Cloud from avalanche descending between two granite peaks on Bilaphond glacier.

Frontispiece.

TWO SUMMERS IN THE ICE-WILDS OF EASTERN KARAKORAM

THE EXPLORATION *of* NINETEEN HUNDRED SQUARE MILES OF MOUNTAIN AND GLACIER

By FANNY BULLOCK WORKMAN *and* WILLIAM HUNTER WORKMAN

WITH THREE MAPS AND ONE HUNDRED AND FORTY-ONE ILLUSTRATIONS BY THE AUTHORS

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NOTE

THE outbreak of the European War in August 1914 unavoidably delayed the publication of this book, which was to have appeared in the autumn of that year. The delay thus occasioned has not, however, in any way impaired the originality or geographical value of the material presented, no explorer having since visited the region described, the greater portion of which was first visited and explored by the authors.

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PART I

EXPEDITION OF 1911

EXPLORATION OF THE SHER-PI-GANG, DONG DONG, MASHERBRUM, KHONDOKORO, CHOGOLISA, AND ALING GLACIERS, AND BASINS

BY

WILLIAM HUNTER WORKMAN, M.A., M.D.

Honorary Member American Alpine Club, Appalachian Mountain Club; Corresponding Member K.K. Geographische Gesellschaft, Vienna, Société de Géographie d'Alger et de l'Afrique du Nord; Fellow Royal Geographical Society; Member Mass. Medical Society, Alpine Club; Medalist Société de Topographie de France, Sociétés de Géographie d'Alger et de l'Afrique du Nord, de Marseille, de Rouen, de Roubaix, etc.

TWO SUMMERS IN THE ICE-WILDS OF EASTERN KARAKORAM

CHAPTER I

INTRODUCTORY REMARKS—RAWALPINDI TO SRINAGAR—DETAILS OF PREPARATION AT SRINAGAR—THE SOLDERING-IRON AS AN IMPLEMENT OF EXPLORING-OUTFIT—ORDEAL OF SECURING SERVANTS—MEMBERS OF EXPEDITION—ILLNESS INTERRUPTS PLANS—EXPEDITION STARTS.

WHEN two authors, who have jointly written up in book-form the experiences of six Himalayan expeditions, which though made in different regions were carried out under similar conditions, approach the task of describing a seventh and eighth, they realize that the field of incident and adventure as well as of other available matter has been greatly narrowed by the descriptions in their preceding volumes.

Details of camp-life, however interesting in themselves, coolie-peculiarities and escapades, anthropological customs, natural phenomena, and the various accidents to which explorers are exposed, having already received attention must be referred to again with caution in order to avoid repetition. Further, those who through long familiarity have become *blasé* to many incidents of exploring life, may fail to notice as worth description occurrences that might be interesting to the reader, which a novice in exploration would seize upon at once.

Intimate acquaintance with such incidents may induce one to regard them and their bearings in a less poetic and imaginative and in a more practical aspect, viewing a spade as a spade without transforming it into a rainbow. It may also teach one to detect the form of the spade in the colour-bands of the rainbow-creations that illumine the pages of travel.

Endeavouring to steer a safe course among these shoals and currents, in Part I of this volume I will attempt to portray such features of the expedition of Mrs. Bullock Workman and myself to the Eastern Karakoram in 1911 as seem to me worthy of record, leaving to her the task of recording the story of our exploration of the great Siachen and Kaberi glaciers in the latter portion of our 1911 and on our 1912 expedition, with an addition by myself of an account of some of the physiographical features of those glaciers and their basins.

First-time visitors to Srinagar, the pearl of the poet's Paradise, in the Vale of Kashmir, especially those having slight acquaintance with India or the East, even at this late day, when the simplicity and charm of life in the valley have largely disappeared, partly through abuses that inevitably follow in the train of the tourist and partly through other causes, may be pardoned for exhibiting a considerable amount of gush and enthusiasm for such novelty as still remains. But when a person, who has made the tiresome and uncomfortable journey from Rawalpindi to Srinagar and vice versa twelve to sixteen times, who has become fully acquainted with its not increasingly pleasing accompaniments, and from whose horizon the novelty and glamour of its attraction have mostly vanished, is obliged to pass that way again, that person may equally be pardoned for wishing to get in and out as speedily as may be, without stopping to linger over any possible romantic charms or to note for the purpose of publication features, that have been minutely described by scores of first-time visitors to Kashmir.

In 1911 and 1912 Srinagar lay in our way for the seventh and eighth time. It was with a feeling of aversion that almost counterbalanced the lure of the magnificent mountain-world beyond, that we contemplated the journey over the two hundred miles of imperfectly constructed, badly kept cart-road constituting the only approach to it from Rawalpindi in the primitive, by no means luxuriously appointed, two-wheeled tongas drawn by half-broken, balky horses or still more fractious mules; the over-filled dak bungalows, and the probability, if late comers, of being compelled to pass the night in the dining-room or on the veranda; the delays and danger to life incident to the April tempests, with their destructive floods and landslides obstructing the road or carrying it away bodily; to say nothing of the damage to one's luggage and effects from exposure to torrential rains and from friction caused by the pitching from side to side of the unwieldy transport-ekka among the atrocious inequalities of the road. With a knowledge born of experience and shorn of romance of the various exigencies which had been, and were likely to be again, encountered on that route, that called for the exercise of a determination unknown to and unappreciated by a first-time visitor to Kashmir, we faced the music, and, after a repetition of certain trying experiences that need not be recorded here, arrived duly at Srinagar.

In this connection it might, perhaps, be stated, that my experience has been, that the inconveniences arising from being herded in with numbers of human beings of various types in insufficient quarters have been infinitely more trying than many things associated with tent-life in trackless mountain-wastes, that would ordinarily be regarded as deprivations and hardships.

The tonga, although a most bone-shaking vehicle, possesses the advantage that one endowed with the requisite amount of endurance of motion, dust, and mud can reach Srinagar in two to two-and-a-half days from Rawalpindi. Should the much slower landau be preferred as being more comfortable, the traveller has to take the chances of the overcrowded bungalows for five or six nights, and the correspondingly greater chance of delay and danger from storms. Still more comfortable, though considerably more expensive, is the recently established motor-service, which covers the distance in two days; but this, with its Indian chauffeurs, upon the narrow road congested by ekka and bullock-trains and with inadequate protecting wall, in places, along the precipices above the Jhelum river, presents special elements of danger from which many would shrink.

On arrival at Srinagar in the early days of April 1911, with an enthusiasm sustained by the prospect of visiting once again the glorious regions beyond, we plunged into the tedious details of preparation for the proposed exploring expedition, which after the experiences of six preceding ones had become unpleasantly familiar. These consisted, among other things, in writing and wiring in various directions to attempt to accelerate the movement of belated supplies delayed through uncertain and ill-regulated transport-facilities; in the clearing at the customs-office, unboxing, listing, and repacking in cases containing a coolie-load each of different stores, some of which were ruined by exposure to rain in transit or by being pierced by strong four-inch wire-nails driven recklessly through the sides of the cases, presumably, during the process of

Instrument-coolie from the Saltoro valley.

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customs-inspection at the ports of entry; in examining and superintending the repair of tents and camp-furniture corrupted by moth and rust after a season of storage; and in vain efforts to procure, properly made and serviceable, of Kashmir artisans, the thousand and one small articles essential to the comfort and convenience of members of the expedition.

On this and the 1912 expedition, as a result of the teaching of past experience, one implement was added to the outfit, which, though not, we believe, usually in the list of those essential to exploring and mountaineering expeditions, proved itself of great value. This was a soldering-iron. Previously, we had suffered much inconvenience from the loss of petroleum owing to leaks occurring, not only in the soldered joints but as well in the continuity of the sides of the tins, in which small checks were developed from bending caused by the frequent contraction and expansion of the contents under changes of temperature. Oil would escape quite freely from checks so small as to require careful examination for their detection.[1]

The coolies who carried the oil did not appear to mind in the least the saturation of their clothing with it, and were more than once seen marching serenely along with oil dripping freely from their backs. Indeed, there was reason to believe, that they regarded an occurrence of this kind in the light of a godsend, as supplying a means of

[1] This offers a possible explanation of the shortage of oil at his depots complained of by Captain Scott on his return from the South Pole, provided the oil was contained in the tin cases usually employed, and that the variations of temperature were sufficient to give rise to expansion and contraction. Checks in the tin might occur here even more readily than at higher temperatures, the metal becoming more brittle under the great cold to which it was exposed.

ridding themselves of a multitude of small beings that led a riotous existence in the folds of their garments. It was impossible to find any one, even at the largest villages, who could repair the defects in the tins. and, in spite of all possible makeshifts, much oil was lost that was indispensable to successful work above the snow-line. The soldering-iron changed all this. As soon as a leak was discovered it was quickly and completely stopped. Scarcely a pint of oil was lost on either of these expeditions. Water-tins, so often rendered useless through rust-holes, also shared in the benefit conferred by the soldering-iron, and were easily restored to a serviceable condition.

One of the most exhilarating features of such preparations is the attempt to secure a corps of servants on whose services any reliance can be placed. It may be imagined, that we put our hands with joyous and sanguine anticipations to the plough to turn over the soil of this arid desert, that had several times already been ploughed with worse than indifferent results. Kashmir servants are not paragons. Many of those offering themselves at high wages have had no training whatever, and know little or nothing of the duties they engage to perform, not only being guiltless of even a smattering of the technical knowledge pertaining to the positions of bearer, kitmagar, or tent-servant, but being unable to stretch a tent-cord with approximate correctness, to drive a nail straight, to turn a screw into a box-cover, or even to dust a blanket with an approach to thoroughness.

From such material one makes the best selection possible—in almost every instance a poor one—on the best available terms, knowing that constant supervision will be required to secure even the semblance of performance of duties which the servants agree to undertake. In the course of an expedition, as in many other experiences in life, one finds that a fool is worse to deal with than a knave—though many Kashmiri servants are a combination of both—as is shown by the amount of destruction of camp-outfit caused by the mishandling of the ignoramus. However, this inconvenience as well as others must be accepted and endured as a part of the game, which, as circumstances go, cannot be avoided.

There are exceptions to all rules, and sometimes a servant turns up who fulfils his duties with a degree of efficiency. On this occasion and again the following summer, we, fortunately, had no difficulty in filling the most important position of all, that of khansamah. Our old khansamah, Khudu, who has accompanied us on every expedition we have made except one, when he was elsewhere in service—in all seven times—having been apprised of our coming, stood ready to take up his customary duties on the usual terms without making the preposterous demands as to wages, outfit, and advanced payment, so common among Kashmiri servants.

He knew our camp and marching customs to a hair's breadth, and fitted into his place in the camp-economy as if there had been no break in the continuity of his service. From the moment of starting his department was managed to our satisfaction, which was a great assistance, as considerable attention had to be given to the other servants to train them to the required routine.

We have considered it good policy, in general, after setting out on an expedition to hold on to such servants as have been secured, incapable as some of them have proved, on the principle of the inadvisability of changing horses when crossing a river, and we have managed to keep them with us throughout the expeditions, taking them to all points where they could be of any service, and to some where they could not. This has not, I think, been the experience of every Himalayan expedition. We remember some years ago meeting the servants of a large expedition returning in a body from Skardo, having been discharged, it was said, for cause, before difficult regions were reached.

The agreeable and stimulating occupation of preparation, some of the rainbow-tints of which have been outlined above, required a month to bring to completion, and everything was ready for the start on the arrival of the other European members of the expedition towards the end of April. These consisted of Cte. Dr. Cesare Calciati, who was to act as topographer; an Italian assistant, Dante Ferrari; Cyprien Savoye, guide; Simeon Quaizier, Cesar Chenoz, and Emile Gléry, porters, the last four from Courmayeur. In addition to these T. Byramji of Srinagar, speaking fluently English, Persian, Urdu, and Balti, was engaged to fill the important position of agent, to precede us in charge of extra supplies, and to arrange for coolies and the collection and transport to the base-villages of rations for them to be on hand on our arrival. He was also to, and did, remain at the base-station to forward supplies of all available kinds as needed, to replace coolies who gave out or were discharged, and to transmit our mails to and from Skardo, the last post-village, by a service of dak or post-coolies, as had been done on all our expeditions.

We had planned to explore the glaciers draining into the Kondus and Hushe nalas, situated in the little-known region south of the Baltoro between the Siachen watershed on the east and the tributaries of the Hushe on the west; and in the case any pass, such as had been reported to

Our Khansamah with coolies entering cleft between two ice-ridges on Sher-pi-gang glacier.

[Note two, who have removed boots, walking barefoot on ice.]

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exist over to the Baltoro, should be found, to cross it, descend to the Baltoro, ascend to and explore the Punmah region.

Early in May the advance-caravan, in charge of Byramji accompanied by Dr. Calciati and his assistant, left Srinagar with orders to proceed directly to Kapalu in Baltistan, where Byramji was to arrange for Dr. Calciati to go on to the Kondus region, while he himself remained at Kapalu to complete, with the Raja's assistance, the preparations for the movements of the main portion of the expedition. We were to follow eight days later, to allow time for the coolies in the Indus valley, whose numbers are limited, to become available after the passage of the advance-caravan.

Just here occurred one of those unforeseen events, that upset the best laid schemes of mice and men. One of the leaders of the expedition was suddenly struck down by a severe attack of influenza, with symptoms, which for the next three weeks made it doubtful whether the expedition could be undertaken at all. Those in advance were wired to halt in the Indus valley near the Shyok junction to await developments. A delay of nearly a month thus occasioned, before a decision to go forward could be reached, curtailed the available time and necessitated a considerable change of plan during the summer. This last, together with the loss of time and cloudy weather which later supervened, prevented Dr. Calciati from being able to map a large portion of the region visited or to do justice to those portions that came under his inspection, the fixed peaks and higher summits being hidden for considerable and sometimes critical periods behind heavy clouds.

In the preparation of Map I published with this volume covering the district west of the Siachen to the Hushe glaciers, the Indian Survey map had therefore to be taken as a basis, the positions of its fixed peaks being adjusted to the latest values assigned to the Madras Observatory, and such changes made as appear to be warranted by the sketches of Dr. Calciati in 1911, and by our own personal observations during the expeditions of 1911–12, aided by photographs and compass-bearings. The result is a great improvement on the Survey map, and gives a fair idea of the general topography of this region. No claim is made to topographic accuracy of all details, especially those of distance, which had, largely, to be made to accord with those shown on the Survey map, which appear to be inadequate in places. Under the circumstances such accuracy would be impossible, and it could only be secured by a systematic survey, to which the general conformation offers serious obstacles. Changes have been made only in those portions actually visited and observed, and no responsibility is admitted for unaltered portions of the Survey map.

By the first days of June recovery, though by no means complete, had proceeded so far that, though with considerable misgiving, it was decided to chance a start, travel by easy stages, and allow our final movements to be determined by the effect of the journey on the health of the invalid. The Sind valley was ascended in a leisurely manner to Sonamarg, where a halt of three days was made. Here the pure mountain-air and brilliant sunshine worked more beneficially and rapidly than had been expected. At the expiration of this time it was found possible to advance henceforth by regular marches.

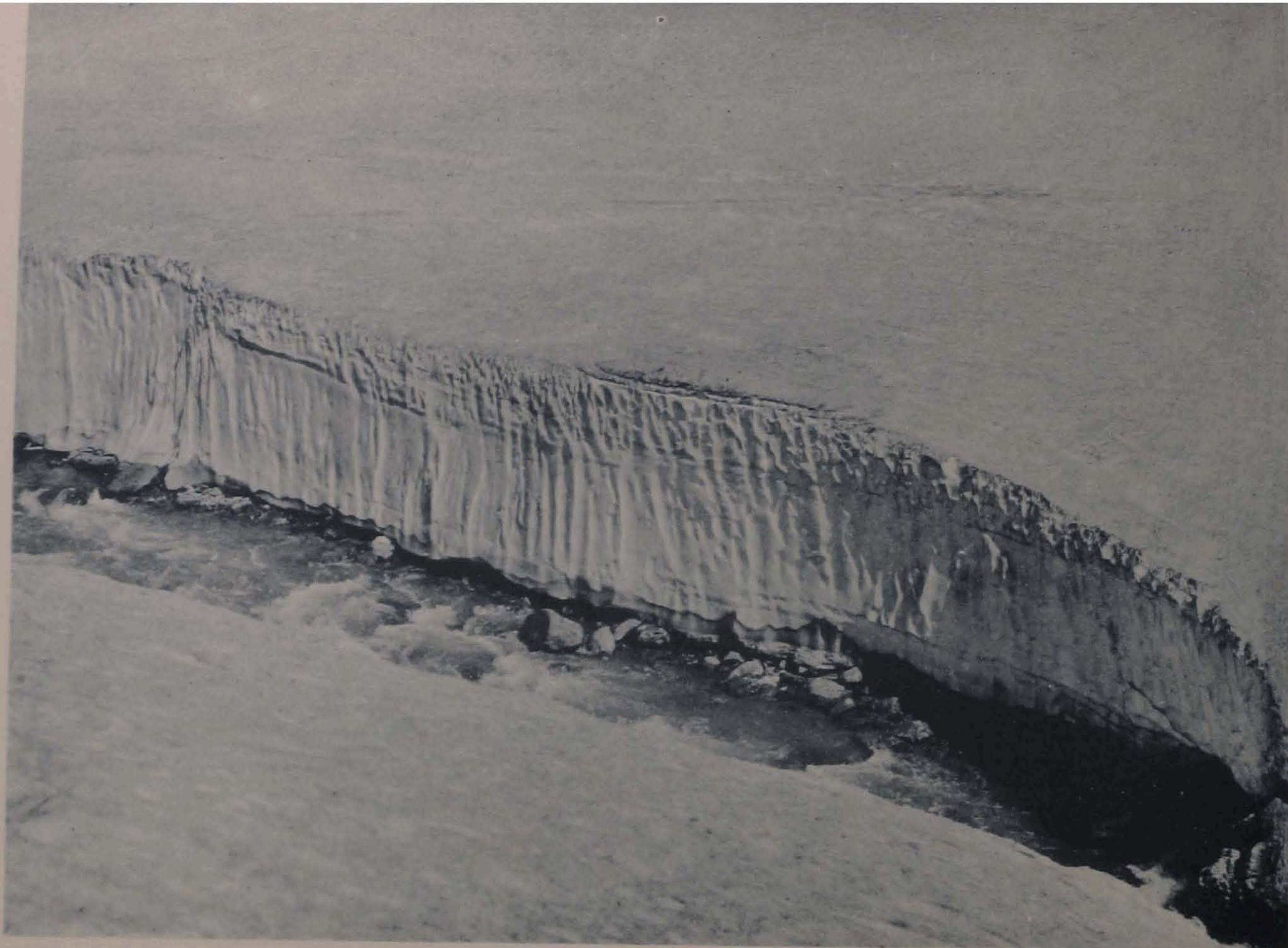
At Sonamarg we camped among the moraine-ridges that ramble over its surface, deposited by ancient glaciers which made the marg their camping ground ages ago, and left behind by them when they took their departure. The rock-débris, that, probably, formed the surface of these ridges, has been thoroughly disintegrated by time and weather, and converted into a thick mould that supports a growth of coarse grasses and other vegetation, and furnishes a camping ground to innumerable field-mice, whose burrows honeycomb it in every part. That the marg was destined by Nature to serve as a camping ground seems to have been recognized not only by glaciers and mice but by other animals and human beings as well, as is indicated by its constant employment for this purpose, when free of snow, by multitudes of ponies and cattle, by trading caravans moving up and down the Sind valley, and by hordes of summer visitors whose tents occupy every available spot.

CHAPTER II

THE ZOJI LA—SNOW-CONDITIONS IN THE GUMBER VALLEY—AT TOLTI—FERTILITY OF SHYOK VALLEY—WAZIR ABDUL KARIM MEETS US—ARRIVAL AT KAPALU—CAMPING PLACES AND MEDICAL AID TO THE SICK—RAJA SHERE ALI KHAN VISITS US—THE EASTERN CONTRASTED WITH THE WESTERN POINT OF VIEW—FINE SITE OF POLO-GROUND—A CURIOSITY.

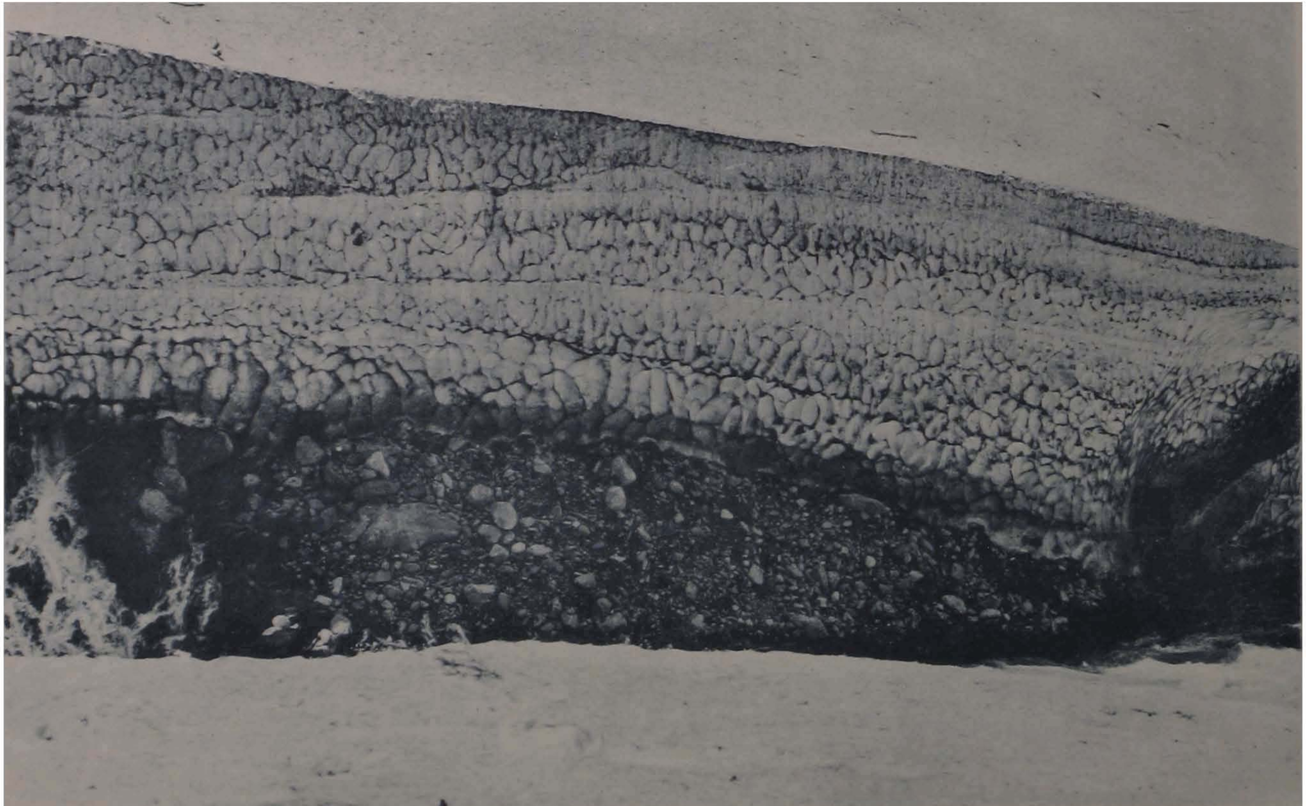
THE route from Sonamarg over the Zoji La, down the Gumber, Dras, and Indus valleys, towards Skardo, as far as the Indus-Shyok junction, has been so often described that little remains to be added. The Zoji La, although a low pass of only some 11,300 feet, with an excellent pony-path over its steeper, western side, and easy to cross in summer, serves as a geographical *pons asinorum* to many tourists in Kashmir, being regarded by them as a supreme limit, beyond which it is rash to venture and the very name of which is to be mentioned with bated breath. To reach it, in their opinion, involves dangerous adventure, hair-raising hardships, and the conquering of enormous altitudes.

I remember at a dinner at Srinagar listening to a glowing account by a gentleman—one of those endowed with the delightful faculty of relieving others of the burden of conversation—of his experiences, sensations, and of the wonderful view he had at an altitude of "over 20,000 feet" which he and his wife had reached during their summer outing. Later in the evening his



Vertical face of névé-bed above Gumber river, showing columnar structure of its substance brought into view by melting. When first laid bare, such surfaces have smooth, finely granular appearance resembling white marble.

To face page 32.



Vertical face above Gumber river of névé-bed formed by avalanches, showing horizontal strata composing it. Also scalloped formation developed by unequal melting of the denser and softer areas of the substance of strata.

To face page 32.

good lady mentioned to me, that the Zoji La was the highest and most distant point they had attained. As is well known, the Zoji La can be in winter and spring a very unpleasant as well as dangerous pass. This redoubtable pass we crossed on the 13th June, and, as late as this, the whole bed of the Gumber valley, almost as far as Matayan, was covered to an unusual extent with a continuous sheet of névé and avalanche-beds, the latter shed down from the steep mountain-flanks on either side. This surface, worn by passing caravans into deep ruts and softened by the sun's heat, was fatiguing to travel upon and, in places, treacherous. At certain spots great care was required to bring the ponies safely over and prevent them from disappearing with their loads through the softened névé into the depths beneath.

The river, which during the winter had been buried deep out of sight, had tunnelled under and cut away the supports of the névé along its course, which had now fallen in and been carried off, leaving on both sides vertical névé-cliffs rising from the river-banks. The surface of these cliffs, at first smooth, had been sculptured out by melting into projecting vertical columns, from a foot to a yard or more apart, extending through the whole thickness of the beds irrespective of the horizontal strata which they cut across and giving the surfaces a fluted appearance, and into scalloped formations, both of which were frequently continuous with similar formations and with lines of nieve penitente scoring the horizontal surfaces above. Horizontal and oblique lines of demarcation running through the vertical cliffs indicated beautifully the areas occupied by different névé and avalanche-deposits, which had contributed from time to time to augment the névé-masses. Vertical surfaces thus sculptured, which I have since noted elsewhere as existing extensively both in névé and ice, demonstrate the internal structure of these substances in certain respects, which I am not aware have been previously recognized, and furnish an important clue to the mode of development of nieve and ice-penitente and other allied formations.[1]

At Tolti we were welcomed by our old friend the Raja, whose dominions we were now passing through for the fifth time. We camped in the familiar, boulder-strewn, grass-covered meadow adjoining the polo-ground, on the bank of the mountain-torrent of crystal clearness, which plunges down from the granite-peaks above. He greeted us with his usual courtesy, and saw to it that all our needs in the way of transportation and supplies were attended to.

An offered game of polo, the chief spectacle provided in this region for the entertainment of visitors, was, at our suggestion, omitted. We rested a day, while the Raja sent a coolie ahead with a letter to the Raja of Kiris, who was a relative by marriage, to meet us on our arrival at the Indus crossing opposite Kiris with zaks, ponies, and coolies to take us over the river and on to Kiris. The Indus at this point was swelled to double its ordinary size, and the rapidity of its current considerably accelerated by flood incident to the rapid melting of the unusual quantity of snow fallen the previous winter, but everything was taken over without accident.

The Shyok valley from Kiris to Kapalu, aside from the broad, sandy flood-bed of its river and from some

[1] For a detailed account of the phenomena here presented vide *Zeitschrift für Gletscherkunde*, Band VIII, pp. 289–330, 1914, "Nieve Penitente and Allied Formations in Himalaya" (William Hunter Workman).

Crossing Saltoro river to Kapalu on zak.

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stretches of rough hill-country even more desert, blasted, and desolate, if possible, than the Indus valley, is carpeted with a succession of extremely fertile and thoroughly cultivated oases, which support a large population. For the greater portion of three marches the path passes through luxuriant orchards, waving grain-fields, and extended villages. The inhabitants utilize every foot of arable land, and get good crops from many areas that would in most countries be discarded as unproductive and worthless. They carefully wall in and terrace their fields in such a manner that these can be irrigated to their utmost confines, for irrigation here, as in most Himalayan valleys, is the key to agricultural success, which means the maintenance of life itself. They lay out areas devoted to the cultivation of vegetables in plots of various shapes arranged with almost mathematical accuracy, an accuracy the more remarkable in view of the simplicity of their intellectual status and the rudeness of their implements. The care bestowed on the land is rewarded by abundant harvests, and the impression produced on one traversing this region in summer is, that the inhabitants are, in proportion to their needs, exceedingly prosperous.

Two crops in a season are obtained, the first consisting of wheat and barley, which ripen and are garnered in June or early in July, and the second of maize, peas, buckwheat, millet, and other grains. Among vegetables, besides peas, are beans, cabbages, egg-plant, marrow, onions, and turnips. Fruits consist of mulberries, apricots, apples, cherries, pears, plums, melons, currants, grapes, and walnuts. The warm colouring of the ripening crops in early autumn is enhanced by the brilliant tints of rows of green, salmon-coloured, and deep mauve amaranth.

On entering the territory of the Raja of Kapalu, a short distance before the wide-spreading village of Dubani, we were met by the Wazir Abdul Karim with a small escort. He was clothed in spotless white from head to foot. As we rode up he dismounted from his lively pony, and salaaming low, held out his hand, in the palm of which rested two rupees, and presented a letter of welcome from the Raja. Following the Eastern custom, with a few words of greeting we touched the money with the tips of our fingers and saluted him. He said he had instructions from the Raja to take charge of all transport arrangements and provide any required supplies, and we need give these matters no further thought. He was immediately sent ahead to find a convenient camping place, while we followed at our leisure.

Abdul Karim was not a great man, nor was he possessed of much executive ability. He was good-natured and bustling, but, in spite of his assurance that he would handle all details, left to his own initiative he did not accomplish much. Still, he represented authority—a *sine qua non* with coolies—and in virtue of this he proved a valuable acquisition to the expedition. It did not take us long to size him up and to see that he would be of little value to us except under careful supervision. He was at once taken in hand and given instructions daily as to what he was to do. As first he was somewhat dense, but after a time, having learned what was expected of him, that he must act promptly and have preparations for all movements complete at times specified, he improved, and was very useful in managing the coolies, to whom all orders were issued through him. He stuck to us manfully through all the vicissitudes of this and the following expedition, going to all high points to which coolies were taken.

Wazir Abdul Karim, who accompanied expeditions of 1911 and 1912 in charge of transport-coolies.

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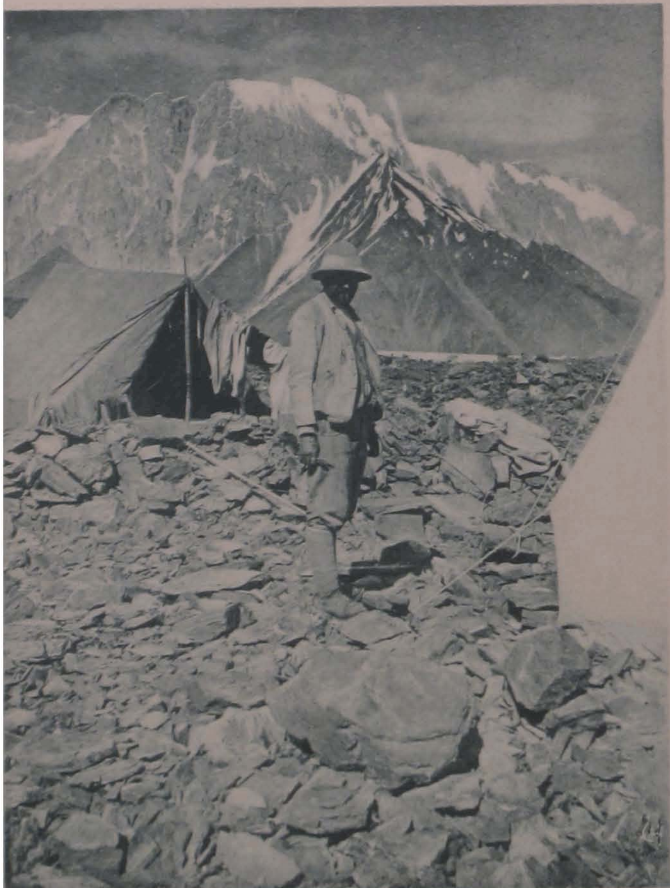
The next day's march was short, but it was followed by the inevitably long zak-crossing of the lower Shyok, with all our people and luggage, to Kapalu. On the river-bank below that village we were met by Raja Shere Ali Khan and his nephew, Raja Nasir Ali Khan, the heir-apparent, with ponies caparisoned with elaborately ornamented native saddles and bridles, to take us to camp. After greeting-formalities had been exchanged, the Raja proposed to escort us to a camping ground in the higher part of the oasis 600 feet above the river near his palace, but we declined his proposal, and sought out a quiet, clean place on the outskirts of the oasis free from the presence of the villagers, where by four o'clock p.m. we settled ourselves.

On our first expedition we camped, as those visiting Himalaya for the first time usually do, in the villages at places set apart for this purpose, or, as often happened, where no such places existed, on any spot where tents could be placed—on occasion, in the village graveyards or even on the roof of a native habitation. Early impressed, however, with the inconvenience and undesirability of such unromantic locations—which, although swept and garnished for our occupation, were none too clean, where privacy was out of the question, the camp being subjected to the constant observation of curious villagers who crowded around and watched with stolid gaze every movement made, where our nerves were set on edge and sleep was banished by the cries, cackling of harsh, discordant voices, ear-splitting coughing, night-howling, and general complex of noises that render the air of native villages vocal day and night—we learned to select our camping places on the outskirts of or at some distance from the villages, where a *pied-à-terre*, if not always comfortable, at least reasonably quiet could be secured. This custom we have followed in all our succeeding expeditions with comparatively satisfactory results.

Another unnecessary annoyance is thus largely obviated, to which those camping in the village-centres are subjected, viz. a constant importunity to heal the sick. The people seem to be imbued with the idea that Europeans are endowed with healing powers, or, at least, carry with them panaceas for all the ills that flesh is heir to. No sooner has one become settled in camp than they bring up the lame, halt, and blind, malformed children, adults afflicted with incurable, organic diseases, and the aged staggering under the burden of senile, degenerative processes, a procession that would tax in vain the physical and intellectual resources of a thoroughly up-to-date hospital and staff of trained specialists, and ask for *dawei*, or medicine that shall restore the sufferer to a state of health.

Incidents of this kind described in Holy Writ as occurring in Palestine two thousand years ago are almost exactly reproduced here to-day, so many thousand miles away. Habits, customs, and modes of thought and action, which have remained practically the same, irrespective of time and distance, over a large portion of the vast continent of Asia, when thus personally encountered, impress one vividly with the stationary character of the unchanging East in contrast with the rapid evolution of human activity in the progressive empire of the West.

I mention the presentation of deformed and incurably diseased persons to the notice of the traveller as an unnecessary annoyance. This term I regard as quite justifiable, for however much one may pity such poor creatures, as one must pity and sympathize with those similarly afflicted everywhere, or desire to aid them, no



At Camp 11 on granite-moraine, Tarim Shehr glacier, at 17,675 feet.

On a boulder in Kondus nala.

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medicine could benefit the great majority of these patients, and nothing is to be gained by spending time or effort upon them, not even on the part of a skilled physician, who would be the first to see the uselessness of any attempt at treatment.

Some patients are brought forward who, under favourable conditions, could be benefited or cured by a properly administered course of treatment, but would not be affected by a dose or two of such emergency remedies as a traveller could administer. The absurdity of leaving any remedies with the ignorant patients or their friends to be taken for a length of time is too manifest to be seriously considered. Even so simple a proceeding as the application of surgical dressings to wounds is not always attended with a satisfactory result. I remember on more than one occasion, after wounds of coolies had been dressed carefully with adhesive plaster and bandages, to have seen the coolies a few hours later with the dressings removed and replaced by rags soaked in some filthy substance.

An occasional case of acute functional disturbance or uncomplicated abnormality requiring surgical aid might be relieved by such means as a traveller could apply, or some temporary alleviation might be afforded through the effect produced on the mind by the administration of a remedy, since these people have a blind faith in the efficacy of *dawei* as such, irrespective of its actual properties or classification in the pharmacopœia. For this last purpose the bread-pill is, probably, as efficacious as the most searching purgative or powerful anodyne, and has the advantage of being devoid of danger, especially if given into the patient's charge to be taken repeatedly. If a traveller, from philanthropic or other motive, chooses to play the part of Good Samaritan and set up a clinic, he will always find plenty of material at hand upon which to expend his efforts.

To return to our Kapalu camp. No sooner were the tents pitched than the customary afternoon-sand-storm of this region set in, in this case later than usual. It begins with a strong wind from the west, at any time after midday, raising a cloud of dust from the sand-covered flood-plain of the river, which fills the whole valley, obscures the sun, sifts into every crevice, and coats everything with a pulverulent deposit. It continues to make life miserable until sunset, when it subsides, and a night of calm can be counted on.

Whether the Raja had any knowledge of that popular feature of English life, five o'clock tea, we did not learn, but the same afternoon at that hour he appeared with his nephew and another young man of the higher class to pay us a visit of ceremony and welcome. They were accompanied by servants bearing plates of red cherries, dried apricots, currants, fried cakes, and a large pot of hot Ladakh tea with teacups. We received them in our largest tent, where the whole party were seated on our two camp-chairs, a camp-bed, and provision-boxes.

Tea and cakes were then served. The tea resembled cocoa in colour. It was prepared with goat's milk, was strongly sweetened, and its flavour was not unpleasant. We could understand that one might soon learn to like it in spite of the goat's milk. It may be stated that the milk of the Himalayan goat is more delicate and less offensive than that of the European animal. Our guides were very fond of it, and could never get too much.

After tea had been disposed of, we returned the compliment with Egyptian cigarettes and chocolate *bon-bons*. The Raja showed due appreciation of both, although he indulged in them in moderation, but the two

Portion of oasis of Chino, Saltoro valley, with mountain-wall behind and gorge from which material composing oasis issued.

[Note cultivated terraces arranged one above another so that water of irrigation passes from those above to those below till all are irrigated.]

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younger men, acting, perhaps, on the principle that the proof of the pudding is in the eating, helped themselves liberally, taking considerably more than they could dispose of at this interview, and transferring to pockets in the folds of their robes the excess for future use. They had, evidently, never seen such *bon-bons* before, as, at first, they put them into their mouths without removing the tinfoil-wrappers. They seemed to be more pleased with these than with the knives, silver cigar-cases, plush, and gold-trimming for coats, etc., we had brought them, in consequence of which boxes of cigarettes and Cadbury's assorted chocolates were added to the other gifts, greatly to their satisfaction.

It has been our experience in the course of our wanderings that, sometimes, men of gentlemanly instincts are met with in lands and under circumstances where they would least be looked for, and, on the contrary, that such instincts fail to be shown by those who from their education, position, and surroundings might be expected to possess them, from which it might with some reason be inferred, that a gentleman, like a poet, is born, not made. In Raja Shere Ali Khan, allowance being made for Eastern customs and the distance of his dominions from civilized centres, we recognized the gentleman.

He was a man somewhat past native middle age, tall and slender, with refined, delicate features and quiet, affable bearing. He was clad in white as befitted his rank. He received us with great courtesy, and in an open, straightforward manner said he would do all in his power to promote the interests of the expedition. And he kept his word to the letter. He was never found wanting. We saw before the close of the expedition, that he was possessed of considerable strength of character in carrying out what he had promised to do, and such success as we achieved was due in no small degree to his efforts and influence with his subjects, who, evidently, liked and respected him.

In the course of discussion of the question of transport the Raja mentioned, with apparent amusement, that two sahibs had, two years previously, arrived in Kapalu carrying their own luggage, having come from Kharmang over the Ganse La, and said that would not be our experience while in his territory. One of these sahibs himself has related this incident in print with evident and, perhaps, according to European standards, not unnatural pride, stating that when their four coolies "struck work" and deserted them above Kharmang they, with the assistance of two orderlies, shouldered the loads and continued on to Kapalu. He adds: "As usual this lenient treatment" (i.e. permitting the striking coolies to depart) "of the local people aided us in our future dealings. A traveller gains far more by showing his own superiority over these people than by coercing them, and we never had any more trouble."

To those acquainted with existing conditions in Baltistan the details related admit of a somewhat different interpretation. The Kharmang coolies struck work, not under circumstances of special stress or danger, as has sometimes been the case in lofty, ice-bound regions, but on a frequented route, a thing that rarely happens after a march on such a route is begun, and, having refused to go on, probably no amount of persuasion or attempted coercion, with the possible exception of the offer of a fat *bakhshish*, that most potent persuader of coolies as well as of other human beings, would have prevented them from deserting, since under the new regime in India a coolie cannot be forced to work unless he elects to do so. He cares nothing for any opinion a

European may form of his delinquencies. The "lenient treatment," therefore, seems to have consisted in accepting the inevitable. The fact of the Sahibs showing "their own superiority over" and independence of these Kharmang coolies could have had nothing to do with their not having had "any more trouble," as they had no further relations with Kharmang coolies, and later employed those of an entirely different district, who acted under the direction of Raja Shere Ali Khan.

The above-quoted remarks present the Western point of view of a traveller on his first visit to Baltistan. It is interesting to contrast with it the Eastern point of view, with which our agent was later made cognisant at Goma. When he was engaging coolies there for our first visit to the Siachen glacier in 1911, the zemindars related that a small party of sahibs had gone over the Bilaphond La two summers previously, but that they were not *bara* (or important) sahibs with a numerous following, and they had even arrived at Kapalu doing the (to the native mind) unseemly and unheard-of thing of *carrying their own kit.* It goes without saying, in the East, that a person's importance is rated in accordance with the number of servants he employs, and that a European doing any manual labour which a native considers his own proper task loses prestige at once in the estimation of that native and of those to whom such action becomes known. Thus the arrival at Kapalu of sahibs carrying their own kit impressed the people, not with their "superiority," but with their inferiority. The force of native opinion in this regard is well shown by the dissimilarity between the mode of life of Europeans in their own countries and that they universally adopt in India.

This incident affords a good illustration of the difference in the points of view from which many of the affairs of life are regarded by Occidentals and Orientals, making mutual understanding and sincere, effective co-operation between them matters of extreme difficulty. Lying, theft, and murder, which are said to be considered cardinal virtues among Pathans, ill consort with justice, security of person and property, and regard for the rights of others, supposed to animate the proper conduct of affairs according to Western standards.

As a matter of fact, without regard to the degree of estimation in which he may be held by the native population, the explorer learns from experience, that it is advisable to employ the least number of coolies that his projected movements will admit of, for the smaller the number of coolies the more mobile will his caravan be, the greater his personal influence, and the less the danger of mutiny or desertion, with the consequent interruption or overthrow of his plans. Unfortunately, if these last are ambitious and involve a prolonged investigation of unknown and uninhabited territory, he has little choice and is obliged to take on a larger number than he might wish, thereby placing himself *nolens volens* in the position of a *bara* sahib.

Byramji having already made arrangements with the Raja for supplying coolies and for the collection and transport to specified points of grain with which to feed them, no business-details remained to be discussed with him except a few relating to the movements of our personal caravan, which were quickly disposed of.

Before taking leave with his suite the Raja invited us to tea the following day at his palace, as his abode should, perhaps, be termed, and afterwards to witness a game of polo. As we were remaining that day at Kapalu to complete some necessary arrangements, we accepted his invitation. He proved an excellent host and entertained us well.

The polo-ground, on a level portion of the slope below the palace, has a situation of rare beauty, the selection of which would have done credit to the good taste of the most eminent of the builders of ancient Greek theatres. Behind it, in nearly a semicircle, rise sheer cliffs of rugged mountains enclosing a gorge. In front, the broad, green expanse of the Kapalu fan, covered with luxuriant fruit-trees and grain-fields, sweeps downwards some 700 feet to the Shyok river bordered on the farther side by cultivated oases backed by barren mountains. Beyond these, above a wide opening in their walls, rises a shadowy vista of castellated Hushe and Saltoro peaks, their pointed summits partly capped with snow towering high into the deep blue of the sky. For variety of detail the view from this spot, though not so extended, can compare favourably with that from Darjeeling toward Kinchenjunga.

After the polo, which was played with the native dash and spirit, the Raja accompanied us some distance downward toward our camp. On the way he took us into one of his gardens to show us what he said was a curiosity, and such indeed it proved to be. It was a small walnut-tree about two feet high, which had sprung up from the seed three years before. Now in its third summer it was bearing three, well-grown walnuts not yet ripe. The Raja said the first year it bore one nut, and in the second two. We should scarcely have thought the statement credible, had we not seen with our own eyes the tiny tree with its trio of nuts.

CHAPTER III

THE SALTORO VALLEY—CHARACTER OF MOUNTAIN-REGION BETWEEN SALTORO AND BALTORO GLACIERS—SCULPTURED ROCKS—VARIETIES OF WEATHERING—UNEARTHLY DESOLATION OF KONDUS NALA—GRANITIC SAND—KARMADING—KORKONDUS NALA AND VILLAGE.

ARRANGEMENTS being completed, and small tents, heavy boots and clothing, ropes, and other accessories necessary for glacier work having been added to the light marching outfit heretofore in use in the valleys, we left Kapalu on the morning of the last day of June to proceed directly to the glaciers draining into the Kondus valley. The route led up over a ridge east of Kapalu, the summit of which, some 1,300 feet above the river, consists of a large, fertile, well-irrigated and cultivated maidan, and thence down on the other side to a group of three or four villages near the Shyok river, beyond Chogrogon, near the last of which we crossed the river on two zaks sent by the Raja from Kapalu.

From here a route passes east up the valley to the Chorbat La, and another west to the Hushe and Saltoro valleys. We followed the latter, which brings one in about two hours to a large amphitheatre enclosed by mountains, the east side of which consists of a long-drawn-out oasis, on which a line of some dozen villages, one following another, embowered in mulberry, apricot, and apple-trees, stretches out under the collective name

Saltoro valley just above its junction with Hushe valley. Oasis of Hulde in foreground.

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of Gourtse. From the last of these the route leads up the Hushe valley to Hulde.

Hulde is picturesquely situated upon a tongue of arable and well-cultivated land, overhung on both sides by high, broken hills, at the junction of the Saltoro valley running east and west with the Hushe running north and south. The Saltoro narrows shortly before the junction to a gorge, through which rushes the Saltoro river, spanned by a wooden bridge thrown across to a great, projecting boulder directly below Hulde. From Hulde paths run up the Saltoro valley on both sides and north up the Hushe valley.

We arrived at Hulde at noon of the second day, lunched beneath the mulberry-trees bending under a heavy load of fruit, which furnished an excellent dessert to our *al fresco* repast, and, as there was no convenient camping place, took a new set of coolies and went on over rock-strewn and desert mountain-wastes to the village of Tagas. On these and succeeding marches Abdul Karim, the Wazir, after having made all necessary preparations for the day's movements, as soon as the caravan was under way would ride ahead on his spirited, black, mountain-pony, speedily disappearing behind a halo of dust and sand thrown up by its active heels, to the village at the end of the stage, where he would announce our approach, look up a camping place, procure supplies, and order coolies for the next march. In this manner no time was lost after our arrival, and we could move on at our convenience without delay.

The Saltoro valley from Hulde to the entrance of the Kondus nala presents little of special interest, its features resembling those of many other similar valleys. It is wide and has a broad flood-plain, over which the river courses in various, shifting streams, enclosing areas of stones rounded and polished by the friction they have undergone during transport. Projecting into the valley on both sides in front of gorges are irrigated and fertile fans, upon which villages are situated. Its immediate walls on either side are, largely, composed of shale mingled with decomposing or incompletely formed crystalline schists. They are topped by rounded summits and ridges. They are channelled by water and scored by ravines.

