandoned.

The lecturers themselves have indicated a practicable route from the Oprang valley, though we cannot make absolutely certain that they saw the Urdok glacier till that region is definitely surveyed. Hayward (*J.R.G.S.*, vol. 40,

p. 59) refers very circumstantially to an old route from Khufelung, leading both directly to Nubra and to Chorbat: in the latter case, the Saltoro pass would also have to be crossed. (Cf. Sir Henry Trotter, *J.R.G.S.*, vol. 48, p. 177, and Sir T. E. Gordan 'The Roof of the World,' p. 15). That it is necessary to cross *two* passes by this route between Turkestan and Baltistan was indicated by what Shere Ali Khan told us in 1909 (*Geogr. Journ.*, vol. 35, p. 624). Again, Vigne (vol. 2, p. 387), when weather-bound on the Bilafond glacier, wrote that "two lofty and difficult ridges were to be crossed on the way." On his map, which I am showing this evening, is printed "Way over glacier by Ali Bransa to Yarkand." I find also a curious association between the names Khapalu, at the mouth of the Saltoro valley, and Khufelung, a camping-place near the head of the Yarkand river, on what I believe to be the old route. Strachey's map marks the latter actually as "Khapalu Agze," while Shaw prints it "Kapaloong." Moorcroft even writes Khapalu as "Kafulun"; of course, in this part of the world, *f* and *p* are often confused. Until de Filippi is able to explore both the Remu and the Khufelung valleys, it is impossible to get at the truth of these traditions, for no part of the main water-parting between the Karakoram pass and the point reached by the Workmans has yet been explored. But I have a strong suspicion that the officers alluded to by Sir Frank Younghusband really crossed the pass we have all been looking for, and preceded our party on the upper Siachen.

There is another interesting problem in this region for de Filippi to solve. As I have often said, none of us ever thought that Teram Kangri was particularly high until Slingsby and I reached the Rgyong La, nearly 19,000 feet. From there we saw and photographed a very imposing group of mountains which I thought was Teram Kangri (*Geogr. Journ.*, vol. 35, plate 1, opp. p. 640; *Alpine Journ.*, vol. 25, plate 1, opp. p. 485, and vol. 26, p. 313). But a comparison of the altitudes of the different peaks of the Teram Kangri group obtained by Mr. Collins for the Survey of India and of the more complete data obtained by Mr. Grant Peterkin for the Workmans' map, with the outline of the peaks shown in my photograph, appears to me to disprove my assumption. In this case, these peaks must constitute another unknown and very lofty mountain group somewhere to the north-east of Teram Kangri, probably in the Remu area, as indeed I might have inferred from a letter I received (March 28, 1910) from Colonel Godwin Austen. Extreme difficulties of access have so far kept the geographical secrets of this north-eastern region of the Karakoram hidden from our view, but if any one can unveil them it is de Filippi and his very talented companions who are even now wintering in Baltistan.

With regard to Dr. Workman's paper; as to the hypothesis which I suggested with regard to the physiographical relations between the Gusherbrum range and the Teram Kangri group, though such a high authority as Professor Novarese has already enunciated (de Filippi's 'Karakoram,' p. 443) the views now brought forward by Dr. Workman, yet no less an authority than Dr. Oldham appears to favour (*ibid.*, p. 447) my own theory. The gaps between Teram Kangri and the Gusherbrums and between the Gusherbrums and K_2 do not necessarily affect the structural unity of the range, and Dr. Oldham considers that they are probably "part of the same general area of special, recent, uplift." My view that the Siachen may turn out to be a homologue of the Baltoro gains very strong support from a photograph shown me by Mr. Grant Peterkin taken from the northern branch of the western Siachen source, not visited I understand by Dr. Workman. In this photograph I recognized, to my astonishment, the Mustagh tower far down the Baltoro, showing that despite the intervening Kondus basin (which I

indicated on my map) the main valleys of the Baltoro and Siachen do form a continuous line of depression. I think that any one reading Novarese and Oldham's Appendix to de Filippi's 'Karakoram' must agree that the Italians are justified in their geological deductions. Furthermore, I see no reason to change mine with regard to the Siachen. Certainly it is impossible for any one to be positive about the succession of the rocks until they have been thoroughly examined *in situ*, and this still remains to be done.