Great, granite boulders are scattered over mountain-sides and valley, many consisting chiefly of feldspar in large crystals, which, the cementing substance between them having been weathered away, project in abundance from the surface like barnacles upon tide-washed rocks. The north wall of the valley from Tagas eastward for about a march to the Kondus opening consists of granite-mountains with pointed tops and sheer sides striated with broad, white, wavy bands, apparently, of feldspar and quartz. These peaks are separated from one another by narrow, irregular gorges. They are the southern foot-hills of a vast assemblage of larger and more savage mountain-masses behind them.

Between the villages of Brakor and Damsam the Kondus nala enters from the north, leading into and typical of the region lying between the Saltoro valley and the Baltoro glacier and extending westward from the Siachen watershed to the western barriers of the glaciers, draining into the Hushe valley.

This region, which we were now about to explore, possesses characteristics that make it almost a region apart, and distinguish it from any other of equal area in the Karakoram. Its mountains are high, seven having been triangulated by the Indian Survey at from 23,900 to 25,676 feet. They have precipitous, often vertical, bare rock-walls, and their summits are serrated and jagged to

View eastward of central portion of Saltoro valley and river-bed. Two cultivated alternating fans project into valley from opposite gorges.

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a marvellous degree, rising in *ensembles* of pointed apices of fantastic shapes that in complexity of outline, size, altitude, and airy grace greatly surpass any combination to be found in the far-famed Tyrolean Dolomites. Many of the most remarkable of these are granite and gneissoid peaks, consisting of parallel, jointed columns vertical or very sharply inclined, the arrangement of which closely resembles in appearance that of bedded rocks. The upper portions of many of these columns, having become detached along the lines of jointing from their original positions by frost, water, or earthquake, have fallen out, and are now to be found on the lower mountain-flanks and valley-bottoms as large granite-blocks. Ragged depressions are left on the skyline where they stood, above which rise their former neighbours still remaining *in situ* as the multiform apices above mentioned, the continuity of which can, in many cases, be traced directly down into the columns of which they form the upper extremities. Their axes usually make the same angle with the vertical as those of the columns of which they form a part.

Where the mountain-structure passes over into gneissoid and crystalline schist, the surfaces are profusely striated with dark and light grey, brown, and white bands, often folded and twisted in intricate curves, which give them a highly ornamented appearance.

The valleys are narrow and deep with abrupt walls, many, in fact, being little more than gorges. Except where the hand of man has introduced irrigation in their wider portions, resulting in the creation of fertile oases, they are arid and desert, covered with enormous boulders, or choked with gigantic tali and fans, the last formed of débris poured out by floods from the side-gorges. Their higher portions are occupied by shaggy glaciers that, originating in reservoirs lying far up among the wild and storm-torn peaks, descend the steep gorge-slopes in broken, crevassed, and tangled ice-masses. Lower down the ice is crowded up by pressure into great hillocks, which convert the glacier-surfaces for long distances into billowy ice-streams. These glaciers bring down vast quantities of rock-detritus from the rapidly decaying mountains, which cover the ice so completely as, over large areas, to bury it from sight.

Glaciers in Himalaya, usually, afford the only avenues of approach to the higher mountain-recesses. Those of this region are not particularly useful in this respect, since they are exceedingly difficult to follow up. Filling the valley-beds, as they do, from wall to wall, no pathway can be found by their sides, in most cases, and one is obliged to ascend directly over their surface, clambering up and down the slopes of great hillocks and ridges heavily covered with rocks, interrupted by crevasses and chasms, or broken into ice-precipices, a fatiguing undertaking neither agreeable nor, by any means, devoid of danger. Moreover the upper, steeper, crevassed, and broken portions are wholly inaccessible.

From these considerations it is not difficult to understand that the exploration and mapping of such a region, where the explorer is mostly confined to the deep, narrow valleys from which the higher fixed peaks cannot well be seen, and where access to favourable observation-points is well-nigh impossible, is attended with difficulties not encountered in regions having wide valleys, great glaciers, and extended vistas.

The vertical surfaces of the granite-mountain-walls on both sides of the Saltoro valley at and opposite the Kondus opening are extensively excavated into small depressions of various forms separated from one another

Eroded face of vertical mountain-wall at Kondus-Saltoro junction, the erosions presenting a diagonal parallelism suggestive of a stratification of the rock not otherwise apparent.

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by thin, sharply defined ridges, both depressions and ridges being arranged in diagonal rows and lines following the trend of what appear like strata in the rocks. The general effect of these excavations, seen from a little distance, is such as might warrant the name of sculptured rocks as applicable to these surfaces.

The question of their mode of origin is one of some interest. The extent and position of the surfaces involved, the configuration of the valley at this point, the sizes, shapes, and arrangement of the depressions, and the sharp outlines of the ridges between them, preclude the idea that they could have been produced by the erosive action of rivers, flowing water, or glaciers. Nor does the view that they are the beds of concretions which have fallen out appear any more tenable. Had concretions existed here in numbers sufficient to give rise to this phenomenon, some of them would be still remaining *in situ*, which is not the case. Not one such was seen, nor were any found lying at the bases of the walls. Further, the long spindle-shape of many of the alveoli and the dumb-bell-shape of others, which were so hollowed out that the diameters of their interiors were greater than those of their openings, were such that concretions, had they existed in them, would not have fallen out.

The most probable explanation appears to be, that the depressions were caused by erosion from exposure to weathering agents. Heat, frost, water from storms or trickling down from above, and, probably, sharp sand, of which there is much in the vicinity, driven by strong winds, have attacked the softer and less resisting parts, causing them to crumble and yield, while the harder ones, having resisted to a greater degree, have remained as intervening ridgelets, thus giving rise to the sculptured surface in question.

In some places the alveoli are less definitely marked, their surfaces sloping away gradually from the ridges to their centres, thus creating a scalloped appearance exactly reproducing that seen on vertical surfaces of melting glacier-ice. In both cases the structure of the mass is revealed during its disintegration as consisting of denser, more resisting, and of softer, less resisting areas and strata.

The above view recognizes weathering agents as acting here in the same manner as elsewhere, the peculiar result being determined by variations in density of the rock-surfaces on which they act.

In addition to ordinary, granular wasting, weathering of many granite-surfaces causes an exfoliation of their superficial substance in scales and large flakes, the grain, so to speak, of the rock running parallel to the surface. In other instances, as will later be mentioned, weathering eats into the texture of granite, and especially of gneiss, along veins of softer material, leaving a series of denser laminæ lying upon one another. In still others the whole mass of a fragment may be so penetrated and disintegrated that its crystals lose their cohesion, and it falls into a heap of gravel. Of this I have seen many instances on glaciers, frost and water being here, probably, the chief agents involved.

As the Kondus nala is ascended, the appearance of the landscape changes markedly. It becomes more completely and intensely desert. At point after point not a living thing is visible. Even burtsa and other low orders of vegetation that manage to exist in ordinary deserts are here absent. Rock-tali slanting away from the bases of tremendous precipices, great rock-masses piled together in promiscuous confusion, protruding ledges, and bare rock-surfaces blackened and weathered by time and

Peak 33,
23,960.

Peaks 35–36,
25,280–25,400.

View north-east from ridge above Zogo. In foreground Sher-pi-gang glacier ascending to Peak 33. Dong Dong glacier ascends from Sher-pi-gang to Peaks 35 and 36.

tempest, reflect the fierce heat of the summer sun in dancing air-waves. Parched columns, buttresses, and ragged ridges, often hundreds of feet high, composed of boulders and rocks of every size and shape cemented together by sand and dried mud, occupy considerable portions of the valley-bed, bearing eloquent testimony to the destructive energy of mountain-floods which have come and passed like whirlwinds, washing out and rending into fragments the massive fans formerly covering the nala, leaving these grim and uncanny skeleton-remains as sign-posts to point out the devastation they have wrought.

Above, rise gigantic, sheer walls of scarred and splintered granite, surmounted by a multitude of jagged points. Flood, frost, and weather have played havoc with everything in sight, and converted the face of nature into a scene of arid, unearthly, diabolic desolation. As one gazes awe-struck upon the dead and ghastly landscape, one may easily imagine that the earth's crust has been rent asunder in various directions by an irresistible force, and that the resulting elevations and depressions have been swept by the fiery breath of an all-devouring conflagration, which has blasted and consumed the substance of the rocks, seared their surfaces, and reduced them to masses of fissured and crumbling ruins.

The sand of the north side of the Saltoro valley, particularly east of the village of Tagas, and of the Kondus nala and its tributaries, where the mountains are largely composed of granite, is peculiarly sharp and gritty. Its grains as well as those of the gravels consist of the constituents of granite, and are evidently derived from the disintegration of the granite-débris covering the valleys. In many places, where it has been distributed by water or wind in smooth surfaces, it presents the appearance of fine-grained granite, the dark mica-particles showing very effectively among those of quartz and feldspar.

No noteworthy incidents occurred during the marches in this region. There were plenty of coolies at the villages where we stopped. The Wazir had them on hand at the hour appointed for leaving in the morning. They shouldered their loads and went on without troubling us in any way to the end of their stage, when they were paid off and discharged. One curious custom was noted, which we do not remember to have observed elsewhere. We frequently met coolies employed as messengers to carry letters from one village to another. These letters they carried inserted in the split end of a stick two or three feet long, which they held upright so that the nature of their mission was apparent to every one.

Six miles up the Kondus nala is the large village of Lachit at the opening of the Lachit nala, the upper part of which is occupied by a glacier leading up towards the Peak K6 or Peak 27, 23,890 feet, as triangulated by the Indian Survey. Two miles above Lachit the path, which, up to this point, lies on the west or right bank of the river, crosses the latter to the left bank by a picturesquely placed and constructed cantilever-bridge of willow-logs, which was converted into a leafy bower with green willow-branches in honour of our passage over it. Two miles beyond, about ten miles north of the Saltoro valley, the Kondus nala divides, one arm running north-east as the Korkondus nala, and the other more important one, the Kaberi, leading north-west. Shortly before its bifurcation the nala widens into a basin occupied by a fertile and well-cultivated oasis, in the centre of which, at an altitude of 9,709 feet, is the prettily situated village of Karmading, its houses, embowered in green, nestling

Bridge over Kondus river above Lachit.

[Note utter desolation of verdureless landscape. Oasis in distance at left.]

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among enormous granite-boulders scattered in profusion over the oasis. Directly over it rises an impressive mountain-mass standing between the opening of the Kaberi and Korkondus nalas, crowned with a multitude of needle-summits.

Karmading, on account of its situation at the entrance of these two nalas, served as a convenient base for movements in both directions. Here Byramji, who had preceded us, had brought up supplies and coolie-rations sufficient for the time we expected to devote to this region. The Wazir, Abdul Karim, had also collected from several villages the coolies, who were to go beyond this point as a permanent corps. No delay was therefore occasioned here by incompleteness of preparation. We camped in a grassy meadow on the outskirts of the village, and remained one day to organize the coolies.

On the second morning we ascended the Korkondus nala on the right bank of the river to the tongue of the Sher-pi-gang glacier. This nala is narrow at first, but widens out at the upper portion. It is quite as wild as any part of the Kondus, and is walled in on both sides by steep, serrated peaks. The path wound among granite-blocks fifty to sixty feet in diameter, over high tali and rock-packed fans, also covered with boulders and gashed by water-washed ravines, giving us a rough scramble.

Near the upper end lies the small, forbidding village of Korkondus on the left side of the river, resembling a collection of shepherd-huts. Being at an altitude of over 11,000 feet, it cannot boast of trees of any kind, and the vegetation of its cultivated fields was rather scanty. Still, its inhabitants are industrious, and many spots among the rocks were in the process of being reclaimed, although they seemed to us to promise small returns for the labour spent on them. The village reminded us in a way of Hispar, situated only a few hundred feet lower.

We intended to camp on a level space in front of the extremity of the glacier, but a steady, cold wind descending from the ice was so disagreeable that we retreated to a rock-strewn, gullied hill, where, after half an hour's search, passably protected, scattered spots were found sufficiently level to place tents on.

Karmading at junction of Korkondus and Kaberi nalas. Former enters on right.

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CHAPTER IV

THE SHER-PI-GANG GLACIER—THE TONGUE—ZOGO—VIEW—THREE SWAS IN TWENTY-FIVE HOURS—ON THE GLACIER—PATHAN SERVANT—ASCENT OF DONG DONG GLACIER—VIEW-POINT ON WEST WALL—AT HEAD OF DONG DONG—LOWER PORTION OF KABERI GLACIER.

THE Sher-pi-gang glacier is formed by the junction of the ice-streams from four large reservoirs lying among the high peaks and ridges between the fixed Peaks 33 and 35, and those to the west constituting the watershed between it and the Kondus basin. It runs nearly north-south with a length of ten to eleven miles. About four miles from its lower end it receives, on the east, the Dong Dong tributary springing from the high Peaks 35 and 36, another small one on the same side just below, and a third directly opposite on the west. The union of these forms a large tongue a mile or more in width. Above the Dong Dong junction all portions of the Sher-pi-gang, even to the upper limits of its reservoirs, descend in sharp gradients, and are crevassed and broken into séracs to such an extent as to be inaccessible.

The tongue, on the contrary, descends in a much gentler gradient, and, although its surface is rendered very uneven by pressure and below Zogo is also greatly crevassed and covered with séracs and ice-hillocks, between Zogo and the junction of its three large affluents it can be traversed without especial difficulty.

It is loaded on both sides, for some distance from the edges, with large quantities of mud and sand piled in heaps and with rock débris, which, constantly sliding down its high, precipitous flank, has built a massive, lateral moraine along its west edge. The central half is comparatively free from detritus.

The tongue terminates in an abrupt, curving, somewhat spreading front about 500 feet high, which occupied at that time the whole width of the nala. It was covered with séracs quite to its end, and fissured by numerous, longitudinal crevasses extending in a direction varying from that of the central glacier-axis, according to the spread of the portions where they occurred. Its colour was dark grey from the admixture of mud and sand, but it bore no great amount of large débris, and had no terminal moraine. Nor was there any moraine in the nala in front to indicate that it had extended in recent time farther down than at present. The débris upon it was collected at several points along its brow, which, sliding down, had formed small moraine-heaps at the base of its final wall. The condition and positions of these showed the tongue to be stationary. Also around its margin lay great blocks of black ice, the remains of séracs that had fallen and been precipitated to the nala-bed. No special ice-cave was noted. The water issued from several points of the end, and the streams combined to form the Korkondus torrent.

Leaving camp early, we ascended the sharply rising nala in a furrow, in places, only a few feet wide, between the massive, west lateral moraine and the overhanging mountain-wall. This was often obstructed by rock-fragments, tali, and dense clumps of rose-bushes bristling with sharp, white thorns, to get over and around which necessitated a sufficient amount of effort to vary the

Extremity of considerably spreading tongue of Sher-pi-gang glacier, from which water issues in several streams.

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On summit of ridge above Zogo.

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monotony of the march. After three hours' hard work we reached a gorge or recess in the mountain-wall, covered with rocks and boulders and washed by floods, called Zogo. A torrent, descending from glaciers far above, flowed through its centre around the base of a hillock, upon which stood a collection of stone-huts used by native shepherds as shelters for themselves and their animals, which they drive up to pasture on a grass-covered hill-side just above during July and August.

A small, sandy terrace safe from stone-avalanches lay at the base of this hill-side of sufficient size to hold our tents, while the guides and servants found a convenient camping place beyond a projecting shoulder nearer the glacier, and the coolies, as soon as they were free of their loads, betook themselves, like ducks to water, to the filth-laden huts, where they speedily made themselves at home. The black flank of the glacier, bordered by its great moraine, shot in a straight line across the mouth of the gorge, a barrier of débris and ice, the top of which stood at an angle of 45° above the camp. Débris constantly fell from the ice upon the moraine with a harsh growling that did not cease for many seconds at a time day or night.

We remained at this camp the two following days, during which Savoye and a porter made a reconnaissance on the glacier above to discover where the next move could best be made, while we ascended the heights above Zogo to an altitude of 15,000 feet for photography and study of the region. From these an impressive and magnificent view opens up. The barren mountains, on all sides, riven and gullied, surmounted by myriad towers and needle-spires, and separated from one another by deep gorges, present a scene of savage and desolate grandeur of a kind seldom approached in other regions even of the Karakoram, in the midst of which the glaciers occupying the beds of the gorges of the lower half of the basin stand forth prominent. The Dong Dong, as shown on the Indian Survey map, is seen in size and position to be almost wholly a product of the imagination, being represented by a much smaller glacier, which makes little impression on the eye, while the Dong Dong, so called by and known to our coolies, descends as a glacier of powerful proportions from the flank of the high, twin Peaks 35 and 36, which dominate the region.

At this camp we had the singular experience of witnessing three *swas* or mud-floods, which occurred at the same point within a period of twenty-five hours. We have seen *swas* at close quarters several times, and on one occasion only escaped destruction by a hair's breadth [1]; but we never saw this phenomenon presented as it was here, and know of no similar recorded instance.

The first *swas* occurred at 12 o'clock noon, the second at 4 p.m., and the third at 12.30 p.m. the following day. They all began with rock-avalanches crashing down from the top of the rear wall of the gorge between two sharp *aiguilles*, leaping from point to point with resounding roar, and sending up clouds of dust. No water was seen to accompany these, but soon a cascade of rocks of all sizes, some of many tons weight, mixed with mud, appeared, which descended in a rolling, tumbling mass of dark-brown colour that followed the windings of the torrent-bed with the greatest facility. After a time the flowing mass would diminish in size, to be succeeded by recurrences of similar character. The mobility of these composite streams and the ease with which they adapted themselves to the course of the pre-existent torrent-bed

[1] Vide *In the Ice-World of Himalaya*, p. 156; also *The Call of the Snowy Hispar*, p. 109.

Goats and sheep on Sher-pi-gang glacier.

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Among the ice-ridges of the Sher-pi-gang glacier.

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were, as always, marvellous to behold. Each *swas* continued for twenty to thirty minutes, and was followed by streams of muddy water of ordinary size. There appears to be no doubt that barriers damming back water gave way on each occasion, but the relation of the rock-avalanches to these, and the question whether they dammed different bodies of water, or were so disposed as to hold back portions of the same body must remain matters of speculation.

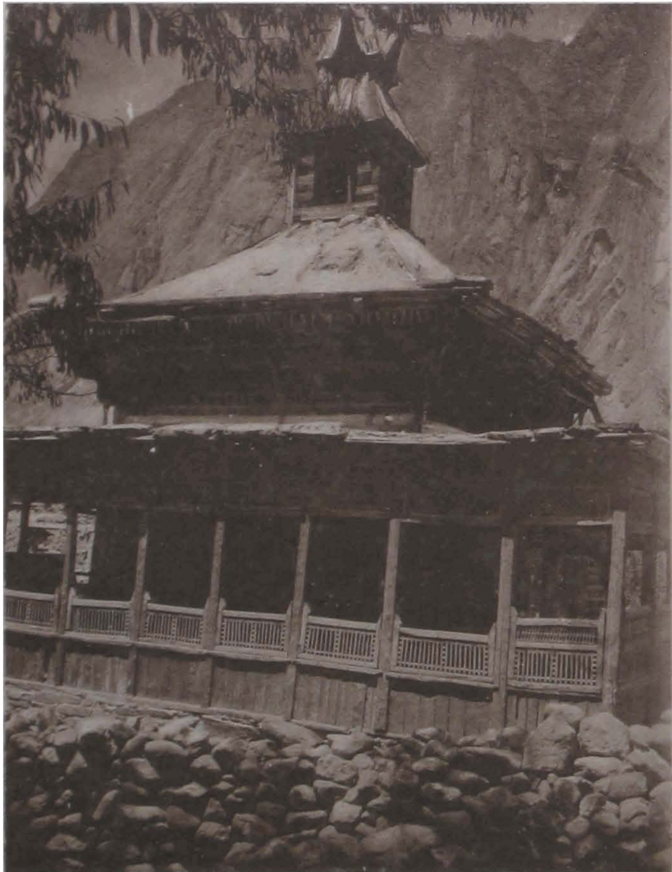
The results of Savoye's reconnaissance and of our observations from the heights above the camp showed that the Sher-pi-gang above the entrance of the Dong Dong could not be ascended on account of its extensively crevassed and séracked condition, and that not even a view of its upper portions from the west side could be obtained except by scaling a steep, 2,000-foot ravine-wall swept by falling stones. The Dong Dong offered the only chance of any investigation above our present position, and its appearance was none too inviting.

Leaving Zogo with sixty coolies and a flock of sheep and goats, we continued for half a mile in the narrow space between the glacier and mountain-wall, then mounted and crossed the lateral moraine at a point where its height measured 260 feet, cut our way some 70 feet higher up the side of the glacier to its upper surface, and traversed it diagonally to the Dong Dong junction. The glacier-surface was thrown up by the pressure developed by the junction of the four rapidly falling glaciers into a succession of great, undulating, parallel ridges separated by deep furrows, and some ravines, up, down, over, and through which we had to find our way. Many glacier-tables and ice-pyramids covered with mud and sand were seen. The sheep and goats, as we had on numerous occasions previously observed, were quite at home at this sort of work, and made nothing of these and later difficulties encountered in this region.

We had with us a Pathan servant, who on the march had charge of the tiffin-basket. He was possessed of a demonstrative and rather officious disposition, which often required curbing, but which we turned to good account by entrusting him, when moving through the valleys, with the duty of going ahead, wherever we met pony or yak-caravans, or cattle, sheep, or goats, which were obstructing the path, and seeing that they moved aside so that we could pass. This was a task of greater importance than those unaccustomed to Himalayan travel might imagine, for, during the marching season, the narrow paths in all the inhabited regions are frequently blocked by long, laden caravans, numberless cattle, and large flocks of sheep and goats driven to and from pasture, which in dry weather raise a stifling dust and are by no means easy to pass.

This task suited his talents exactly, which could not be said of some of his other duties, and he performed it admirably, not only by vigorous use of voice and stick forcing the pony-wallahs and shepherds to drive their animals forthwith from the path, sometimes on to declivities of dangerous gradient and character, but also with an air of great authority compelling native travellers, mounted or on foot, of any rank lower than that of a Raja or Tehsildar, to step aside till we had passed. His zeal in the performance of this office proved a great convenience and also a source of considerable amusement to us.

He had never, up to this time, seen a glacier. When we reached the rough ice of the Sher-pi-gang a change



Temple at Tagas, Saltoro valley.

Pathan camp - servant with Saltoro valley child clad in scanty garment of rags sewn together.

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came over him. He became unusually quiet, and his face assumed an earnest, thoughtful expression. He no longer wandered to the side, but, permitting others to take precedence in the marching line, followed strictly in their track.

He was soon observed to be engaged with devout bearing in actively fingering the beads of a rosary produced from some fold of his garment, meanwhile muttering prayers constantly in an audible whisper. This occupation he continued to the end of that day's march, and repeated on subsequent marches till we returned to less dangerous environment. One accustomed to the exploration of the glaciers of this region can quite understand, how the glacier-features encountered on that and the following days might tend to develop religious fervour and call forth in the mind of a novice the exercise of all the faith he might possess in the protective power of amulets and prayers.

The ridged surface was succeeded by a labyrinth of huge séracs, among which we had to thread a tortuous way. On the farther side of these lay a large and very steep moraine leading up the left side of the Dong Dong. Getting on to the lower end of this we paused to rest and look around. In front of this spot the converging trunks of four glaciers met, all falling at sharp inclines to the séracked amphitheatre we had just come through, and all so crevassed and broken as to be inaccessible. The moraine we were on offered the only avenue of approach to the upper Dong Dong. The trunk of this glacier, although a powerful one descending in a massive ice-fall, did not force its way into the tongue below as one of its component streams, as under ordinary conditions it would be expected to do, but stopped short against the Sher-pi-gang, being apparently swallowed up by it, a phenomenon similar to one we have recorded as occurring on the Shafat glacier in the Nun Kun.[1] The west affluent, which after its entrance into the tongue formed its west marginal ice-stream, brought down the whole of the débris of which the great, west lateral moraine was composed.

After a rest the caravan started up the moraine. In addition to its excessive steepness this was covered with a profusion of vast boulders and rough, angular, sharp-edged rock-fragments, one piled upon another in utter disorder, to get up, over, and around which taxed to the utmost the energies of the strongest. Every one speedily realized that ascending it was no child's play, and was one of those experiences that one did not desire to repeat. It was certainly the most strenuous and fatiguing effort of the kind we remember to have made, and, while it lasted, was comparable to that of ascending a steep and rugged mountain. The coolies were over two hours in reaching its top. An exception should be made of the sheep and goats. The *terrain* suited them to perfection. They sprang from rock to rock, and perched themselves upon projecting points with an agility, which quite put in the shade the movements of their less active human companions.

Above this moraine rose a high, vertical rock-wall, the source of many of the rock-masses we had to scramble over. This continued on as the south-east barrier of the Dong Dong till it was merged in the precipices of Peak 36 at the head of the glacier. The proximity of this wall directly overhanging the moraine was a source of anxiety and danger, since, from time to time, detached rocks came crashing down from it upon the glacier-edge, bringing

[1] Vide *Peaks and Glaciers of Nun Kun*, p. 44.

Summit of sharply descending portion of left lateral moraine, Dong Dong glacier.
Vertical overhanging rock-wall at right.

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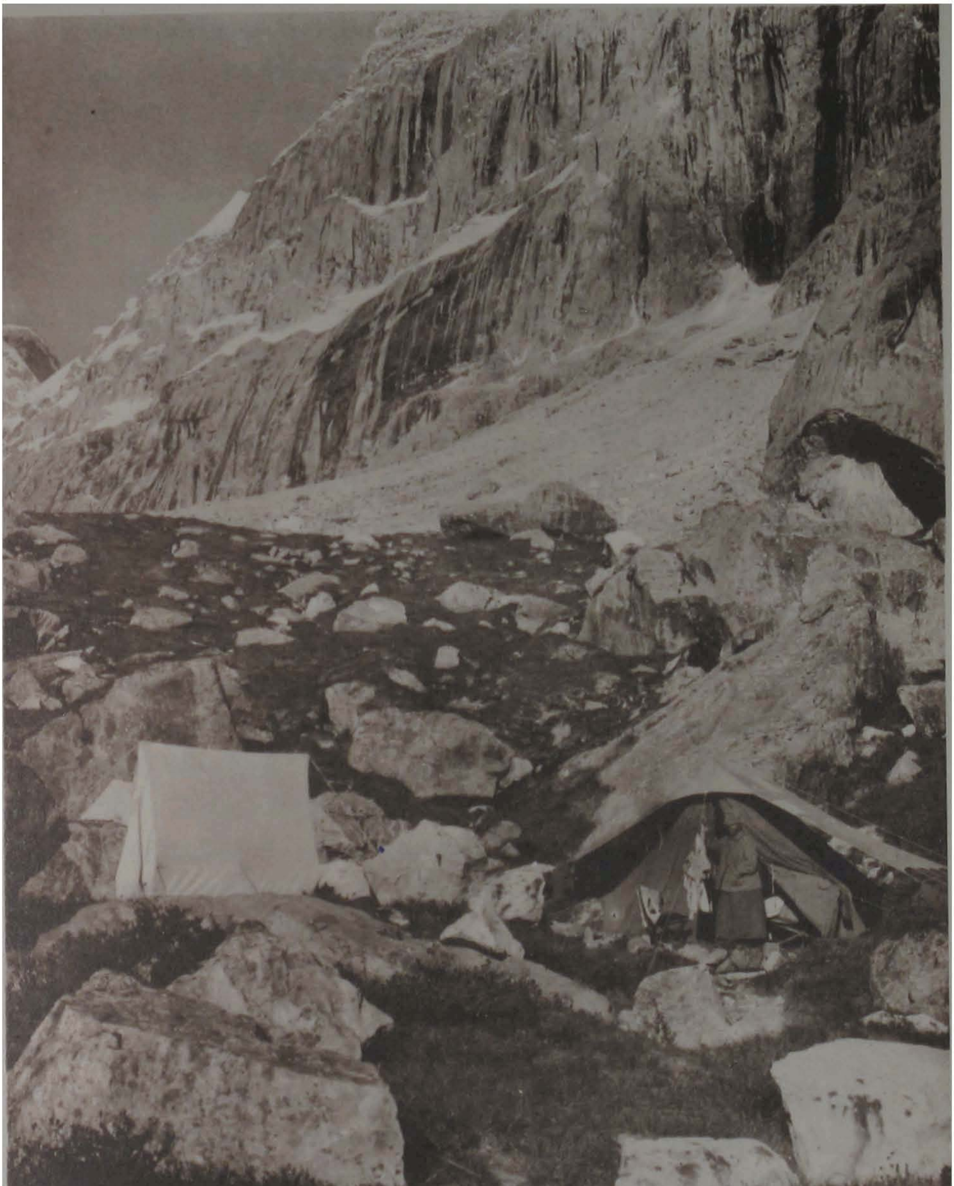

Camp among boulders on ancient, lateral moraine beneath vertical rock-wall near head of Dong Dong glacier.

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with them showers of splinters and dust. Fortunately, none of them fell sufficiently near to injure any one.

Above the brow of the moraine the gradient was easier. About three p.m. a sandy maidan thinly covered with grass was reached, from which an unobstructed view opened up of the south-west face of the massif of the twin Peaks 35 and 36, heading the nala and soaring in impressive majesty high above all surrounding elevations. This was the only view we obtained of their entire south-west face, which is hidden from all points below by intervening mountain-walls, and during the remainder of our stay on the glacier it was partly covered by clouds.

After a further scramble of half an hour over a rough talus we came to a sloping surface, between the high moraine and the rock-wall, clothed with grass and stunted willows, one to three feet high, growing between granite blocks fallen from the heights above. This was as far as one could go on that side of the nala. Beyond, stretched only vertical precipices and, directly beneath them, the crevassed, impassable glacier. As the afternoon was waning and we had made a fatiguing march of nine hours with a rise of 2,500 feet, in the course of which we had encountered a succession of unusually difficult and dangerous obstacles, the surmounting of which had required sufficient effort for one day, especially for the Pathan, the fervency of whose prayers had not been abated for many minutes at a time, and to the efficacy of which, perhaps, the caravan owed its escape from accident, we camped among the boulders. The following morning, descending somewhat, we crossed the furrowed glacier and camped again in a hollow of a large surface-moraine near the north-west glacier-edge, at an altitude of 15,000 feet. This served as a base from which the exploration of the neighbourhood during the next three days was carried out.

The west Dong Dong wall consists of a triangular *contrefort* of Peaks 35 and 36 massif running at first west and then south, its upper, broader portion rising into serrated peaks the highest of which closely resembles Peaks 35 and 36 in shape, while its lower half narrows into a tapering arête separating the Dong Dong from the Sher-pi-gang and ending at their junction. We ascended this arête to a point on its skyline 1,600 feet above the camp, higher than which we could not go, being stopped by the vertical wall on one of the lower peaks of the *contrefort.* We had reason, however, to be satisfied with having reached this spot, for it was, by far, the best observation-point attained in this region, being situated in the centre of the basin directly between and above the two principal glaciers, and sufficiently high, 16,604 feet, to command a bird's-eye view of the whole length of the Sher-pi-gang and down the nala to beyond the village of Korkondus. From it with the aid of compass-bearings we were able to obtain a fairly accurate idea of the intricacies of this basin and also a series of satisfactory photographs of the four Sher-pi-gang reservoirs and of the ice-streams issuing from them, which had not previously been seen from any other point.

While the general mountain-view, similar in character to that seen from the heights above Zogo, was grand in the extreme, and that of the glaciers and of the bizarre, lofty, inaccessible reservoirs of the Sher-pi-gang, at the head of which Vigne located his Ali Bransa pass to Yarkand, framed in shattered peaks and ridges of black rock, was more immediate and impressive, perhaps, the most remarkable feature was the view obtained by leaning over the edge of the precipice, on which we

Panorama north-west from arête between Sher-pi-gang and Dong Dong glaciers, showing four heads of Sher-pi-gang, from which steep, crevassed ice-falls descend to glacier-trunk.

stood, of the face of the absolutely perpendicular, indeed rather overhanging rock-wall, which fell away 1,500 to 2,000 feet to the trunk of the Sher-pi-gang, and of the long, curving ice-fall directly beneath, pressing hard against it, and split up from wall to wall by wide crevasses into ribbon-like sections covered with gigantic séracs. We had, for years, been familiar with crevasses, séracs, and ice-falls. We had seen them from various view-points. We had traversed them, ascended them, and descended into their recesses, but this was the first opportunity we had had of looking down vertically from an overhanging height upon them collectively.

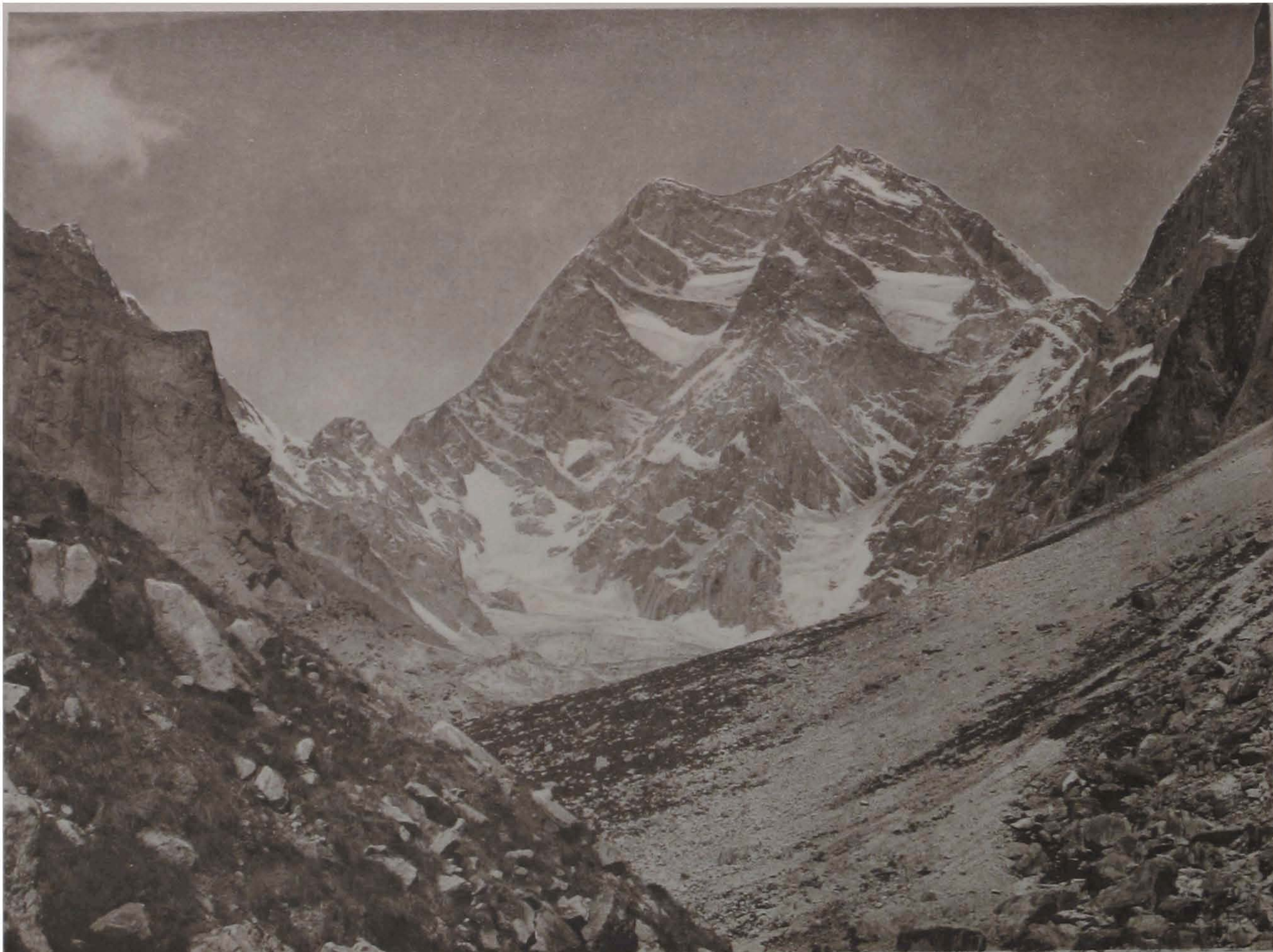
The séracs, as might be expected from the position of our observation point, appeared flattened, and conveyed to the eye no adequate impression of their actual height, but the circumference of their masses and the irregularity of their arrangement were plainly visible. Through the gaping mouths of the crevasses between them we could see far into the glacier-depths, in fact, into its very bowels and into abysses which lost themselves in blue darkness beneath. Some of the shallower openings were partially filled with the splintered ruins of séracs that had fallen, and, in places, the bluish green ice served as a setting for tiny lakelets reflecting the sapphire blue of the sky.

We also ascended the nala to see if any passage over its barriers near its head could be discovered. The moraine on which the camp stood was followed for some distance, till the glacier became too broken to permit of further passage on it. We then descended to the narrow interval bordering its west edge. This was choked by boulders, tali, and projecting rock-shoulders, and following it up was rough, grinding work. After three hours a narrow grass-covered maidan overhanging the glacier was reached, the last spot showing vegetation, beyond which lay the desert of rock and ice which had stopped our progress on the other side and was equally impenetrable from this point on.

Since this maidan commanded a view of the upper end of the nala, it answered the purpose for which we had come, so we proceeded to examine the surroundings, took boiling-point and temperature-readings and photographs, after which, seated on the grass, a rare product in this region, and sheltered from wind by boulders, we ate our tiffin spiced by the grand panorama before us. The altitude here worked out at 16,100 feet. The cascaded glacier rose sharply in ice-falls 1,500 feet higher before it merged into two initial reservoirs upon the flank of Peaks 35 and 36. Its upper limit as a glacier may be stated as lying at approximately, 17,500 feet.

What was here seen proved the Dong Dong nala to be a cul-de-sac, its upper end enclosed by Peaks 35 and 36, 25,280 and 25,400 feet high, and its sides by two great *contreforts* extending south-west from the main massif, with no opening or passage at any point above its mouth. These barriers rise in sheer, dizzy precipices, unscalable except at the place where we ascended the arête between the Dong Dong and the Sher-pi-gang.

The same is true of the Sher-pi-gang, the upper portion of which is larger, more complicated, and more snow-bound than the Dong Dong. The whole basin draining into the Korkondus nala forms a great, scalloped cul-de-sac, in which the explorer, even were the contained glaciers accessible, would find himself cut off from the Bilaphond and Siachen basins on the east and from that of the Kaberi on the west by impassable mountain-walls. In character the peaks resemble those of the Hoh Lumba and Sos Bon more closely than those enclosing any other Karakoram glacier we have explored, but that region is



South-west face of Twin Peaks $\frac{35-36}{52A}$ at head of Dong Dong glacier from summit of steep, left lateral moraine of Dong Dong. Section of this moraine in left foreground.

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Head of Dong Dong glacier springing from south-west face of Peaks $\frac{35-36}{52A}$ beyond extreme left.

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more open, its glaciers larger, and its grand mountains are seen to better advantage.[1] Not a single peak of this basin is climbable.

The weather on this day, as had been the case for several days, was lowery, and the heads of the twin peaks that dominate the glacier and form its most impressive adjunct were veiled in heavy clouds, which obstinately refused to move during three hours we waited with cameras ready for instant use, should even their momentary parting grant an opportunity to secure a picture of what lay behind them. Experiences of this kind are not at all unusual, and the explorer can seldom succeed in accomplishing all he has planned to do. It is certainly most disappointing and exasperating; after he has devoted perhaps a whole season of time, been at much expense, and undergone deprivation and hardship in order to attain some supreme goal in a region he can never visit again, to be prevented by unfavourable weather from carrying out his object or even seeing what lies behind a curtain of cloud that will not rise.

Monsoon atmospheric conditions as well as the influence of unknown factors in unexplored districts are likely to interfere with the complete success of undertakings in Himalaya, however carefully the details of preparation for their attainment may have been arranged. After some experience, one learns to realize, that exploration in these mountains is decidedly a game of chance, in which the stakes must be put up without any assurance of success, with a willingness to accept failure and to be satisfied with whatever prizes circumstances permit one to carry away.

We had now accomplished all that could be done here.

[1] Vide illustrations of Hoh Lumba and Sos Bon in *Ice-bound Heights of the Mustagh*.

A stone-cairn was built on the top of a large boulder, which rested on the brow of the glacier behind the camp, and was visible from the lower parts of the Sher-pi-gang and from the nala to below Korkondus. We then crossed the glacier and descended to Zogo by the only available route, that taken in coming up, and the next day returned to Karmading.

During this time Dr. Calciati had been on the Kaberi glacier. About six miles above the end of its tongue he found the glacier divided into two streams, an easterly and westerly, each running, approximately, north and south. He followed the easterly stream about four miles upward, but did not see its end nor establish the relationship of the upper portions of either stream to known points above. His report of his observations, with topographical sketch of the glacier as far as he went, was not forwarded to us till late in the summer of 1912, and we did not receive it until after we had finished the expedition of that year, during which we had discovered and crossed the, previously, unknown and unsuspected glacier-passage leading from the Siachen to the Kaberi basin, and descended the whole length of the Kaberi glacier, having had no suggestion from his report that might have been of value in determining our movements after reaching the Kaberi.

Savoye and a porter with ten coolies, leaving the main party at the upper Dong Dong camp, went ahead and made a reconnaissance of the Kaberi tongue and of the western arm for some distance above the bifurcation, after which they rejoined us at Karmading. They reported, that the glacier filled the entire nala-bed between the mountain-walls, which rose above it on both sides, and were constantly sending down rocks upon it, and that its surface consisted of a confused mass of

Two western heads of Sher-pi-gang from ridge between Sher-pi-gang and Dong Dong glaciers.

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Portion of northern head of Sher-pi-gang glacier from Sher-pi-gang–Dong Dong ridge.

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large, débris-covered hillocks difficult to traverse, upon which camps would have to be made, as no safe spots existed along the sides. In short, attempting to ascend it with a coolie-caravan would be a hazardous undertaking, full of unpleasant possibilities. As will later be mentioned, we had opportunity the following year to learn by experience that they had not overdrawn the picture.

In view of this report, supposing that Dr. Calciati would be able to obtain an idea of the northern extension of the glacier and its relation to the fixed points to the north, and in view of the time already lost, we decided not to attempt to ascend it, but to go at once to the Hushe region and pursue our further personal investigations there.

CHAPTER V

The Hushe valley—Tree-growth on rock-mountains—Alternating fans—Stratified clay-deposit—The Masherbrum glacier—Surface-moraines and configuration—Remarks on climbing-rates—Ascent of quartzite peak—No passage to Baltoro—Crescent glacier—Descent to camp.

Leaving Karmading early on the 18th July we returned through the Saltoro valley in two days to Hulde, at the junction of the Saltoro with the Hushe valley, and without stopping there passed on up a steep, sandy hill-side into the Hushe and camped beyond the first village, about two hours' march above. After coming from the Sher-pi-gang and Kondus, the Hushe valley is at first disappointing, but later it presents plenty of points of interest. For the first five miles above the Saltoro junction it is wide. Its eastern side to left of river is an uninteresting, stony wilderness, while the side west of the river is carpeted with a succession of fertile oases with many fruit-trees. The mountain-walls on both sides consist of uniform ridges with rounded tops of fragile, brown shale, breaking up easily into small fragments. These slope back gradually, and do not rise into high peaks.

Farther up, the valley becomes narrower and wilder. Granite-ledges appear among the shales and sedimentary rocks, and granite-peaks come into view right and left, which become more numerous, more pointed,

Fan poured out from gorge in east wall of Hushe nala cut through by Hushe river, its end forming abrupt cliff. Fan formerly extended to opposite valley-wall. Section on right (west) of river eroded in quite different manner from that on left.

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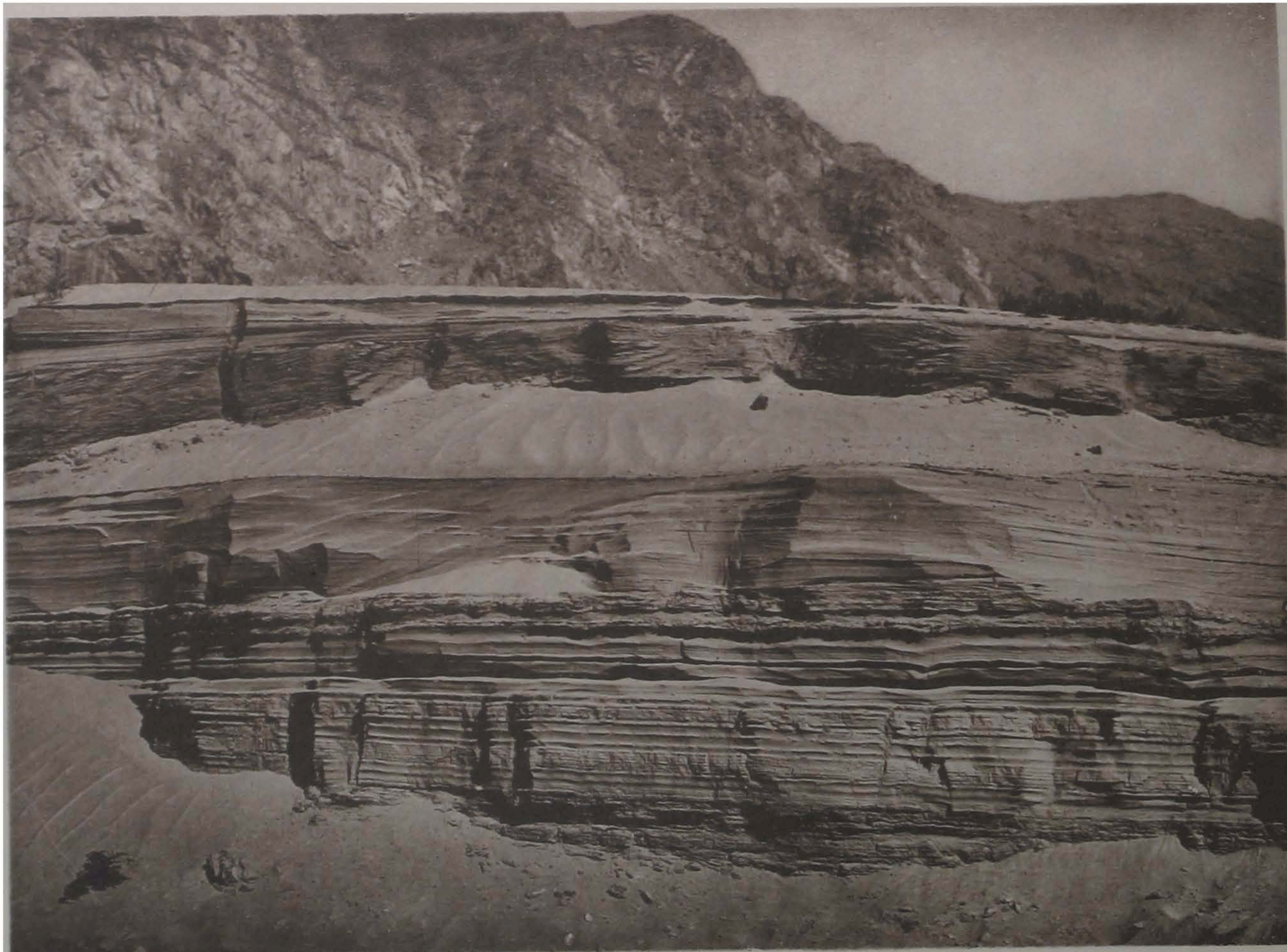
and more picturesque the higher one goes, till in the upper portion they rival those of the Sher-pi-gang and Kondus. From their flanks massive tali, 1,000 feet or more in height, project, over which the path passes. The sand of the Hushe is not coarse and gritty like that of the Kondus and Saltoro, but has small, smooth grains, and mingled with them a large proportion of alluvium, so that it feels soft under the feet.

A curious phenomenon occurs in the upper Hushe and its tributary nalas, as well as in those farther east, in the growth of evergreen trees, probably mostly cedars, of rather large size, high up, at altitudes we estimated at 13,000 feet and over, in niches upon projecting rocks, and even upon vertical or nearly vertical rock-faces of mountains and along the skylines of their ridges, where no soil, apparently, exists and where no water could lodge and remain. They strike their roots into the crevices and joints of the rocks, to which they hold firmly. Here they flourish with a vitality and luxuriance of growth that would do credit to trees planted in good, well-watered soil. How they can derive nourishment from dry, sun-baked rocks seems a mystery. I have nowhere seen trees approaching them in size at similar altitudes in the nala-beds. Also, deciduous trees, resembling mulberry-trees as much as anything, were seen in similar positions, but they were so high above that we could not distinguish their nature with certainty even with field-glasses. Such trees, torn off and brought down into the nalas by winter-avalanches, supply the inhabitants with fuel where no other wood is to be obtained.

Among the interesting features of the Hushe are its fans, composed of débris poured out by floods from gorges on both sides. They spread out at the widest portions from half a mile to a mile. The vast amount of material in them seems to have been well held together so as to give them great thickness, often of many hundred feet. Some of them shoot entirely across the valley to the opposite side, and most pass far over beyond the central line. At several places they occur in pairs, coming from gorges nearly opposite one another, in which cases they overlap each other, often with only a narrow interval between, so that they present to the eye of one ascending the valley the appearance of a continuous raised barrier, extending across from mountain to mountain. Owing to these the valley-bed seems to rise in a series of steps or terrace, several hundred feet high, one above another. They might be called alternating fans.

The river has cut its way down, through, and around their ends, leaving high, vertical precipices composed of mixed débris, much of which, on their faces, loosed by weather, has fallen out and formed tali of considerable size at their bases. On account of the obstruction offered by the fans the river runs in a serpentine course from side to side of the valley between them, and, where alternating fans occur, its curves are sharp. The débris composing these fans, like that of many elsewhere, is stratified in horizontal sections of varying thickness, showing that they were not formed to their present thickness by the outpouring of any single flood, but were built up in successive layers by repeated floods occurring at various intervals of time. The character of the strata varies, one being composed of gravel and pebbles, another of alluvium alone or mingled with stones and boulders, and still another, perhaps, of stones only.



Portion of face of stratified clay-bed, Hushe valley.

[Note the thinness of many of the strata.]

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Not far below the village of Hushe we passed along the front of a semicircular amphitheatre many hundred feet long and running back into the mountain-side a considerable distance—how far we did not stop to trace—composed entirely of light grey, fine clay mingled with some sand without any stones. Its vertical face, about 150 feet high, was weathered so as to show a structure of horizontal stratification in thin layers, some no thicker than card-board. How this great body of fine clay without admixture of coarser débris came to be deposited here in this striated form I leave to those better versed in geology than myself to explain. No other, similar formation was seen in this region.

We reached Hushe village at 9 a.m., and, after a brief rest, continued on up the valley, crossed the river to its west side by a bridge a short distance above Hushe, and followed a path leading through a luxuriant growth of rose and currant bushes, willows, tamarisks, juniper, and cedars, to a level, grassy, park-like maidan two miles beyond, which was well watered and sprinkled with larches, in addition to the growths mentioned. Here we camped at an altitude of 10,817 feet.

The valley here expands into quite a large basin, out of which three nalas lead, one east to the Khondokoro and Chogolisa glaciers, another, the direct prolongation of the Hushe valley north, to the Masherbrum, and a third west to the Aling glacier.

The next morning rain fell from four to half-past seven o'clock. At eight-thirty we broke camp with the caravan to push up the Masherbrum nala, which leaves the basin a mile above. A mile and three-quarters up the nala we encountered a mass of dark-coloured granite and gneissoid débris lying over the nala-bed in front of and deposited by the receding tongue of the glacier. A quarter of a mile farther the first ice appeared beneath the débris on the west side of the nala, and from here the tongue slanted steeply upward in a ragged, irregular, rock-covered mass to a high brow on a level with the glacier-surface. The ice projected down on the west considerably farther than on the east side. Near the centre was a large cave, from which a good-sized stream of water issued.

By the time we had begun the arduous ascent of the tongue the weather again thickened, and a steady rain set in. In this we struggled on till noon, when the brow of the tongue was gained. Here we ate tiffin, sitting without shelter on the wet rocks and drenched by the pouring rain, after which, as there appeared no prospect of improvement in the weather, and we did not know when, or where, or what kind of a camping place could be found above, we descended again and camped on sand among the cedars and willows in the nala, a short distance below the end of the tongue, at an altitude of 11,300 feet. The rain continued until evening.

The following morning, starting again, we ascended the tongue to the west bank of the glacier, clambered over large tali, among the rocks of which cedar roots and splintered fragments of trunks fallen from above were scattered, and came to a gigantic, ancient moraine several hundred feet wide, towering 200 to 300 feet above the glacier-surface, clothed with vegetation and dwarf-willows. This furnished an easy pathway, which we took advantage of. Five miles above the glacier-end a grassy maidan was found on this moraine, where camp was pitched at an altitude of 13,633 feet. The dwarf-willows, on which we relied for fuel, grew to the altitude of 13,400 feet. The glacier-surface,

Ice-cave at central line near termination of Masherbrum glacier, from which glacier-river issues, that flows away through débris-strewn ice-gully.

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from somewhat below this point upward, was crowded up into hillocks and broken into séracs, both heavily loaded with detritus.

Two miles below this camp a short nala opens out to the west leading to a cirque of snow-clad peaks, which sends down a glacier into the nala. At its entrance there was quite a large, shallow lake. Later in this season, after our departure, Dr. Calciati ascended over the eastern moraine of the Masherbrum glacier for two miles and then crossed the glacier diagonally to the south side of the entrance of this nala, where he camped at an altitude given as 13,808 feet, apparently, on a spur considerably above the glacier-surface at or near a point indicated on the Indian Survey sheet 44A, S.W., by the figure 13,985. He places the extremity of the glacier-tongue at the altitude of 11,705 feet, which accords well with the altitude we obtained for our camp, somewhat below, of 11,300 feet. He ascended a height west of his camp, to which he assigns an altitude of 16,905 feet.

Our camp commanded a fine view of the glacier above to its end and of the southern face of Masherbrum and neighbouring peaks. We much enjoyed such fleeting glimpses of these as the monsoon-conditions permitted. The moraines of this glacier contain, in addition to granite and gneissoid débris, quartzite, sedimentary rocks, shales, limestones, and much serpentine in large masses, which would make a fine showing if polished. Serpentine also exists in quantity in the rocks of the west wall. All these rocks were laminated.

Colonel Godwin-Austen, in the *Journal of the Royal Geographical Society*, 37, 1864, pp. 20–21, mentions his "survey work" of the Khondokoro and Masherbrum glaciers in 1860 very briefly, devoting only seventeen lines to the description of them both, the first under the name of "Atoser." He does not state that he ascended the Masherbrum any appreciable distance, but on the Indian Survey sheet 44A, S.W., on which this region is shown, what appears like a route-line runs up the nala on the west side of the glacier to a point marked 13,985, three miles above the end of the tongue, which, presumably, represents his route or that of some other surveyor and the point where it ended. That he did not go beyond this point would also appear from his statement: "Some five miles up, this glacier forks, each branch being about seven miles in length." This statement does not accord with his own map, or with the Survey sheet, or with the conformation of the glacier as we found it in 1911.

Masherbrum glacier consists of a single trunk, which, nowhere dividing in such a manner as to constitute a fork, broadens as it ascends, and, at the point where it is said to fork, viz. five miles up opposite our camp, attains a width of at least three-quarters of a mile, becoming even wider above. It receives on both sides a number of small affluents, very small as compared with the size of its trunk, descending from the enclosing walls, none of them having a length approaching "seven miles." No indication was discovered, that the form either of the glacier or of its basin has undergone any essential alteration within the last hundred years.

The next day presented a variety of weather, frequent snow-squalls with intervals of sunshine. We went up the west side of the nala, partly over lateral moraines and partly over mountain-slopes, to

Front of tongue of Kaberi glacier, with ice-cave towards its eastern side, from which issues the chief glacier-stream, the origin of Kaberi river. This uniting at Karmading with the Korkondus stream from Sher-pi-gang glacier forms the Kondus river.

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its upper end, where it expands into a basin enclosed by the flank of Masherbrum and a sheer, ice-covered wall running from it north-west and curving around to join the nala-wall. The bed of this basin, in the walls of which no opening was found, was entirely filled by the much broken and séracked head of the glacier, fed by an uninterrupted succession of cascaded glaciers and ice-falls descending from the overhanging barriers. At the south-west side of the basin-entrance five large moraines lay between the glacier and the mountain-wall.

The second morning broke clear and bright. Taking camp-outfit, we went up again to the base of a projecting shoulder on the west side next the basin, which led up by a steep incline to a snow-summit directly opposite the south-west face of Masherbrum. This was ascended. The first 12,000 feet of this shoulder consisted of sharply rising, grass-covered slants, such as are rather frequently encountered in the Alps though rarely here, that prove fatiguing on account of their unvarying gradient, without presenting any especial obstacles. Having remained behind the caravan at its base to attend to a matter of detail, I hastened my pace somewhat to overtake it. At the end of an hour I found I had ascended by measurement 1,150 feet.

This is not mentioned as a particularly noteworthy feat, for many a younger and stronger climber would, undoubtedly, have made a better showing under the same conditions. Yet, considering the gradient and character of the slant, that its altitude was above 14,000 feet, and that I was carrying something of a load of cameras and other instruments, it seems a fair performance that may be taken as a statistical point for what it is worth. In actual altitude-distance made it is quite in contrast with the less than 300 feet per hour to which step-cutting on steep ice-slants or deep snow has, on occasion, restricted the movements of our parties. The upper part of the mountain was climbed the next day by us and guides at the rate of 500 feet per hour.

Within the past few years the rate of climbing per hour accomplished by mountaineers has been rather a favourite topic of discussion in certain quarters. I am not one of those, who consider it profitable to spend time and effort in attempting to draw from such discussions deductions as to the altitude or accessibility of summits that have been gained or that may be attempted, or as to whether a high summit should be attacked from a high or low camp.

So many factors enter into the determination of possible rates on different pathless mountains, and even on the same mountain on different occasions, such as the age, strength, condition, and endurance of altitude of the climber, temperature, state of the weather, the gradient and character of the slopes, whether of rock, ice, or snow, smooth or rough, hard or soft, with surface continuous or interrupted by crevasses or precipices, exposed to avalanches or themselves liable to become detached and slide, that each instance must stand by itself. Its result cannot be forecast by results obtained in other instances under dissimilar conditions, and no one can foresee what obstacles may be encountered on an untried mountain.

In the course of the discussion of a paper by Dr. A. M. Kellas at the Alpine Club on February 4, 1913, as reported in the *Alpine Journal*, vol. xxvii., Dr. Longstaff placed himself on record as quoting an opinion

South-west face of Masherbrum, 25,660 feet, from camp on Quartzite mountain. Masherbrum glacier beneath.

[Note the two crossed summits.]

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from me on such a subject. On page 224 he says: "I remember Dr. Workman telling me that there must be some mistake about the height of Trisul, because it was impossible at that altitude to climb, as I appeared to have done, at 600 feet an hour."

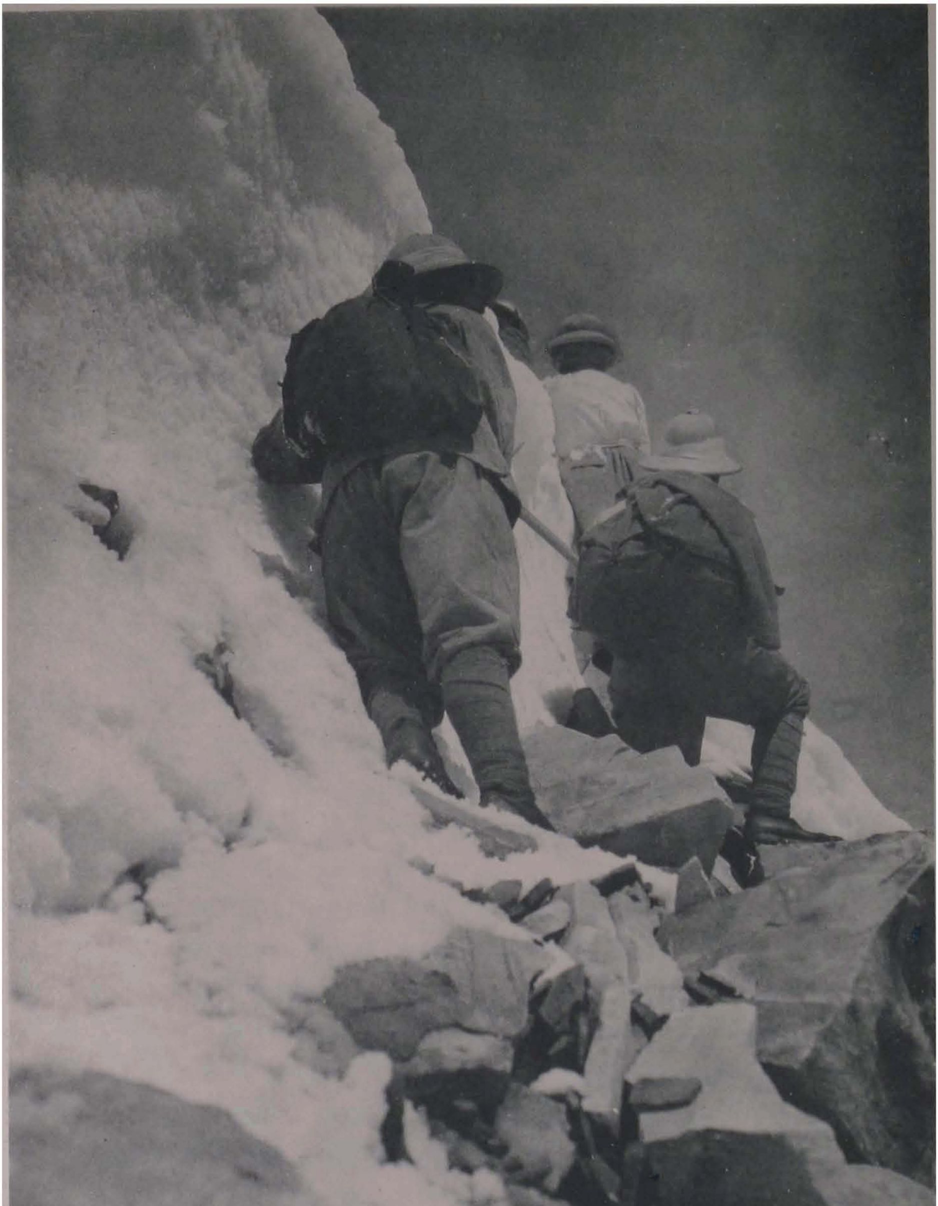
This association of my name with such an opinion compels me to explicitly disclaim the authorship of it. During the only and very brief conversation I ever had with Dr. Longstaff on any mountain subject I am very positive, that neither the altitude of Trisul nor his climbing rate upon it was mentioned. I am just as positive, that I never expressed to any one else the opinion he attributes to me, and the idea it involves never entered my mind, till I read it in the pages of the *Alpine Journal.*

It is, indeed, unthinkable that any question could have been raised regarding the altitude of Trisul, which is one of the most carefully measured of Himalayan peaks, having been triangulated by the Indian Survey from *seven* different stations, with a resulting altitude for its highest point of 23,360 feet, as to the substantial accuracy of which figure there can be no room for doubt.

It is equally unthinkable that any person of average intelligence and common sense would risk his reputation by attempting to throw doubt on the altitude of a so thoroughly triangulated peak by an argument based on Dr. Longstaff's climbing rate on its side. I think, therefore, that Dr. Longstaff, on further consideration, will see that his memory was at fault in ascribing to me a remark, which it is very evident I could never have made.

Above the grass, the shoulder passed over into a shale-arête falling with ragged, vertical face towards the basin. We camped on the slant of this arête just below the skyline, at the edge of a stretch of recently fallen snow, at an altitude of 15,200 feet. The slope was such that it was necessary to excavate terraces for the tents. The spot selected for my tent was on a ledge of pure talc, so soft that it could easily be cut into with ice-axes. In the course of our expeditions our ice-axes have proved useful in more ways than in step-cutting and as aids in climbing. Many have been the occasions, on which they have served as pickaxes to loosen up the compact soil of hill-sides or the mixed débris-deposits of moraines, to remove roots or dig out the earthy packing from around boulders in the construction of tent-terraces, and, at ice and snow-camps, they have made the strongest possible pins to fasten tent-cords to. As implements they were so greatly superior to any the coolies were accustomed to that the latter appeared to greatly enjoy using them for the purposes mentioned, and always worked with unflagging energy when they were permitted to do so. In this instance they worked with a will, and sent the talc-chips flying in every direction. The terrace when finished was dry, but the smooth soapstone communicated a peculiar, greasy sensation to the feet that gave the impression it was wet.

From this camp the view of the upper Masherbrum region opened up grandly, and, although it was surpassed by that obtained the next day from the summit, well repaid the effort of coming up. Far over across the great ice-expanse of the upper reservoirs, high up towards the skyline, a coal-black shoulder projected from the ice, blacker than the black slate usually seen in the Karakoram, and the question arose was it not coal? The débris from it formed a large moraine,



Passing through the cornice of Quartzite peak shortly below its summit.

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that descended the reservoir for more than a mile till finally swallowed up by crevasses and abysses, and the ice on the leeward side of the moraine was blackened for a considerable distance by dust, seemingly, derived from the pulverization of soft, black fragments falling from the shoulder. Such a condition I have not elsewhere noticed in connection with black slate-moraines, the outlines of which are usually sharply defined; but it would be likely to occur in case the shoulder were of coal. If this could be proved to be coal, it would be an interesting geological discovery, for the shoulder stands at a height of 21,000 to 22,000 feet. The moraine appeared to lose itself completely in the abysses of the ice-fall. It was not seen to crop out again, nor was coal observed in the lateral moraines lower down.

The next day we continued the ascent to the summit above. The slant was steep and entirely covered with angular, sharp-edged fragments of various sizes and shapes piled thickly upon one another, the majority being under two feet in diameter, of light grey, hard quartzite. Ascending this was somewhat hazardous, and was rendered more so by the covering of soft snow, which, while concealing the irregularities of the rocks, did not prevent one's feet from crushing through it into the interstices between them. The whole surface-rock of this peak was shattered to a degree I do not remember to have seen elsewhere. The snow-mantle made it difficult to form a definite opinion at the time as to the cause of this condition, but, viewing this and various, similar instances in the light of experience and observations the following year, I am inclined to attribute it to the disruptive effect of earthquakes.

After a three hours' scramble we approached the summit, which consisted of a thick snow-plateau with corniced edge. The cornice was cut through, and we soon emerged on the upper surface, where a gentle incline led to the highest point, the altitude of which, as determined by the hypsometer, was 16,839 feet, though from the depth and solidity of the snow-cap we should have judged it to be higher. This was named Quartzite peak.

This summit was the highest point of a ridge projecting from the western barrier of the Masherbrum basin. From it the whole sweep of the basin enclosed by steep walls of jagged mountains with pointed apices, as well as the glacier and its affluents could be seen. *Vis-à-vis* across the glacier towered the mighty form of Masherbrum, 8,000 feet above where we stood, the monarch of the region, its two summits crossing each other, as they appear from points to the south to do, like the mandibles of a cross-bill. It figures large in the background of views northward from the glacier and from the Hushe valley to its lower end, lifting its hoary head high above all surrounding elevations. Beyond the immediate glacier-barriers rose on all sides a forest of sombre, savage peaks, the greater portion too pointed to hold even a capping of snow. Among them could be recognized, looming above their neighbours to the east, the fixed peaks 6, 7, 9 (Peaks 27, 26, 25 of the Survey degree-sheets respectively).

As mentioned in the early pages of this book, a tradition has existed of a pass from the Hushe region across the northern ridge to the Baltoro. In 1903 Mr. Sillem, a Dutch traveller, visited the Hushe valley, and on his return, reported that he had found at the head of the Masherbrum glacier a snow-pass leading over to the north, which he wished to attempt to cross, but was prevented from so doing by the refusal of his Kashmiri

On summit of Quartzite peak, 16,839 feet. Masherbrum in background.

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shikari and coolies to go. When at Kapalu we asked Raja Shere Ali Khan about this tradition. He said a pass was reported to exist, but further than that he knew nothing regarding it. The view from the glacier of the steep mountain-wall extending north-west from Masherbrum and then around the head of the basin without a break was fully verified by the more comprehensive panorama obtained from this summit, revealing its features in their truer and more formidable proportions with no interruption nor attainable depression in their solid phalanx, which puts to rest the question of a passage northward from the Masherbrum glacier.

Mr. Sillem may have thought, that a passage might exist at the summit of a large feeder, greatly foreshortened as seen from the glacier, entering the Masherbrum on the west, which descends from an extensive, high reservoir, one arm of which extends north to a slight depression in the skyline, that might be called a col. This is the only place where a passage could by any possibility be supposed to exist. If this was the case, and he proposed to try to ascend that feeder with only native companions, both the shikari and the coolies showed practical wisdom in refusing to make the attempt, whether their judgment as to its accessibility was worth anything or not. Every part of it, from the Masherbrum glacier to its highest limits, a distance of some three miles, is so seamed by crevasses and chasms curving among huge séracs that a traverse of it, especially for a loaded coolie-caravan, would be impossible. As Mr. Sillem lost his life two years later on the Col du Geant, and I am not aware of any publication in print of his experiences, further details are not available.

One object we had in view in ascending this peak carries us backward to the summer of 1899, when, from the summit of Mt. Bullock Workman east of the Skoro La, we discovered a large glacier, which, coming from many miles to the east in the direction of Masherbrum, turns to the north in a crescent around the south and west sides of Mango Gusor between that mountain and Mt. Bullock Workman, and ends about three miles from the opening of its nala into the Braldoh valley just west of the termination of the Biafo tongue. This glacier filled the whole bed of a verdureless nala, the smooth, desolate, ice-covered walls of which, as we remember them, slanted up sharply from the ice. We named it Crescent glacier. (Vide *In the Ice World of Himalaya*, p. 152 and illustration.)

To avoid confusion as to the localization of the portion of this glacier seen, it may be stated, that Mango Gusor is a peak situated seven miles south of the extremity of the Biafo tongue and of the head of the Braldoh valley, shown on the Indian Survey sheet 44A, S.W., as "Snowy Peak No. 13," triangulated by the Survey at 20,635 feet. It is the culminating point of a mountain-ridge extending directly south from the head of the Braldoh valley. Its immediate relations to the neighbouring heights are not, however, correctly represented on the Survey map. It is not only the highest but the most southerly elevation of the ridge which turns eastward from it, being cut off from Mt. Bullock Workman on the west and from the mountains on the south, with which it may at one time have been connected, by the curving Crescent glacier and nala. (Vide *In the Ice World of Himalaya*, map.) The ridge terminates at its northern extremity in a handsome, pyramidal peak considerably lower than Mango Gusor, facing the extremity of the Biafo tongue, which almost abuts against its base. This last peak has been mistaken by several explorers of this region for Mango Gusor.

View of Crescent glacier, discovered by Authors in 1899, from summit of Mount Bullock Workman.

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When we descended the Biafo from the Hispar glacier in 1908, we intended to ascend and explore Crescent glacier from Askole as a base. Preliminary examination of the outlet of the Crescent glacier-nala into the Braldoh valley, indicated on the Survey sheet as Stokpa Cho, showed access to it to be impossible. Smooth, vertical walls guard both sides of the entrance, across and against which flows the swift, powerful torrent from the Baltoro and Biafo glaciers, swelled still more in volume by the junction of the Crescent glacier-torrent. The stream was too deep to be forded. There were no boats, and had there been, they could not have been used on account of the rapidity of the current. There was also no bridge nor any other way of access to the nala. So, to our disappointment, the undertaking had to be abandoned.

In this connection I would call attention to two statements in *Karakoram and Western Himalaya* regarding our work in this region, which do not quite accord with the facts, and which the author would, doubtless, not object to have corrected. (1) On page 166 is written, "The Workmans on their return to the region in 1908 noted the Biafo [tongue][1] as practically in the same position in which they had found it in 1899." As to this I may say, I am not aware that we have anywhere made any statement regarding the position of the Biafo tongue or lower extremity in 1908. (2) On page 335 is also written that we "climbed the two peaks nearest the Skoro La, 18,600, 18,450 feet high." What we did climb were the nearest peak, named by us the Siegfriedhorn, 18,600 feet, and the *sixth* east of the Skoro La, Mt. Bullock Workman, *19,450* feet, next to and west of Mango Gusor, from the summit of which Crescent glacier was discovered. The second high peak, apparently, the highest

[1] "Tongue" inserted by myself to make meaning clear.

of the group, was at that time unclimbable, its steep slopes being cleft by numerous, huge chasms extending deep into the mountain.

As a last resort, we hoped on the present expedition to be able, at least, to see the source of Crescent glacier from some height in this vicinity, but our hopes were again doomed to disappointment, for, from the one we now stood on, the only one accessible, although openings between the mountains to the west were visible, nothing definite could be determined. We can therefore only call attention again to the existence of a large glacier flowing west from the vicinity of Masherbrum to the south side of Mango Gusor and turning north along its western side, and leave to others, in the future, the possible exploration of it.

At the north end of the snow-cap of Quartzite peak where it overhangs the upper amphitheatre, a narrow rock-ledge jutted out of the snow. From this a narrow, ragged couloir descended almost vertically to the snow-slope beneath. Although it had a very ugly appearance, it offered the shortest return-route, so we decided to descend by it. We roped in two parties of three each. On account of the broken and loosened condition of the surface-rocks, fragments of which were certain to be detached, the second party waited till the first had passed through the couloir. The descent was decidedly a matter of rock-work, involving the use of hands and feet. The leaders, held by those above on the rope, tested all hand and foot holds before trusting themselves to them, and these were carefully noted by those following. Progress was slow, but by the exercise of caution all got safely down and returned to camp.

CHAPTER VI

CHARACTER OF GRANITE-BOULDERS—KHONDOKORO GLACIER: ASCENT, TRUNK, SOURCES, MORAINES—FORMATIONS AT HEAD OF GLACIER—INCIDENT OF CAMP LIFE—STRUCTURE OF MASHERBRUM—CHOGOLISA GLACIER—ALING GLACIER.

HAVING finished with the Masherbrum glacier, we descended to the maidan at the head of the Hushe valley, camped there for a night, and the next morning, crossing the bridge above Hushe, ascended the east river-bank to the nala leading to the Khondokoro and Chogolisa glaciers. From the south-east side of the opening of this nala into the Hushe valley Masherbrum is seen through the opening between the bare rock-walls, which guard the entrance to the Masherbrum nala, towering more than 15,000 feet above.

The valley-bed and bases of the mountain-flanks here were strewn with immense blocks and slabs of a pinkish brown granite fallen from the heights above, which, on account of their warm tint and size, formed striking objects in the landscape. On casual inspection they appeared to have a dense, fine-grained, even structure, that was not only handsome in itself, but promised to be resistant to weather-action and suitable for architectural purposes. Closer examination did not bear out this appearance. The masses were found to be veined and banded, in places, with cleavage from weathering along the lines of the veins, which placed this rock in the gneissoid category. Also its substance was everywhere intersected by small joints, and, instead of being dense, it was comparatively soft and brittle.

This rock showed the tendency, noticeable in Karakoram granites and granite-gneisses in general, to be much veined, of friable texture, extensively divided into small sections by jointing, and to offer relatively slight resistance to weathering influences. Indeed, a laminated structure in them is often rendered apparent by weathering. I observed a large gneissoid block on the river-edge at Hulde which presented the appearance of a partly opened book resting on its back, the leaves radiating from the back upward and outward. In the Saltoro valley large blocks of biotite-granite, twelve or more feet cube, were seen, which were being split into slabs by weathering along veins. In some cases the lines of fission ran entirely through the blocks.

A block was met with in the Saltoro valley with a diameter of above 50 feet, split into two portions, seemingly, by the weathering away of a soft vein running through its centre. It is possible that frost may have assisted in producing this result. The opposed surfaces of the two parts, separated by an interval of a few inches, were parallel throughout their whole extent. The only other available supposition, that the boulder was split in two by falling from above, appears unlikely from the exact parallelism of the surfaces of the two fragments, which, had it been fractured in falling, would probably have been inclined towards each other at an angle in consequence of the fragments separating or bedding themselves unequally in the earth. As it was, they rested on an even base.

During our marches through the Saltoro, Hushe,

Khondokhoro nala with lower extremity of Khondokhoro glacier.
Above characteristic granite spires.

Shyok, and Indus valleys I examined granite-blocks along the route with especial reference to the question whether any could be found showing a clean, firm, crystalline structure, free from veins and joints, sufficiently large to supply material for a good-sized architectural detail or a statue, but was unable to find one. Perhaps such did exist, but none fell under my observation.

The bed of the nala leading to the Khondokoro glacier-tongue was covered with an abundance of cedars, roses, willows, and tamarisks growing among the rock-débris. The rough path ran, now over tali, now over stone-paved bottoms shaded by cedars, and now over the flood-plain of the river loaded with heaps of cobbles and rounded boulders brought down by floods. The river, fed by water from the Khondokoro and Chogolisa glaciers, had about double the volume of that from the Masherbrum glacier. After a six-hour march we reached a sandy maidan east of the end of the Khondokoro tongue and about on a level with it, where we camped at 11,207 feet. Dr. Calciati places the end of the tongue at 11,653 feet. The sky on this day was cloudless, and the sun's heat rendered the nala too warm for comfort. The temperature in the sun at 12.30 p.m., as measured by black-bulb thermometer, was 192° F.

The tongue of the Khondokoro glacier, descending in a mass of hillocks heavily coated with débris, ended in a bold front near the centre of the nala. It had, apparently, been stationary for a considerable time, as it had deposited quite a strong terminal moraine before its front in heaps, which were heavier at some places than at others.

The ascent of the Khondokoro nala took us at first up the crest of a long and massive ancient moraine, well-clothed with cedars, currants, roses, and smaller vegetation, and later over mountain-slopes. The glacier was too broken to afford a pathway. At the time of our ascent the roses were aflame with all the luxuriant splendour that characterizes the flowering of the Himalayan rose, stems and leaves being scarcely perceptible among the masses of blossoms.

Although the glacier has great volume and thickness, it does not fill its nala on the eastern side. At some distance up the nala there existed between the sheer rock-wall and the ice, first a rather wide river-bed, well cut out and stone-packed; second, the ancient moraine we were ascending; third, a deep furrow, 100 feet or more wide; fourth, a small moraine; fifth, another furrow, succeeded by, sixth, a strong moraine then forming against the high glacier-side which rose 50 feet or more above it. Somewhat higher the nala widens out at the entrance of a side-nala, but the glacier follows a straight course across the interval at a distance of, perhaps, 800 feet from the mountain-wall.

We made two camps in the Khondokoro nala, one four miles up beneath a vertical, striated wall of gneiss at an altitude of 13,573 feet, and the other four miles higher opposite the entrance of its larger affluent coming from Masherbrum at an altitude of 14,270 feet. From these our investigations were carried out.

The Khondokoro originates, mostly, in the Masherbrum ridge east of that mountain, and the Masherbrum glacier in the same ridge west of it, both receiving large tributaries also from the main massif. Both have about the same length, twelve miles more or less, but the Khondokoro has the greater volume. Colonel Godwin-Austen calls this the "Atoser" glacier,[1] "Atosur" on the Indian

[1] Vide *Journ. Royal Geog. Soc.*, 37, 1864, p. 20.

A northern affluent of Khondokoro glacier. Glacier-table with gneissoid boulder-top. Ice-pinnacles, remains of glacier-table-pedestals, at bases of which the former rock-tops are seen lying on ice.

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Survey sheet, but all our coolies and the Wazir spoke of it as the Khondokoro. I inquired of the Wazir to what the name of Atosur referred. He replied, to the first, small, east nala entering the Khondokoro above its lower end.

Colonel Godwin-Austen in his brief mention of the glacier writes: "This glacier is continued for 6 miles further up to the ridge, which on its northern face gives off another great glacier some 15 to 18 miles in length." The ridge he refers to is, evidently, the Masherbrum ridge 6 miles, as he reckoned the distance, north of the point in the Khondokoro nala which he reached; but the great glacier, 15 to 18 miles in length, he states it gives off is not so evident, for this ridge runs also at a distance of 6 miles and less from, and parallel to, the Baltoro glacier, to which all the glaciers given off from its "northern face" are tributary at, approximately, right angles. No glacier approaching a length of 15 to 18 miles could be crowded into a 6-mile space, and none such appears on Colonel Godwin-Austen's own map or on other existing maps.

While marching and camping in this nala supplied no unusual experiences or adventures, the glacier proved very interesting in a glaciological sense, presenting many structural peculiarities which need not be described in detail here, though some of the more obvious may be mentioned.

Seven miles above the glacier-end the largest and most powerful of its affluents enters on the west, originating in the lofty south-east wall of the Masherbrum massif. The glacier above and below the entrance of this tributary presents quite different features, those of the portion below it being conditioned on the pressure exercised by it on the main trunk. This portion, with its very irregular, crevassed, and débris-covered surface, is not easily traversed, but on the upper portion, just above the entrance of the tributary, white ice, comparatively free from débris and with relatively smooth surface, exists, which furnishes an easy pathway upward to the glacier-head.

The Khondokoro originates in several reservoirs, the ice-masses from which unite in one channel to form its trunk, in which the different ice-streams, some white and some moraine-laden, move downward side by side, the weaker ones being compressed and either amalgamated with the stronger or extinguished. A short distance above the Masherbrum affluent I counted seven prominent ice-streams—first, on east side a crevassed one covered with dark gneissoid moraine; second, one of white ice; third, a dark moraine-stream; fourth, one of white ice; fifth, another of dark moraine; sixth, one of red moraine; seventh, one of dark grey moraine, forming west edge of glacier. The moraine-streams were much larger than the white, and the largest, a huge one carrying reddish-brown débris, began at the eastern head of the glacier, and ran its whole length to its termination.

When the glacier-trunk thus composed came within the range of the powerful pressure of the Masherbrum affluent great changes occurred. The two white streams were snuffed out and swallowed up. The remaining five moraine-streams were crowded together, compressed to a third of their former width, considerably mingled with one another, and pushed over to the east side of the glacier-bed, the red moraine being pressed up into a line of great hillocks laden with detritus, which continued down to the end of the tongue.

Meanwhile the affluent entered and occupied the

North and east heads of Khondokoro glacier.

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portion of the glacier-bed from which it had driven the trunk, and henceforth descended with the others as one of its streams, forming nearly half its width. Above the Masherbrum affluent many glacier-tables were seen, some of them capped with large blocks of dark grey gneiss banded with quartz and feldspar veins; also many ice-pinnacles, the remains of séracs pointed off by melting. For a considerable distance the free ice-surface was forced up by pressure into long, transverse, parallel ridges, their tops rounded by melting.

In pursuance of our object in seeking for possible passes, the peaks and ridges between them were carefully scrutinized without the discovery anywhere of a passage. The walls were everywhere inaccessible except at one place above the northern head, where a lower portion of the ridge was reached after a strenuous climb. From this no passage downward on the northern side existed. Beyond to the north a high rock-wall with sharp peaks was seen running east and west, seemingly, connected with the northern side of the Masherbrum massif, and intervening between the ridge our party stood on and the Baltoro. A glacier of considerable size lay between the two. This view-point was nearly seven miles east of the Masherbrum summits, and corresponds almost exactly to the position of the head of the Stachikyungme affluent on Sir Martin Conway's Baltoro map. This was undoubtedly the glacier seen, and the wall was its northern barrier. Clouds in the direction of Masherbrum veiled the opening shown on Sir Martin Conway's map as existing between this barrier and the Masherbrum massif through which the glacier turns. Even had the sky been clear, the opening might not have been observable from that distance and position.

At our upper camp, at 14,270 feet, flies were exceedingly troublesome, reminding us of our experience at Chalt above Gilgit in the summer of 1908.[1] The heat was also oppressive in the tents, which were fully exposed to the sun till 5.30 p.m. On July 30th, which was cloudless, the sun-temperature at 12.30 p.m. was 196° F., not so high as temperatures ranging from 200° to 208° which our black-bulb thermometers have often registered, and 219° on one occasion, but sufficiently so to render the interior of our tents unendurable till the sun sank behind the mountains.

I venture here to describe an incident of a somewhat personal character involving a moral and certain humorous features, which, had circumstances varied but slightly, might have had a tragic termination.

The incident occurred not at this camp but at a later one on the same expedition, at well over 16,000 feet, and its interest centres on the precaution the explorer in these regions is obliged to adopt, if he wishes his food-supplies to hold out for the required time, of keeping them under lock and key, and serving them out himself as needed.

One evening, after we had settled ourselves in camp, our bearer came to my tent shortly before dinner-time saying the khansamah had not received any soup-ration with the other articles sent to him for that evening's dinner.

It so happened I had taken a small tin of concentrated pea-soup (*erbswurst*) wrapped in paper from the serving box with other things, and laid it with them on the tray of an opened yakdan at the front of my tent, where it was overlooked when its companions were forwarded to the khansamah.

When the bearer applied for it, being busily occupied in making and noting down observations due at this

[1] Vide *The Call of the Snowy Hispar*, p. 19.

hour, I, mechanically, took what I supposed to be the tin of pea-soup from the tray and handed it to him.

When the soup was served, we both noticed that it was thinner, darker in colour, and had a more greasy surface than *erbswurst* usually presents. Mrs. Bullock Workman, eyeing it askance and tasting it with great caution, declined to have anything to do with it and sent it out forthwith, while I, having dusted a liberal quantity of celery-salt into my portion, which effectually disguised any peculiar flavour it might possess, and remarking that the khansamah probably prepared it in a saucepan previously used for cooking meat or some greasy food, with that disregard for trifles which the "simple life" is apt to beget in explorers, consumed almost the entire quantity in my plate.

Before the meal was half finished I began to experience an unusual and unaccountable dryness of mouth and throat, associated with a strong desire to swallow. In spite of frequent draughts of water these symptoms increased to such an extent that by the time the *entremets*, consisting of an excellent custard pudding, was served, my interest in the dinner had entirely vanished.

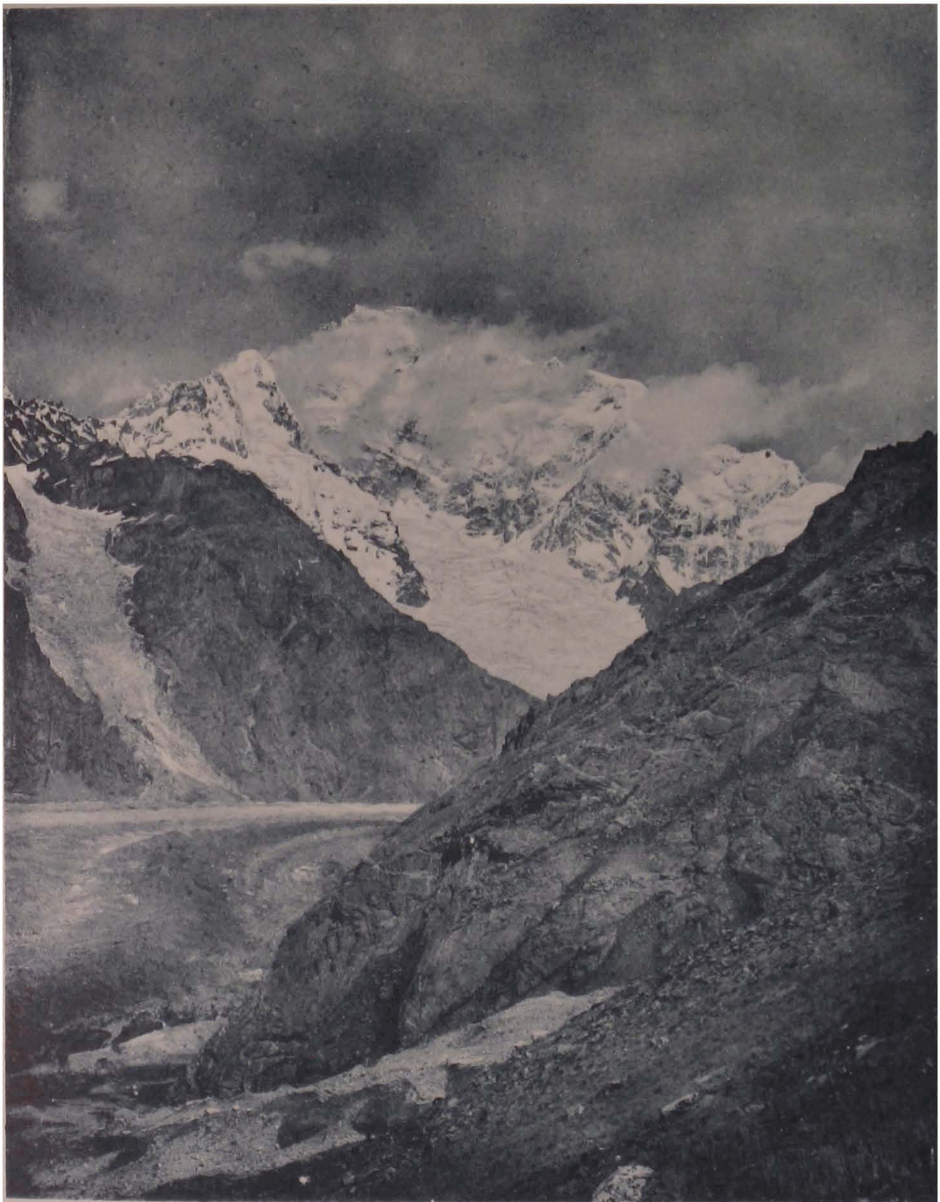
Feeling that something must be wrong with the viands and strongly suspecting the soup, of which I alone had partaken, I sent for the khansamah and asked him what he had done to that soup. He replied that he had prepared in the ordinary manner the soup he had received, and that the saucepan had been used for nothing else.

With the mystery still unsolved, fortified with a flask of water, I, at length, betook myself to my camp-bed in a temperature falling to 3° F. before morning, but not to sleep. By this time my mouth and throat had become as parched and dry as a bone. The constant impulse to swallow had become irresistible, and the numerous efforts to effect this process painful. Water sipped every few moments from the flask afforded no relief to either condition. There was also a marked stimulation of the nervous system, which of itself would have prevented sleep had the other distressing symptoms been absent. The hours dragged slowly on till after two o'clock in the morning, without bringing any relief. The lonely midnight-vigil afforded full opportunity for the excited imagination to disport itself with suggestions of various unpleasant possibilities as to the causation and outcome of these abnormal phenomena. About three o'clock the symptoms began to abate, and toward daylight subsided sufficiently for existence to become more bearable.

After breakfast the khansamah was again summoned and questioned. He adhered to his assertion that he used nothing but the soup he had received. I then asked him, "Have you kept the tin that contained the soup?" He said, "Yes, here it is," drawing forth from a pocket and handing to me a china gallipot about the size of the *erbswurst*-tin labelled "Belladonna Ointment." The mystery was explained. The gallipot of ointment, also wrapped in paper, had been thrown into my yakdan before the expedition started, and had remained unnoticed there till this incident brought it to light.

Neither the dissimilarity in appearance between it and the ordinary soup-tin nor the red danger-label with which it was adorned had suggested to the khansamah, who could neither read nor write, the desirability of making inquiries regarding it before using its contents.

As circumstances turned out no serious harm resulted, but I have always felt, that they led me that night



South-east face of Masherbrum from east bank of Khondokoro glacier. Section of latter seen in foreground.

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close along the brow of a precipice towering above an abyss of destruction, for, as might easily have happened, had an additional plate of that soup been taken, another heretofore unheard of cause of danger to life in mountain-exploration would doubtless have been added to the list embracing sudden storms, avalanches, falling stones, floods, precipices, crevasses, gathering edelweiss, earthquake, and lightning.

The moral is so evident as scarcely to need stating: Never carry a poisonous substance in such a manner that it can, under any circumstances, be mistaken for an innocuous one.

The view from this camp of the high, precipitous, south-west face of Masherbrum surmounted by its two summits, 25,610 and 25,660 feet, still presenting the cross-bill appearance already noted, and of the long ridge sloping away from it into the distance to the east, both extensively ice-clad, was most impressive. Beneath the summits a sheer precipice descends far down to the head of the Masherbrum affluent. The lofty mass from which the summits rise is separated from the highest part of the ridge by a great rift, the depth and full extent of which we could not see from any point that could be reached.

From the camp, distant about four miles from the Masherbrum summits and about three from the projecting portion of the massif, as well as from the junction of the Masherbrum affluent with the main glacier a mile nearer to both, I spent considerable time studying the rock of the south-west face through a Zeiss field-glass magnifying eight times. Owing to the abundant covering of ice, and the weathering and staining of the exposed surface, it was difficult to determine the exact nature of the rock.

So far as could be seen, its colour was light brown or yellowish brown interrupted with streaks of grey, which latter resembled staining rather than strata of a different formation. The general appearance was that of a massive, sedimentary rock, though in places more or less stratified, the strata lying vertical. It had a dense, fine-grained aspect, and was, apparently, harder and more resistant to degrading influences than most of the rocks of the region, giving off very little débris. In this respect it contrasted strongly with the granite and gneissoid formations bordering the glacier, which had thrown off a vast amount of débris, much of it in large blocks that covered the glacier and lateral moraines, as well as the mountain-slopes.

The Masherbrum affluent springing from this face had no visible moraines and bore almost no detritus. I was unable to secure at its line of contact with the main trunk any rock-specimens, that could be identified as derived from the Masherbrum massif. This, like other affluents coming from the Masherbrum side, descended sharply from its origin in a tumultuous mass of séracs and crevasses. After it had forced its way into the trunk-bed, the crevasses mostly closed and it flowed on as a clean, undulating, white stream forming the western side. Another large affluent from the ridge not far above this was one of the wildest, most chaotic ice-streams imaginable.

To describe the Chogolisa and Aling glaciers in detail would involve a repetition of much that has been said of the other glaciers of this region, which is scarcely warranted by the comparatively small size of these glaciers. The Chogolisa is considerably smaller and less complicated in form than it is shown to be on the Survey map. It has a singular shape, and consists of a strong trunk flowing from north to south, which unites at a right angle with another of about the same size flowing from east to west. It occupies a deep, irregular basin enclosed between the Masherbrum ridge on the north, the Kaberi watershed on the east, from which rise the two high, fixed Peaks 26 and 27 of the Indian Survey degree sheet 25A, an unexplored region to the south, and the Khondokoro watershed on the west. This basin is walled in on all sides by the roughest and most savage type of mountains, ribbed with arêtes bounding gorge-like recesses and rising sheer to sharp skyline-ridges and turreted summits bearing little snow.

The Peaks 26 and 27 overhanging the east and south ends of the glacier, as fantastic and typical as those of any other portion of this region and topped by clusters of pointed rock-needles, appear to be composed, mainly, of dark grey slate with vertical strata, permeated by bands of granite and gneiss. No outlet appears at any point except the narrow nala leading to the Khondokoro.