Sir MARTIN CONWAY: It is just over twenty-one years since I returned from the region which is on the extreme edge of this map, and it is, therefore, with some diffidence that I venture to speak on the question at all, because one's memory of detail naturally grows feeble in that time. One thing, however, I may say, which touches in no manner on geographical detail, and that is, that if there did exist any ill-tempered critic desirous to make the worst that he could of the work in the mountains of the Karakorams of Dr. and Mrs. Workman, he would, after saying his worst, have to make certain omissions. He would be compelled to allow that, during the best part of fifteen years, they had devoted a great portion of their time to the serious study of this enormous mountain region. He would be obliged to say that they had undertaken expedition after expedition of the most arduous kind; that they had carried those expeditions through with ever-increasing ability, increasing elaboration, and with the increasing success which comes from accumulated experience. He would be obliged to say that the map of this part which was in an unsatisfactory state, over a considerable portion of it, has, since their visits, been filled out with detail which is obviously truthful; that they have added, therefore, enormously to our knowledge of the greatest knot or group of mountains on the face of the Earth; and that as a matter of fact they have "hitched their chariot," as it were if not to a star, at all events to a great mountain group, and as long as those mountains continue to attract the attention and the admiration of people who take an interest in such matters, their name must be indissolubly associated with them. Dr. Workman has referred to a set of glacial phenomena, which he has classified and in which he has taken a great interest. I have before broken a lance with him as to the use that he makes in relation to them of the term "nieves penitentes," because I think he stretches that term to cover certain phenomena which it ought not to be used to cover. The term "nieves penitentes" is a South American name for a particular thing, and I doubt if South Americans would recognize that object in some of the phenomena to which Dr. Workman applies the term. That, however, is not a matter of great importance. He referred to a particular set of forms of glacier-ice on the Baltoro glacier, which he had not seen, but which have been seen now by three or four parties—I mean the blades of white ice that jut up out of the surface of the glacier to considerable heights—30 or 40 feet, and that follow one another down the glacier in a long succession. I looked in his photographs for any examples of the same formation, and though there were some that distantly resembled them, there were none of identical form or nature.

I have no doubt that the explanation he gives of them is correct. These blades of ice are denuded pressure ridges; where the ice has been most compressed there it melts the least readily, and consequently these blades of ice stick up above the rest of the surface of the glacier. What, however, I principally noticed as the general outcome of looking at the photographs they showed us, was that in the Siachen district we come into a mountain area altogether different in kind from that which surrounds the basins of the Baltoro and Hispar glaciers, which I myself traversed. In that other region the mountains are, for the most

part, unclimbable mountains. They are, for instance, such needles as that first view Dr. Workman showed; peaks overwhelming in altitude, precipitancy, and every quality that is least favourable for a climber. On the other hand, this group of mountains we have been taken to to-night is one that suggests possibilities of ascent, and, if I was not far beyond ever thinking of going off the level ground now, I should feel tempted to have a try at them myself. I feel no doubt that in the future we, as a Society, shall have the opportunity of making the acquaintance of some of these great peaks in detail, when the story of their further exploration is related before us, and then we shall be able to congratulate whoever it may be that returns in triumph from some great ascent, as warmly as I congratulate Dr. and Mrs. Workman on the renewed success they have attained in one more great expedition.

The PRESIDENT: I should like on your behalf, and as President of the Society, to associate myself with the words that have fallen from the speakers this evening—all of them experts of the highest authority—as to the interest and value of the two papers to which we have listened. I shall not presume to add anything to what has fallen from their lips, but I am expressing your feelings as well as my own when I say that we have never here listened to two papers of higher scientific interest, illustrated by more beautiful slides.

IS THE EARTH DRYING UP?*

By Prof. J. W. GREGORY, D.Sc., F.R.S.

1. The Reported Desiccation of the World and its Effects.
2. Three Forms of the Desiccation Theory.
3. Changes of Climate in Recent Geological Times.
4. Palestine—a Test Case; Evidence for Desiccation; Ancient Population; Woods and Rainfall; Ancient Climate and Water Supply; Evidence of Date Palm and Vine; The Pluvial Period in Palestine.
5. Egypt.
6. Greece.
7. Cyrenaica.
8. Northern and Western Europe.
9. Hungary; Roumania.
10. Central and Western Asia.
11. Africa, exclusive of the Mediterranean Coastlands.
12. North America.
13. Greenland.
14. Local Character of Climatic Changes.
15. The Pluvial Period of the Mediterranean a Result of the Glacial Period.
16. The Test of Synchronism.
17. Local Variation of Post-Glacial Climate.
18. Summary of Conclusions. References.

1. THE REPORTED DESICCATION OF THE WORLD AND ITS EFFECTS.

UNDERLYING the irregular and apparently capricious variations of the weather, a regular cycle of change has been recognized by the study of long continued observations. This cycle appears to be only a secondary movement on a still greater cycle, and it, according to some geographers, is in turn controlled by variations the length of which can only be measured in geologic ages, while glacial deserts were being changed into torrid wastes. In recent years we have been often warned that one of these great climatic changes is now carrying the world, slowly and irresistibly, toward world-wide drought. The view that the Earth is becoming steadily

* Royal Geographical Society, December 8, 1913. Map, p. 232.