The glacier fills the entire bed of the basin, between the opposing sides of which it is tightly jammed. Its tongue abuts against a high hill that has to be crossed to reach it, on the southern side of which a narrow ravine conducts the water from the tongue to the Khondokoro stream. The obstruction to further advance offered by this hill renders the rate of flow of the glacier very slight, and reduces the glacier itself, practically, to the condition of a stagnant glacier. From the hill, the tongue from the junction of the two portions to its end is seen to be well laden with grey detritus and thrown up into hillocks on its southern side, while the eastern part beyond the junction is white and séracked, stretching from mountain to mountain with no apparent chance of a passage anywhere. The northern arm is also extensively séracked, and, like every portion of the glacier, dangerous to venture on.

At first the most available route up the glacier was along the base of the north lateral moraine, down which rocks were showered by the ice towering above it. One sharp fragment struck Savoye above the knee, cutting his trousers and bruising the skin, but, fortunately, doing no serious damage. From half-way to the entrance of the northern arm the edge of the mountain-slope could be followed. The north arm was crossed to the east slope, and the glacier again resorted to at the entrance of a side-affluent. Well up the north arm, the upper end of which was much crevassed, the skyline of a descending arête afforded a view of the upper end of the basin, which bore no near relation to any known points.

The Aling glacier and its basin, the walls of which have a similar, sheer, wild character, and over which no chance of a passage at any point could be discovered, was also examined. A rough march of five miles up the Aling nala brought one to the tongue of the glacier. This was difficult to get upon from the steep rocks surrounding it, but by using the rope in the descent of a cliff for some 50 or 60 feet the glacier-surface was gained. This was considerably broken and its gradient steep, but it was followed up for about two-thirds its length to a hill which commanded a view of the upper portion. The glacier is shorter than it appears on the Survey map and of somewhat different shape. It presented no features of unusual interest.

CHAPTER VII

VISIT TO SIACHEN GLACIER DECIDED UPON—HEAT IN VALLEYS—OASIS OF DAMSAM AND FAN FORMING STEP IN VALLEY—LANDSLIDE OF TALUS—RESEMBLANCE OF FAN-REMAINS TO GLACIAL DEPOSITS — ABSENCE IN MOUNTAIN-CURVES OF TRACES OF FORMER GLACIAL EPOCHS—AN AMUSING VISITOR AT GOMA—REMARKS ON ALTITUDE-EFFECTS—INSOMNIA AT HIGH ALTITUDES.

IT was now the 7th of August. We had finished the examination of the Sher-pi-gang region and of, practically, the whole line of the great ridge running east and west from Peak 25 (Bride Peak) to several miles west of Masherbrum without finding any passage over it from south to north. A month of the season suitable for mountain-work still remained, and the question arose how it should be employed. It was too late to think of transferring our base via Shigar to Askole and attempting to carry out the original plan of exploring the Punmah. So after consideration it was decided to retrace our steps through the Saltoro valley to Goma, the last village, which could be done in four marches, and from there as a base ascend the Bilaphond glacier, cross the Bilaphond La, and have a look at the Siachen glacier.

On the 8th and 9th we descended the Hushe valley, arriving at Gourtse on the afternoon of the 9th. On both days the sun burned from a cloudless sky, and we suffered greatly from its heat, which was the more unbearable on account of the sudden change from the ice-cooled air of the glacier-districts to which we had become accustomed. At 12.50 p.m. of August 9th the black-bulb thermometer registered 207·5° F. It was a noticeable peculiarity of this season's work that, when moving through the valleys where cloudy weather would have been a godsend to shut out the scorching rays of the sun, we were always favoured with clear skies accompanied by singeing heat, while on the glaciers, where clear weather was necessary for successful observation, rolling monsoon-clouds too often obscured the mountain-summits and other important features.

The next day was again cloudless and hot. A march of three and a half hours from Gourtse, first some 1,200 feet up a ridge between Gourtse and the Saltoro valley and then gradually down over the side of the ridge, brought us to Pharon, or Parao, as the coolies pronounced it, and after a further two hours over the cobble-strewn river-bed, meadows, and hill-sides we reached Damsam, where we camped on a sandy maidan near the bank of the Saltoro river, shaded by tall, slender poplars.

From some of the gorges at the bases of the fans of the Saltoro and other nalas from which torrents issue, the water of which is utilized to convert the fans into fertile oases, so far as one could see into them, the débris which naturally collects in them from the decay of their enclosing walls had been entirely swept out by floods, leaving their rock-surfaces bare and clean. In others débris had accumulated to an appreciable extent, indicating that a considerable time had elapsed since any powerful flood had passed through them.

The village of Damsam is interesting, chiefly on account of the physical characteristics of its surroundings. It is situated on a fan, projecting like a tongue from the

Damsam oasis and fan seen from Kondus-Saltoro junction. Fan above oasis mostly covered by large granite-talus derived from mountain at left. Fan extends up Saltoro valley. Saltoro river descends between fan and opposite tali on right and unites with Kondus river bounding opposite side of fan in foreground.

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apex of the mountain-mass separating the Saltoro from the Kondus opening due west for some distance into the flood-plain, at the confluence of the Saltoro and Kondus rivers. Its northern edge is washed by the stream of the Kondus, and its southern edge by that of the Saltoro. From its base, which has a thickness of several hundred feet and is continuous with the descending mountain-flank, it slopes gradually down to a pointed end 30 to 50 feet above the level of the flood-plain. When formed it must have extended out farther than at present, for its area has evidently been curtailed by the erosive action of the rivers on either side. Its edges have been cut away so as to present a vertical cliff around the projecting tongue, which affords ample opportunity to observe its structure.

The fan is composed of a mass of rock-fragments and boulders of various sizes mingled with alluvium, sand, and gravel, of which the rocks form a conspicuous portion and extend close to the upper surface, where there is little soil to cover them, which renders more remarkable the great fertility of the oasis, that produces an abundant growth, not only of poplars and fruit-trees, but, in summer, of such crops as are necessary to the sustenance of the inhabitants.

This fan, though lying directly in front of the Kondus opening, did not originate in that nala, but is composed wholly of débris derived from and poured out of the Saltoro. Its light grey material, stratified in places, can be traced upward along the northern bank of the river-gorge, of which it forms a part, for a mile or more to a broad and high massif on the northern nala-wall with gullied front and serrated summits of the same light grey rock, from which the accumulated débris was swept downward during, probably, more than one flood. Directly opposite this massif another fan, much shorter but of considerable depth and of more alluvial character, connected with a gorge behind it, occupies the south side of the valley, and helps to raise its apparent bed, but it does not extend to Damsam.

Just above Damsam the Saltoro valley suddenly narrows, turning south-east through a gateway, the pillars of which are formed by two opposite, massive, smooth-faced, steeply slanting, brown granite-mountains. Through this gateway the Damsam fan issued, its base or higher portion spreading nearly or quite across the interval between its two pillars, and forming a high step in the valley at this point. This has mostly persisted to the present time, and its upper surface is largely covered by a huge talus of dark brown granite-débris derived from the face of the northern mountain. This talus has overridden the north-west edge of the fan next the mountain. Meanwhile the Saltoro river cut its channel through or along the weaker southern edge of the fan not far from the base of the southern pillar.

Just here an event occurred in the not very distant past that has left its traces in an unequivocal and interesting manner. A large talus had also formed upon the smooth, rather sharply inclined surface at the base of the southern pillar, which it covered to a considerable depth. Owing to its increasing size and weight the anchorage of a large portion of this, at last, proved insufficient to hold it longer in place, or was weakened by some convulsion of nature, such as flood or earthquake, and the vast mass was precipitated downward as a landslide against and over the edge of the base of the pre-existing fan, blocking the passage previously excavated by the river and completing, probably for the second time, the continuity of the step across the valley.

Vertical edge of Damsam fan above Saltoro river.

[Note its stone-packed structure and shallowness of the soil sustaining the luxuriant vegetation above.]

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The smooth, sharply sloping granite-surface of the mountain-flank thus denuded is very conspicuous. The easterly portion of the same slope is still covered by talus *in situ*, which has remained unaffected by the causes which operated to dislodge the rest from its position, the line of demarcation between the two being sharply drawn.

The river thus dammed must have risen behind the obstruction and formed a lake, that increased in depth and extent till its water reached the top of the barrier, which it overflowed, and through which it soon began to hollow out a channel. The river has since cut its way along the line of lowest and least resistance nearly or quite to the former level of the valley, completely draining the lake and excavating a deep, narrow, ragged gorge, the bottom and sides of which are encumbered by immense blocks of brown granite derived from the overhanging mountain. It should be noted that all the débris at this point, with exception of the débris of the fan, appears to be of local origin, being identical with and derived from the rocks of the mountain immediately above.

For the next eight miles the valley runs south-east. It is narrow, walled in by steep, bold mountains pierced by gorges, is everywhere V-shaped and choked by great tali and fans descending sharply to the river, which occupies a narrow bed at the apex of the V. Many of the fans and some of the tali have been deeply furrowed and cut into fragments by floods. Remains of fans thus destroyed may be mistaken for glacier-moraines. Undoubtedly, they have been so mistaken more than once by travellers, who have brought back reports of glacier-deposits in places where the deposits mentioned may have had no connection with glacier-action.

A source of liability to error of this kind lies in the fact that fans often contain rounded boulders similar to those seen in glacial deposits. Rocks and boulders may have their angles rounded off in other ways than by glacier-activities. Those found in the fans of this section of the Saltoro valley have, too evidently, been transported to their present positions by floods to admit of the supposition of glacier-agency. It is possible that some such boulders may have been rounded by ice-movements back among the mountain-heights and have found their way into the gorges, whence they, with other detritus, were swept out by floods. If this section of the Saltoro was ever occupied by a glacier, no traces of such occupation now remain either in moraines or in marks on the rocks, so far as I was able to discover by careful observation of its whole length on the three occasions we passed through it. Its bed was, evidently, at a former time considerably lower than at present, but how much lower and whether it was V or U-shaped it is now very difficult to determine on account of the enormous quantity of débris accumulated in the fans and tali, which cover it.

During our movements in various parts of this region I sought in the valleys and nalas for evidence of former glacial epochs in the curves of the opposing mountain-flanks without definite result. At the outset at several places, as seen from a distance, symmetrical, concave contours converging from both sides appeared to indicate, that at least two such epochs had occurred. I secured photographic evidence of these contours, and went forward with sanguine anticipations of obtaining interesting results from closer inspection. When the places were reached, the appearance of symmetrical curves was found to be due to the enchantment lent by distance to the combined effect, as seen in profile, of several projecting shoulders considerably removed from one another, they and the intervening slopes being composed of broken and shattered rocks showing no vestiges whatever either of the excavating or smoothing action of ice, or in any other way, of the previous presence of glaciers. Even where glaciers may formerly have occupied valleys, the brittle and friable condition of the rocks, leading to the rapid breaking up of their surfaces from weathering, might easily destroy all traces of any sculpturing effects that had been produced on them.

I do not wish, from the relation of the above experience, to be understood as implying, that there have been no glacial epochs in the Karakoram previous to the present. I am merely pointing out conditions unfavourable to the preservation of records, that might have been left on the rocks by glaciers of former ages.

When one takes note of the incredible amount of débris, which has been and is being brought down by the myriad glaciers of these great mountains and excreted by them as gigantic moraines; which lies piled up everywhere throughout the valleys in huge rock-heaps or tali, 1,000 feet or more high, against the faces of the cliffs; which, accumulated in, has been washed out of the gorges by floods and deposited on the valley-beds as vast fans hundreds of feet thick and with a spread of more than a mile; all of it within recent geological time having formed portions of solid mountain-walls, one can understand how evidence left on rock-surfaces by former glaciers might be totally obliterated.

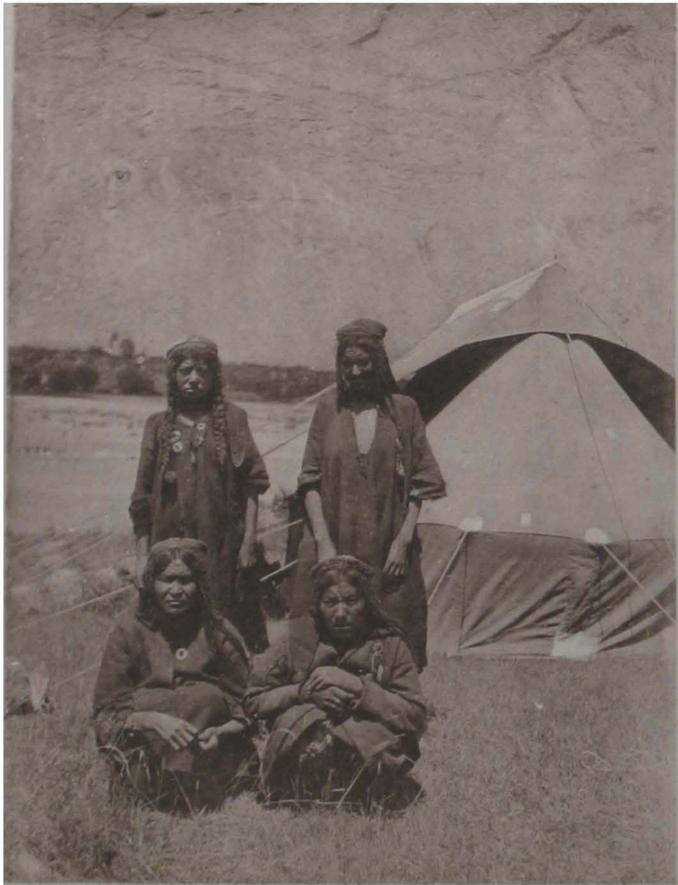
Above the village of Mandik the valley again widens and turns east. Its bed is covered with fans, some alluvial and cultivated, others composed of rocks and arid. Another four miles brought us to Goma, opposite the mouth of the Ghyari nala, which served as the base for our future movements.

The expedition of 1911 up to this point and the last days of that of 1912 resulted in the exploration and bringing within the range of definite knowledge of the fantastic and super-savage region partly described in the foregoing pages occupying the southern flank of the great divide between the Baltoro and the Hushe, Kondus, and Saltoro basins.

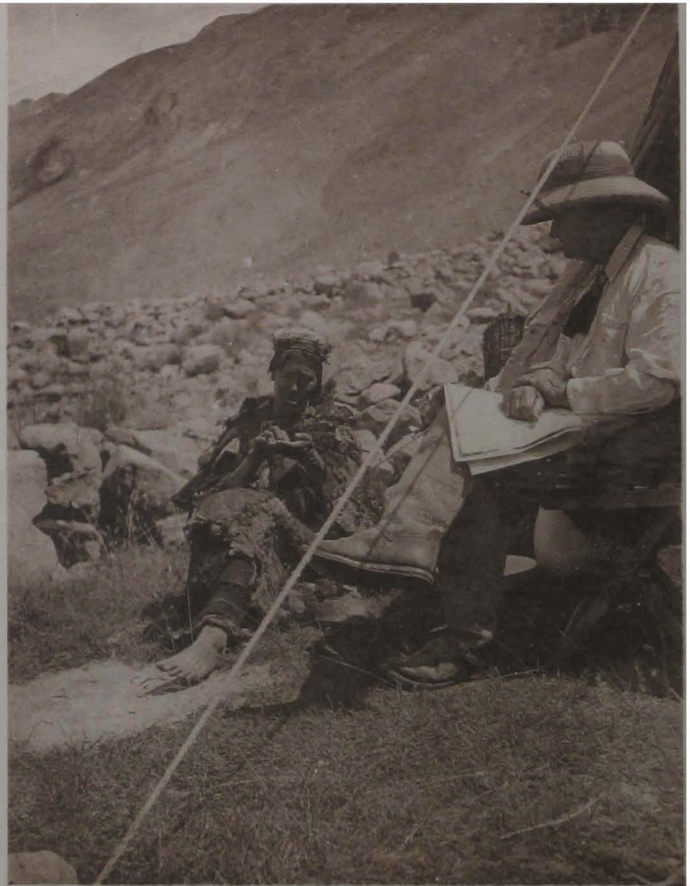
Although this region adjoins on the south the Hushe and Saltoro valleys with their travelled routes, it appears, before our exploration, to have attracted little attention, and large portions of its inner recesses remained unvisited and unknown. While it does not possess the kind of geographical interest attaching to regions traversed by distant or historic trade-routes, its peculiar conformation and the character of its glaciers give it a geographical, physiographical, and glaciological interest of no slight moment, and makes its delineation and the linking up of it with the adjoining portion of the Eastern Karakoram a matter of geographical importance.

After we had settled ourselves in camp on the hill-side west of the village, an extraordinary visitor came to pay a call in the person of a gaunt, wrinkled woman no longer young. Her feet bare, she was clad in a round, close-fitting cap, jacket, and short, tattered skirt, made of ragged patches of many textures sewn together with an equally miscellaneous collection of thread and twine, one fragment superposed upon another to a number and extent that would quite put in the shade the completeness of the scaly epidermis of any fish that, probably, ever swam in the waters of this earth.[1] As to colour, if Joseph's

[1] Patchwork-garments made of any rags available regardless of size, shape, colour, or texture, sewn together one upon another



Women of Goma.



Our lady visitor at Goma.

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historic coat in any measure approached the multiplicity of colours displayed in the scanty draperies of this lady, it must have been a marvellous garment, the fame of which was worthy of being handed down in tradition to future generations. In chromatic complexity the rainbow had no chance in the comparison with the modern imitation now before us.

Her jewels, which were suspended upon her breast by a cord around her neck, consisted of a wooden comb of native fabrication shaped like a hand with spread fingers and handle tapering to a point, the mouth and neck of a soda-water bottle, and four blue Birmingham beads.

She approached without fear or timidity, a somewhat unusual circumstance with native women so far from civilization, many of whom are as shy as ibex of Europeans, and, without asking leave, seated herself in a confidential manner beside me in front of my tent where I was resting, much as a domesticated monkey or petted house-cat might have done. She brought with her two turnips in a wilted, wrinkled condition that had, evidently, had no acquaintance with the nourishing embrace of mother-earth for a considerable period. These she presented to me as a gift-offering.

We gave her some biscuit-tins and a cigarette-box, of which she eagerly took possession. Such tins, as well as bottles, are greatly prized by the inhabitants of these distant villages as household utensils, and well they may

without seams, with tattered edges hanging free, or so often repaired in the same manner that the original fabric is no longer discernible, are frequently worn by Baltis, particularly children. This does not, apparently, indicate that the wearers are paupers or socially inferior to their neighbours. Another instance is seen in the short shirt worn by the child in the photograph with the Pathan facing p. 62 and in that of "The Maid of Askole" in *The Ice-World of Himalaya*, opposite p. 128.

be, for they are superior to any of the simple utensils of their own manufacture. The smaller tins, such as pea-soup, tobacco-tins, and the like, provide them with drinking cups of convenient size. After due inspection of some Huntley and Palmer biscuits, which were given her, she proceeded to nibble them in a leisurely manner with evident relish, displaying none of the aversion almost invariably shown by these people to European foods, which leads them to refuse to touch them. Her appearance, manner, and actions were so contrary to those of the ordinary native woman as to make her an amusing and interesting study, and also to give us the impression that her mental condition was not wholly normal.

After we had observed her odd ways for a sufficient time, we tried to convey to her mind, by words and signs, that it was not necessary for her to further prolong her friendly visit, but she did not take the hint and would not stir. Repeated admonitions and even forcible gesticulations produced no effect. She calmly remained seated nibbling a biscuit, eyeing us meanwhile with a self-satisfied air.

The Pathan servant was whistled up, and ordered to try to induce her to depart by the use of some of the persuasive measures he had employed so effectively in clearing the path of obstructors on the march. It did not take long for him to make her understand that her presence was no longer desired, so, gathering up her treasures of empty tins and several other presents, she took her departure, followed by the Pathan, who accelerated her pace by stern exhortations till she disappeared from sight.

In both seasons when the coolies who volunteered for the expeditions were lined up at Goma for inspection and registration, a number with grey hair and beards, who appeared too old to be able to endure the rough life in prospect, were told to stand aside. This they did very unwillingly, and they returned to the line two or three times, pleading to be included among those who were to accompany us. They were, however, definitely rejected, as we did not wish to take any chances of their becoming ill or giving out under circumstances where they could not receive adequate attention, or of our being made responsible in the case of their death, or of the disturbing effect such incidents might have on the freedom of movement of our caravans.

When we left Ali Bransa, three marches above Goma, to cross the high Bilaphond La, four or five of them, who had been sent up a march after us with grain, were noticed in the caravan. Two of them gave out two days later and had to be sent back, but the others continued with us throughout the expedition and were never found wanting, so far as strength and marching ability were concerned. It is difficult to judge of a coolie's actual age after his youth is passed, and grey hair does not always indicate lack of energy. As we have previously pointed out, some of our most energetic and enterprising coolies, who have carried the heaviest loads and been among the first to arrive at the day's goal, have been grey-haired men who would have been rejected, had there been opportunity for choice.

In our preceding volumes we have noted certain disturbances of physiological function which came within the range of our observations at high altitudes. During the expeditions of 1911–12, while no startling deviations from the normal occurred among the members of our party, such as did occur accorded with those previously described. They will be briefly mentioned later. Personally, above

17,000 feet my experiences were the same as they have always been above that altitude, viz. accelerated respiration on slight exertion, insufficiency of ordinary respiratory movements in the recumbent position, necessitating frequent deep inspirations, sensation of lassitude, indisposition to exertion, and inability to sleep well. These were not sufficiently marked to interfere with the performance of daily work, but, especially during the expedition of 1912, when we passed six weeks at heights of 16,000 to 21,000 feet, they produced a feeling of discomfort that constantly suggested the relief which a return to lower altitudes would give.

I would here call attention more in detail to one of these, viz. insomnia. Having regard to the experience of ourselves and European companions, in all ten Europeans, at high camps at the head of the Chogo Lungma and upon the Nun Kun plateau, I expressed the opinion, or made the suggestion, that in attempts to scale the higher Himalayan peaks insomnia might be found an obstacle to success. No claim was made that all or a definite proportion of mountaineers would suffer from insomnia. The implication plainly was that, judging from our experience, a greater or less number of mountaineers might be affected by insomnia at higher altitudes than have yet been camped at, and that the loss of sleep for a number of nights, which would, probably, have to be passed at such altitudes, would so weaken them as to greatly handicap their efforts, if it did not entirely prevent success.[1]

In the course of quotation, through some inadvertence, this suggestion became twisted into "*Dr. Workman believes*

[1] For grounds on which this suggestion was based vide *Ice-Bound Heights of the Mustagh*, p. 297; also *Peaks and Glaciers of Nun Kun*, pp. 81, 89, 90.

it impossible to sleep at heights of over 20,000 *feet*," in which form it has been widely published, and was used by Dr. de Filippi in lectures and in his book *Karakoram and Western Himalaya*, p. 316, where he cites the experience of the Duke of the Abruzzi and guides as contradicting this sweeping belief.

Reviewing our own experience and that of the Europeans with us on various expeditions, I do not consider that my suggestion, as above stated, needs any qualification. The fact that the Duke of the Abruzzi with three[1] companions "spent nine days at a height of over 20,700 feet" does not invalidate its force nor obliterate the experience it was based on, nor prove that all mountaineers would be exempt from insomnia or mountain-sickness at great altitudes, any more than the immunity of some persons to enteric fever and variola proves that these diseases have lost their power to scourge mankind.

While some climbers may be able to sleep at any altitudes that may in the future be reached, sufficient evidence, even at altitudes considerably below 20,000 feet, has been recorded, to show a strong probability against every one being able to do so. As in the case of mountain-sickness, it could not be determined beforehand what climbers might thus suffer, whether the strongest or the weakest. As confirming our experience in this regard, I would state, a number of young and vigorous sportsmen in Himalaya have told me they could not sleep well at 15,000 feet, and have felt other altitude-effects. One said he was used up at 13,000 feet. I have known several

[1] Dr. de Filippi asserts on p. 364 of work cited that *seven* Europeans spent nine days at a height of over 20,700 feet, but on p. 317 he states that three porters descended on July 13th to the base camp 16,637 feet, and did not return till July 16th, thus reducing the number who remained nine days to *four*.

apparently healthy persons, who have suffered so much from insomnia, circulatory and respiratory disturbances at 10,000 feet that they have been obliged to descend to lower levels. I have known of two instances and heard of others where for the same reason an altitude of 5,000 feet could not be endured.

In addition to the above a good deal of confirmatory testimony to the occurrence of insomnia at comparatively low altitudes (13,000 to 15,000 feet) has been brought to my notice during the past seven years in conversation with persons having a practical acquaintance with high mountain-regions. Without any allusion to insomnia on my part, it has been asked of me time after time with surprising frequency, whether we could sleep at the altitudes at which we have done much of our work. This question has invariably been followed by the remark that the questioner, having attained some such moderate altitude as that mentioned, had either been unable to sleep at all, or, at best, but little.

Supported by so much independent testimony as to the occurrence of insomnia at rather low altitudes as well as by our own experience at camps above 19,350 feet, the suggestion, that in attempts on the highest peaks at considerably greater altitudes it might prove an obstacle to success, appears to be well within the bounds both of experience and probability. Two facts, at any rate, appear to have been established by the evidence already available, of which the above is only an indication: (1) that insomnia, as well as other physiological disturbances, is caused in many persons by altitude, and (2) that insomnia and other disturbances manifest themselves in different persons at different altitudes. How far my suggestion may be borne out by the experience of those who may in the future camp at altitudes of over 23,000 feet remains to be seen. It is possible that those liable to be thus affected might suffer so much before reaching that altitude that they would be eliminated from a climbing party, and that those who remained to camp higher would be immune to this affection.

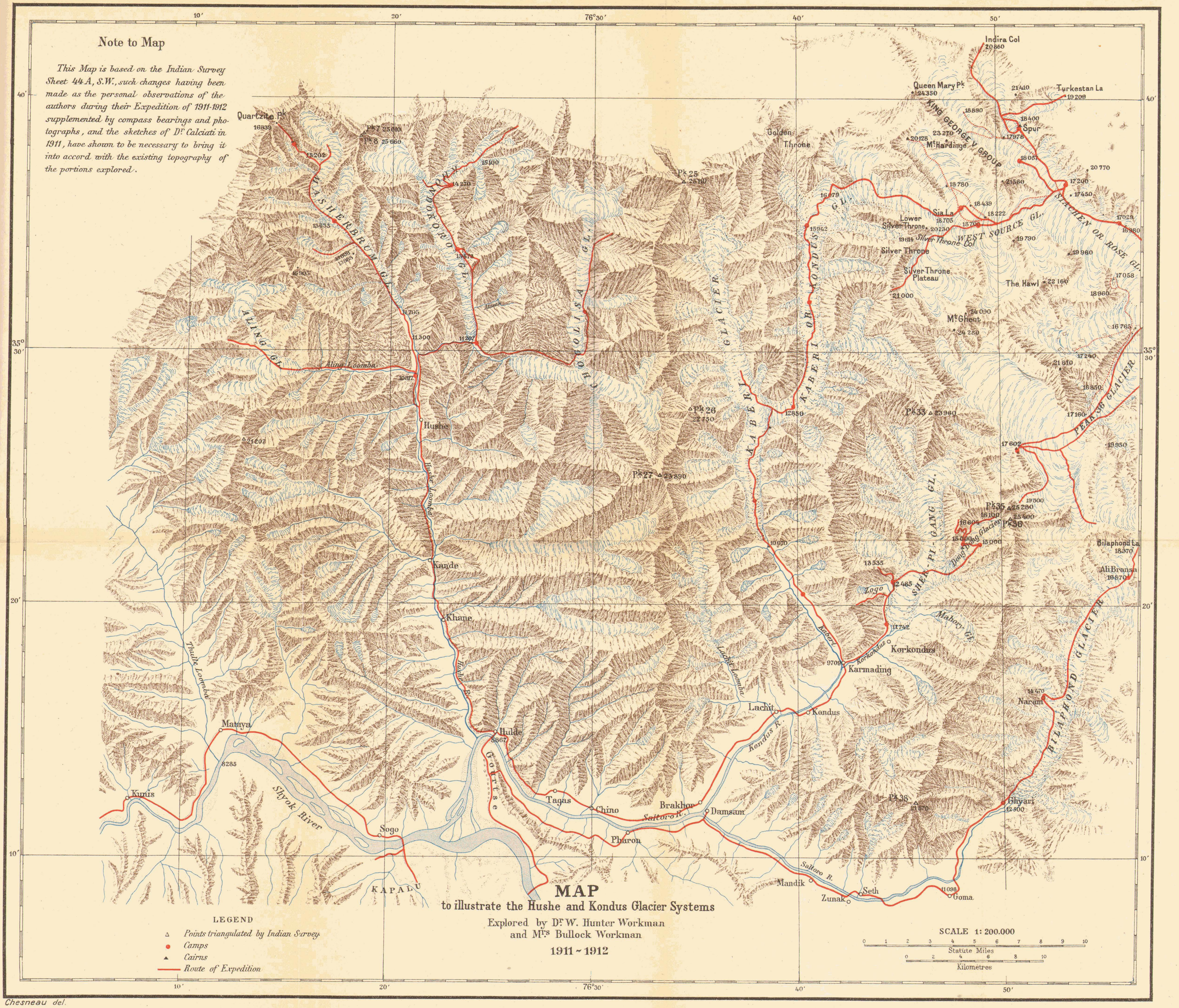
So far as I have been able to analyse my own personal experiences and sensations at high altitudes, I am inclined to attribute the occurrence of altitude-insomnia, largely if not wholly, to the insufficiency of ordinary respiratory movements in the recumbent position, and to the disturbing effect of the constant, forced, compensatory respiration demanded to relieve the distress caused by deficiency of oxygen in the air. Insomnia under these conditions does not necessarily imply that drowsiness and inclination to sleep may not be present. They certainly have been at times in my own experience, but, if yielded to, the attendant diminution in the force and frequency of respiration very shortly causes one to gasp violently for breath, and even, at very high altitudes, to start up into the erect position in order to breathe more easily, thus preventing sleep that might otherwise be obtained.

The ultimate effect of respiratory insufficiency at high altitudes resembles closely that produced by a mild attack of asthma, though the underlying conditions are quite different, the effect in the former case being due, apparently, to a deficiency of oxygen in the air, and in the latter to deficiency of the same gas in the blood in consequence of spasm and congestion of the respiratory tract.

In either case, when one is sitting still one may not be conscious of any marked deviation of respiration from the normal, but as soon as movement is attempted, especially sudden movement, one becomes conscious of a painful sensation of respiratory oppression or deficiency, a so-called want of breath, that necessitates gasping and strongly accelerated respiratory efforts for its relief.

In both cases the effect of the recumbent position on the respiration is similar to that of movement. One cannot breathe so well in this as in the erect position, and the disturbance of respiration thus induced would appear to be the chief factor in the production of insomnia in both.

Leaving Goma on the 14th of August, we ascended the Bilaphond glacier, crossed the Bilaphond La at its head, a glacier-pass of 18,370 feet altitude, and descended another large glacier leading down east to the Siachen glacier, of which last we explored a portion and two of its largest affluents. This served as a preliminary to the more thorough and important exploration of the great Siachen glacier in 1912, which will be described in Part II.



MAP
to illustrate the Hushe and Kondus Glacier Systems
Explored by Dr. W. Hunter Workman and Mrs. Bullock Workman
1911 ~ 1912

PART II

THE CONQUEST OF THE GREAT ROSE, OR SIACHEN

THE WORLD'S LONGEST NON-POLAR GLACIER

BY

FANNY BULLOCK WORKMAN

Officier de l'Instruction Publique et Beaux Arts de France; Fellow Royal Geographical Society, Fellow Royal Scottish Geographical Society, and Member Royal Asiatic Society.

Lauriate[1] of the following Societies :—

Geographical Societies of Marseilles, Algiers, Rouen, Angers, Nantes, Roubaix, Academie des Sports France, Club Alpin Français, Italian Golden Eagle of Italian Alpine Club, Société Alpine Tridentini.

Honorary Member of :—

American Alpine Club, Appalachian Mountain Club Boston, Société Royale de Géographie Antwerp, Nancy, and Marseilles.

Corresponding Member :—

K.K. Geographische Gessellschaft Wien, Nat. Geographic Society Washington and Brooklyn Institute of Arts and Sciences.

[1] Lauriate is used in the Continental sense, as indicating recipient of the Gold or highest Medal.

CHAPTER I

"Whatever the hardships, whatever the difficulties, let me O Allah, return thither again."

THE Siachen or Rose glacier is situate between latitude 35° 11′ 20″ and 35° 43′ 30″ north, and longitude 76° 45′ and 77° 17′ 30″ east. It was first seen by Colonel Henry Strachey, who in October 1848 ascended its tongue for two miles. It was thought by Thomson and Strachey to end in a mountain-wall about twenty miles above the end of its tongue, and the Survey map gives it that length, approximately. Dr. T. G. Longstaff first crossed the Bilaphond La from Baltistan in 1909, and descended into the Siachen basin, remaining one day and taking angles with clinometer to various peaks. The same autumn he ascended the tongue of the glacier from Nubra for about nine miles. As a result of his visit it was decided the glacier extended farther north than had been supposed.

This was all that was known of the great glacier until 1911, when, as previously stated, Dr. W. Hunter Workman and I at the close of our summer's exploring work crossed to the Siachen, and made as much of a reconnaissance of its basin as the short days, variable weather, and glacier-conditions at the advanced season would admit of. Two of its largest affluents were also explored, and a peak of near 21,000 feet climbed. But the exploration of the great Rose[1] was as yet only begun, and to me the most important sensation of the time passed there in 1911, the one that, in spite of hardships and obstacles encountered, was ever tightening its grip on my soul, was, that I must return to it, further examine its basin, force a way to and cull the secrets of its high sources, and have the glacier completely surveyed and its important peaks triangulated.

This was an ambitious project for a private explorer without Government assistance, as one was faced with the undeniable fact that the Rose was not only the longest and widest in Asia, but incomparably more inaccessible from any proper base of supplies than any other great Karakoram glacier. Those who, like ourselves, have investigated glaciers such as the Hispar, Baltoro, and Chogo Lungma, all of which may be ascended from their tongues, will experience the shudder which the thought produces of visiting in its entirety a 46-mile-long glacier with a useless tongue. I say useless tongue for the following reasons: The sparsely inhabited Nubra valley, devoid of large villages that can supply the needs of an explorer's caravan, winds its wild, uncultivated way north of Ladakh to the Rose glacier-tongue. From this tongue issues the Nubra river, which in ever-increasing volume from the melting of glaciers above bears down upon the valley, cleaving it in the centre with its seething torrent. Some three or four fordings have to be made, from one side of the valley to the other, before the glacier-snout is reached, and these, between May and September 15th, because of the height of the water and the numerous quicksands existing in the river-bottom, cannot be made by man or beast.

[1] I use both the name Siachen and the English translation, Rose, for this glacier.

Camp 7 at 17,602 feet on ridge of rock-promontory near head of Peak 36 glacier. Tents on rock-terrace at left and in depression at right. Two and a half miles of glacier separate this promontory from mountain in middle-ground, behind which rises summit of the Hawk.

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Thus has Nature rendered the Rose glacier-tongue "useless" and impervious to human approach during the five summer months.

Hence the exploration of the Rose resolves itself at once into solving the problem of making a last base at Goma, in the Saltoro valley, Baltistan, which is separated from the Rose by the five-mile-long Ghyari nala, the thirteen-mile-long, difficult Bilaphond glacier, the 18,370-feet-high Bilaphond La, and the Lolophond glacier descending for seven miles. When this has been done, and the little feat of traversing these intervening stretches performed, 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 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 returning over the Bilaphond La in September 1911. But no sooner had I turned my back to the Rose and reached again the top of the pass on that brilliant September 16th, than my mountain-ego reasserted itself, saying *tant pis* to the obstacles, "Return you must."

Thus April 1912 again found us at Srinagar. Byramji was re-engaged as agent, and dispatched at once to Kapalu and Goma, where he was to take charge of collecting the large quantity of grain required to feed the caravan, of selecting coolies, buying sheep, and making general arrangements. Dr. Hunter Workman accompanied me, this time, in charge with me of commissariat and as photographer and glacialist, but I was the responsible leader of this expedition, and on my efforts, in a large measure, must depend the success or failure of it.

Through the kind assistance of Mr. E. A. Reeves, F.R.A.S., I secured the services of Mr. C. Grant Peterkin, diploma-holder of the Royal Geographical Society, as surveyor. Col. Sir Sidney Burrard, R.E., C.S.I., Surveyor-General of India, most kindly loaned me a native plane-tabler, Sarjan Singh, of Party No. 1 Indian Survey, to assist Mr. Peterkin. This man rendered great assistance by his work, without which it would not have been possible for one person working alone to produce a fairly accurate map of the region in a single season. He was most painstaking and diligent, hardy of body and of obliging and agreeable disposition. I have also to express my sincere thanks to Col. Sir Sidney Burrard for the loan of theodolite, plane-tables, chronometer watch, and other instruments. My best thanks are also due to the Royal Geographical Society for the loan of plane-table, chronometer watch, and other instruments. Major Pirrie, in charge of Party No. 1, selected Sarjan Singh for the work, and I have to thank him for seeing that instruments were ready at Srinagar and for doing all he could to assist the expedition.

Of late, it has not been the custom of the Government of India to assist private explorers visiting outlying districts of Kashmir, beyond giving them a permit to do so, but I have, nevertheless, to thank the Hon. Stuart Fraser, C.I.E., C.S.I., for kindly notifying the native authorities of my needs, and for doing what was consistent with his position as Resident in Kashmir. Two reservist Sepoy orderlies from the Indian Army, Pindi Division, accompanied the expedition, and were very useful in leading coolie-caravans to and from the Goma base. Cyprien Savoye of Pré St. Didier, Italy, came for the fifth time as chief guide, and with him the guides Quaizier Siméon, Rey Adolf. The two latter are first-

Camp 17, 16,776 feet, on slate-ridge 300 feet above Rose glacier. At right Rose joined by Lolophond affluent, at left black slate-moraine from Tarim Shehr glacier, beyond which Rose descends in south-east direction.

To face page 124.

class Italian guides, but agreed on this journey to act as porters or guides as occasion demanded. Chenoz Césare and Rey Julian, porters of Courmayeur, were also attached to the expedition.

We left Srinagar, Kashmir, on June 5th, Mr. Peterkin, Sarjan Singh, and Quaizier preceding us by two weeks for Baltistan. Raja Shere Ali Khan, the intelligent, charming man who assisted us so greatly the previous year, had died in January and been succeeded by his nephew, Nasir Ali Khan, a young man who appeared to lack all the tact and force of character of his uncle. I dubbed him the "Coölie Raja," for while we stayed at Kapalu two days for preparatory purposes, after making his salaams to us he passed most of his time drinking tea and *tamashing* with the servants in their tent.

The Resident, Mr Fraser, had requested the Wazir Wazirat at Leh to ask this small Raja, or more accurately, Jagadir, so far as was in his power, to procure enough coolies and grain for the work on the glaciers. This the Raja told me he had done, and perhaps he had, although we never saw much evidence of this assistance, and, from what we later learned, his power to move the inhabitants of the Saltoro valley to visit the Rose was practically nil. However, he gave me our old headman, the hardy, good-natured, little Wazir Abdul Karim, who hung to our camp from start to finish, always working in our interest, trying his best to lead the coolies and prevent their absconding in batches, which at times they elected to do.

Dr Longstaff had this same man on his short visit to the Rose glacier, and gave him a chit of highest praise. He was, certainly, the best of the Kapalu Court retainers with whom we had to do, the others being most egregious rascals, and when not handling coolies for weeks on glaciers was capable of fair work. But after two weeks on the Rose, according to my observations, both the Kondus and Saltoro men under his leadership regarded his presence with as much interest as they might that of the harmless little denizen of that glacier, the mouse-hare. Dr. Longstaff in 1909, assisted by the former Raja, had, because of his short stay on the Rose and the limited number required, no trouble in retaining coolies. In 1911, ordered by the same Raja, the Saltoro zemindars were willing enough to return to the Rose, because they supposed our sojourn would be short.

When they saw the amount of grain collected at Goma, they remarked scornfully to the agent, that there was small need for all that flour, which would not be used, as the Sahibs, meaning Dr. Longstaff and party, remained only one day on the Siachen, and surely a Memsahib would not stay longer. In 1912 Byramji found on his arrival at Goma, that the zemindars, or coolies, were perturbed at our return and at the prospect of a still longer sojourn than the previous one of three weeks on the Rose. The mullahs, or priests, of the valley had been doing a lucrative business in exhorting the gods and preparing amulets, for which they were paid by the coolies. After our arrival I noticed the odd little *tawiz*, or magic amulets, hanging by bits of cord from the coolies' necks. They were said to contain petitions to the gods to bring storms or other calamities, that might limit our stay in the snows, and force us to return and leave the Saltoro valley. This the mullahs told the agent were the facts, and they doubtless spoke the truth.

The Baltis, being Mohammedans, might not be sup-

Telephotograph of Mt. Ghent (two summits 24,090, 24,280 feet) from Camp 17, Ledge camp, at 18,776 feet.

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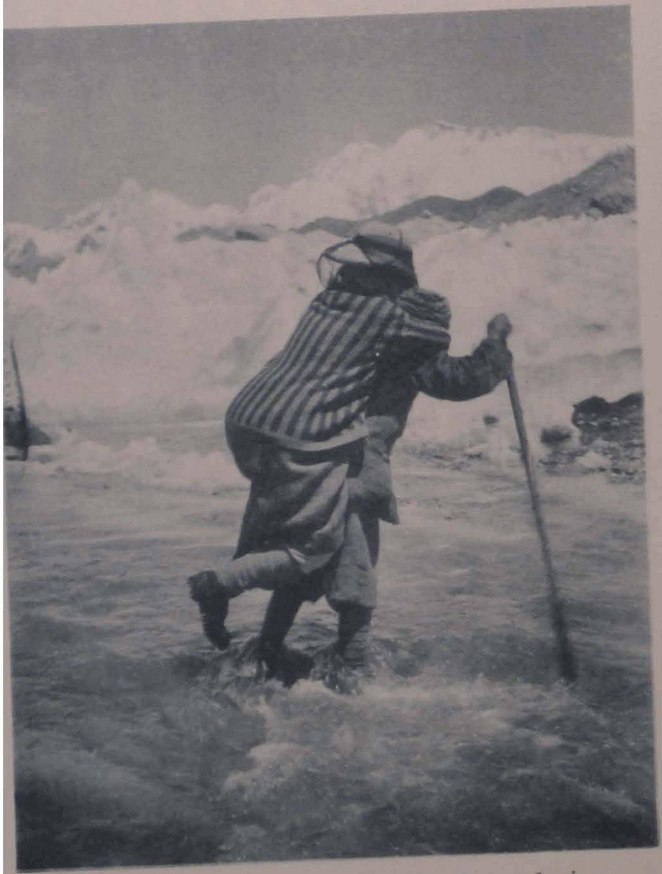
posed, like the Hindus, to worship deities, but from what one observes and hears of their habits, the ignorant rurals of the mountain-districts when in difficulty appeal to their so-called gods. These may, possibly, be regarded as intermediaries, or be appealed to in the same way as the people of Roman Catholic countries address petitions to special patron saints. Whatever the more erudite mullahs may know of the tenets of the Prophet, or however much they may bow in the direction of Mecca, in no way interferes with their exercise of priestcraft in fostering belief in the power of magic and gods in the simple minds of the villagers.

After three weeks, the weather-god having shown himself to be decidedly on our side, many Saltoro men disappeared, hiding in the hills behind their villages, as they found the *tawiz*-amulets had not exerted the power expected of them. Coolies from the Hushe and Kondus nalas were then requisitioned by Byramji to take their places. Some twenty-eight of the Saltoro coolies, however, remained faithful, and stayed on to the close of the expedition, some of these being grey-haired and old, as natives go.

An amusing remark from one of the recalcitrants was that, probably, we ate too much bacon, which neutralized the effect of the magic contained in the amulets. These experiences, however disagreeable to us, brought to light some of the fanciful superstitions which pervade the minds of the Kapalu district Baltis, and show that faith in the power of magic is as strong to-day among the semi-barbarous natives of India as it was centuries ago. Indeed, one need not travel to Asiatic wilds to find examples of such superstitious belief. In a tragic motor-car-smash, which cost the lives of a Spanish Count and Countess in Auvergne in 1913, their chauffeur, who miraculously escaped, had in his coat-pocket amulets placed in it by his wife to safeguard him against accident, as his employer was known to travel at a reckless speed.

At Goma, the last village of the Saltoro valley, I took on a zemindar named Mullah Halim as grain-basha, who is mentioned by Dr. Longstaff as "a very fine fellow." In 1911 we tried to get him for the same service, but he was then held in jail at Skardo by the Tehsildar, because of complaints against his conduct by men of his village. In 1912 the agent, Byramji, found him again retained at Skardo under suspicion of like offences. I was determined to have this "fine fellow" at all hazards, and, as nothing positive could be learned in his disfavour, I requested the Tehsildar to give him leave of absence for eight weeks, after which time I agreed to return him to answer the charges against him.

My request was complied with, and he entered my service, his duties being to escort coolies carrying grain to and from the Rose glacier. Six weeks later, in order to put an end to the delivery to us of nearly empty grain-sacks, and the prolonged detention on the wrong side of the Bilaphond La of squads of coolies, and to prevent the breaking up at a critical moment of the expedition, we were obliged to curtail our visit to the lower Rose glacier, return to where Halim had arrived with an overdue caravan, and send him forthwith under escort to Goma, where he was dismissed from service. On one occasion, when flour for the coolies was at a low ebb, and our caravan on the Rose was stalled, threatened by famine, this native paragon sat feasting with the coolies in his charge for seven days on the Bilaphond glacier, burning out our scanty, treasured supply of wood, and busy in forwarding back to his home for sale numerous sacks of grain paid for by me, which were sorely needed by the expedition.



Crossing river near centre of Rose glacier.

[Note high ice-wall above river and beyond it dark summits of hillocks of great hillock-moraine.]

On Silver Throne plateau at nearly 21,000 feet.

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Perhaps, native morals, like the weather, vary with the seasons, or, perhaps, some in our employ become possessed of the "evil eye," for, on different occasions men we have employed, praised for character by other persons, have proved harmful and even dangerous to the furtherance of our interests.

Two days at the end of June were passed at Goma arranging for the main caravan that was to accompany us. I had arranged before this with Byramji to send a large quantity of wood to Naram, six miles up the Bilaphond glacier, and to Ali Bransa, two hours below the pass, as it was easier to take wood from Baltistan over the Bilaphond La than to send down the Siachen for it. On July 2nd, with sixty coolies and twenty sheep, we left to ascend the Ghyari nala, which runs nearly north by east from the Saltoro valley to the tongue of the Bilaphond glacier. This number of coolies was not sufficient to carry the necessary loads even for two weeks, but a start had to be made, and Byramji promised to secure forty more to follow the next day with the remainder.

At the foot of the Bilaphond snout, at about 12,500 feet, a grassy maidan shaded by small willows was found for camp. This was the last place where trees were seen, until the Kondus valley was reached at the end of August. The five-mile-long Ghyari nala, said by tradition to have been formerly densely populated to the end of the glacier, is now deserted, and used only by goatherds, who pasture their live stock there in July and August.

The Bilaphond glacier was first ascended for six miles by Vigne in 1835, and again in 1909 by Dr. Longstaff, Dr. Neve, and Mr. Slingsby on a search for the "Saltoro pass." Judging from the appearance of its snout in both

1911 and 1912, it may be said to be advancing slightly. For the first seven miles this glacier is a most tiresome one to negotiate from the condition of its jumble of huge, rickety moraines, which extend from side to side of its boundary-walls. Even the large boulders, in spite of their size, are seldom firmly placed, and topple about when stepped upon. This "moraine hopping," aptly so called by Colonel the Hon. C. G. Bruce, is not a rapid process, and a mile an hour may be called fairly good time for a laden caravan. At Naram, 14,700 feet, six miles up the glacier, where the large east and west affluents enter, we made two substantial tent-terraces with stone retaining walls on the grass and rock-covered mountain-slope.

It is not well to attach too much importance to names given by coolies to glaciers, particularly 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 will 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 zemindars' minds, if possible.

As the nomenclature of this glacier and of the pass at its head is of no small importance to the geography of this region in the future, I must expand somewhat on this subject. 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 "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, that he must go farther into the question of this name as well as others, and consult the mullahs and

View down Bilaphond glacier from Bilaphond La.

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oldest inhabitants, which he did. It happened that several intelligent, native settlement-officers, a part of whose business it is to get at the ins and outs of local names, were in the Saltoro valley, and they went carefully into the matter with the Parsee, with the following conclusion, viz. that Bilaphond thus spelled, but with "d" silent in pronunciation, in Balti means butterfly; that the reason for calling it thus was not because many butterflies were seen on it, as had been said by the coolies, but that, in former days, this name was given on account of the shape which the glacier assumes at Naram, 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 the vicinity of 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 fancy, certainly, not to be found among Saltoro people of to-day. Perhaps in the old times, when, as I before mentioned, the Ghyari nala was, according to legend, populated to the foot of the glacier, a select few lived capable of such flights of imagination. Any one standing on an eminence above Naram on a clear day, bearing in mind the pretty idea, can easily make the main glacier and its affluents picture to his mind's eye a monster ice-butterfly.

At any rate the legend has been handed down, and has permeated the dull minds of to-day's Saltorites, and I am pleased to record such a poetic and also fitting reason for the naming of the Butterfly glacier. The possible existence of a previous, more intelligent race in Baltistan revives the feeling of sadness, which possesses one when studying the commonplace population of Central and

Southern India that has succeeded the higher races, which were once able to construct such marvels in architecture as the manifold Indo-Aryan and Chalukyan temples still existing. It may be the modern Balti has, in a measure, retrograded in intelligence, as has the modern rural of the plains, to a lamentable extent, when it comes to the exercise of the higher attributes of the mind and the artistic sense.

Ali Bransa camp, 16,970 feet, on east edge of Bilaphond glacier seen from above.

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CHAPTER II

ALI BRANSA AND ITS TRAGEDY.

To return to Naram, six miles above the Bilaphond snout. About a mile above that point the wearisome moraines are shaken off, and the ascent by ice-bands running between median moraines is fairly easy to below Ali Bransa. The scenery is wild, grand snow and rock-peaks forming precipitous barriers to both sides of the glacier. One huge granite-monolith, where no snow can lodge, juts up 2,000 feet from the middle of the ice with impressive effect. Fine specimens of glacier-tables are strewn all about the ice, adding weird charms to the icy scene.

In 1911 we had no trouble in finding Ali Bransa, the last camping station before the pass, but this season 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 wide, dangerous crevasses, which were not easy to handle in the blinding snow. It is at about 17,000 feet, and is separated sufficiently from the high border-cliffs to be safe from falling stones. In 1911 eight native stone-shelters were found here, which showed no signs of fires or recent usage, and may have been standing in this protected spot for a century or more. Dr. Longstaff does not appear to have actually visited this place, although he was told of the huts, and there is no account of any European having camped there before us. Our many coolies, however much they have known of its existence, were quite unable to pilot us to it, so that we and the guides had to find the way ourselves. The native shelters have been greatly demolished by the different parties of our expeditions, which constantly bivouacked here on their way to and from the Rose glacier with supplies.

For several reasons it clings to my memory as the most gruesome camp of our Rose glacier experiences, and, when we finally left it to cross to the Rose, 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, particularly if one is kept up at night knocking snow off one's tent. Our plan had been to push on, if possible, the next day to the pass, but in Himalaya one must be prepared, after 16,000 feet, not to carry out one's intentions with undue speed. The snow-storm in which we camped lasted sixteen hours, so the following morning we passed in freeing the tents of their snow-burden and digging out paths, a wholesome but not inspiring occupation. The weather also had to settle itself. The expected supply-caravan, without which no move could be made, did not, under the circumstances, put in an appearance. Owing to the rapid and severe change in two and a half days from a shade temperature of 85° F. to 16°, and the rarefied air suddenly encountered, Chenoz, my special bag-porter, and the Pathan camp-servant became incapacitated. In fact, all felt more or less the change from normal to abnormal conditions. When the sun finally shone again, the heat was intense during the day. A black-bulb thermometer-reading gave 197° F. at noon.

Thus two days passed. The weather became gloriously fair, and my mind was buzzing with thoughts of a tall

Last photograph of Chenoz on sérac near head of Bilaphond glacier just before his disappearance in crevasse.

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snow-peak west of the pass, which I had been waiting a year to climb. At last Savoye and Rey, who were ever watching the glacier below, sighted the belated caravan toiling upward. At dark it arrived, the coolies groaning and pointing to their hands and feet, but in reality not half so badly off as they professed to be.

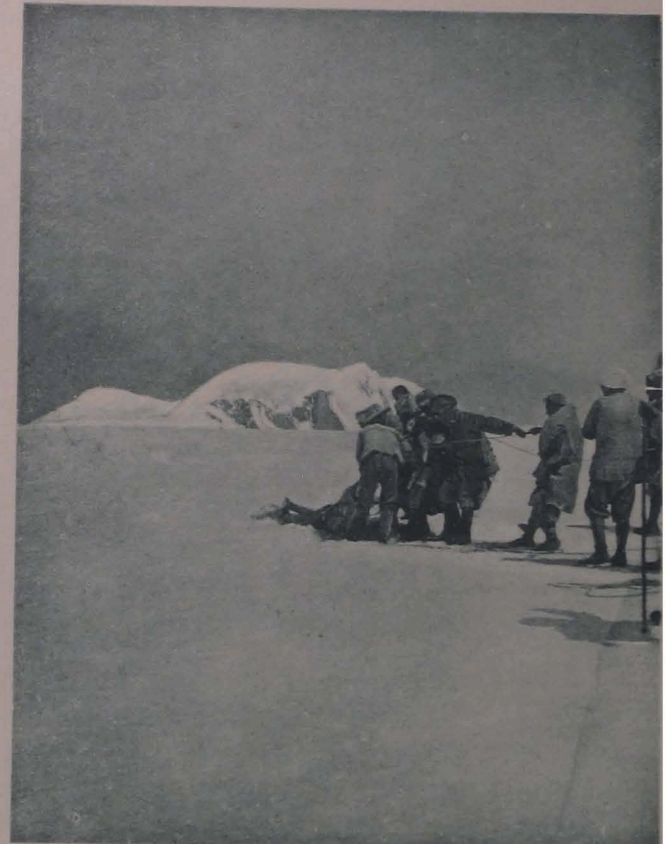
The next morning at dawn, as the beautiful steel-mauve tones were transformed into deep, fine weather, Himalayan blue, camp was called, and soon tents were struck and the caravan of ninety men was moving to the music of crunching snow. The Pathan servant, although really much better, feigned a relapse on seeing the way we were to go and was accordingly sent valleywards. The porter Chenoz, when he shouldered my bag of coats and cameras, answered merrily to my inquiry after his health, "Oh, I am quite cured now, madame, and ready for anything." In view of what happened one hour later, I often recall how we stood there that sparkling morning looking with joyful anticipation towards the sunlit pass, unconscious of approaching tragedy. About an hour after leaving camp, as the snow was in excellent condition and all appeared plane sailing, after a short consultation with Savoye I gave him the order to go ahead with the second guide Rey, cross the pass, and continue north to look up a route to the peak I wished to climb, rejoining us on the far side of the pass. They accordingly left, taking one rope with them. Guide Quaizier and Chenoz remained with us.

As we moved upward it was suggested, that Chenoz and I be photographed on some ice-hummocks a short distance away from the line of march, for the purpose of showing the nature of the route to the col. Before crossing to this spot I consulted the guide as to the advisability of roping. He laughed at the idea, declaring the surface to be solid and free from crevasses. As I wished to take the remaining rope, Chenoz threw it over his back above my bag. When the photo had been taken, Chenoz started off in a direction above the hummocks to join higher up the line on which Dr. Workman and the caravan were moving. Supposing the track to be quite safe, as it had been, and leaving the matter of testing the ice in front to the porter, which one falls into the habit of doing when such persons are leading, I walked quickly after him, hardly glancing at the ice-surface. My consternation may be imagined, when I saw him suddenly, without uttering a word, disappear into an ice-depth a step in front of me.

Fortunately for me, I held up, and did not take the step that would also have precipitated me into the gaping chasm. I stood paralysed for two or three seconds, gazing distractedly at the uncanny hole at my feet, surrounded by the radiant, sunlit peaks and glacier expanse, which had just drawn my companion so ruthlessly into its blue death-chamber, powerless to help in any way. All this was visualized within two seconds, and then I turned and called backward to the others. Dr. Workman and the guide, seeing me standing alone, and realizing at a glance what had happened, started at once towards the spot, followed by the servants and coolies tearing along behind; but it was of no use, as I appreciated while standing guard by the silent chasm, for Chenoz had taken our remaining rope with him into the gruesome abyss, and the other was with the guides on the other side of the pass.

The guide Quaizier approached the aperture from the upper side, which was solid, and leaning over called to Chenoz, who, answering faintly as from a far distance, said he was alive and could wait for help. Quaizier then

On snow-covered height at 17,280 feet above camp 5 Rose glacier.



Rescue of Chenoz from crevasse on Bilaphond glacier.

To face page 136.

with three coolies left to cross the pass, find the guides, and bring them with the rope to the scene of horror. The coolies sat in long lines, and, for the first time in their lives, in solemn silence, while we and the servants unpacked boxes and got ready blankets and stimulants for use, should Chenoz be taken out alive.

Still, as we saw the four men, held in the grip of the oxygenless air, toil higher towards the col, our preparations were made with a feeling of *vergebene Mühe*, for it was certain Chenoz would remain, at least, another hour in his icy tomb. Could even he, endowed with great strength and youth, withstand the cruel test? We doubted it. It was an awful period of inaction for all, as we sat looking at the dazzling, sun-bathed snow-slopes, trying to shield ourselves, thinly clad as we were in marching costume, as well as might be from the chilly wind blowing down from the col and thinking of the deadly danger from cold to which our poor, battered companion was exposed in the depths below, while we could do nothing to help him.

Regarding the tragedy being here enacted, I would remark that Chenoz was well accustomed to all sorts of snow-work both in the Alps and during four seasons passed with us in Himalaya, and I marvel that he did not observe the slightly depressed, yellow-tinged snow-streak at the point where the crevasse was encountered. That he was not testing the ice was, of course, quite unpardonable in a leader, and this could only be attributed to a moment of temporary inattention, to which, perhaps, all are subject at times. Although, usually, following and working under orders, he had always been a steady, careful man. My explanation is, that too much familiarity made him momentarily careless, and that, supposing himself to be quite safe, he ceased to be vigilant. Alas! he was never able to explain the matter.

At last Quaizier was seen hurrying back from the pass, followed by the coolies, and soon Savoye and Rey arrived on the summit and began their breathless descent in the deep snow, for it was near 11 a.m., and the sun's rays had turned the crisp surface into a toilsome snow-*soufflé*. On their arrival the rope was quickly tied about Rey, the smallest guide, and, bearing stimulants, he was lowered through the aperture, the other two guides with six natives holding the loose end, prepared to lengthen or shorten it as Rey might direct. It was fully ten minutes before any sound came from the subterranean ice - depths. Rey first attached the end of the rope Chenoz had carried and my clothes-bag to the end of the rope he was lowered on. These were then drawn up, a second line of men manned the second rope, and both were let down again, so that two ropes were now available. After giving cognac to the half-conscious Chenoz, Rey made him fast to one rope, and attached himself to the other. Then, on his giving the signal, the men above began to pull. Fortunately, there was enough space in the crevasse to permit of these manœuvres. Rey first appeared on the surface, and a moment later, after slow, hard hauling, the limp form of Chenoz rose above the ice-mouth, and was received by his brother guides' sheltering arms, and unroped.

It appeared that he had first crashed on to an upper ice-shelf, landing, probably, on his back, and had then fallen from this still farther to the crevasse-bottom, a distance in all of 80 feet. My topie and various things in the *rücksack* were smashed to atoms, which makes it the more singular that none of his limbs was fractured.

He was perfectly conscious although unable to stand,

Chenoz, after rescue from crevasse, on stretcher made with tent-poles and blankets about to be carried down to Ali Bransa camp.

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and suffering intensely from shock and cold. His hands were blue, and there was no pulse at the wrists nor sensation below the elbows. Stimulants were administered, he was wrapped in blankets, massaged, and soon after carried by the coolies down to Ali Bransa, where camp was again pitched. There, on careful examination, no bones were found broken, nor could any signs of internal injury be discovered. Under the warming influence of the sun he, largely, recovered his bodily temperature and sensation in his hands, but he remained pulseless at the wrists, his heart's action was feeble, and he suffered considerable pain in the lower part of his back. At six p.m. he sank into a quiet sleep. At nine he awoke and asked for water, drank a little, and immediately slept again, alas! his last sleep. At ten o'clock Savoye, on attempting to arouse him, found he was dead, which heartrending news he brought immediately to our tents. Everything possible under the circumstances was done for him, but the long exposure to cold in the crevasse had so greatly depressed his vitality that he was unable to rally from the effects of cold and shock.

That night at unlucky Ali Bransa was a ghastly one. We were overcome by grief, yet action was imperative. We sat up into the small hours talking matters over with Savoye in a temperature of 16° F. The only course possible was decided on during this awesome vigil. At daylight the guides and coolies were to bear Chenoz's body down to the first grass at Naram and bury it, while we were to remain at the camp of mourning to guard the supplies and belongings of the expedition. Accordingly, as the sun gilded the glacier the next morning we watched twelve coolies bear away the body of Chenoz, followed by the sorrowing guides, a strange contrast to the scene of twenty-four hours previous, when Chenoz and I stood gaily talking about ascending to the col. At Naram the last rites were performed, and a large cairn built to mark the final resting-place of Césare Chenoz, my faithful porter and companion on many exciting climbs and trying journeys of exploration, a man always willing and ready to assist in every way. His cheerful answer when I thanked him for any service rendered, such as tightening tent-cords, or readjusting pegs during a snow-blizzard, will ever echo in my memory, "A votre service, madame."

My own escape from sharing his dire fate was quite miraculous. Those who share the Oriental belief in "Kismet" might say his passing here was fore-ordained, while others, believing in the "survival of the fittest," have said that I, having the work to carry on, was, by not taking the one step more, and by chance not being roped, saved to accomplish it. *Qui sait?*

We all agreed that in that climate the remains could not be carried three marches to Goma for burial, and, moreover, there was another danger in connection with Goma, and that was the probability of the villagers desecrating the grave in search of such booty as clothes or coverings. To our knowledge, which has been corroborated by military men in India, such pillaging of European graves sometimes takes place. On the second day the guides returned, and, while heart-broken, all appreciated that the work of the expedition must be carried on at once. Chenoz's place as my particular porter was taken by Rey Adolf, who filled it most conscientiously.

During this second detention at Ali Bransa news was brought of the death of a coolie in Mr. Peterkin's caravan on the Rose glacier. Two coolies had been sent back a mile or two to bring a forgotten tent, and while returning one fell into a glacier-river. His companion helped him out, and then, as the man was overcome by cold, left him, ostensibly, to hurry on to the camp for aid. Reaching Mr. Peterkin's camp, the coolie said nothing about the accident that night, reporting it to Mr. Peterkin only the next morning. Mr. Peterkin and some coolies at once returned to where the man had been left, and found him lying dead on the ice. His death was, probably, due to the neglect of his companion, for when the body was found it was hardly cold. These two were the only fatal accidents of the summer, and both occurred near the beginning of the expedition.

The day before we finally left Ali Bransa the Sepoy, Gulab Khan, arrived with thirty more wood and flour-carriers, for which I was thankful, as I felt sure that when the report of two deaths in the expedition spread through the valleys, it would for a time be wellnigh impossible to impress new coolies into service at Goma. As a matter of fact, a number of the Surveyor's coolies, on being sent to Goma for supplies after the death of the coolie, never appeared again on the Rose. As evidenced in this case, a Balti will not take much trouble to save a brother-coolie's life, but he is pretty sure to turn such an incident to account in making good his own escape from service and in frightening off others inhabiting even distant villages.

Unbeknown to us until our return to the valleys, weeks later, most garbled reports of these accidents were carried by natives to Skardo, and thence by wire to Simla and throughout Europe and America. The coolie who carried the news of a Sahib's death to Skardo, which had been passed on to him by various other natives, did not know what Sahib was killed or how, and thus the report of Dr. Workman's death by avalanche first made the rounds of the Press, and later my demise was announced; so that, when our mail reached us in the Kondus nala weeks later, we were treated to much delectable literature in the form of varied accounts of a fatal accident, of letters of condolence from friends, and some three hundred obituary notices. According to one of these accounts Dr. Hunter Workman had been killed while motoring over a Himalayan snow-pass.

No accident to a European had happened on any of our seven previous expeditions in Himalaya, and I do not recall our ever having lost a coolie. On some occasions natives, who died weeks after they left us, of other causes, have been reported to have succumbed when with us, which naturally was not the case.

View of Twin-Peaks 35 and 36 from Tawiz peak.

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CHAPTER III

The Bilaphond La and First Ascent of Tawiz Peak.

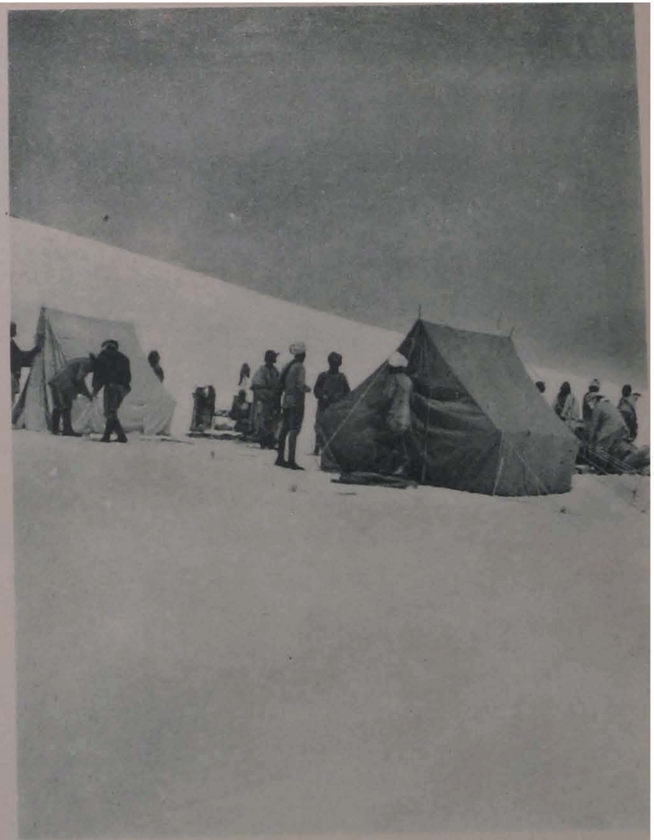
On July 11th we again, and for the last time, left Ali Bransa. The weather, as it had been for eight days, was glorious, when for the third time in eleven months we arrived on the summit of the Bilaphond La. This saddle was measured by Dr. Longstaff by aneroid at 18,200 feet. The mean of hypsometric readings taken by us in 1911 and 1912, and by Mr. Peterkin, give a height of 18,370 feet for it. I would here refer to the term "Saltoro pass," a 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 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 the Bilaphond La. If this local name for a pass, which has never been reached or even seen by a European until within the last five years, is not the proper name, where shall it be found? Among what people have tradition and usage given the name Saltoro to this pass? Further, the Bilaphond La is separated from the Saltoro valley by the Ghyari nala and the whole length of the Bilaphond glacier, and bears no direct relation to that valley. So far as I could gather from the "learned men" of the region, who are possessed of whatever saga there is 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 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 Moorcraft mention of the name 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 La to be correct, both in local usage and as designating its geographical position, I have elected to have it so called on my map. This name 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 nomenclature of previous maps, but in this case I regard myself as quite justified in not adopting the name Saltoro substituted by Dr. Longstaff for the appropriate and long-used name Bilaphond La for the pass at the head of the Bilaphond glacier.

Too much reliance should not be placed upon the mention by early travellers of legends relating to routes in regions with which they themselves were not

Caravan on march from Bilaphond La to Tawiz camp. Bilaphond peak in background.



Tawiz camp, 19,000 feet, on flank Tawiz massif.

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Bilaphond peak seen from Tawiz peak. Camp 13, 19,000 feet in foreground.

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acquainted as evidence in favour of problems which have not yet been solved. The circumstances connected with Mr. Vigne's search for a pass from the Saltoro valley to Nubra show that his ideas of the region he was in were not over clear. On the map accompanying his book he places a scarcely perceptible glacier without any name in a position corresponding to that of the Bilaphond glacier, and Ali Bransa, the pass he was seeking, at the head of a glacier marked "glacier," draining into the Korkondus nala, i.e. at the impassable head of the Sher-pi-gang, indicating the position of the pass by the words, "Way over Glacier by Ali Bransa pass to Yarkand, 13,500 feet."

In the discussion following my paper on the Siachen, or Rose glacier, in the February 1914 number of the *Geographical Journal*, on p. 144 Dr. Longstaff says, "The name 'Saltoro pass' has already been accepted by the Survey of India," in support of his application of the name "Saltoro" to the Bilaphond pass. In this connection I would add a note by the Superintendent of the Trigonometrical Survey sent me in May 1914 by Colonel Sir Sidney Burrard, R.E., C.S.I., Surveyor-General of India, which expresses the opinion of the Survey of India on this subject:—

NOTE ON THE NAME SALTORO.

The name Saltoro is frequently used by Montgomerie and others as the name of a river, and on Indian Atlas Sheet 44A S.W. (1868) and on a map in the *Geographical Journal* of 1864 it is used as the name of a district or tract of country. It was first applied to a pass by Younghusband. He had been told that there was a pass from the Oprang valley into Baltistan, and as he thought that it would give access to the Saltoro basin he decided to call it by this name. It will be remembered that he was baffled in his attempt to cross the pass and so did not discover that he was mistaken in this idea, and that the Siachen glacier, the main source of the Nubra river, lies between the basins of the Saltoro and the Oprang. From Sir F. E. Younghusband's remarks in the discussion which followed Mrs. Bullock Workman's paper on her visit to the Siachen glacier (*Geographical Journal*, February 1914) he admitted that he called the pass Saltoro because it was the best name that occurred to him. It is clear, therefore, that if he had known the true lie of the land he would not have used this name.

In the Survey of India map, published in 1890, to illustrate Sir F. E. Younghusband's explorations, the name Saltoro is given to a pass which is shown as connecting one of the glaciers of the Saltoro basin with the Oprang valley ; no name is given to the glacier. This part of the map is based on Sir F. E. Younghusband's account, and naturally shows the same imperfect knowledge of the geography. In chart No. XX of the *Sketch of the Himalayan Geography and Geology* the same Saltoro pass occurs, but this chart is derived from the above-mentioned map, so that the use of the name in it is not fresh evidence.

It seems to be clear, therefore, that the use of this name for a pass depends wholly on Sir F. E. Younghusband's guess. In the Atlas sheet already mentioned (44A S.W.) the several glaciers of the Saltoro basin are named ; one of them is called the Bilaphond. When that sheet was drawn it was not known what lay beyond, and the topographical detail ceases at the watershed. We now know that at the top of the Bilaphond glacier there is a pass which gives access to the Siachen. For this pass the name Bilaphond La is proposed by Mrs. Bullock Workman, and as the name Bilaphond seems well established it is quite appropriate that the pass should be called after it.

The pass which Sir F. E. Younghusband attempted to cross must be on the other side of the Siachen glacier and must lead over the main watershed, which separates the Nubra from the Oprang—India from Turkestan.

Henceforward it would seem advisable to discontinue the use of the name Saltoro for a pass, and use it for the river only ; to adopt the name Bilaphond La for the pass connecting the glacier of that name with one of the branches of the Siachen ; and to wait the definite discovery of a pass from the Siachen to the Oprang before considering what to call it.

G. P. LENOX CONYNGHAM.

The salient object of interest from the pass is the distant Rose glacier seen flowing south-eastward past the

On Bilaphond La, 18,370 feet. Tawiz peak in background at right.

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entrance of the large glacier which descends from the Bilaphond La and which we have named Lolophond. Coolies coming and going between Goma and our camps arranged a camping ground on the left marginal moraine of this glacier some distance above the Siachen at the place where we made our first camp after crossing the pass in 1911 and 1912, which they called Lolophond. As this name harmonizes with Bilaphond, we decided to give it to the glacier.

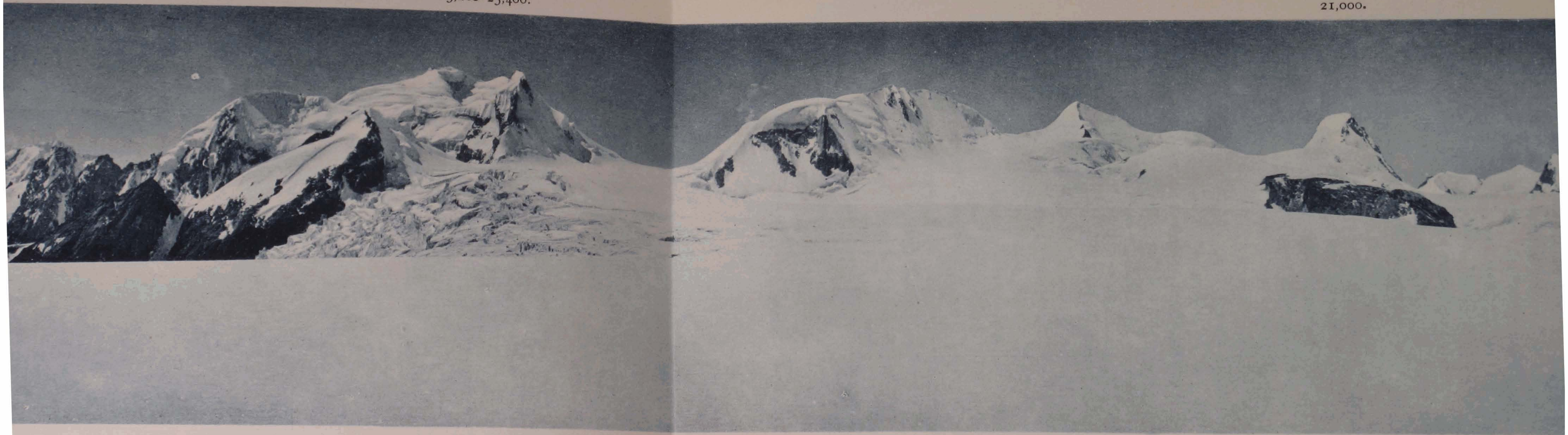
In the *Geographical Journal*, February 1912, p. 145, Dr. Longstaff says this was apparently his "second camp beyond the Saltoro pass," and suggests that the coolies named it "Loloff" after his name. We saw the spot on the edge of the Siachen where he made his second camp after crossing the Bilaphond La, and it is a long distance from the camp on the Lolophond glacier, called Lolophond by our coolies, which was first and constantly thereafter made use of on our expeditions. I am obliged also to confess that our coolies, when asked the name of the Sahib who went over to the Rose in 1909, said they did not know and made no mention of "Loloff." Dr. Longstaff might with equal propriety claim that the long-used name of Bilaphond was derived by the coolies from that of Dr. Neve, who accompanied him.

The question of names for the various affluents becomes a serious one, for unlike the Baltoro, Biafo, and Hispar glaciers, whose lower affluents are well known to natives, the Rose from its inaccessibility has not been visited by them, and no native names have existed for any of its tributaries. I have, perhaps, erred on the side of giving too few names, but I have studiously avoided on my map naming any of the affluents after members of the expedition, as has been done on one large Karakoram glacier, and have chosen rather to connect their nomenclature with that of the peaks dominating their sources, or to name them after the sources themselves, a method which I think will stand the test of time better than that of personal nomenclature.

The width of the Rose is $2\frac{3}{4}$ miles at the entrance of the Lolophond, but, owing to foreshortening, such a width is not apparent to the eye from the pass. The largest east affluent is seen entering on its far side, curving gracefully around a bold rock-promontory like a shaggy, white serpent, if such a simile may be used, and continuing its way south-eastward with the Rose in mazes of tangled séracs and crevasses. To the east of the pass the Bilaphond peak rises, and to the west the summit of Peak 36 (25,400 feet) towers above the mountains forming the Bilaphond wall. The latter peak, an object of great scenic effect elsewhere, here makes itself known only as a well-fixed Survey-point to help the topographer. The Teram Kangri group is seen in the distance nearly north-east.

A peak, which I am about to describe, strikes the eye north, being one of the landmarks of the Bilaphond La. I had selected this mountain in 1911 as offering a probable fine point of view, but the weather was unfavourable to attempting its ascent on our first crossing of the pass, and on our return, September 16th, the ice-conditions of the main peak were prohibitive. If it were ever to be climbed, this seemed to be the opportunity. The caravan was accordingly divided, the portion with the main supplies continuing on in charge of the Wazir to the Lolophond camp, while a smaller one with us, leaving the pass, descended north to a snow-hollow, from which a steep, furrowed slope led to a large plateau, where camp was pitched on the snow at 19,000 feet.

As the plateau caught the sun throughout the day and



View north-west from Bilaphond La. Ice at left descends to Bilaphond glacier, at right to Lolophond.

To face page 1

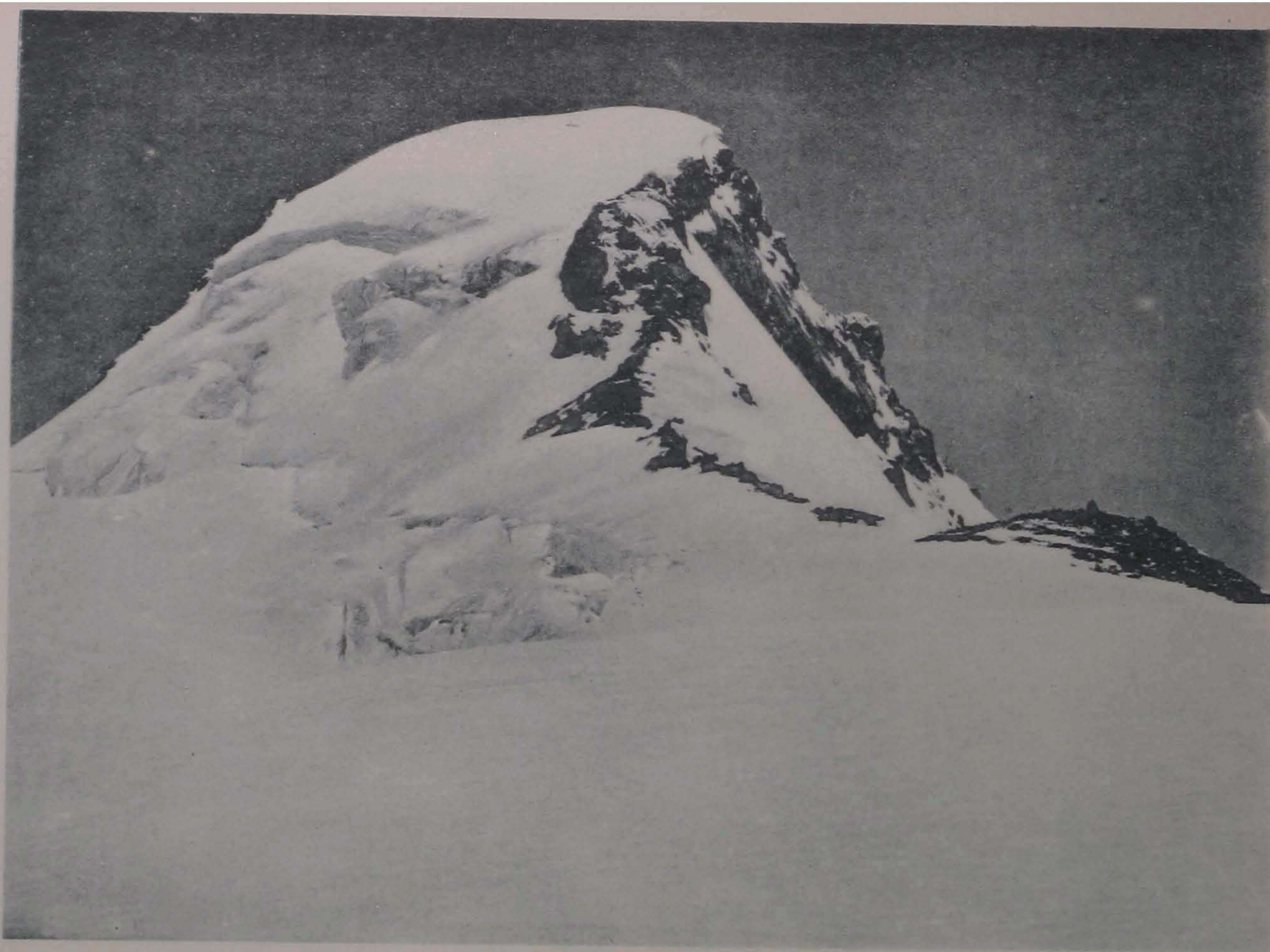
there was plenty of space, large tents were used for a two days' halt. Just as I was preparing to brew afternoon tea by melting snow over a "Primus" stove, a delegation of strapping Saltoro coolies prostrated themselves before my tent. Each wore hanging from his brawny bare neck two or three *tawiz*-amulets before described. They voiced the wish of their fellow-coolies that, now our tents were placed, they might all leave and go down some 5,000 feet to moraines and camp. After some parleying through the cook, who spoke Balti, they were made to understand that we were obliged to remain in this sunny snow-camp and could not possibly spare their presence during our stay. I further assured them, that they would not have to go higher up, and need only wrap themselves in the warm blankets I had provided, eat their two days' prepared rations, and lie in their lined tents. Being thus reassured, they rejoined their comrades at the coolie-camp, and nothing more was heard from them.

The sun blazed its fiercest until 6 p.m., softening the surface to a depth of two feet or more, so that tents nearly tumbled in and could not be properly fastened until after sunset, when a freezing temperature at once set in. An exquisite effect was observed about sunset, which I have seen but twice, and both times in the Siachen region. A lovely wistaria-mauve mist floated over the plateau and the snow-hillocks rising toward the peak, making the tents appear to stand in a billowy, gold-tinged, purple sea. The night was clear and cold, the minimum temperature being 3° F. The next morning, as soon as the mercury rose to 10°, with the guides and one coolie carrying instruments we set out toward the peak. After two hours' ascent of moderate snow-slopes a rock-ridge jutting out below the final peak was reached at 19,900 feet, where Dr. Workman set up his instruments and remained for observation and photography, while I continued the climb with the three guides.

The first part was wearisome because of numerous, long, steep rock-slabs, offering little hand or foot-hold, which had to be negotiated. Above these the mountain became very precarious owing to the melting snow, through which we sank on to hard, black ice, which necessitated constant step-cutting. The gradient of the last 800 feet was never less than 60°. We were, however, glad, even by dint of prodigious effort, to find we could win the mountain, for, when studied the previous August, the final peak presented a sheer coating of verglas, and it would most likely be in the same condition two weeks later this year. Near the apex the snow became more stable, and it was possible to stand on the extreme summit, a small, fairly firm snow-cornice.

When ascending such peaks as this for the first time, when the return journey is unknown, my mind is usually at work anticipating the difficulties of the later descent. The only way, of course, is to get to the top and trust the descent to luck. I have made several very bad descents with Savoye, but one way or another they have been accomplished, which is the main point.

I saw most wonderful things from this peak, which aided me in laying out the coming exploration of the Rose glacier. The scene towards the south, while glorious to look upon, was, because of the position of the sun, impossible for the camera. The vision of most startling grandeur was the double-summited Peak 35 and 36, 25,280–25,400 feet, which loomed directly west. This mountain is K 3 and 4 of Synoptical Vol. 7 of the Indian Survey, but its most up-to-date symbol is Peak $\frac{35\text{–}36}{52\text{A}}$ according to the degree sheet on which it falls.



Tawiz peak, 21,000 feet. Cairn on rocks at right 19,939 feet.

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On summit of Tawiz peak, 21,000 feet.

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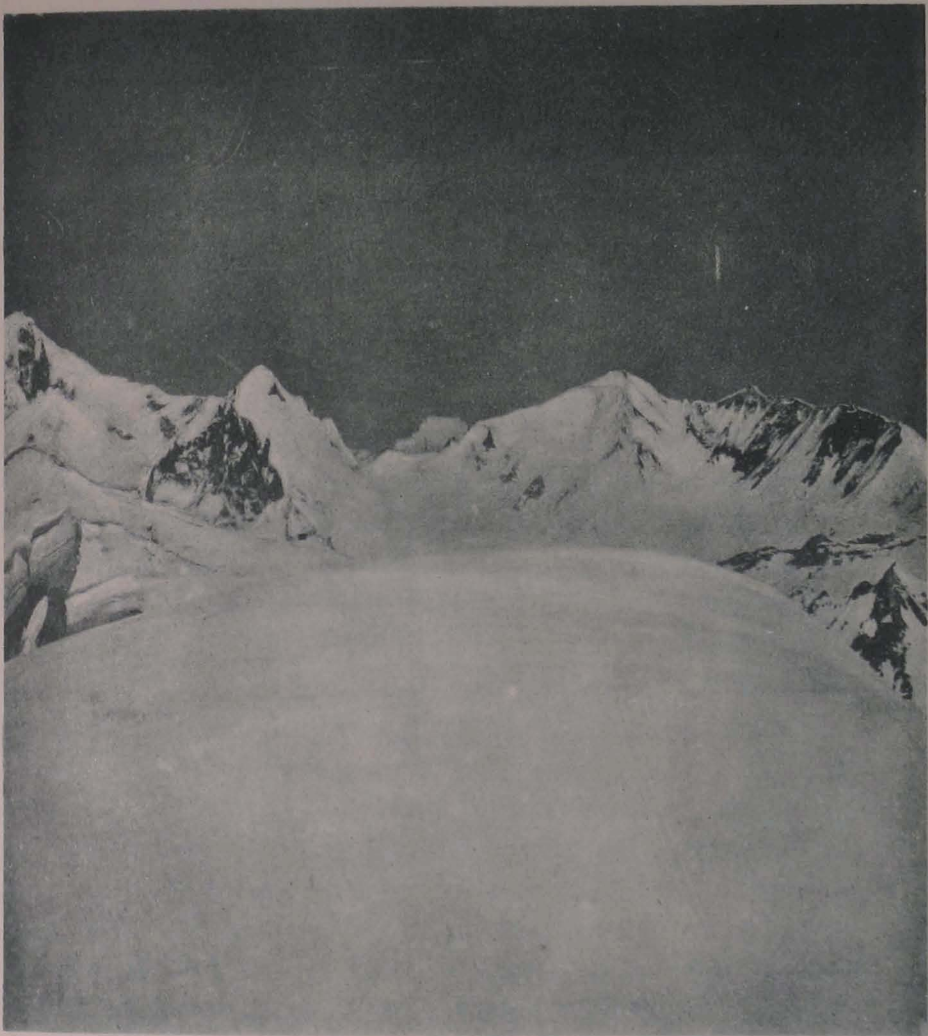
From my summit, as may be seen in plate facing p. 142, it is separated only by the elevated plateau of over 19,000 feet, from which the great massif rises abruptly 6,000 feet. One point in connection with it was especially substantiated, viz. that the snow-basin on the north side, much foreshortened in the view, is flanked by the unscalable watershed-wall rising between the Dong Dong and Sher-pi-gang glaciers, which lie directly behind, and the west Siachen affluent named by us Peak 36 glacier. As already stated, we visited the Dong Dong and examined the wall in question from that side the previous year, as well as from the Peak 36 glacier, and discovered no passage over it from one region to the other. This is the wall upon which Vigne's "Ali Bransa pass to Yarkand" would have to lie at the inaccessible head of the Sher-pi-gang glacier. East of Peak 36 I had a clear view of a long snow-trough leading to a col which was visited by our expedition in 1911. From this col a glacier descends, probably, to Naram in the Ghyari nala. The peaks forming the west boundary of the Bilaphond La enclose the snow-trough mentioned. Overlooking these points thus completely from a great height, I was able to define exactly the relation of Peak 36 to the important glaciers in its vicinity and see distinctly what snow-area intervenes between it and the Bilaphond glacier.

The great Rose glacier was seen in the distance 6,000 feet below where I stood, running for many miles downward between wild ranges to a point where it was lost to sight in mountain-chaos. The sources of the Rose were invisible, being cut off by its west mountain-walls. High peaks beyond its eastern wall were visible, and one loftier than the others I secured rather faintly with my small camera. This is, probably, one of the high peaks we afterwards discovered from the north-east source, or Turkestan La. The Teram Kangri group, the Tarim Shehr promontory abutting the Rose, and two-thirds of the Tarim Shehr glacier were also photographed. The only Baltoro peak which I could identify was the flat-topped Bride Peak, 25,110 feet. For quite 75 miles on three sides great mountain-schemes of weirdest rock and snow-splendour met my eye, but such miles of intricate mountains intersected by immense glaciers fill one with despair when viewed only for few minutes; the geographical importance is so evident, and the camera and one's mind are so inadequate to wrest the full meaning and value of the wonderful environment. Perhaps the best summing-up of it would be to say we overlooked a vast area of over a thousand square miles of peaks and glaciers devoid of vegetation extending from one horizon to the other.

I named the peak we had conquered Magic or Tawiz Peak, for it overlooked the Bilaphond La, where in the olden days, so runs the legend, the Baltis placed the *tawiz* destined to bring about their revenge on the Yarkandis of the fabled city of Tarim Shehr. Its height is 21,000 feet.

Well satisfied with the day's work, we began the dangerous descent of the ice-clad cone, and, rejoining the rest of the party at its base, built a rock-cairn and returned safely to our snow-camp, where a second, near zero night was passed. The next day we descended to the Rose glacier by the left Lolophond side, which in both years was found to be the most feasible route. The descent of the Lolophond glacier, like that of all high Himalayan glaciers, particularly after 11 a.m., on account of softened snow and frequent crevasses, necessitates constant vigilance, but for troublesome ice-conditions it cannot compare with the upper part of the Tarim Shehr glacier as we found it.



View north-west from Tawiz peak. At right, twin peaks of Mt. Ghent. In centre, behind snow-slope of Mt. Ghent, summit of Bride peak, 23 miles distant. At extreme left, Peak 33.

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On reaching Lolophond camp, Camp 4, 17,100 feet, at the second indentation above the Siachen, where we had camped in 1911, and to which the Wazir with the main supply-caravan had preceded us, we picked up him and the caravan and continued on to the junction of the Lolophond with the Siachen. Here, turning north-west, we clambered over broken moraine-hillocks to a high hill covered with much large and small, slaty débris, which was ascended. At its base on the north side, bounded by it, an end of the Siachen south-west barrier, and the glacier ice-wall, lay a large lake. This we were obliged to contour on a very narrow and treacherous shelf to reach the main barrier, which was ascended for several hundred feet to a broad, descending ridge on which we made our first camp in 1911, Camp 5, at 16,278 feet. Here we camped on the terrace made at that time. In 1911 we remained two days at this camp, and ascended the mountain-flank above it—much covered with loose sedimentary rock-débris—to an apex at an altitude of 17,280 feet, where a cairn was built. From this cairn an excellent view may be obtained of the whole Lolophond to the Bilaphond La, and of large portions of the Tarim Shehr and Rose glaciers.

The next day, ascending over a massive, lateral moraine in front of the camp and traversing the wide, rough, marginal moraine covered chiefly with granite and gneissoid blocks, we crossed to the centre of the Siachen, and, ascending for a time, pitched camp on a grey moraine at 16,374 feet. The crossing here was almost as difficult in July as it had been in 1911 at the end of August. Seven glacier-rivers intersected the route, several of which, failing snow-bridges, had to be forded. After camp was arranged, sixty coolies, in charge of two guides, were sent to Tarim Shehr for burtsa, and twenty-seven back to Goma for supplies and wood. Preparations for the higher work were thus at once started, for from here on all camps for weeks would be above 16,500 feet.

In 1911 a base camp was made on the Tarim Shehr promontory at 15,676 feet, which I shall later describe. As crossing the Siachen to it meant the passage, in some cases the fording, of ten or twelve glacier-rivers and finding a way through several intricate sérac-belts, which might prove hazardous to coolies coming and going under native leaders, it was not used on the present expedition, except for harbouring sheep and for collecting burtsa for fuel. A higher base above the entrance of the Lolophond glacier on the grey moraine of the Rose at 16,370 feet was established for collecting bags of grain and wood as they were brought from Goma, and put in charge of a Srinagar babu. This camp was of prime importance, it being my intention to explore the upper Rose and its sources before doing anything with the lower parts.

Before leaving Srinagar, knowing we should need a man in the main camp who could read, write, and keep accounts, I had interviewed several babus, all of whom seemed mentally deficient and unsuited to such work. An Indian babu is, as I was well aware, not the person to be placed in a position of trust in an exploring caravan. However, babus only were to be had in Srinagar, so I finally, with misgiving, chose one who had been educated at a missionary school there, who had later even taught in the school, and still later assisted in an Indian Survey expedition. This pundit proved to be the second, human, black sheep in our caravan, and, although somewhat different from those of the headman, Mullah Halim, his methods of imposition and pilfering were quite as sinister in their effect.

When we were working at various distant points,

Tawiz peak from Lolophond glacier.

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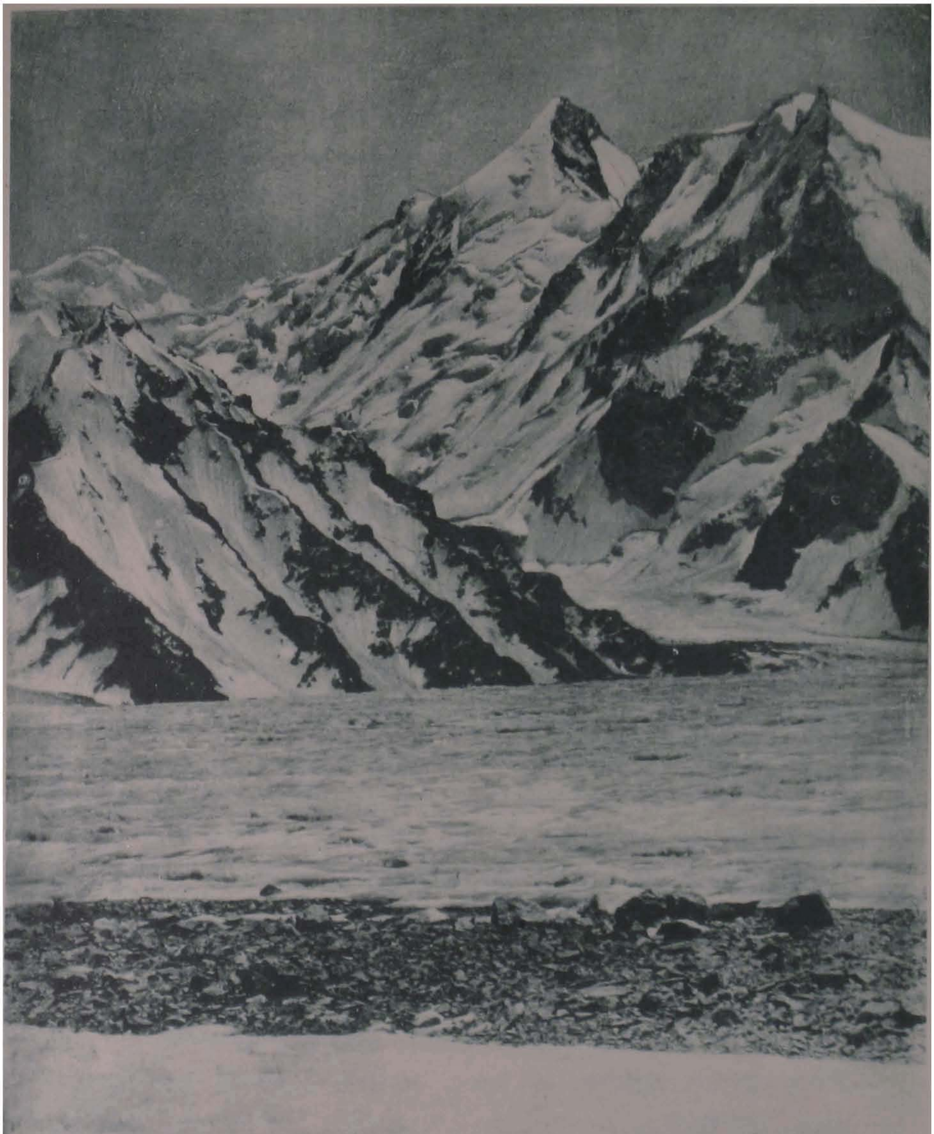

Telephotograph from Camp 15. Tawiz peak in centre, Peak 8 at left.

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he would send on most detailed and scholarly written bulletins of goods arriving and in his charge, which might soothe and put to rest the mind of the most sceptical explorer. On the rare occasions when we were able to visit and examine his camp, the carefully announced goods were usually found missing and matters generally at loggerheads. The Parsee agent at Goma, in general well versed in native defections, said, "The babu will do well enough on the Siachen, for he will not get much chance to steal himself, or sell your goods to coolies who have no money to pay for them." But, according to the Sepoy's reports, this was just what he did do. The full bags of flour, the receipt of which was so ostentatiously heralded to us, had a way of slipping back over the pass down to Saltoro villages where they were sold, the pay for them being quietly handed over to the babu when the coolies next returned to his camp. Luckily this and other devious ways of intrigue, which brought us into several tight places, were practised with some moderation and discretion, for, had this not been the case, the expedition, destined to be successful, would have completely failed for want of supplies.

The Rose glacier is 46 to 48 miles long, according to the point at which it may be considered to take its origin. Its width for 25 miles varies from $2\frac{1}{2}$ to $2\frac{3}{4}$ miles. It is the longest valley-glacier in Asia, and without much doubt in the world, excepting those of the Polar regions. According to Dr. Merzbacher the Inylchek, the largest glacier in the Tian Shan, has a length of 65 kilometres or $40\frac{1}{2}$ miles, and a width of 2 to 4 kilometres, $1\frac{1}{4}$ to $2\frac{1}{2}$ miles. The name given to this glacier on the Indian Survey map is Saichar. Dr. A Neve appears to have heard it spoken of by Nubra people as the Siachen, and after his cursory visit to it Dr. Longstaff gave it this name on his sketch-map. Upon much inquiry I learned that 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 legion in the nalas, and flourish in pink splendour to the tongues of the glaciers in Baltistan and Nubra. 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.

The pronunciation of Siachen is guttural, something similar to the German *ch*, and requires an effort to pronounce. I consider the English translation quite as appropriate. Its very incongruity as applied to this huge ice-sheet pleases the fancy. On many Asiatic glaciers the jungle-rose is found on mountain-flanks well above the snouts, but on the lower Siachen mountain-slopes one is fortunate to find stunted edelweiss and other small Alpine flora, while on the route of its upper thirty miles only snow-roses thrive. Ice-formations resembling roses I noticed in some of the large chasms.

As the names Siachen and Rose have the same meaning, it is of no importance which is employed. In the February 1914 *Geographical Journal*, p. 145, Dr. Longstaff says, in reference, I suppose, to my paper: "Surely Siachen should stand unchallenged as the name of the greatest glacier in Asia." For the benefit of future explorers I would here state: so far as anything I have written or said, this name does "stand unchallenged." In treating of this glacier I shall not describe the daily itinerary, but limit myself to mentioning the most important camps, physical features, mountains, affluents, and paramount geographical points explored and mapped.

View from edge of gully at 19,000 feet on Junction mountain across Rose trunk of massif of $\frac{\text{Pk.8}}{\text{52 E}}$, 24,300 feet.

Note moraine and white ice-streams of section of Rose glacier trunk in view.]

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CHAPTER IV

CERTAIN CHARACTERISTICS OF THE ROSE GLACIER—THE TARIM SHEHR PENINSULA AND GLACIER.

THE Rose glacier is somewhat Tibetan in character in that, unlike the Biafo and Hispar, where wood is found 15 and 20 miles from their tongues, after 10 miles no wood is to be had in 35 miles of the Rose. It actually proved to be easier to send men for wood over the Bilaphond La to Ali Bransa, where Byramji had it constantly carried, than to send them to look for it on the inaccessible mountain-flanks of the lower portion of the Rose. The paucity of wood was, indeed, most vexatious. Often it failed entirely and we had to depend on burtsa, the supply of which also became scanty toward the end of our stay. When coolies brought wood from Ali Bransa or Ghyari, their loads on delivery at camp were, invariably, small. They had three ways of lightening their burden of wood en route: first, by burning it where they camped; second, by carelessly dropping it as they marched; and third, most ingenious of all, on nearing the camp where the loads were to be delivered, by hiding it away in crevices of the moraines, which they covered with stones. The wood-graves thus made were for their own convenience, as from the outset, owing to the great scarcity of fuel, the order was that the natives should burn only burtsa.

Likewise earth and grass-carpeted maidans, met with far up the Biafo and Hispar, are here non-existent beyond six miles above the tongue, and camps on the middle Rose had to be pitched on moraine-strewn ice; while still higher, above 17,000 feet, only ice and snow-surfaces or rock-promontories were available. On three occasions we climbed bare shale-shoulders and constructed tent-terraces on damp, loose shale, which involved much extra work. In general the border-mountains of the Rose rise too sharply for this purpose and are quite inaccessible. Thus even fairly comfortable bivouacs during our six weeks' stay on the Rose were out of the question. There is just one place above 15,500 feet on this desert-glacier where from the middle of July to the middle of September coarse grass grows in some profusion, as well as the woody shrub burtsa, the root of which may be used for fuel.

When sitting in my tent at Camp 5 on the west Rose bank during our first reconnaissance at the end of August 1911, I looked out after a snow-squall on the wild mountainscape. As my eye wandered across the three miles of glacier covered with newly-fallen snow to a long, grim peninsula jutting into it from the east, the sun suddenly peered through a rift in the clouds, transforming the upper part of the peninsula and the cliffs above into a screen of golden green. Everywhere else ice, rock, and storm reigned. Having noticed no green there before, I called up the cook, my camp-factotum during six mountain seasons, and said, "Ask the Wazir what he thinks that is." "No need of that," he answered. "Memsahib should go there. The coolies call it 'Teram Shehr,' and say it is a nice

Camp and cairn on Junction mountain at 18,400 feet. View across Siachen trunk of Peak 36, 25,400 feet, rising beyond Lolophond glacier, which enters Siachen at extreme right.

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home with much grass." When asked by us, not a coolie admitted he had been there or knew anything of the place, but they persisted in calling it Teram Shehr. Dr. Longstaff did not visit it, so that there was no reason to think that any of his coolies had been there. A few days later we went across to this beacon of green, which furnished a fine base for some of the investigations made at that time. To reach it took hours, for distance counted as nothing in comparison with the difficulties involved in crossing, and sometimes fording, a dozen glacier-rivers, some of them 12 feet or more wide, and climbing over stretches of huge, corrugated séracs.

This most interesting physical formation of the middle Rose is indicated on Dr. Longstaff's sketch of the glacier as a nunatak, which, perhaps, very long ago it was, but on approach it is found to be a large granite and shale-promontory descending from the slate-peaks forming the barrier-wall between the Rose and the large east, or Tarim Shehr, affluent. As seen from Tawiz peak it looks like the long, sleek body of a whale jutting into the Rose, but when reached it is not so whale-like as it appears from that height of 21,000 feet. The lowest point where it touches the Rose glacier is 15,670 feet, and directly overtopping it is a slate-peak, height 20,840 feet, which was first ascended by us in September 1911, and named Junction Peak.

At the point where the base of this 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 large, white séracs. Below this are several acres of grass-clad undulations watered by glacier-streams. Here any number of grass-camps can be made in July and August, and here the mystery of the promontory having been previously visited by man deepened, for not far from the tents we found a stone-circle twelve 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 a number of large ibex horns attached to round and oval sections of skull-bones were piled together, certainly by human hands. They were old and decayed, falling into shreds when touched. No carcasses were seen outside the circle, but the vicinity near a stream was strewn with ibex horns, some attached to complete skulls with fur on them, apparently from animals that had died or been killed by wolves or snow-leopards.

In other places the footprints of foxes and wolves were observed, as well as those of some other animal which we failed to recognize. Possibly they were those of the mysterious snow-leopard known to exist in Himalaya, which, I regret to say, we have never met with, even at a safe distance, on our expeditions. Large ram-chikor flew out from the rocks when disturbed by footsteps, and besides a few pigeons, a number of small grey birds flew about, which the guides called snow-birds, they being exactly like those found in the Italian Alps. Examples of bird-life are scarce on the upper Rose and those existing seem to make their home here at the last grass. Saxifrage, gentians, small orchids, and edelweiss added life and colour to the coarse grass-tapis of the peninsula.

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-district,

View south-west from Junction mountain over great bend of Rose glacier. Black slate-arête in foreground.

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nestling in the hollows of which two good-sized lakes were found. We camped here at 16,273 feet, Camp 12 or Two-lake camp, the first year. Very large ibex grazed calmly within six hundred feet of the tents. This promontory, could he reach it, would be an El Dorado for the British sportsman, who travels each season many miles in Kashmir in search of "good heads," of which he rarely secures more than two or three during his short shooting stint.

This part of the promontory is bounded on the north and south side by bare shale-headlands, which rise abruptly from the glacier to a maximum height of 17,800 feet. Even on these rocky eminences rising to 1,000 feet above the second grass-area tiny maidans for tents may be found. Perhaps in the dim future, when the Alps are out of date and the Karakoram glaciers have become the playground of health and air seekers, Tarim Shehr may be converted into a second Righi with *Luft Kur* hotels disfiguring its plateaux. At present it is a unique spot in the heart of the Rose surrounded on all sides by many miles of glacier and ice-girt peaks, and may well be named Tarim Shehr (Oasis City). Thus spelt, Shehr, in Persian, means city.

When inquiring of the oldest inhabitants and "learned men" of the Saltoro valley as to whether they had any previous knowledge of the Rose glacier, they furnished me with a legend that had been handed down to them which, in its simple, picturesque romance, might well form the basis of a great Indian epic. It ran thus: That the now deserted Ghyari nala was in ancient times densely inhabited to the tongue of the Bilaphond glacier. The Baltis of that time were supposed to have crossed the Bilaphond La and met the Yarkandis of Tarim Shehr, with whom they played polo. Polo always plays a great rôle in Balti saga. The learned men did not say how the people of Turkestan came to be in this distant ice-region, only reported that a large city was said to stand on the present site of Tarim Shehr. The Baltis feared the Yarkandis, who are said to have often crossed to the Ghyari nala to "loot" cattle and destroy property in the villages. On one occasion they kidnapped one of the "best looking" Balti women, who was working in the fields. An important mullah or priest, named Hazrat Ameer, happened to be in the village at the time. He gave the enraged Baltis a *tawiz* magic amulet, and told them to put it at once on the summit of the Bilaphond pass, and ordered them after so doing not to return home the same way, but to go around via Yarkand.

The Baltis, having placed the *tawiz* on the pass, disobeyed the priest's orders, and returned to their village the same way from the pass. Soon afterwards 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. The Balti priests say the calamity would have been even greater had the avengers of the woman gone around by Yarkand home, as ordered by Hazrat Ameer, and that to-day not even grass and burtsa would be found to mitigate the rocky desolation of Tarim Shehr.

Regarding the term Tarim which I have adopted, I would say that neither have experts in Tibetan, Persian, or Arabic been able to tell me of the existence in those languages of the word "Teram" given by Dr. Longstaff as a name to a peak on the Rose glacier, nor did the best informed persons of the Kapalu and Saltoro districts admit any knowledge of such a word in the Balti dialect. As "Tarim" is used in Chinese Turkestan for

Camp 9, 15,993 feet, at Tarim Shehr, after storm.

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cultivated areas or oases, 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. In any case it seems best to adopt a term, the meaning of which is, in a sense, descriptive of the Tarim Shehr promontory, for it and the large east affluent which curves around it, rather than to take one for which no authority appears to exist. I am well satisfied to adopt so appropriate a native name as this, for, beyond this point, not a suggestion of a name for any spot above or below on the glacier was obtainable from our Baltis.

In connection with this name I am obliged to refer to a remark made by Dr. Longstaff in reference to my paper in the *Geographical Journal*, February 1914, p. 145. He says: "The suggested change of the name Teram to Tarim is unfortunate." I deny that I have suggested any such change. The name "Teram Kangri," which he gave to a peak, I have left unaltered on my map. My reasons not for "suggesting" a change in the name of but for *naming* the promontory or rock-peninsula Tarim Shehr have just been explained. Again, on the same page he mentions the "Teram peninsula." In calling Tarim Shehr a peninsula he acknowledges that we discovered the real character of this particular formation, which he himself failed to discover. On his limited visit to the Siachen he did not go to the place nor did he determine its nature, as may be seen by his marking it on his sketch-map as a *nunatak* without any name. Because he obtained a name "Teram" from the coolies, which he gave to a peak; and because this name for the peak was accepted, so he states, by the Indian Survey, is absolutely no reason why I should attach it to a promontory first visited and identified as such by our expeditions. Equally there is no ground for my attaching the name "Teram" to the largest, east affluent of the Siachen, which was first explored and measured by the 1911 and this expedition.

At Tarim Shehr three solid cairns, marked "B. W." in black, were placed at different points, and a fourth at a camp at 18,400 feet on Junction peak. As I said before, Tarim Shehr was too inaccessible for us to avail ourselves on the 1912 expedition of its sheltering hillocks for camping purposes.

As previously explained, the natives must have got the title Rose for this glacier from the rose-bushes growing in the barren valleys. This was a meet and appropriate idea for the dwellers of the grass-regions, who never penetrated to the higher, icy ones; but I, who dwelt for weeks among the snows of this glacier, prefer to find in the ice-roses I saw sculptured in its chasms my symbol of the Rose. In this connection a curious phenomenon, which occurred one night on the upper plateau of the fabled city of Tarim Shehr, also left its imprint on my memory. We were camped there on September 15th on our first expedition, in tempestuous weather, waiting to recross the pass to Baltistan. I had been kept awake late by great gusts of wind racking my tent, and, more especially, by the loud dirge-like chanting of the coolies at their camp, which rose irritatingly above the howling of the wind. Exasperated, at last I threw on a fur coat and went out into the frigid air to call the guides and have them stop the coolie-noise. It was still snowing and blowing on the glacier, but above Tarim Shehr the clouds had parted, and a full moon shone with silvery splendour upon an exquisite scene. As I stood there I

Junction mountain, 20,840 feet, from Tarim Shehr. Slopes flattened from elevation of camera.

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Approaching the summit of Junction mountain.

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beheld all about me the undulating hillocks covered with large, feathery, full-blown snow-roses. It was not an hallucination. They appeared completely formed, although the snow-covered grass-blades aided, no doubt, in the fantastic composition. I buried my hands in their cold, silvery petals, and then, forgetting the zero temperature, stood chained by the poetry of the surroundings. A tall snow-peak, moon-bathed from base to apex, looked down upon the rose-hills, the chant of the coolies clanged stridently yet in harmony with the now distant roar of the wind, and the moon, hung in a black sky, cast its resplendent light over all.

The weird glory of the scene and the discovery of the snow-roses so impressed me that I returned to my tent without stopping the chant of the coolies, feeling for the first time in years that their voices mingled fittingly with those of nature. I had quite forgotten, what I well knew, that rural Baltis always chant prayers at the time of the full moon, and, doubtless, on this occasion our coolies were vigorously exhorting their favourite gods to take them safely back over the snow-pass the next day.

There are two points of interest, to visit which Tarim Shehr may serve as a base, and these were investigated on our reconnaissance-expedition in September 1911. The first is the peak overhanging Tarim Shehr, and the junction of the great, east affluent with the Rose glacier. After waiting through a seven days' attack of monsoon at the lower camp on the promontory, during which it snowed much, blew much, cleared a little, and snowed again, the clouds finally lifted on the mountains. On September 4th, in apparently fair weather, we started up the peak with a small caravan. After a very steep and toilsome climb over rotten shale and slate-arêtes, a good-sized plateau was reached, where a halt for the night was made at 18,400 feet. The next day, leaving the camp, we and the guides continued the ascent over unstable slate-rocks alternating with snow, which was in very bad condition. The gradient grew sharper and sharper and our advance slower and slower, as the snow let us in on to ice and loose slates, causing us to slip back one step, at least, for every two forward. From the position of this mountain the view is one of the grandest on the glacier, as it comprehends the upper Rose and affluents and many of its highest peaks lying mostly towards the west. Downward, the main glacier can be seen for a long distance to below the great bend, but not as far as the tongue. We photographed while there was a chance, but by 10 a.m. monsoon conditions returned, the peaks became covered, and by the time we neared the summit the wind blew with such velocity that we could barely advance. There was no pleasant sun-basking, photographing, and lunching on the summit for us that day, as sometimes falls to the lot of the mountaineer; and after a few notings of instruments we beat a retreat in a gale accompanied by snow, glad to find at last even fair shelter under the rather unstable tents at the edge of the snow on the plateau. This peak, though sharp and tiresome of ascent, and its sides scored by great gullies with ragged slate-walls, offers every recompense to the photographer in good weather in July and August, but it is no child's play to be caught at its summit, at 20,840 feet, in the September cold by monsoon-storms.

On September 8th, in a temperature of 22° F., we again left the promontory to visit and examine the second point of interest, the Tarim Shehr glacier, striking it at about three miles above its entrance into the Rose. After five hours of easy slate and shale-moraines came badly broken and very rough granite ones, which so impeded the

View from point on Tarim Shehr glacier seven miles above Tarim Shehr promontory westward across Rose glacier. Three highest peaks from right to left, the Hawk 22,160, double peak Mt. Ghent 24,280–24,090, Peak 33, 23,960 feet.

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Mt. Lakshmi, 22,910 feet, on south side of Tarim Shehr glacier.

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caravan's progress that camp had to be pitched on moraine at 17,500 feet. After a very cold night we continued up the glacier, the névé-surface of which here after an hour or two became soft from the sun's heat. The route was dotted over with water-pools covered with thin ice, into which one was constantly breaking through up to the knees. This zone ended, roping became necessary on account of the presence of frequent, large, transverse crevasses.

Seen from the Rose this glacier appears to rise gradually for miles, but in reality its higher part was composed of three slopes broken by short snow-terraces, and its whole upper area was cleft by crevasses of a size and depth not met with on the Rose or its other large affluents. A wide plateau was finally reached lying at over 18,000 feet. This white sea is cut up by schrunds and chasms running in all directions. Leading the caravan cautiously in and out of this maze, we advanced slowly, until Savoye said the responsibility for him was too great, as the caravan might at any moment become engulfed in this vortex of, seemingly, bottomless chasms. We had wished to reach the end of the plateau, now quite visible, and see if any possible passage existed leading towards Nubra and the Remo glaciers, but this was no smooth, lustrous expanse, such as are some elevated plateaux in Himalaya, but a mountain-devil's snow-continent set with death-traps to entice unwary men into their pitiless jaws.

From where we stood at 18,300 feet the plateau rises imperceptibly to what looks like a snow-depression on the north side of its east end. The passage, if there is one, would be by this narrow yoke. Should a descent on the farther side be practicable, the head of one of the glaciers of the Remo system might be reached, and a route to the Shyok Valley found. We considered well before turning back here, but at last decided the risk was too great of camping the caravan at over 18,300 feet for two nights in the September cold, that year very severe at night, particularly as the chance of overcoming the six miles of crevasses leading to the col the next day was an uncertain quantity. So, reluctantly, we again headed downward, and by covering a long distance reached a bad bit of moraine at 17,675 feet for camp at 4 p.m.

The Tarim Shehr glacier is seventeen miles long from its junction with the Rose, and averages a width of a mile and a half to two miles before reaching its reservoir-basin. Peaks of from 21,000 to about 23,000 feet form its north and south boundary-walls, and two of about 22,000 feet rise as isolated points from its terminal plateau.

During the present expedition, 1912, which I am especially narrating in this book, I considered the north and west Siachen sources must claim first attention. When toward the end of August we were recalled by the delinquencies of the headman Halim from the lower Rose, my hope 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 Upper Rose. Finally events worked together to make it a question of forcing a new passage at the Rose west source-head, or of attempting to reach the Tarim Shehr glacier-col, which, if reached, might be found to furnish a passage to some other glacier.

Both could not be accomplished by the expedition. We had just the force of men and provisions necessary

Upper six miles of Tarim Shehr glacier, greatly crevassed, east of point at 18,312 feet, noted on map. At extreme left col at 19,300 feet leading, probably, to Remo basin.

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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 was found, and wander down to somewhere in the Shyok valley, where, most likely, the caravan would get no supplies. As things turned out I chose wisely, I think, to do the former. An expedition relying on its own resources only, while it must be prepared to take many risks, cannot take all, and, when two goals are presented as alternatives, the one of greater geographical importance should have the preference. Dr. de Filippi explored the Remo glacier in 1914, which he says is "formed by two large glaciers, a western and a northern one." He refers to two cols at the head of the northern branch, and states that the one to the west "communicates with the Siachen basin." This fact was not, however, proved, for, owing to continued bad weather the party did not visit either of the two saddles. It is most probable that there is a passage from the Remo to the Tarim Shehr affluent of the Siachen, and it is to be regretted that the de Filippi expedition, after a stay of more than a week in the upper basin of the northern Remo, was unable to definitely establish this communication.

CHAPTER V

TERAM KANGRI—PEAK 36 GLACIER—TO THE NORTH WATERSHED.

I WOULD briefly mention the Teram Kangri, a massif-like ridge, culminating in several peaks rising from the Siachen basin and forming part of the east boundary-wall, some eighteen miles from the northern water-parting between the Siachen Glacier and Turkestan. This was first seen by Dr. Longstaff from the Bilaphond La in 1909, and judged by him to be a mountain-mass of exceptional height. During his day's visit to the middle Siachen he took angles with clinometer to three summits of the group, giving on his sketch-map later the height of 27,610 feet to the highest, named 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, where from several high stations he triangulated the highest and lowest of the three summits with altitude results of 24,489 and 24,218 feet.

That same season Dr. C. Calciati, during a short visit to the Siachen, triangulated the peak east of the one measured by Mr. Collins as the highest, for which he obtained a value of 24,793 feet, or 7,559 metres. This he regarded as the highest summit. In 1912 Mr. Grant

Teram Kangri, 24,510 feet from height on west bank above camp 5. Massive, west marginal moraine of Siachen in foreground.

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Peterkin triangulated all three peaks of this ridge with results of 24,510, 24,300, and 24,240 feet respectively. His observations show the central peak to be the highest, thus corresponding with the result obtained by Mr. Collins.

In the course of seven seasons of daily companionship of Himalayan mountains, one acquires a certain habit of roughly estimating the height of a peak when it first strikes the eye. Obviously no great accuracy can be expected from such eye-estimations, but they flash upon the mind and are not to be suppressed. These impressions, however, usually prove to be correct to within, say, 1,000 to 2,000 feet. The seasoned Himalayist, if he has the mountain-eye at all, can pretty accurately estimate whether he is looking at a 21,000, 24,000, or 27,000 foot summit. When we first saw Teram Kangri, we said at once we could give it 24,000 feet. Asking guide Savoye, who has been on six expeditions among Asiatic mountains, and who at the moment did not know what mountain he was looking at, what he would estimate the altitude of the peak at, he replied "About 24,000 feet." This was, of course, before any of us knew the results obtained by the three later triangulation-measurements. Dr. A. Neve says in his *Thirty Years in Kashmir*, p. 293, that, judging it by the eye, he reckoned Teram Kangri at less than 25,000 feet.

These peaks when seen from the Bilaphond La make no extraordinary impression on the observer, and I wonder that any one, at all accustomed to Himalayan surroundings, 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 sources of the glacier, and to Peaks 8, 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 for height fairly accurately.

Camp 6, on the north, marginal moraine of Peak 36 glacier at the junction of the latter with the Siachen, at an altitude of 16,730 feet, commanded one of the most impressive views of the region. The Rose in its greatest width was seen flowing downward twelve to fifteen miles past Tarim Shehr. The Tarim Shehr glacier was visible from its junction with the Rose to its head, while the Peak 36 affluent spread like an open, white fan westward. Fringed by distant peaks, these great glaciers, converging from east, west, and south, produced more perfectly upon the mind the impression of an immense Arctic sea of ice than any glacial scene I can recall on the other Karakoram trunk-glaciers. Peak 36 glacier is the longest, west affluent of the Siachen. Its reservoir, broadly speaking, may be found on the ridge from which the Survey-triangulated Peaks 33, 35, and 36 rise. Defined more closely, it may be said to consist of two portions, one to the south occupying a wide plateau directly under the east side of the high Peaks 35 and 36, and one to the north another plateau or basin lying east of Peak 33.

From the head of the latter reservoir the glacier has a length of some sixteen miles to its junction with the Rose. Its length to the south head under Peak 36 is about thirteen miles. Its width varies from three-quarters of a mile above to a mile and a half at its mouth. Ascending gently in a broad, honeycombed ice-sheet, it is quite an ideal glacier, nowhere disturbed in its symmetry by moraines. Those that exist on its lower trend, forming long, lateral ridges of pale

Camp 6 on moraine at junction of Peak 36 glacier with Rose. In background Junction mountain, behind large tent, with Tarim Shehr promontory at its base. At left Tarim Shehr affluent with col at its head 17 miles from Rose glacier.

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hillocks, serve only as picturesque adjuncts to enhance the beauty of the monotone of rising ice. Its south containing wall is composed of five snow-peaks broken by three small affluents which enter the main glacier in shimmering streams of white ice. Devoid, toward the last, of even a trace of rock, it bends south around snow-peaks soaring directly from its shore in a plastic, high sweep, which brings the wondering visitor to the base of the frowning precipices of Peak 36. From these precipices northward to Peak 33 and beyond, these peaks and their crevasse-riven linking ridges are stupendous and complex enough to satisfy even the most avid seeker after mountain-grandeur.

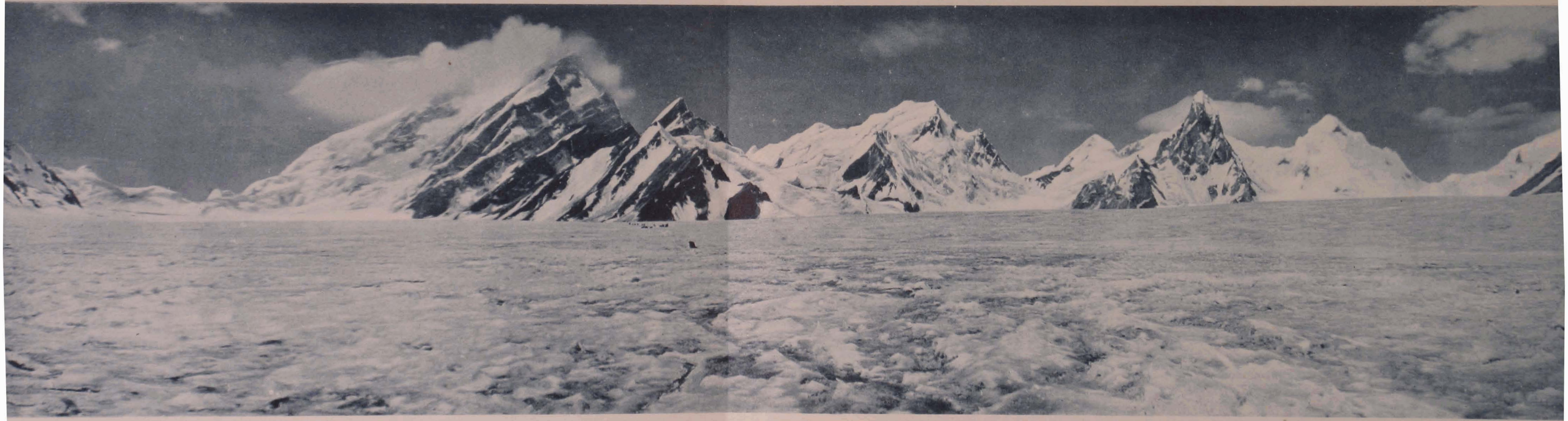
All the more does Nature force one to admire the noble glacier, which pursues its serene course in unbroken lines to here, where it finds oblivion in this scheme of rock and ice, which forms a background of extremest mountain-tumult. This chaos of peaks and bergschrund-harrowed walls is of great interest to the passage-seeker, who has knocked in vain, as we had, at its doors on the other side, for it forms the barrier between this and the Dong Dong and Sher-pi-gang glaciers, its icy ramparts calling out the mandate—Here and no farther shalt thou, poor human thing, advance.

To obviate camping in deep snow on the glacier, at twelve miles above its end the steep side of a bare, projecting spur, the only spot free from snow in the vast, icy expanse, was ascended. This, composed of rotten, crumbling shale, overhung the glacier in a precipice about 400 feet high. It seemed a hopeless place for a camp, as its sharp, narrow top afforded no room sufficiently large or level for tents. After some three hours' hard work the guides and coolies, by building up retaining walls with rock-fragments bestrewing the surface, digging out and rolling down boulders, and using smaller débris to fill up the empty spaces behind the walls, succeeded in constructing several terraces or platforms on the slanting side sufficiently large to hold tents.

The coolies stowed themselves away in rock-crannies at the base of the spur. The weird beauty and scanty comfort of this camp at 17,650 feet were greatly increased by the presence on the glacier below of a large, blue lake, surmounted by a striated ice-wall. A delicate tracery of ice covered the scintillating, blue water throughout the day, so cool was the temperature of the place. The sun left the spur at 3.30 p.m., and a temperature of 5° F. reigned at night.

The next day a mile of ice-walking brought us into the wide Peak 36 plateau which, as I mentioned in connection with Tawiz peak, is bordered east by the Bilaphond La and Tawiz peak ridges. Directly under Peak 36 to the north-east we came to a narrow aperture not seen from below, and, after ascending a snow-wall, found ourselves on a still higher, smaller plateau, from which rose the actual dividing ridge between the Dong Dong and Peak 36 glaciers. This plateau rises from an altitude of 19,100 feet at its lower end, as measured by hypsometer, to the high ridge in question.

This nearly perpendicular watershed-ridge, scarred by a series of huge bergschrunds, being impossible of ascent, we contented ourselves with climbing on Peak 36 itself to the base of its north-east vertical wall, at 19,500 feet, which was as far as the constant danger from avalanches would admit of. Even here the guide, Quaizier, beset us with petitions to descend at once, for nothing could have saved us had the avalanches started in their daily manœuvres, which they did within half an hour of our visit.



Panorama from centre of Peak 36 glacier 4½ miles from Rose looking south-west, showing large portion of north-west and south-west heads of glacier. Large massif at left is Peaks 35–36, 25,280–25,400 feet, summits in cloud. Caravan seen approaching promontory on which Camp 7, 17,602 feet, was pitched.

To face

I do not relate this as a notable ascent, but I was rather pleased to reach on this redoubtable mountain the point where the last 5,000 feet of sheer precipice begins. The two actual summits 35 and 36 are near together, bearing about the same relation one to the other as do the twin peaks of Masherbrum. Could one be borne by aeroplane to the dip between them, both would, probably, succumb to the foot of the mountaineer. Whether seen from the Dong Dong glacier or from different places on the Rose and its affluents, one always feels inclined to pause and admire this mountain, so noble is its build, so supremely picturesque and beautiful its varied aspects. Like a few people one meets on life's journey, it possesses a commanding personality.

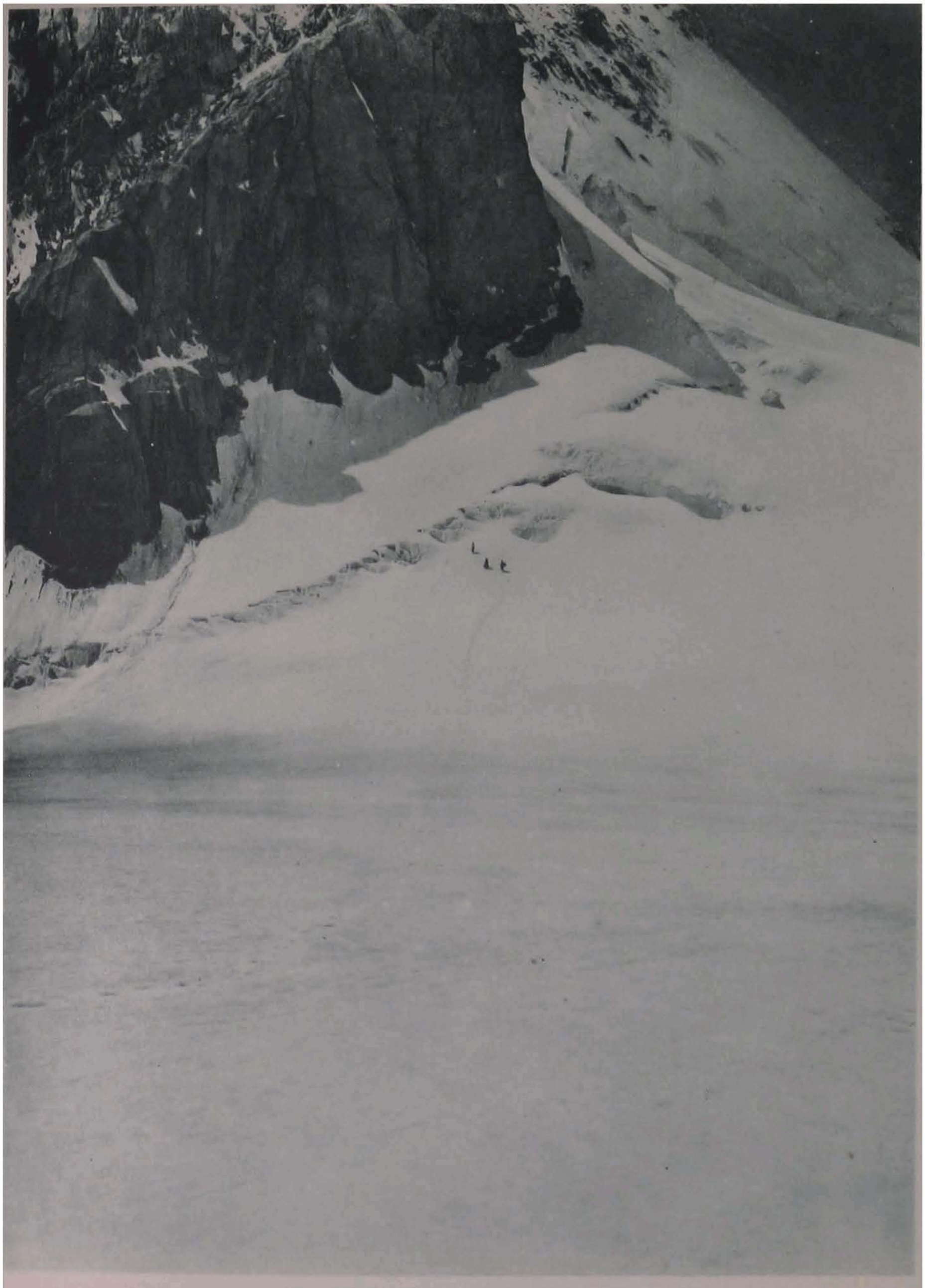
Another scarcely less impressive peak of the upper, west Siachen, first seen and triangulated by this expedition, is the double-summited Mt. Ghent, 24,280 and 24,090 feet, which at the suggestion of Mr. W. P. Cresson, F.R.G.S., I have thus named after the Treaty of Ghent, which terminated hostilities between Great Britain and the United States in 1814.

I mentioned at the outset that twenty sheep accompanied us from Goma to the Siachen. On past expeditions, usually, from two to three have run away or been lost by coolies in crevasses, but this time all twenty, I believe, arrived safely at Tarim Shehr, where they took up their abode under two goatherds. As needed, they were killed and brought up the glacier by coolies to supplement the different camp-larders. Nineteen supplied the full needs of our own and the Surveyor's party, and the twentieth, grown round and plump, after seven weeks' good grazing, returned safely home to Goma at the close of the expedition.

Beautiful clear lakes are numerous on the Siachen, adding much to the picturesqueness of the general ice-entourage. When threading a way through reaches of high séracs one comes on them suddenly, encased in stratified ice-walls, often 50 to 60 feet high. The ice-banks of one lake at an altitude of 17,000 feet were peppered black with large mosquitoes. Perhaps they were affected by altitude, as they were quite sluggish when brushed off the surface with the hand. They appeared to hover only about the lakes, for none were seen at the camps.

The gradient of the Rose glacier in a distance of twelve miles upward from Tarim Shehr is easy, showing a rise of 1,442 feet, or one foot in thirty-seven. 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 very sparse and tents stand, practically, on thinly covered ice. These miles of moraine strewn with blocks of marble and other débris are very interesting, but, as I am dealing only with the geographical and historical part of this region, they will be described elsewhere.

On the 18th July we left one of these camps at 17,000 feet for an attempt to reach the north Rose source. Passing the last west affluent, which enters above 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 very slow with the coolies complaining and halting for rest every two minutes, so we looked for a safe spot for tents, and camped in the middle of the glacier at 18,057 feet. The sky had been clear all day, but by evening the weather grew uncertain, and the next morning we found our tents laden with snow and a heavy storm in progress. When



At 20,000 feet beneath final vertical wall of Peak 35, near southern head of Peak 36 glacier.

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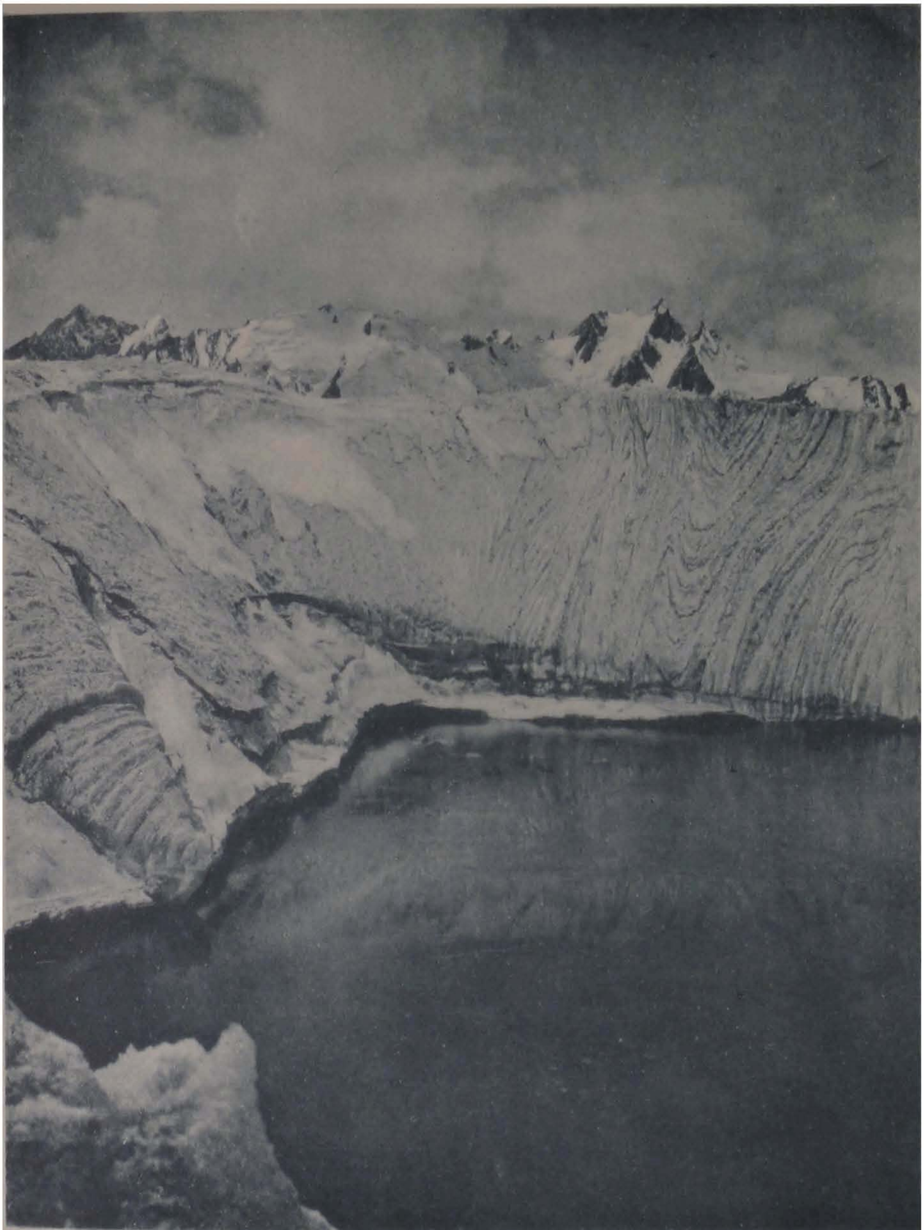

Mosquito lake near centre of Tarim Shehr affluent.

[Note synclinal arrange of ice-strata. At and beyond right strata were anticlinal. This formation shows well the folding ice-strata may undergo. Extensive melting of surface has greatly reduced original height of strata.]

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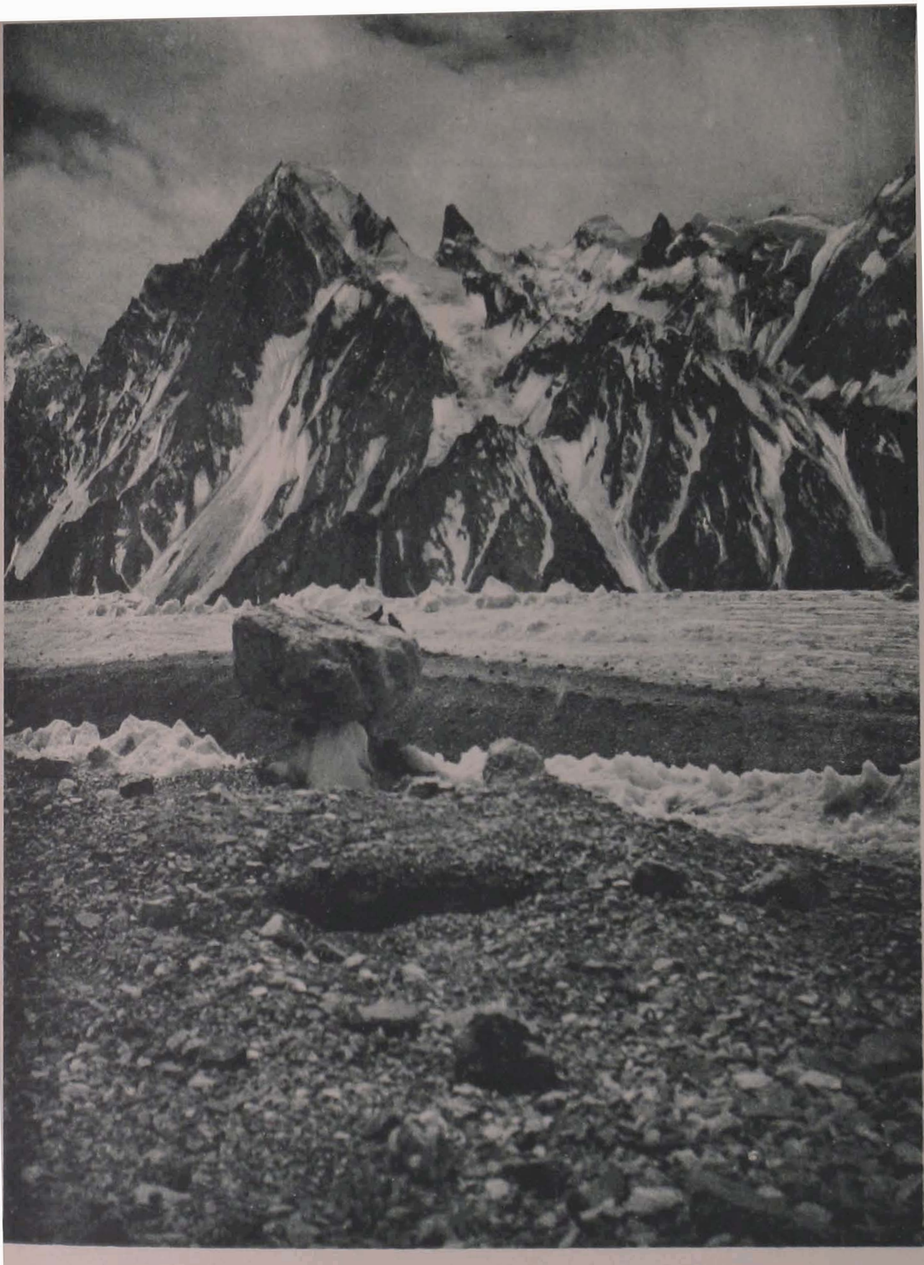
escape is possible it is folly to wait about under such conditions, so we packed up our impedimenta as best we could and descended in a dense mist accompanied by a blizzard-like wind that drove the snow-particles through the woollen face-covers so as to cut the skin. Camp was finally pitched in the storm on some snow-covered moraine at 17,200 feet. Luck was not yet ours, and that night the elements raged again and continued to do so, with intervals of calm, for two days more. When the clouds broke a little the third day, but with the wrong wind holding and 4 feet of new snow now lying on the upper glacier, as provisions were at a low ebb, we marched farther down to a mountain-arête, where we camped to await favourable skies.

From this perch at 16,776 feet, some 300 feet above the Siachen, for a day, before the snow melted, the glacier stretched above and below like a uniform white sea, not a crevasse or a 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 that set us to hoping. Lastly, our three mascots appeared on the scene and began to caw loudly. I have not before spoken of the three crows, that had followed the camp from Ali Bransa and had continued to accompany us to the glacier-sources and to all high camps, not disappearing until the Kondus valley was reached on the homeward journey. They were not even distinguished by red beaks, as are mountain-choughs, but were well nurtured, black crows of great size, which took good care to find a living off the camp and did not suffer for five minutes from mountain-lassitude even at 20,000 feet. Their speech was more the croak of the raven than the caw of the crow. I confess to having found them more agreeable camp-companions than the best coolie I have met with.

After this delay, on July 25th a second start was made, and we camped again on moraine-strewn ice 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 250 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. To reach the spur the caravan had to be taken over a sharp, slippery snow-slant shelving towards the lake below. When, by roping, this was safely accomplished, we came out on the rock-chaos-projection, which, after a lot of hard work on the part of the whole caravan, was converted into sets of camping terraces. Before the lake froze entirely over at sunset, like the common well in small villages, it became the rendezvous of the thirsty guides, servants, and coolies carrying water-buckets. Even the crows enjoyed a good drink, sipping at the iced water and sharpening their beaks upon a group of icicles. We thought ourselves fortunate indeed to find such good quarters on dry ground fairly 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 very nearly demolished, but it was obvious that human hands had placed the rocks as they were found. This was no evidence at all that caravans had used this place as a camping ground, for where natives are in the habit of bivouacking they invariably build stone-huts, which are much less likely to be demolished than cairns, and there was no sign whatever here of huts or shelters such as were seen at Ali Bransa.

The cairn-fragments indicate merely that natives once reached this point, but they do not, in the least,



Two of the three crows that accompanied Siachen expedition of 1912 perched on glacier-table.

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Camp 19, Spur camp, on rock promontory at 18,400 feet near head of Rose glacier.

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augur that there was formerly a caravan-route over the inaccessible north Rose source. On July 27th, with temperature 15° F., we left Spur camp, as we called this camp, and descended to the glacier. The ridge of the last wall, before spoken of, upon which the camp was located, projects into the glacier for some distance, thus causing a narrowing in of the Siachen before it reaches its upper basin. After contouring this we ascended sharp, crevassed slopes for about an hour and a half before reaching a large snow-plateau. In spite of an icy wind blowing down from the heights above, which chilled to the bone, good progress was made, the surface-snow being crisp and firm. From this basin on the west a snow-mountain rises, and beyond it the high, precipitous walls of the King George V group, which enclose the Rose glacier-head on the north-west with an impenetrable barrier.

Although high enough in themselves, these are really only the lower walls of the group, which in four high peaks dominates the north-east head of the glacier. Neither Peak 23 nor its satellites are seen from this point. As we stood on the plateau, gentle slopes were observed rising to the east 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 nearly every step. The wind had momentarily ceased, and as we plunged through the deep, soggy snow, our faces were grilled by the reflected rays of a tropical sun. I have often suffered greatly from the sun's heat in the higher regions of Himalaya, but never experienced the least inconvenience with my head or eyes when wearing a sun-topie and glare-glasses. Some persons, I know, find comfort in face-masks, but I cannot endure them for five minutes, as they impede breathing. The two best preventives of the torture of skin-burning I have personally found to be burnt cork and a German-made cream called nivalin. I mention this because people often ask what I use for snow-burn and because long hours on snow in the upper Himalayan heights entail the keenest suffering to some skins.

There was not much to guide us in our search for the watershed-ridge, so we headed for a snow-peak of about 22,000 feet, which appeared to stand at the end of everything. On the left or west we passed a snow-gap with a bergschrund at its base, that is seen thirty 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. It is, however, no pass, and bears no relation to the real water-parting ridge, which latter is not seen at all from any part of the Siachen glacier. The supposed saddle is a narrow connecting link between two elevations of the intricate Siachen reservoir, merely an idiosyncrasy of Nature thrown in to mislead any one casually looking up from the middle Rose. Beyond this false saddle lies a deep snow-basin.

Leaving this point a mile or so behind, we came to the base of the peak above mentioned and, after consultation, decided to ascend over its sharp, east flank, which we did to a height of quite 21,000 feet. Here a wonderful vista of the Rose could be seen falling downward thirty-five miles, the first half a glittering ice-river, which later became ribboned by long, grey and black moraines. Having crossed the mountain-flank and lost

Peak at north head of Rose glacier, over the flank of which Authors passed to reach Indira col, at right.

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sight altogether of the Siachen, a descent was made to another previously unseen, high snow-field. This presented a death-trap-labyrinth of yawning crevasses. After contouring and overcoming this hodge-podge of obstacles, we were greatly relieved to see an ice-ridge ahead with distant peaks rising from beyond a void. The whole *trajet* in the deep snow and the mental tension produced by continual vigilance in avoiding chasms had become most exasperating, and we were glad that Nature was about to put an end to further advance and allow us to stand at last on the eagerly-sought-for north Rose water-parting.

CHAPTER VI

ON THE NORTH WATER-PARTING OR INDIRA COL—DISCOVERY OF AND VISIT TO THE EAST COL OR TURKESTAN LA.

SAVOYE, leading on the rope, called, "Slowly! It is a line of huge cornices." And so it was, like most of our best mountain-culminations, a cornice; and not one, but rows of them, extending straight across the ridge to the base of a sharp peak which forms the east boundary of this water-parting ridge. With the guides tautly holding the rope we went as near the edge as possible, and saw the monsters curling over in great, white hoods fringed with massive pendants of ice. Below these fell a perpendicular snow-wall 5,000 to 6,000 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 north-west on the flanks of the Gusherbrum range. From the latter the glacier at first descends in chaotic ice-falls.

At the moment of our arrival on the ridge three tremendous rock-peaks were seen piercing the clouds to the north-west, beyond much doubt from position and appearance the Gusherbrums; but before the cameras could be used their tips were lost in cloud. The main

dira col at north head of Siachen (Rose) glacier, discovered and ascended by Authors. Its centre was measured at 20,860 feet. Watershed between Indus and Chinese Turkestan basins passes through heights left and across edge of col, from which greatly broken ice-precipice descends some 5,000 feet to Gusherbrum glacier, seen behind its centre. The portion of Gusherbrum glacier in view was first discovered from this col. is glacier, originating in Gusherbrum peaks behind heights and clouds at left, descends beneath Indira col and flows north-east into Turkestan. Mountains in background form north-east extension of Gusherbrum ridge.

To face page

precipices of the range may be seen in the panorama taken from the col. The continuing wall 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 or left of the watershed-col, as one faces north, running in intricate lines east and west, form a part of the very long but continuous east arête of Peak 23.

Hence the Siachen glacier may be said to find its main source in the King George V Group, while the east arête of Peak 23 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 is, apparently, formed by the remainder of the wall extending to the head of the Tarim Shehr glacier. With the exception of the Gusherbrums all the mountain-area visible towards Chinese Turkestan appeared less high and snowy than on the Karakoram side. The arid mountain-flanks were variegated in colour, and I noticed many slashed with deep red. A geologist would, doubtless, find much of interest in that region. A triangular mountain-massif, the beginning of which is seen in the panorama-view, runs south-east from this Turkestan glacier and forms, from what we saw from the East col, a barrier between the Gusherbrum glacier and another large glacier, which we discovered from the East col.

The glacier seen from this water-parting is different from those I have met with on the Karakoram side. As observed, grey moraines—and they are high, hillocky ones—descend through its centre and run thus a long way towards its tongue. As we saw, but could not photograph, the ice bordering the moraines on either side was composed of lines of tall pyramids 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 head by a moraine-route.

From my own observations, and after consultation with Col. 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 hypsometer, works out for height at 20,860 feet. 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. A high wind was blowing, which had, perhaps, wafted them up to greet us from Chinese Turkestan. The thermometer registered 50° F. when we left the col to descend the long miles of sodden snow which separated us from our distant camp.

Much more might be said about overcoming the difficulties of the upward and downward route to the Indira col. They were all present—the treacherous, snow-hidden crevasses on the smoother parts, and the explosive cracking of the surface-crust observed by us before, and on the steeper slants the ploughing out with hands or ice-axe of a path, and the constant sudden plunging into soft snow to the waist, so irritating to tired nerves, with the added labour of having to get

View down Rose glacier from ridge, at over 19,000 feet altitude, above Spur camp. At lower edge lake at foot of Spur promontory. Caravan on glacier approaching camp.

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View down Rose glacier from ice-field above Camp 19, Spur camp.

[This camp stood on southern base of rock-eminence in centre of picture seven hundred feet below the base of portion here seen.]

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out when once comfortably in. Yes, all the dangers and obstacles of a long, arduous climb at from 19,000 to 21,000 feet were in superlative evidence; but in a narrative of Asiatic snow-life, where frequent reference to these snags must be made, the reader has a claim to be spared too much detail. The writer, after seven seasons of Himalayan exploration, likewise, to use a French word as more expressive, grows *lassé* of their description.

The next morning Rey instead of Savoye came up to my tent early for orders. As the latter had never failed in this particular duty, I inquired what was wrong with him, to which Rey replied that he was nearly snow-blind and could not leave the tent. It happened that, on his return to camp the night before, after the long day on the snow, Savoye had given his face a good bath with soap and water, and in doing this doubtless rubbed soap into his eyes, which, of course, played havoc with them.

As I wanted him with us on the visit to the east watershed-ridge, we waited a day at Spur camp for him to recover. The weather appeared clear and settled, so we all rather welcomed the rest. The following day a return was made to the high plateau, where, turning east, we ascended fairly easy slopes for two and a half hours to a snow-col. This col lies at the base of a long slate-arête, and its height as measured by hypsometer is 19,210 feet. Small tents could be placed on the rock of the slate-arête, but the place is exposed and unsuitable for camping. It bore no traces of having been visited by any one before. However, it is of interest to note that, on this most forbidding of glaciers for tent nomads, at one of its heads a dry spot for a tent may be arranged in case of emergency.

The first thing that impresses the visitor here is a grand group of high peaks looming up 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. The position of the sun was such that in the two hours we waited on the col no really clear photographs could be secured. The double peak in the centre of the photograph of them is, probably, the distant high mountain I detected from the Tawiz peak lying in this vicinity. The group has not been placed on previous maps and was, evidently, here seen for the first time. The col we stood on forms a semicircle and ends in the bergschrund-festooned wall visible in the foreground. Directly below the col a sharp drop occurs, say of 2,000 feet (it is difficult to estimate height from above a wall). 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 toward 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 latitude, 35° 41″ 20′, of the point reached by Sir Francis Younghusband on the Urdok glacier would about correspond to 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 when in search of the Saltoro pass, and named the Urdok. The

On Turkestan La, 19,209 feet. Group of high, hitherto unknown peaks in Turkestan beyond the east wall of Rose glacier.

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View from Turkestan La, eastward of a section of Urdok glacier and its eastern wall.

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col he saw culminating the Urdok is probably a ridge of the mountain-group seen by us from the east Siachen col. If this is the case, it is the col at the head of the Urdok glacier, which should bear the name of Younghusband's saddle, and not the meaningless, false col lying some miles west, which I mentioned our passing on our route to the north water-parting, which Dr. Longstaff honoured with the name "Younghusband's Saddle." In his remarks following my paper, published in the *Geographical Journal*, February 1914, he says, "It is satisfactory to find that our location of Younghusband's saddle was substantially correct." I would put here on record that I do not find his "location" of Younghusband's saddle to be correct at all, and I should consider, as no doubt others would, that any one placing on a future map the name Younghusband's Saddle where Dr. Longstaff puts it on his sketch-map of the Siachen, would be guilty of an obvious error, to say nothing of paying Sir Francis Younghusband a more than doubtful compliment. The saddle, or pass if it be one, he saw at the source of the Urdok glacier, could not lead to the Siachen, as in the east Siachen wall above Tarim Shehr there is no break, nor, so far as we could observe in the five times we passed along its entire length, is there any possible pass.

This east col, our visit to which I have been narrating, is, therefore, another more easterly point on the watershed-ridge toward the Turkestan side, which with the north or Indira col 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 (pass) on my map, because under proper European leadership it might, with considerable difficulty, be crossed by coolies up to August 1st 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 with too many mountaineering obstacles to be used as a caravan route by natives of Chinese Turkestan; and second, not being the culmination of a main artery, it would be observed by them only as a ridge at the top of a tributary 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 to seek a way out from Baltistan or Nubra to Turkestan, and on ascending to the Rose reservoir found an exit here, or vice versa. This, if accomplished only once, would account for the cairn-remnants found at Spur camp. Another explanation of these cairns may be sought in the possibility of Nubra or Goma people having penetrated thus far up the glacier in search of a pass, and not liking the appearance of the snow-wastes above, having returned down the Rose. This might also account for the stone-circle at Tarim Shehr.

So far as present knowledge is concerned 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, although they may talk of a passage as existing from the Rose to the Remo region, the people there appear to have little knowledge of the Rose glacier. In the February 1914 *Geographical Journal*, p. 145, Dr. Longstaff says that he "understands the lecturer [myself] to say further, that the name Siachen is not known to the people of Nubra." Of course one cannot account for the way in

which some people understand plain language, but I disclaim having anywhere made such a statement.

One may weave what romance one will about the cairn-remains of Spur camp, 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 existed there.

From Sir Francis Younghusband I learn that a sportsman with a few Kashgar natives is supposed to have crossed a 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. I wrote to the gentleman, recently, myself, and in his reply he said, "I must warn you, as it is years ago since I did that trek, that details are lamentably wanting, and I find it almost impossible to now substantiate my explanations. This I found in talking with Dr. de Filippi and Sir Francis Younghusband." Comment is needless. The reader can judge of the value of such evidence. At any rate it appears quite certain from what we have observed at the watersheds that he did not cross this region by the north, east, or west Siachen sources.

During these days a white mist hung over the mountains and the Rose, which marred the splendid downward vista and interfered with photography. In Kashmir and Baltistan great heat and drought were reigning. Here it was cold at night and very hot after 11 a.m. On the col just described the glass stood at 32° F. in the shade at 9 a.m., and at noon a black bulb thermometer-reading at 200° F. was noted. Before leaving Spur camp a large cairn was built and marked with black paint "B. W.," with the date.

CHAPTER VII

EXPLORATION OF WEST SOURCE GLACIER AND ITS ICE-BARRIERS.

THE weather still holding fair, it was decided to push the study of the Rose sources, if supplies held out, to the last enduring point of the coolies. We accordingly started for the west Rose sources lying above the West Source glacier or highest west affluent. Descending the Rose for a time by the same route taken in ascending, 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 affluent enters the Rose at just 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 into August. At the south side of its entrance into the Siachen, the snow-streaked rock-buttresses of the mountain we named the Hawk are grandly seen.

This peak, while not one of the highest, is, like Peak 36, a Siachen landmark. It is seen from all parts of the upper thirty miles. Below the upper west branch its outline is that of a graceful, snowy Cervin, but above that it unfurls its broad granite-wings, assuming the appearance of a hawk. After the first quarter-mile the

On West Source glacier. Upper and Lower Silver Throne peaks in background.

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Camp 20, 18,700 feet, on West Source glacier. Silver Throne peaks in background, highest estimated at above 23,000 feet.

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gradient of this affluent is a steadily ascending one. In its upper portion the glacier spreads into a gently rising plateau, from which its sources, still distant, may be seen, backed by two beautiful snow-cones, which we called the Silver Throne, about 23,000 feet high, and Lower Silver Throne.

After 1 p.m. the snow-conditions became so dangerous, and the caravan-progress so slow, the loaded coolies sinking in to their waists with each step, that camping was obligatory. We managed to get them to a point beyond the zone of continual crevasses, and pitched tents not far from the centre of the glacier at 18,700 feet. This camp, where three nights were passed, was a source of many lamentations from the coolies because of the absence of rocks and of lakelets, which latter are so abundant on the Rose glacier. In the course of the afternoon, after camp had been established, the discovery was made that water existed at a depth of 3 to 4 feet beneath the surface of the snow. This was a find not only unusual at such a location but of great importance, for the water was pure, and without it it is doubtful whether the coolies could have been induced to remain at such a height. In fact, the desertion of our picked lot of thirty-five strong Baltis was hourly expected.

Two days previously I had sent down two men to order up a small caravan from the babu with *satu* for the coolies. These, arriving the next day, helped to save the situation, as the new ones relieved two or three who complained of illness, so that they could now return to the base camp. Toward night, as I stood before my tent admiring the immense, flawless snow-expanse on all sides, I saw three black birds flying toward the camp, and shortly afterwards our crow mascots appeared, filling the still air with their croaking. They had guarded the tents all the time we were at Spur camp, and here also they remained during the three days' snow-bivouac. Where they turned in at night was a mystery, the nearest mountains being somewhat distant, and of very inhospitable character.

The next day, in a strong wind, temp. 14° F., we continued on due west towards a depression between the Lower Silver Throne peak and the north border peaks of the glacier. On near approach a reach of open crevasses and enormous, square chasms was found to stretch three-quarters of a mile across the whole glacier, to get around which we should have to traverse the glacier and climb up the mountain-flank in order to look over the dip now seen to exist. As geographical information from a high point was our object, it was clear that this was not the place to find it. Savoye insisted that, did we go, we should see only a precipice instead of a pass. I decided that the depression must, however, be later examined, as it might prove to be a west source passage to another region.

A high col connects the higher and lower Silver Throne peaks. We climbed the snow-slopes a little south leading over the lower peak-flanks, and in two and a half hours reached it. We should have ascended the Lower Silver Throne itself had not its broken side, ending in ugly bergschrunds near the top, made its apex inaccessible. From this col an interesting scene lay before us. A large glacier, the visible source of which was walled in by high rock-cliffs, spread out 4,000 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 Kaberi or Kondus glacier backed against the Siachen west tributaries farther east near the Sher-pi-gang wall, so for the moment the idea of its being the Kaberi was

On Silver Throne col, 19,614 feet, overhanging Kaberi glacier just below its head. Bride peak, Peak 25, 25,110 feet, in background.

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Queen Mary peak (24,350 feet) at left, Mt. Hardinge (23,270 feet) at right, seen from altitude of 21,000 feet on Silver Throne plateau. In front of them rock-wall forming northern boundary of glacier descending from Sia La to Kaberi. In front of wall summit of Lower Silver Throne. At right of this Sia La. In foreground Silver Throne plateau.

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put aside. It did not appear wide enough or far enough north to be the Baltoro. Awaiting further developments, photographs were taken of the glacier-head and of the surrounding peaks, including one facing the Silver Throne on the opposite side of the new glacier, which proved to be a lower peak of the Golden Throne, the highest being behind, farther north.

To the right of this, above the glacier-wall, one of the Gusherbrums was seen in the distance, and beyond it Peak 23 with its unclimbable precipices was recognized. We faced an unknown, unmapped area, being confronted by four or five first-order Karakoram giants, the tortuous ridges, intricate depressions, and lesser peaks of which were hurled into a stupendous mountain-ensemble, not to be accounted for with precision at first glance. I shall later return to these peaks, which are seen to greater advantage from the high Silver Throne plateau. The saddle named on the map the Silver Throne col is 19,610 feet high. It could probably be crossed at considerable risk by mountaineers, but is not possible for a laden caravan.

With weather still fine the next day, facing a still more glacial wind than on the previous morning, we retraced our steps towards 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, a real outlet of the west Rose source was seen. I say I, because most other members of the party had been possessed with the idea that precipices would prohibit a passage at this point. 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 the head 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 of the main Silver Throne. Finally surmounting a snow-wall, which had obstructed the view, a large snow-plateau not previously supposed to exist was reached, stretching south. A ridge at its end was climbed, which overhung the glacier discovered the day before. This interesting basin, containing, certainly, four square miles of snow, lies at an altitude of 20,450 feet at its lowest, and of 21,000 feet at its highest part. From its upper part the top of the Lower Golden Throne was overlooked, and a grand view of the Gusherbrums and 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 this glacier as its *motif majeur*. As I said before, its great, eastern arête forms the north water-parting-ridge, and its eastern and southern flanks throw off the snows that produce the initial reservoir and upper névé of this glacier. Its high satellite-peaks again drain to and contribute much of the snow-supply of the upper west source tributary, 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 from them. This mountain, with the three high mountains south-east of it on the same ridge, builds a group of its own over eleven miles long, distinct from the mountains to the north, which I have the honour, with the gracious permission of His Majesty, to call on my map the King George V group.

Telephotograph of King George V. group from Camp 17. At right Peak 23, 26,470 feet, in centre Queen Mary peak, 24,350 feet, at left Mt. Hardinge, 23,270 feet.

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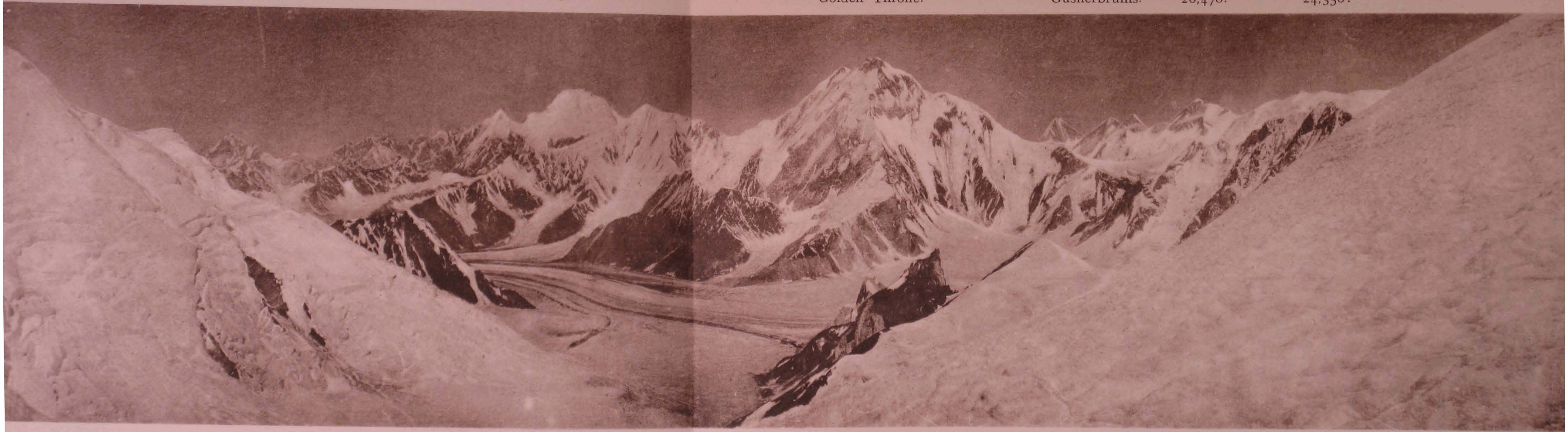
Particularly impressive from the Silver Throne plateau were the two next highest mountains of this group, which were first discovered and triangulated by this expedition. The highest of these, seen in the plate facing p. 192, taken from a height of 21,000 feet on the Silver Throne plateau, I have, with the permission of Her Majesty, named Queen Mary Peak. Its height is 24,350 feet. The second highest, 23,270 feet, I have pleasure in naming Mt. Hardinge, after H.E. the then 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. Colonel Sir Sidney Burrard says: "The numerous peaks which have no native names have been numbered in a scientific way after the astronomical system. The mapping of India has recently been placed upon a new basis as more peaks of the Himalaya and Tibet are becoming known, and it has been thought advisable now to name all peaks according to the map in which they fall." As the present system of nomenclature has been extended throughout Southern Asia, the new Survey symbols placed on my map seem likely to become permanent. 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 grace the first detailed and fairly accurate map made of Asia's greatest glacier. It serves also to associate this expedition made in British territory, in point of time, with the reign of the present King and with the term of office of Lord Hardinge. Personally I have nothing to gain by giving these names, but high peaks first identified and measured by this expedition must have titles, and my reason for giving them these is purely complimentary.

The high plateau was of particular geographical interest, as from it could, conclusively, be seen that the mighty King George V group, with its formidable precipices, intervenes as an impassable barrier between the Baltoro and the main Siachen head and, with the Golden Throne, also between the Baltoro and the sources of the upper west Siachen affluent, prohibiting any passage to either from the Baltoro, which, so far as any direct connection is concerned, cannot properly be regarded as having any complementary relation to the Siachen. If such a relation must be sought between the Baltoro and any of the three large glaciers originating east and south of its head, it would rather be with the eastern head of the Kaberi, where the intervening heights are the lowest, though still over 21,000 feet, but here the relationship also fails.

Behind the sheer, snow-painted rock-wall seen in the foreground of King George V group, in plate facing p. 192, a snow-valley ascends to a col visited by my surveyor, Mr. Peterkin, who saw a distant snow-ridge below the Golden Throne, possibly lying above the Baltoro glacier, in which direction he was obviously looking; but near the point where he stood the snow-expanse he overlooked ends in a high rock-precipice falling to the main Kaberi source, that we later examined from a point near its base, and found to be an impassable wall. A photograph which the surveyor took from the place he reached is, as are many such photos, deceptive, and to one ignorant of the region, who had not, as we have, seen it from a still higher point, and from the Kaberi head, it might convey the quite false im-



View west from Silver Throne col, 19,614 feet, across Kaberi glacier, near its head. In left foreground flank of Silver Throne, in right foreground flank of Lower Silver Throne with lower rock-extension descending to edge of Kaberi glacier.

To face page

pression of a continuous snow-expanse extending behind the King George V group to above the Baltoro.

Even if such a snow-expanse did exist—which, obviously, it does not—and were it accessible from the Baltoro, that would not make the Baltoro and Siachen complementary glaciers in a manner analogous to the Biafo-Hispar junction, with a passage the full width of the glaciers connecting their heads at the low altitude of 17,500 feet; for the passage in this case would be narrow, and would only in an indirect manner, at an altitude of above 21,000 feet, connect the Baltoro basin with an arm of an affluent entering the Siachen far below its head, its main trunk leading northward more than ten miles on the east side of the King George V group, which separates it from the Baltoro basin.

As the configuration of the mountains and glaciers of this region now stands, it looks as if a passage from the Baltoro to the Rose would have to be reserved for a future, venturesome aeroplanist.

During luncheon on the Silver Throne plateau, clouds rising from the south swirled over our heads, dropping occasional snowflakes as a warning that it was time for us to depart. We had gleaned most of the secrets of the Rose, and could not well grumble if the weather-god now turned his attention to fulfilling the prayers for storm contained in the *tawiz* of the coolies. For the second time at near 21,000 feet a grey wasp settled himself on my ice-axe, like the previous high-altitude one, evincing no disposition to attack me.

Contouring wide chasms and sinking to above the knees in traversing snow-hillocks, we descended the circuitous route to a lower plane, where at about 19,500 feet the Wazir was found with twenty coolies huddled up in the snow. He had brought them up to facilitate our passage over the last stretch to camp by treading down the surface in front of us, but the snow was so dry and granular that their efforts in our behalf were quite ineffectual, the path they broke out being more difficult to walk upon than the untrodden snow.

Our first visit to the West Source glacier ended in storm, and, after a night of snow and blustering wind, we descended to the Rose glacier in a half-blizzard. I was, however, convinced that, in order to complete the exploration of the Siachen basin and sources, a task especially laid out for the expedition of 1912, a return must be made to the icy west head and a first traverse of its westerly water-parting made, thus linking the Rose and Kondus basins.

View north-west from Silver Throne col of west wall of Kaberi glacier just below its head. Peaks in background, right to left, Queen Mary, 23, three northern Gusherbrums.

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Head of Kaberi glacier from Silver Throne col. In centre, easterly peak of Golden Throne massif. At right, three northern Gusherbrums.

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CHAPTER VIII

Camp life and incidents on the great glacier—To the west water-parting.

A period of over two weeks of monsoonish weather now set in. The days at first were partly fair, but subject to snow-*tourmentes*, usually after 1 p.m. This in no way specially prevented the investigation of the lower trend of the Rose. The glacier leading to the base of the Teram Kangri group was the first one examined, and then we wound our way over the tiresome, black and grey moraines and through the complicated sérac-belt which marks the sweep of the Tarim Shehr glacier around the Tarim Shehr peninsula. On this peninsula we camped a day on a sandy maidan strewn with picturesque boulders, awaiting news from the babu's camp of the arrival of Mullah Halim with supplies greatly needed and overdue by ten days. In weeks we had not seen a bit of vegetation, and I recall the strange effect the scanty tufts of grass and clumps of small orchids made on my eyes. The green appeared unnatural, and the flowers bizarre in form and out of place, so accustomed had I become, even in a few short weeks, to only rock and snow environment.

With supplies only sufficient for four or five days Tarim Shehr was left on August 8th. Cutting our way through mazes of huge ice-pinnacles, we reached the grey moraine in the middle of the glacier in a couple of hours. This was followed downward over great moraine-hillocks till late in the afternoon. The next day we pursued our downward course over the same moraine, which grew more broken and irregular, till we came to a point at the beginning of the great bend, where further passage on it was barred by a labyrinth of vast sérac-masses separated by wide and deep depressions and high slants topped by sharp ridges sweeping around from one ice-summit to another, enclosing lakes and profound ravines. Here we camped, intending the following day to cross to a smaller, smoother moraine more in the centre of the glacier and continue the descent by that.

At this camp, just under 14,000 feet, my lungs were affected by the lower altitude, much as my eyes had been by the unexpected presence of grass at Tarim Shehr. Not having in five weeks descended even to the contemptible height of 15,000 feet, I experienced a relaxation of the lungs and nerves, which prevented proper sleep and produced a slackness of energy, from which recovery was found only when the standard heights of over 16,000 feet were again reached. Had I remained at the lower altitude these contradictory symptoms would doubtless have speedily given way to normal ones, as they did later, on finally arriving in the lower valleys.

That evening news was brought by a coolie from the base-camp of the arrival of Halim with nineteen coolies, bringing only a small amount of ata. This was quite contrary to what had been counted on. Had he obeyed orders he should have brought some thirty maunds. There was, evidently, mismanagement or something worse somewhere. The babu at the base-camp having

Lake in centre of Rose glacier. Pinnacles of thin débris or pocket-penitente in foreground and scattered over ice-slopes. Beyond, black summits of hillocks of hillock-moraine.

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Boulder camp, 16,402 feet, on limestone moraine of Rose, opposite entrance of Tarim Shehr affluent.

[Note size of limestone boulder behind tents.]

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shown himself both incompetent and untrustworthy, there was no hope of any assistance through his efforts. Coolie-rations must be had, and that quickly, if our plans were to be carried out and premature breaking up of the expedition prevented. Our immediate return to base-camp was, therefore, imperative. We accordingly started to return at daylight the next morning.

Base-camp was reached in two marches. There, as was expected, commissariat-matters were found quite awry. We marched on a quarter of a mile above it, and camped on moraine-covered ice at 16,400 feet under the shelter of a huge limestone-boulder. Here we were obliged to settle down for some days for thorough reorganization before any further move could be made.

Mullah Halim had been sent fourteen days previously to Ali Bransa to meet and fetch thirty maunds of ata, which had been forwarded there from Goma by Byramji. He should have returned in four days, but did not until the evening of the fourteenth day. Inquiry now developed the fact that, instead of taking charge of the coolies and returning at once according to orders, he left the coolies at Ali Bransa and descended to Goma. Going back to Ali Bransa, he remained there eight days with the coolies, and the whole lot spent the time in feasting on the ata and burning out the supply of wood collected there. When at last he started to come to us he brought only nineteen coolies, the others having deserted, and, undoubtedly, taken a large portion of the food-supply with them without the least regard to the safety of their *confrères* with us, who might easily have died of starvation, had bad weather held us prisoners.

There being reason to believe that considerable ata was still remaining at Ali Bransa, Rey and Quaizier were dispatched immediately with forty coolies over the pass to look the matter up and to bring over all the ata and wood they could find. Mullah Halim was sent with them and ordered to go down to Goma with two natives who were ill. I gave him a letter to the agent, directing that he be paid off and dismissed from service.

There was much parleying before the coolies, under the guides, set out, for they said they were tired of the Rose, and, if they went, would not return with supplies. After considerable wrangling they were finally brought to a semblance of reason by the Wazir, and they departed with the guides as ordered. They would be gone four days, in any case, and our minds were quite made up not to see them again. The only thing to do was to wait. Supplies must be had both for the surveying party, which still had the lower Rose to map, and for us with the upper passage to make.

After their departure the grain-supply at the babu's camp was overhauled. None of the bags was found to be of full weight. Instead of sixty pounds, which they contained on leaving Goma, some had fifty, some forty, some thirty pounds. Five bags brought by Mullah Halim had only ten to twelve pounds remaining in them. This shows the shrinking in the contents of those actually delivered after what should have been a four days' march under the leadership of the good Mullah Halim, to say nothing of the not inconsiderable number which never reached their destination.

The grain was all collected into bags of full weight, which were sealed and deposited at our camp as part of the coolie-supply for the projected movement. When Ray and Quaizier returned with all the grain at Ali Bransa, which with that on hand proved sufficient for our purpose, they reported that all the wood had been burned, that the ground was blackened by large fires,

Camp, not shown on map, on east marginal moraine of Rose glacier, about midway between Tarim Shehr and West Source glacier. In background at right, King George V. group, at left The Hawk.

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and that there was other evidence, that Halim and his coolies had held high carnival.

Our stay at this camp enabled us to get more than one hypsometer-reading for altitude. The figures, calculated from two readings taken at the same hour four days apart, compared with simultaneous readings at Skardo, worked out at 16,402 and 16,400 feet, consistent results in view of what has recently been asserted regarding the inaccuracy of hypsometric measurement.

The weather grew steadily worse. When it was not blowing and snowing, fog hung over the glacier. The minimum temperatures were from 10° to 15° F., but, with no sun by day and high winds often at night, the cold was more trying than at higher, dry camps where the mercury fell to near zero. Tinned provisions disappeared slowly, for even the guides, of late, had come to the point of 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 five weeks, with the exception of three days, always above 16,400 feet, and most of that time above 17,000, and I noticed that all the Europeans ate steadily less as time elapsed. I have often observed this effect on the appetite of our Europeans after any stay beyond a couple of weeks above 16,000 feet. I still maintain, the Duke of the Abruzzi's experience 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 also very decidedly upon our numerous, hardy, young guides and porters during seven Himalayan expeditions.

During our stay at this camp the coolies remaining with us were not permitted to be idle. They were twice sent down half a day's march to Tarim Shehr for burtsa, and thirty loads of it were forwarded to the upper moraine opposite the West Source glacier, for there the last cooking operations of the caravan before advancing to the pass would have to be made. This set the coolies agog, and on their return from this mission a strike that lasted eighteen hours was inaugurated, during which the music of human voices quite deadened those of Nature and of our loud-toned ravens. Having lost a night's rest from the dismal howlings which penetrated from the fairly distant native camp to my tent, I called up the ever cheerful Wazir with the cook as interpreter, and inquired what the "much ado about nothing" meant. He replied that the coolies wished to go home over the Bilaphond La when the guides returned with new grain and would not ascend the Rose again. I replied that that was just what I would on no account do, and that the guides had not been sent all the way to Ali Bransa to bring ata to enable the caravan to make a luxurious return over the Bilaphond. I next resorted to a subterfuge that had occurred to me in the small hours. I had among my papers the permit given me by the Government of India to visit the Siachen glacier, tied with a rather impressive purple ribbon.

I now waved this at him, saying, "You know the mail-coolie arrived last week?" To which he answered, "Yes." "Well," I said, "he brought me important letters, and one in particular announced the arrival in September of the Viceroy in Srinagar." Then I added, "Look at me, Wazir," which he did, raising his eyes from contemplation of the purple ribbon. Holding his gaze, I continued, "Whatever happens I return by the new snow-road. When I reach Kashmir I shall talk with the Bara Sahib from Calcutta. Would it not please you, if I told the greatest Sahib in all India that Abdul Karim leading

Peaks on Peak 36 glacier adjoining Peak 36 on north.

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the coolies made it possible for us to do this?" I further added, that the new route was quite easy and short, for as soon as the pass was crossed we should reach moraines leading in a few days to villages. Of this last, of course, I actually knew nothing.

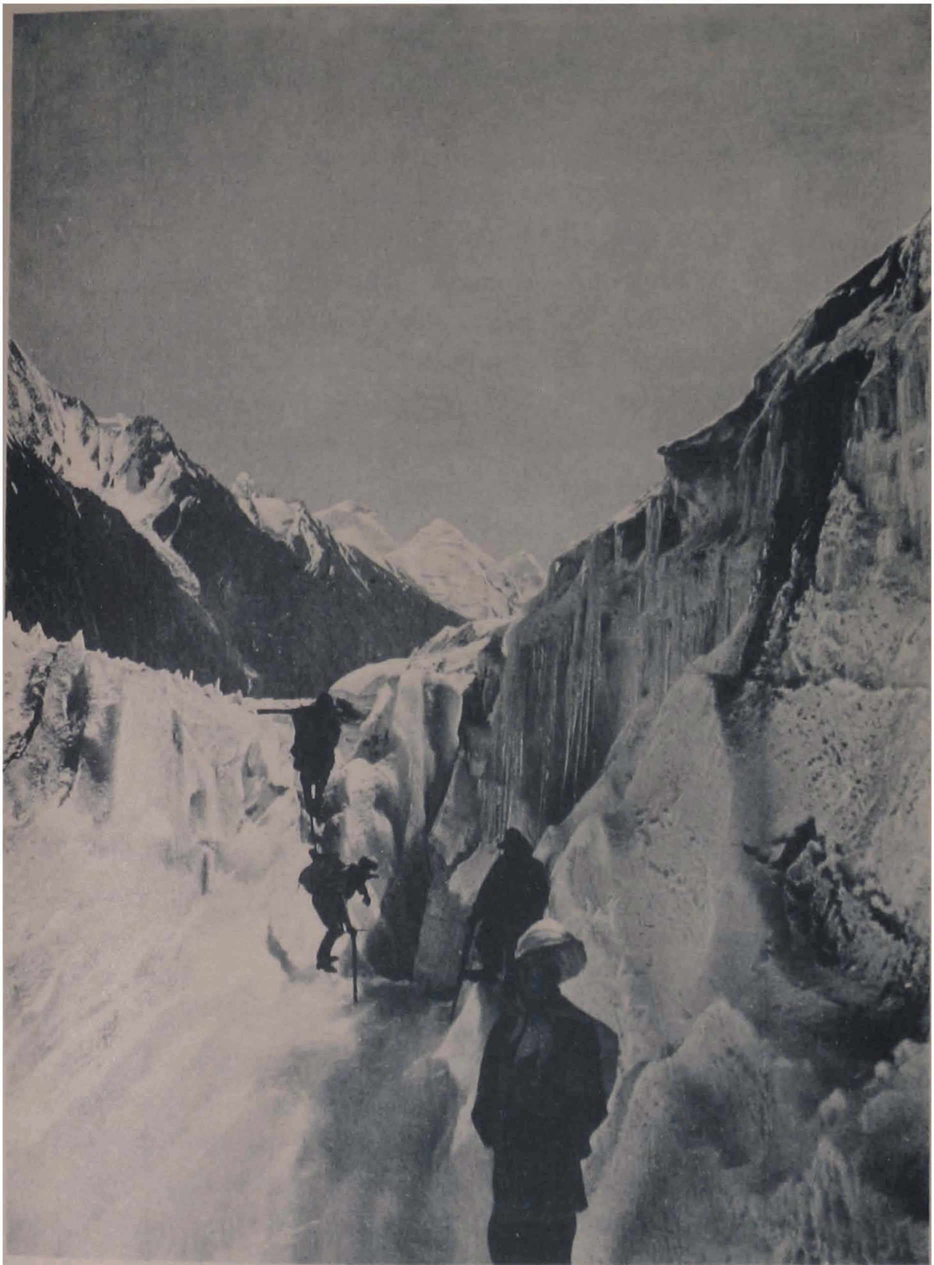
What I said appeared to strike home, for, smiling all over, his eyes again reverting to the purple ribbon, he assured me he was ready to go wherever I wished, and would at once tell the coolies they must go also.

Later in the day he returned to tell me that, if sufficient ata arrived and Madame would give out more nailed boots to certain men who had none, the coolies promised they would go. The Wazir himself seemed anxious to make the pass, while, as was natural, food and boots were the paramount objects with the coolies.

I promised what boots were left, some fourteen pairs. I had been giving them out before, as coolies now and then asked for them, though they are really of small service to natives except in climbing mountains. On the glaciers the coolies this season made little use of them; in fact, they often discarded both them and their own sheepskin pabus and walked barefoot by preference.

Among other events that broke life's monotony at this camp was the arrival of a coolie from the Goma base badly bruised. The agent had dispatched two coolies with two boxes needed for the coming journey. One box contained provisions, the other money and some of the writer's personal effects. The man carrying the latter fell into a rapid glacier-river on the Rose glacier. After being helped out by his companion he promptly left the box to its fate and hurried on as fast as he could several miles to our camp, where Dr. Workman at once dressed his wounds with adhesive plaster and bandages, for he had numerous severe bruises and his hands were considerably cut.

It was too late to do anything that night about the lost box, but the next morning guide Savoye with a band of coolies, after finding out as nearly as possible where the accident had happened, followed down with much difficulty for two or three miles a wide torrent. The water-mass was so limpid that in moving slowly he could constantly examine the ice-bottom, in doing which the coolies carefully assisted him. At last a cry of "Rupees!" was raised, and lying six feet under water a few single rupees were seen. A coolie dived and, assisted by others, brought these up. A short way farther on Savoye espied two bags resting on the river-bottom. After more diving these were rescued. They went farther down the glacier to where the torrent fell in a rapid *chute* over some séracs, forming below a noisy *moulin*. As not a piece of wood was anywhere seen, Savoye thought the box must have been broken into splinters at this point, which with its other contents were carried away. Anyhow the writer's clothing and a number of loose rupees were not found, and probably continued their downward journey with the torrent. Perhaps one day the silver coins may be thrown out on the bank of the Nubra river to delight the hearts of the monastery lamas, who are the last dwellers of that valley. For the next three days, while we remained at that camp, batches of coolies each morning descended the glacier, regardless of weather, in an energetic quest of rupees, but were not, I heard, rewarded by very big finds. I would remark that the coolie, a good-natured, elderly man, who had fallen into the river with the box, was one of the very few coolies we have had who appreciated medical assistance. Instead of tearing off and discarding bandages in the usual native manner, he allowed his to



Extremity of channel of glacier-river at base of one of the enormous séracs of Rose glacier, where river disappears in a crevasse.

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remain and seemed thankful when Dr. Workman renewed the dressings. In a few days he said he felt fit, and he left in good spirits with some others who were returning to Goma.

Meantime the caravan, under Rey and Quaizier, were collecting ata and wood at Ali Bransa, where the agent, *au courant* of our intended departure by the new route, was forwarding things with zest. The guides finally arrived with twenty-one loads, and the next day also Gulab Khan, the Sepoy, with fourteen bags of ata. I now felt that the situation was saved, for, if the weather-god would only soon hold out his hand, there would be enough for our large caravan for fourteen days, and for the surveyor's on the lower Rose. I forgot to mention that Gulab Khan had brought besides coolie-food two luxuries for us, nine dead chickens and a dozen frozen eggs. Perhaps the servants enjoyed the last named, for we did not, having early in the season lost our taste for this sort of iced *bonne bouche* with which Byramji sometimes favoured us from Goma.

The frozen chickens hawked over the pass by the coolies were not much more tasty; still, as a relief from tinned food, they passed, and I confess to holding in pleasant memory on the tops of various high peaks and passes my lunches of tough, cold, roast fowl.

On August 17th a great blow-out reigned all night at this camp, nearly demolishing our well-moored tents. We named the camp Boulder camp, from the immense, soft limestone-boulder under the protection of which our three personal tents were pitched. It was hoped this would usher in clear skies, but it did not yet, and the next day, while quiet, was foggy and so cold—15° F.—that we dared not start the caravan upward. On the 19th it was decided to risk a start, though mist hung low over the mountains and it was horribly cold; so with sixty-six loaded coolies the march was made to the upper end of the east latero-median moraine at 17,200 feet. Here, where the loads of burtsa before sent were stacked, the final preparation of coolie-food for twelve days was made. Smoke rose from six different fires that night toward the leaden sky, while, muffled to his eyes, the tiny Wazir presided over his large, fairly complacent coolie camp.

The next morning in much the same weather the Rose was crossed, the three crows leading and cawing fiercely. The snow, owing to the fog, was at its worst on the West Siachen glacier, and the caravan lagged badly, notwithstanding its many booted adherents. When the last remaining boots were dealt out by Savoye at Boulder camp, the applicants had seized them without glancing at the different sizes, the results being that coolies with huge feet were now limping along in boots three sizes too small, while others with more dainty feet were wallowing about in Nos. 12 and 13, in which their feet seemed wholly lost. After a time, their attention being drawn to these facts, they exchanged their footgear among themselves, thus facilitating their advance a little. We also noticed during these marches that those wearing boots would frequently exchange them for pabus worn by others.

Camp was made in a freezing temperature and snowstorm not far from the col at 3 p.m. I did not much care if it stormed, for the coolies were quiescent, making no protest, and somehow I felt sure we should cross to the other side in spite of the elements. At 6 p.m. our old friend the weather-god issued his command. The clouds broke and rolled away behind the mountain-tops. After a cold, still night, minimum temperature as usual at this point 3° F., we continued on to the ridge, Nature for the first time in many days smiling radiantly upon us. A

Camp 18 on east marginal, limestone-moraine opposite junction of West Source glacier
Altitude 17,200 feet.

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somewhat long descent occurring before the final climb over the mountain-flank to the col places the actual saddle, measured by boiling point, at the same level as the camp—18,700 feet. This Siachen-Kaberi water-parting col I have named the Sia La or Rose pass. Here the caravan, with Wazir Abdul Karim proudly standing guard, was photographed against a background of the Lower Silver Throne arêtes, with Bride peak looming grandly behind into the deep blue vault. I took a farewell, before-sunrise view of the Hawk, our ever-present friend of the Rose glacier, now seen for the last time. As *rücksacks* were shouldered preparatory to departure, the adorable, golden god of India rose over the great ice-scarp, transforming the scene into one of transcendent beauty.

It is in such moments as this, vouchsafed here and again to the explorer, that are forgotten all the hardships, deprivations, and obstacles of preceding weeks, and one is imbued only with an intense appreciation of the great reward offered to its devotees by Himalaya. We were sorry to leave for ever the fascinations of the Rose glacier. Its great basin framed in magnificent mountains and its long, white affluents entering east and west make a deeper impression of snow and rock-expanse and sublimity than is obtained on the other largest Karakoram glaciers. The picture cast by it on the mind of the Balti Wazir is worth quoting. Returning to Goma much impressed by his experience, he related to his pals that he had been to a valley like that of Kashmir, but instead of a green plain watered by rivers, with fields of flowering grain, bounded by grass-covered mountains, he had seen a vast region of snow, with rivers banked by ice, blue lakes reflected through ice-covers, and mountains of snow and ice—in fact, a big country like Kashmir, where all was white like winter and no green thing grew.

CHAPTER IX

DESCENT FROM THE SIA LA TO THE NEW GLACIER—THE KABERI GLACIER—EARTHQUAKE—RETURN TO VALLEY-LIFE—NOTE 1—NOTE 2.

A GOOD-SIZED glacier descends from the Sia La to the Kaberi glacier with a fall of about 1,600 feet. The gradient of the upper third was sharp, but being early in the day, the going was good over smooth, firm snow. At about the half-way point the surface became greatly broken by huge chasms, and fissured by wide crevasses running from side to side, often treacherously covered by soft snow, which necessitated long *détours*. Fortunately Savoye chose the best route on the right or north side, or we might have been stalled, for by the end of August the left side had become such a riven, broken-up ice-chaos that it was untraversable. Considering the lateness of the season for glacier-work, we were lucky to get through 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 part of the Kaberi or Kondus glacier.[1]

[1] To natives of the Kondus valley this glacier is known only by the name of Kaberi.

Camp 26, on West Source glacier, near Sia La, at altitude of about 18,500 feet.

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Caravan on Sia La, 18,705 feet, just before descent to Kaberi glacier. Lower Silver Throne at left. Bride peak in background.

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The glacier leading from the Sia La descends to the Kaberi, not at its head, but somewhat lower down from the east, and its existence would not be suspected by persons ascending even the upper part of the Kaberi. Near the Kaberi source, behind the western Silver Throne arêtes and on the true left side, this affluent leading up to the pass is first seen. Hence the topography is as follows. Peak 25, or Bride peak, seen apparently nearly over the Kaberi from the pass, really lies some miles west—so far west that it is actually beyond and west of a second Kaberi north-west branch seen on the map, of which I shall presently speak.

A lower peak of the Golden Throne rises above the Kaberi source north, and the King George V group lies behind the Kaberi head also north. Peak 23 itself lies some eight miles north of the Kaberi reservoir, and its snows on this side do not drain to that source. Those of a part of Queen Mary peak do fall to a shelf above the Kaberi precipices. The deduction made by the Abruzzi expedition, that a probable pass exists from the Kaberi or Kondus head to the Oprang basin and Urdok valley, is quite awry, but the opinion of Signore Novarese, that the westernmost extremity of the Siachen communicates with the Kondus is exact, so far as it goes. He is, however, wrong in his supposition that the Kondus head intervenes between the Siachen and Urdok glaciers. The Kondus head lies farther west than he supposed, and between that head and the north Siachen waterparting, overlooking the Gusherbrum glacier, the broad, eleven-and-a-half-mile-long King George V group intervenes.

Overtopping the Kaberi reservoir is a high granite and shale-wall broken at one point by a projecting shoulder, between which and the main glacier a short affluent descends to the reservoir. An 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 the point on Conway's map marked "Kondus saddle," there is in reality a sheer snow-wall, which does away with that saddle as a passage altogether. Thus these two so-called saddles have no importance as indicating passes. The Kaberi or Kondus basin is entirely closed as far as any communication with the Baltoro glacier is concerned, and has but one outlet, which is to the Siachen West Source affluent.

The mountain-topography here is complicated, and can only be unravelled by overlooking the Kaberi source and its outlying great mountains from elevated points and by visiting the source itself. We were so fortunate as to do this, in the one case from near 21,000 feet, and in both cases in fair weather, and I think my report of the connections, geographical positions, and conditions here will be found by future explorers to be, in the main, correct.

Following the Kaberi downward to the south, numerous affluents are seen entering from the right side, descending from the precipitous, narrow ridge which divides the main north-east stream from a second, large north-west affluent. About ten miles down, the chief stream, with which we are dealing, makes a distinct bend south-west and below this 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 Kaberi from its tongue would,

View of Kaberi glacier near its head from connecting glacier descending from Sia La.

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View up connecting glacier toward Sia La from point near Kaberi glacier. Note crevassed surface.

To face page 212.

in ten miles, see nothing of the main north-east stream, 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 Dr. Calciati on our 1911 expedition, accounts for the inaccuracy of the Survey map, which shows a single glacier running to the base of Peak 23. To return to the north-west affluent. This is shorter than the north-east stream and is separated from it by a narrow mountain-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 from the Kaberi head on the north-west side. Our 1911 expedition ascended this affluent far enough to see that Bride peak lay also west of its source, and that its reservoir was, like that of the main stream, walled in by high cliffs which offer no passage to the so-called "Chogolisa saddle" 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 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 or main Kondus glacier. He was above the north-west Kondus basin, and, doubtless, could not see the reservoir of the main stream.

Further, there is no pass from the north-west Kondus to the Chogolisa glacier next west of it, for we found on examination in 1911 an impenetrable mountain-wall on that side of the Chogolisa glacier-head. Dr. Calciati states that, if he understood rightly, one of his older coolies said that, in his youth, he had crossed from the Kaberi glacier to Hushe, but the coolie could not state the point on the Kaberi from which he started nor give any particulars of the crossing. Such passage, if feasible anywhere from the Kaberi, would afford a difficult, indirect route to Hushe not likely to be used by natives. At any rate no passage exists at the north-west Kaberi head to the Hushe region. Also, as obviously there is no pass from the Kaberi to the Baltoro or Chogolisa glaciers, the name Chogolisa as indicating a pass should not be inserted on future maps. As a euphonious native name there is no objection to it, but since the glacier bearing the same name lies several miles to the west and can claim no topographical relation to the so-called saddle, the name is, to say the least, an irrelevant and misleading one.

The Kaberi is the most extraordinarily difficult glacier of moderate gradient to travel upon we have met with in Asia. Its moraine-trails are not only much more accentuated but last three times as long for distance as do those of the Bilaphond glacier. After the first three miles from its source ice-areas and easy moraines end, and it descends in vast hillock-moraines, in places 200 to 300 feet high, which must be clambered over as best one can. These extend from one containing wall to the other. I recall only two small stretches, of a quarter of a mile each, where it was safe to proceed in a narrow, sand-covered ravine existing between the hillocks and the cliffs of perpendicular rock-peaks which border the glacier.

At a point six miles from the tongue the letters "F. B. W.," with date were painted in black on a left oro-

Camp in centre of Kaberi glacier at junction of middle and upper thirds.

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Abyss in affluent descending from Sia La to Kaberi glacier.

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graphical border-cliff, and a cairn was built on a ridge beneath the rock-face. Also on a large boulder standing on the left side of the Kaberi nala just below the tongue Dr. Calciati painted in black the letters "F. B. W.," and date, in 1911.

Because of the glacial conditions above described, grass-maidans, or even level spots suitable for camps, were non-existent on the Kaberi, and rock-terraces, either in hollows or on the tops of the moraine-hills, had to be constructed for tents. At one of these most rickety, cheerless bivouacs a few miles above the tongue, at 6.30 a.m., the glacier under my tent began to rock, as if the ice-foundations were being uprooted. I rushed from my tent, fearing the ice-hill would split and let me and my belongings into uncanny depths. They did not, but a rain of rocks and boulders composing the surface of all the surrounding hillocks was prodigious, while added to the clatter came the incessant booming of avalanches from adjacent mountains, producing such a tumult of nature as only seismic disturbances in a great, unstable mountain-region can call forth.

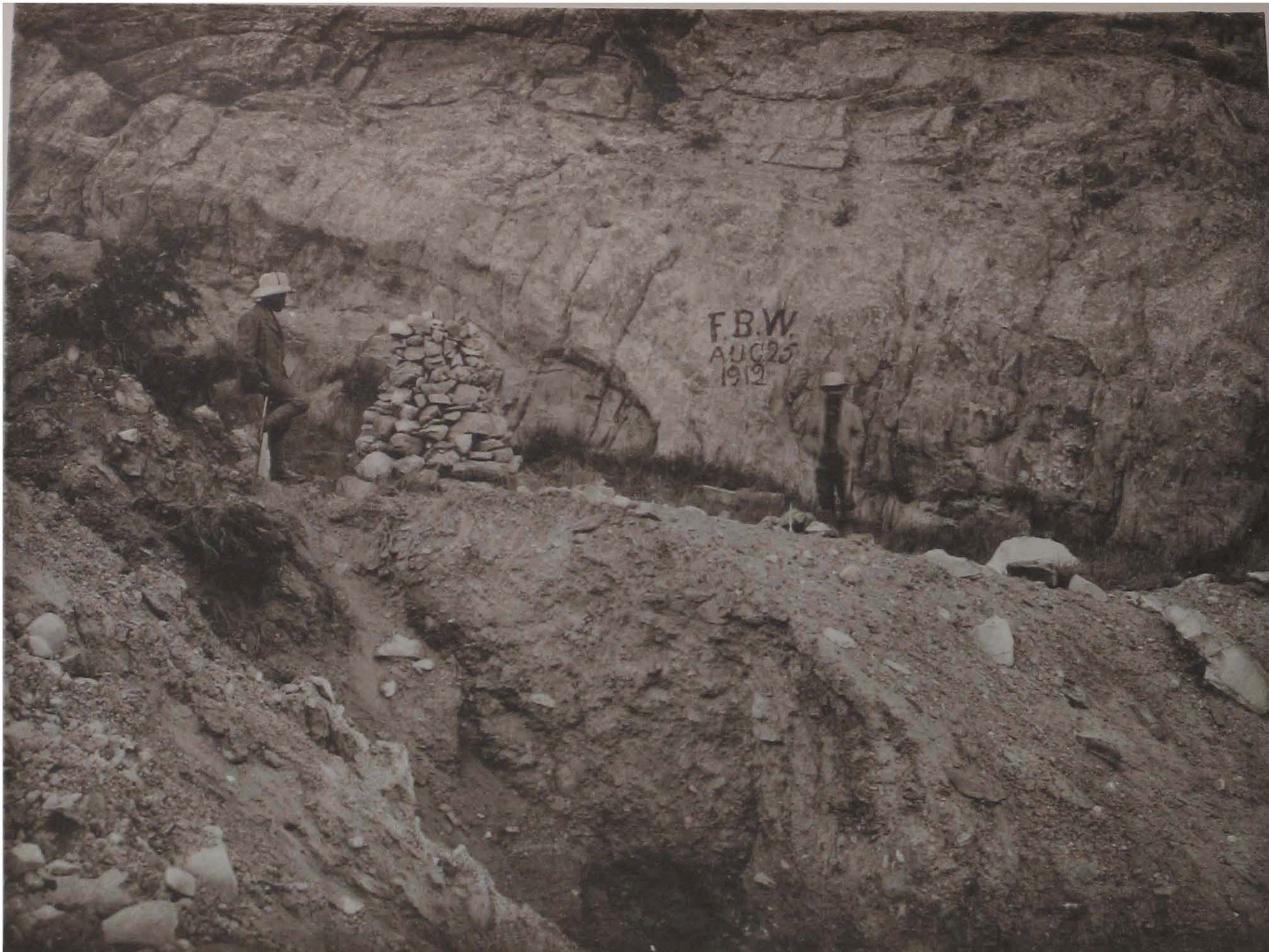
The oscillations were sharp and short, but in that environment, accompanied by the near thunder from peaks and glacier, which continued for forty minutes, the effect on the mind was decidedly gruesome. I once remarked, when experiencing an earthquake in a Srinagar hotel, that if I were only in a tent I should not much mind, but since this experience I have decided that earth-tremors are about as endurable in houses as under canvas, particularly if one is poised on a shifting foundation of loose rocks and ice. Curiously, Dr. Workman scarcely felt the earthquake in his tent a little distance from mine, his attention being called to it chiefly by the surrounding uproar.[1]

[1] Vide p. 270.

This earthquake was rather widespread, being severely felt in the Saltoro valley, from which pitiful tales emanated of the falling of houses and great destruction of cattle and property. Later on at Kapalu my perfidious headman, Mullah Halim, fell at my feet relating a harrowing tale of having lost a cow, goat, and the pair of nailed boots I had given him. The Kondus valley, when we reached it, was murky with dust for two days, and we noticed a curious phenomenon at the first camp below the glacier-tongue. On the opposite side of the valley a high rock-peak, with a pedestal of earth-slopes, was, on our arrival in the afternoon, throwing off rocks and large boulders in continual streams, making such a clatter that one could not hear what was said fifteen feet away. Clouds of dust were blown up from the earth-slopes, over which the rock-débris fell, and the mountain continued to smoke and roar until ten o'clock p.m.

The tongue of the Kaberi glacier had, apparently, advanced around the mountain-wall about thirty metres since 1911, when the guide Savoye first saw it. He had then no trouble in getting on to it, while this year we experienced much difficulty in getting off, and were in danger from constant volleys of falling stones. At the camp of the smoking mountain our faithful crow-mascots took flight, having escorted us safely through the snows to grass, and we saw them no more. Karmading, the last and highest village of the Kondus valley, was next reached, where, at the beginning of travelled paths, interest in the movements of the expedition practically ceased.

I may add, that from Kapalu we crossed the mountains to Karmang, in the Indus valley, by the Ganse La. This is a short cut between the above villages well known to and constantly used by the natives, so that we found no



Cairn and inscription on east mountain-wall at point opposite entrance of west arm of Kaberi glacier.

To face page 216.

K 7, $\frac{\text{Pk.26}}{\text{52 A}}$, 22,750 feet, from Kaberi nala.

To face page 216.

trouble in procuring coolies for the journey. The crossing can be made by unloaded natives in two days, but, owing to the exceeding steepness of the route, laden coolies take three.

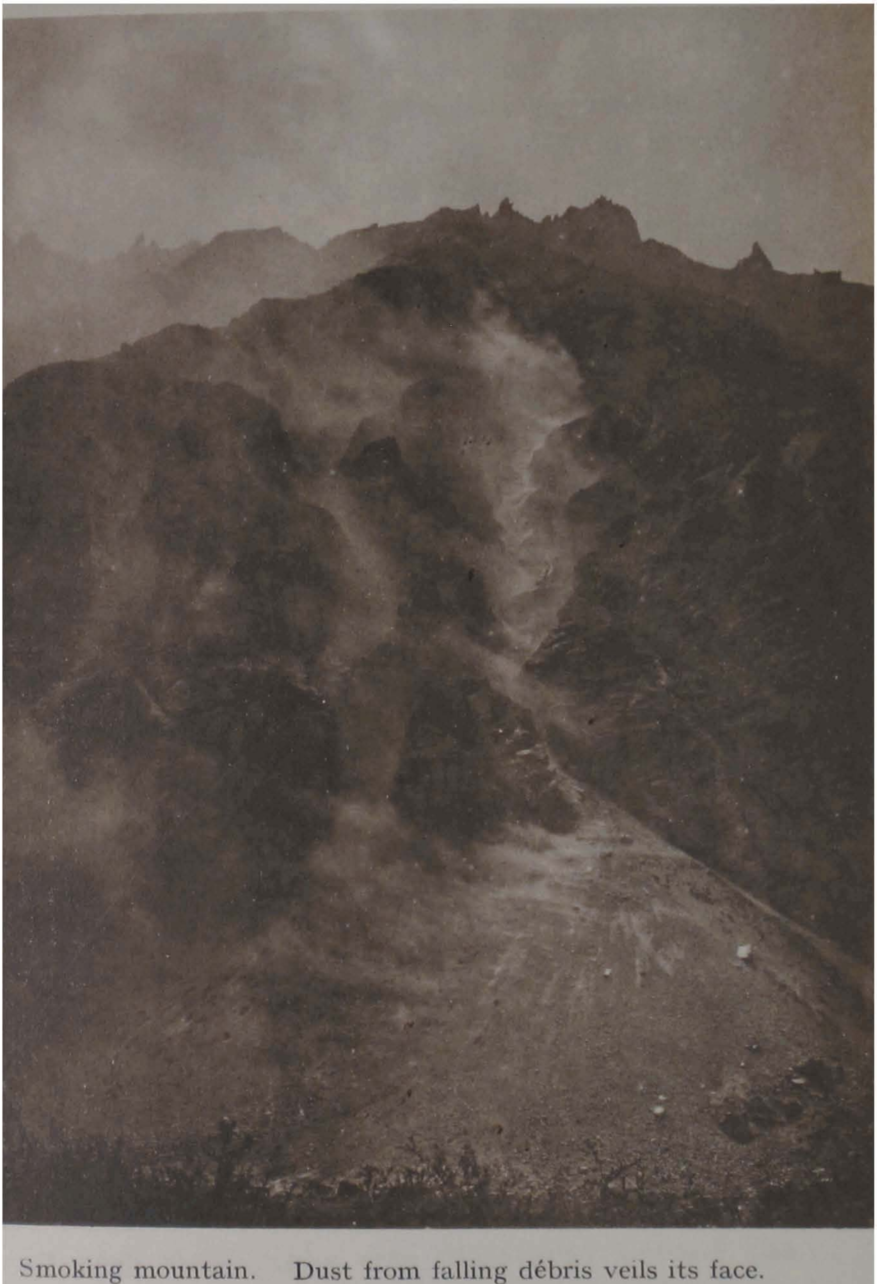
For a long distance above Kapalu the ascent is very sharp, then follow long, gentle ravines, beyond which two sharp ridges must be climbed before the main one, known as the Ganse La, is reached. The summit does not appear to have been measured by the Indian Survey, as no height for it is placed on the Survey sheet. Our reduced aneroid-readings give it a height of 17,200 feet. Our hypsometric readings could not be used, as the readings at Skardo had ceased to be taken on the previous day. While no snow was met with on it except near its summit, it being early in September, owing to the rock-strewn character of the route, which is not well kept up, and to the frequent absence of any trail, it is one of the most arduous passes of its kind we have seen in Baltistan. It has been crossed by several Europeans, but the old Raja of Kharmang declared no woman had come by that way before myself. At Kharmang we were received by the three Rajas who live there, and escorted by them two miles along the Indus bank to a point where a small zak was waiting, which took our party across the river to join the further route. Coolies were changed at Kharmang. The new ones carried the loads over the jhula bridge to the Skardo route, which they followed down to meet us.

At the zak-crossing the Wazir left us to return to Kapalu, as he was no longer needed. Though, at times, he had proved rather inefficient in dealing with the more vociferous coolies, on the whole he had done us well, and, certainly, without his help it is doubtful whether the expedition could have been carried out as successfully.

Best of all, he had never fallen ill nor failed to accompany us when his presence was needed. As the Raja's Wazir he could receive no salary, but could consistently accept a reward at the end of his services. This, the year before, had been given him in Government notes, and, although he salaamed and thanked, we noticed a somewhat distressed expression overspread his features as he nervously fingered the papers. We well knew that coolies and lower class natives always wish to be paid in silver, having a horror of paper money which they do not understand, but we supposed the higher class Wazir would be satisfied with notes, which he could easily exchange for silver at Skardo. But it appeared he was not at first, being a very simple man, for he told the agent that the sahibs had given him only pieces of paper instead of a present.

This year I made a point of carrying some gold with which to reward him, and great indeed was his joy when he noticed the clink of the sovereigns which I placed in his hand. He trembled with delight, and his habitual smile extended from ear to ear. On finishing his profuse salaams, still broadly smiling he sought out the cook and bearer, to whom he showed the yellow pieces, fondling them the while with his fingers. As we moved away on the zak, he was last seen standing on the river-bank bowing and holding fast with both hands his treasure of gold, his face illumined with the eternal smile.

As regards climatology, I would add that in 1911, between August 20th and September 16th, and in the present season during July and August, we found, as a whole, better weather-conditions on the Rose glacier than we ever noted in the Western Karakoram. The south-west wind brought mist and storms, and there



Smoking mountain. Dust from falling débris veils its face.

[Note size of talus at base largely composed of detritus shaken down from mountain by earthquake.]

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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 Lungma, or Hispar glaciers. It has been stated by one or two explorers that June is the best month for high climbing in the Karakoram, but in 1912 July was a better month for high work than June. In both 1911 and 1912 the south-west monsoon was light in India, and the whole of Kashmir suffered much from drought. In the Kapalu district almost no rain fell in July and August of either year. These facts, doubtless, counted 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 sufficient basis for claiming better or worse climatic conditions in general for the Eastern over the Western Karakoram.

To sum up the most important geographical results of this expedition. About 850 square miles of mountain-territory were mapped with plane table. Forty or more peaks were measured in different ways, many by triangulation, by Mr. Grant Peterkin. The Rose glacier was first explored from end to end, and surveyed to its tongue in the Nubra valley. The north and east Siachen sources, altitudes 20,860 and 19,210 feet, were discovered and first visited, and the relation of the Eastern Karakoram and Indus watershed to that of Chinese Turkestan at these points established. From these were seen and photographed a large part of the Gusherbrum glacier, running north-east from the Gusherbrum peaks, and a section of, probably, the Urdok glacier in Chinese Turkestan. All of the chief Siachen affluents were visited and mapped. A new group of high snow-peaks was discovered beyond the east Rose wall on the Turkestan side. The King

George V group was first seen and identified as such, and its three highest peaks triangulated. Two first ascents of peaks of 21,000 feet were made. The Silver Throne plateau lying between 20,500 and 21,000 feet was discovered and visited, and a first ascent of the Silver Throne col, 19,610 feet, on the ridge forming the water-parting between the West Source glacier and Kondus basins, made. A little farther north on the same ridge a new pass, 18,700 feet, was discovered and crossed, and a first descent made from it to the head of the twenty-mile-long Kaberi glacier, which was followed down its whole length to its tongue. Two ends we had in view had to be left unaccomplished, which, had the means at our disposal been more reliable and more under control, could have been attained; but our efforts were crowned with a degree of success which justified the expenditure of money, time, and endeavour.

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 was ours came, not through the assistance of Governments, or high or low officials, but through persistent endeavour and the aid of the weather-god, who on special occasions favoured us, and to him are due my deep salaams.

NOTE 1

On 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 our expeditions 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, Colonel Godwin-Austen says that "after looking at the map"—what map is not stated—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 regarding them 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 seventeen 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 twenty-three miles to its tongue, the unfordability from May to September 15th of the Nubra river, and the sparsely inhabited and supplyless area encountered in the Nubra valley before Panamik 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, crossed 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 towards 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 2.

When in London on different occasions I have been asked by staunch and indignant women-friends to deny publicly at lectures an assertion, which they had frequently heard made in regard to me by men and also by women, but much oftener by men. This assertion, made with more emphasis than knowledge, was to the effect that I did not really climb the peaks and passes I lectured upon and wrote about, but that I was invariably "hauled to the summits by coolies."

I regard it as beneath my notice to deny such a trivial accusation, made by people who know really nothing about me, who know less than a Swiss pack-pony about mountain-climbing, and whose motives for making such statements appear to be inspired by but one feeling, that of jealousy. I must leave the refutation of such accusation to our books and to the illustrations shown in them and at our lectures. If the persons who vouchsafed this remark will take the trouble to study the text of these books, they will see what a colossal strain was often put upon us to persuade coolies themselves to go even to high camps.

Of course, a person who has reached a certain pre-eminence in any line is bound to fall foul of ill-timed and unjust criticism which it is best to ignore. Unfortunately, at the present time a woman fares worse than a man in that line.

Had I confined my work to climbing in the Alps, Tyrol, or Norway, or even to fifth-class ascents in India, I should doubtless have been vociferously praised by the "man in the street" and patted on the back for my womanly climbs by the average male mountaineer, but as I went beyond these ladylike accomplishments and became an Himalayist, I was bound to run the gauntlet of what, there is no denying, is an often present sentiment in these advanced times—sex-antagonism. I recall a delightful commendation in a letter from a man living in India, who prided himself on his ascent of a 20,500 foot peak, which, by the way, I had first ascended. He was nothing if not patronizing, and reached his acme by designating me as one of the most deserving lady travellers of the day.

Among certain explorers and mountaineers one meets with a singular want of *esprit de corps*, which is to be deplored, as it interferes with useful and amicable comparison of notes. On more than one occasion at Geographical and Alpine Congresses women *confrères* have seen fit to greet me not at all, or with sarcastic comment, while men who might be supposed to be interested in Himalayan subjects have, unavoidably, absented themselves from my lectures.

On the other hand, I hold in pleasant memory many appreciative remarks by persons in my audience, and have letters of hearty appreciation from noted explorers of different nationalities which are a delight to me to recall. When giving a series of popular lectures at the Vienna Urania Theatre a few years since, a small porcelain boat, filled with simple flowers, was handed in to me with a few lines from a poor woman, saying these were all she was able to offer as a token of her delight at what I had been describing. Such a tribute compensated many times over for petty slights shown by others of my own profession.

As a *doyenne* explorer and lecturer, I may be pardoned the advice to younger women-explorers when attending lectures or meeting their *confrères*, men or women—say something pleasant and relevant to their work; it need not be much, but the effect on the recipient's mind will be golden! I remember with much more pleasure a rather infantile remark recently made by a woman about "my pretty pictures" than that of a severe-looking man who, one stormy night, shook my hand after I had been speaking, adding only, "Is the weather not beastly?" Still, I dare say he meant well.

It is scarcely needful to say that the real explorers stand quite without the pale of the before-mentioned "lesser lights" or second-class explorers, or still more properly speaking, travellers. For whatever they may think, men of such standing in Asiatic exploration as Conway, Stein, Younghusband, Sven Hedin, and the distinguished President of the Royal Geographical Society, Freshfield, all of whom have titles too numerous to mention here, would, I fancy, scorn to make unfriendly public comment upon the one woman who has entered the arena of Himalayan research with them.

Lest book-critics, sometimes prone to "take one up," should dispute the expression "one woman," I would add that several women have ascended Himalayan passes of 18,000 and 19,000 feet, and particularly missionaries in Tibet have faced long, hard journeys in pursuit of their calling, while two or more women have, I think, successfully crossed the Pamirs, but no other has carried out the exploration and climbing of great glaciers and high peaks in Asia.

That they will now begin to compete with men in this field, as in all others, is greatly to be hoped, and to those who may contemplate so doing I would here express my sincere good wishes for the success of their undertakings. They will have to toil and overcome, but by persistent effort they will achieve, not all they desire, but much knowledge, and, on the trail to still untrodden heights and lands, enjoy to the full the most glorious and freest of lives, in comparison with which all ordinary so-called civilized existence is of the deadliest commonplace. I have had what no man or woman can take from me, what is above all price, the satisfaction of my work, which I have made as good as circumstances would admit of, and which, I trust, will receive a favourable verdict from those who come after me.

PART III

PHYSIOGRAPHICAL FEATURES OF THE BILAPHOND, SIACHEN, AND KABERI BASINS AND GLACIERS

BY

WILLIAM HUNTER WORKMAN

CHAPTER I

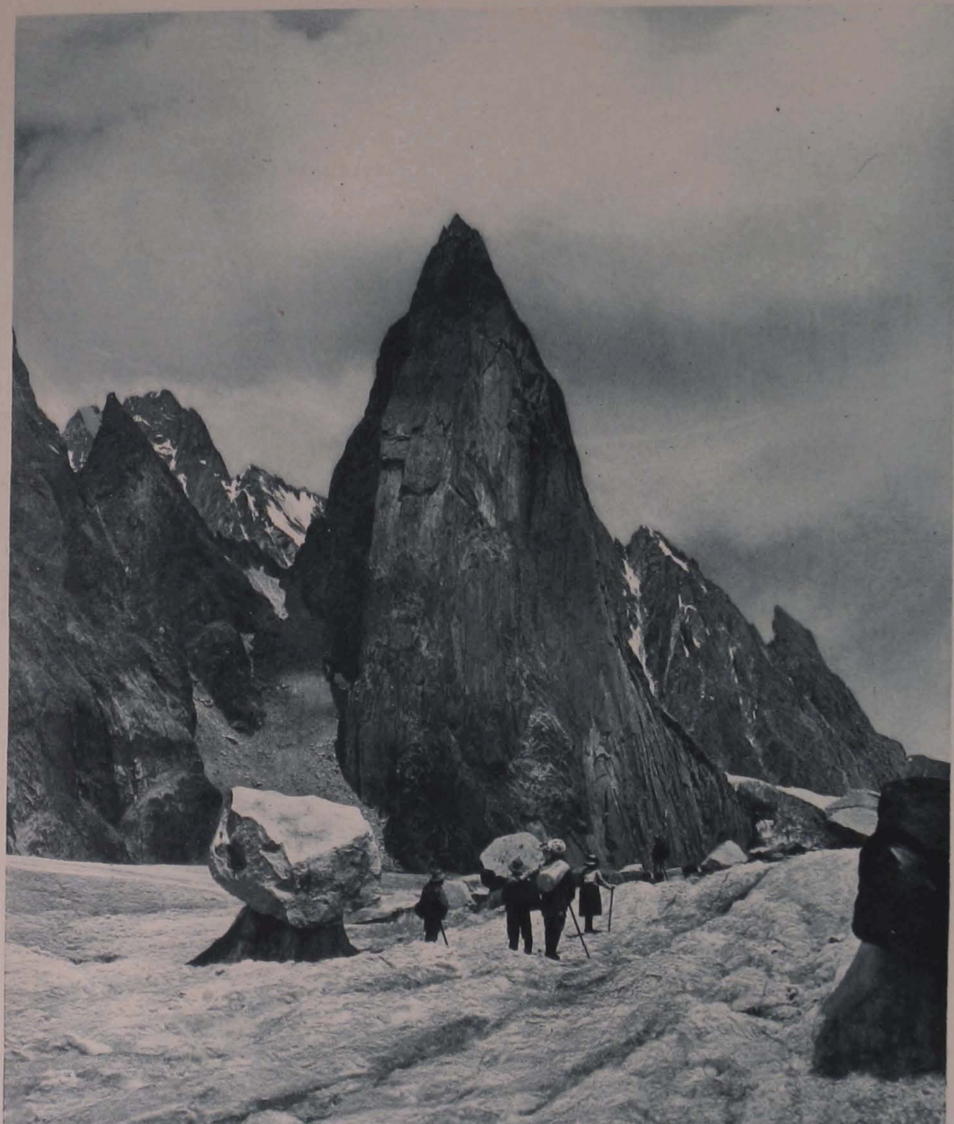
CHARACTER OF GHYARI NALA AND ENCLOSING MOUNTAINS—SURFACE-FORMATIONS OF BILAPHOND GLACIER—PRESSURE-EFFECTS—ALI BRANSA.

THE Ghyari nala, leading from the Saltoro valley opposite Goma, approximately N.-30° E. to the Bilaphond La, belongs in its physiographical characteristics to the region described in Part I of this volume. It is walled in on both sides by bold mountains, chiefly of granite, gneiss, and crystalline schist, with broad, smooth, steeply rising sides and strata approaching or reaching the vertical, capped by sharp needle-summits. The mountains of the west side are, perhaps, the most distinctive and accentuated in form, several rising from base to summit as symmetrical pyramids. Those of the eastern side are more irregular in form.

For five or six miles above its mouth the nala up to a willow and cedar-covered maidan in front of the Bilaphond glacier-tongue, called Ghyari, is considerably clothed with vegetation, and opposite the entering tongue of the lowest side-glacier quite a large area is under cultivation. The surface-débris of this portion is almost wholly of biotite-granite, though a considerable amount of white crystalline limestone is mingled with it.

In the middle third of the distance to Ghyari the tongues of two side-glaciers enter the nala, the lower one barely reaching the side, but the upper one penetrating to its centre and turning downward. The latter, although its surface was not in either summer bearing much débris, had at some time brought down a vast amount, and had built a large, terminal moraine-field several hundred feet high composed of enormous, angular granite-blocks piled one on another in wild confusion, which appeared as if blasted out of a solid granite-mass by a powerful explosive. This moraine, in conjunction with great tali at the base of the mountain-wall on the east, forms a high step in the nala-bed. The river has cut a channel between the moraine and the edge of the talus.

From Ghyari to the Bilaphond La the nala is occupied by the Bilaphond glacier, which spans it from wall to wall. Between Ghyari and Naram the granite-mountains on the west side rise very sharply from the glacier with broad flanks, the angles and projections of which have been rounded off by abrasion from avalanches and sliding débris, and their surfaces smoothed by weathering so as to present an even, granular appearance. On two of our three passages up and down this glacier we passed along the base of this wall, over the moraines adjoining it, and through the narrow intervals scarcely wide enough for one to pass between them and it. I examined it with care on both occasions, to see if any indication could be found that the glacier-level had formerly been higher than at present. The conformation and condition of the surface of the wall afforded an ideal tablet for the recording by the glacier of evidence of previous movement at higher level. The ice was not found anywhere to quite touch it, being separated from it by narrow lateral moraines, which in a few places were crowded hard against it. The wall-surface descended everywhere,



Granite monolith on west side of Bilaphond glacier.
Glacier tables.

smooth and evenly weathered, to the level of these moraines, being nowhere undercut or scratched above its present line of contact with them, so that it may safely be inferred that the volume of the glacier has not been appreciably greater than at present for a long period.

The character of the glacier-surface undergoes a sudden change opposite Naram. For several miles above this place the different glacier-currents or streams coming from the Bilaphond La and from affluents below the glacier-head concentrate themselves into three principal ones, the central and widest being composed of clear ice carrying comparatively little débris, in reality consisting of two white streams marked off from each other on the surface by a shallow furrow, while the two outer ones are massive moraine-streams flanking the central one on either side and rising considerably above it. I measured the height of the ridge of the eastern moraine-stream two miles above Naram, at 100 feet above the central white ice. The central white stream diminishes in width and volume as it descends, whilst the moraine-streams increase, converging on each other and compressing the white stream between them, till it becomes quite narrow above Naram.

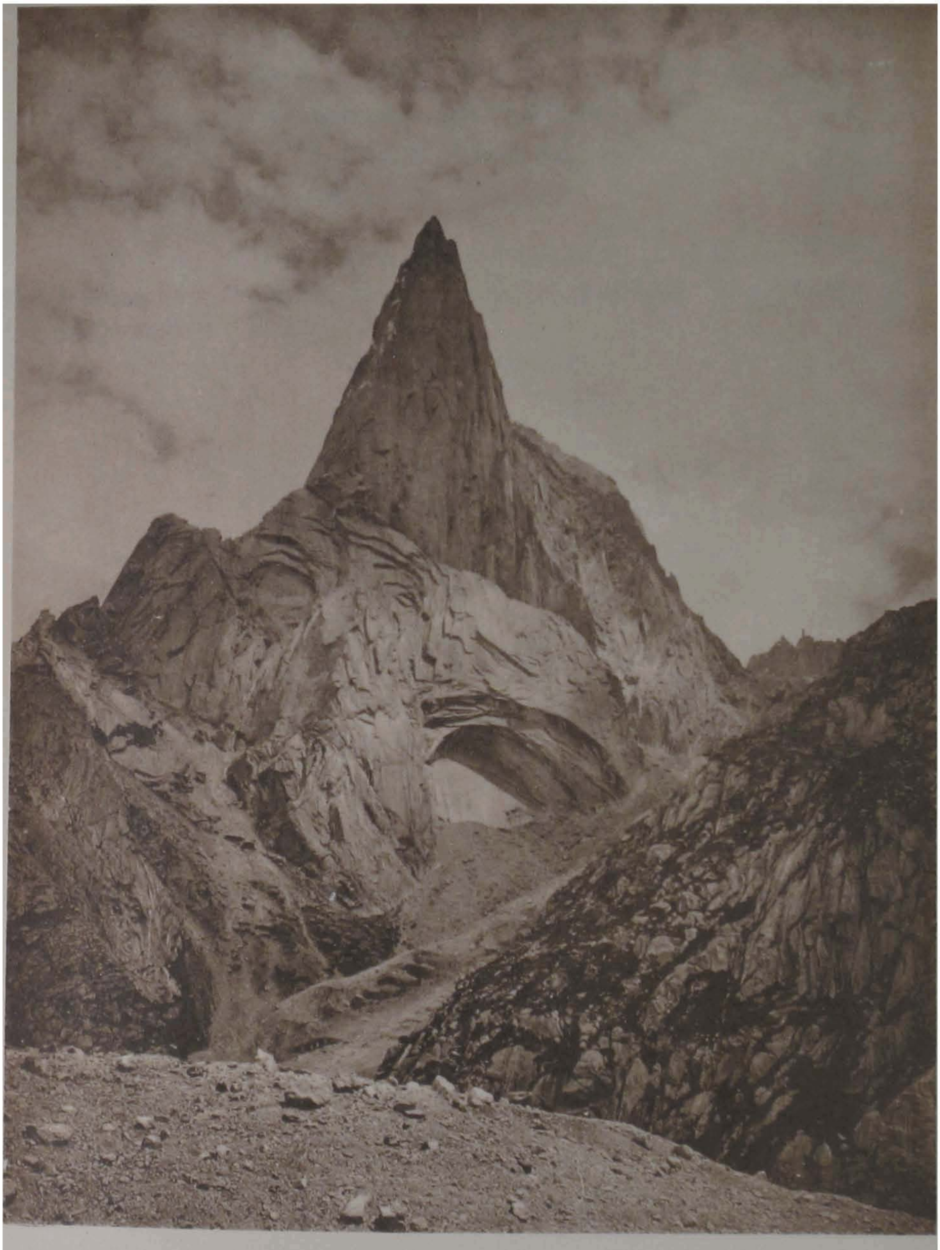
Opposite Naram a large and powerful affluent coming from the vicinity of the high Peak 8 group joins the Bilaphond on the east, and directly opposite just above Naram another large glacier comes down to it from heights on the west. The pressure of these two affluents forming the wings of the Bilaphond butterfly, but more especially of the eastern one, produces a profound impression on the Bilaphond, and gives rise to interesting phenomena.

The eastern affluent impinges on the Bilaphond at a right angle, crowds it over against its west bank, and compresses it so as to greatly diminish its width. Into the space thus cleared it forces itself and turns downward, henceforth forming a material portion of the Bilaphond trunk. Its pressure is so great that it overbalances that of the western butterfly-wing, which, although large and descending from a considerable height, is completely arrested in its downward course at the side of the crowded-over Bilaphond, and is unable to gain any lodgment in the bed of the latter. It can therefore, as a whole, only advance as fast as its front melts away against the Bilaphond side.

The attenuated, central, white stream of the upper Bilaphond is completely annihilated, and the two moraine-streams—previously consisting of unbroken, horizontal ridges—are forced together, more or less intermingled, and crowded up into large débris-covered hillocks, which roughen the glacier surface from here to its end, and render movements over it arduous, while above Naram the central white streams furnish an easy pathway to the pass. The rock-débris on the glacier is of the same character as that in the nala below. Considerable white, crystalline limestone appears amongst it, the origin of which could not be traced.

The *pied à terre* called Ali Bransa, the only spot near the head of the glacier free from ice and in any respect suitable for a camp, is an ancient moraine-fragment lying beneath a steep rock-wall, from which it is separated by a furrow sufficiently wide and deep to arrest rocks falling from above, and thus render it safe. The furrow contains many large boulders. Ali Bransa is nearly overwhelmed by a higher and more recent moraine pressed hard against it by the glacier.

The glacier above and below Ali Bransa presents many



Granite spire on east wall of Kaberi glacier.

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interesting features of ice-formation, in vertical, longitudinal stratification, séracs and sérac-pinnacles (ice-penitente), ice-pinnacles associated with water-pockets (thin débris or pocket-penitente), pinnacles formed from the ice-columns of former glacier-tables, etc., which cannot be described at length here, but which have been treated in detail elsewhere.[1]

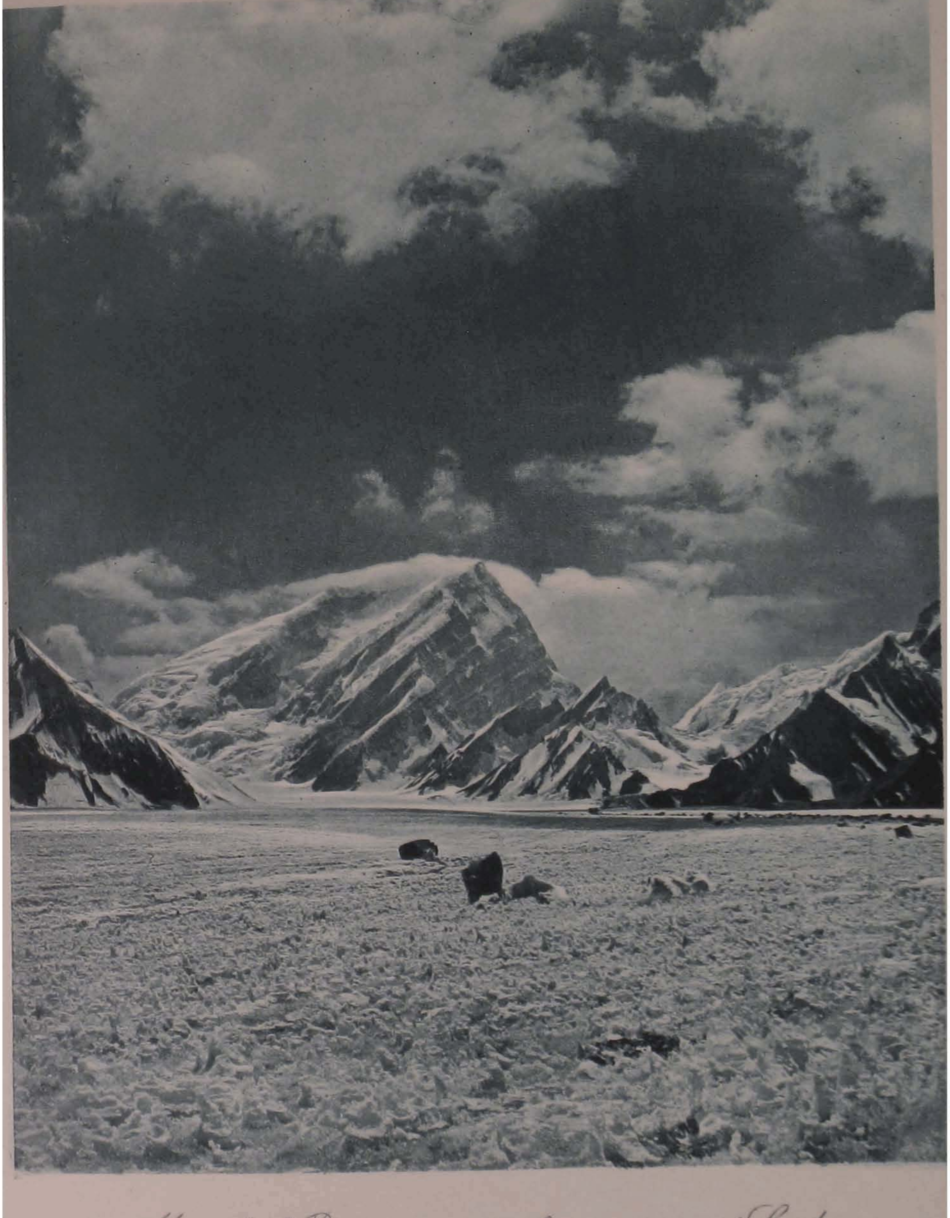
[1] Vide "Nieve Penitente and Allied Formations in Himalaya," Dr. W. Hunter Workman, *Zeitschrift für Gletscherkunde*, Band VIII, 1914, pp. 289–330.

CHAPTER II

KARAKORAM TYPE OF GLACIER—ROCKS OF SIACHEN BASIN—EXTENT AND STRUCTURE OF ENCLOSING WALLS—RELATION OF GUSHERBRUMS TO TERAM KANGRI—STRUCTURE OF MOUNTAINS BETWEEN HEADS OF BALTORO AND SIACHEN GLACIERS.

THE term "glacier" is not sufficiently comprehensive to designate accurately the immense, and, in arrangement, complicated bodies of snow, névé, and ice collected in the great rock-basin extending north-west from the source of the Nubra river to Peak 23 (Hidden peak), forty-nine miles, with an east and west average width for a considerable distance of twenty miles, and having an area, approximately, of 900 square miles.

The basin is crossed in various directions by many glaciers of the first order, and innumerable lesser ones, fed by snow precipitated upon the mountains and slopes of its watershed, all converging on a great central trunk averaging 2·5 miles in width, that stretches the length of the basin in a north-west by south-east direction, and discharges from its tongue water derived from the snow collected in all parts of this extensive region to give birth to the Nubra river. This central trunk, with its multitude of affluents resembling a river-system, is more fittingly styled the Siachen glacier-system. The four other great Karakoram glaciers, as well as many smaller but by no means insignificant ones, are fashioned



Massif of Pks. 35-36 seen from centre of Siachen.

on the same plan. This type is peculiar to the Karakoram, being conditioned on the configuration of its valleys and the arrangement of its peaks. For this reason, as well as on account of certain structural features referable to existing conditions, all these glaciers merit the designation of *glacier-systems or glaciers of the Karakoram type.*

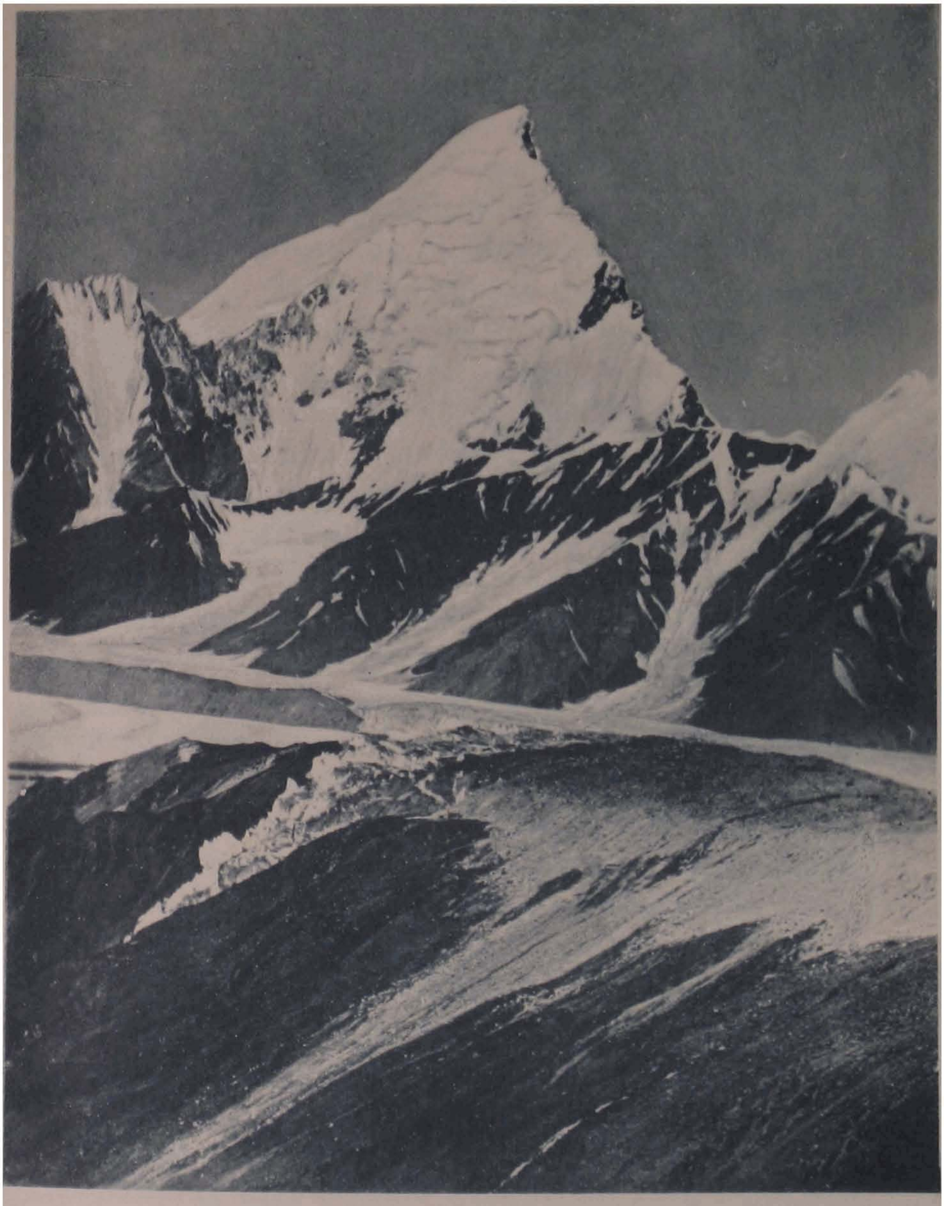
The enclosing barriers of the Siachen consist of granite, gneiss, crystalline schists, slates and shales, sandstones, amorphous and crystalline limestones, and conglomerates, with some igneous intrusions. These rocks alternate with one another at short intervals, and are, in places, intimately intermingled and interfolded. They are extensively foliated, friable, and easily disintegrated by frost and weathering. Even the granites, largely of the biotite-variety, are divided into small sections by joints crossing one another, and intersected by bands of quartz, feldspar, schists, and shales, in consequence of which they split up easily into fragments. The physical condition of the gneiss and crystalline schists would suggest to the ordinary observer, that they were formed, largely, by metamorphosis of sedimentary deposits. But whether this be the fact, or whether it be that they originated as primary granites and were afterwards metamorphosed and folded, they are brittle and present in the one case an immature appearance as if incompletely developed, or in the other a decadent one, as if the original structure had been overwrought and disorganized by strain and violence in the upheaval of the great ranges of which they form constituents.

This fragile condition of the rocks accounts for the irregular, jagged outlines of the mountains of this region, especially of the granite-peaks, many of which are greatly serrated, and for the vast detritus-deposits that load the glaciers and play an important rôle in the development of their structural features. Owing to the amount of snow covering the mountains and the staining and weathering of the visible rock-surfaces, it is often difficult, even from a short distance, to distinguish the character of the rocks composing a mountain, so that the observer, particularly if he is not a trained geologist, may well be in doubt as to what formation lies before him. The shales and slates, the latter largely of very dark colour, are the most easily distinguished.

The north-east wall of the Siachen trunk resembles in structure and extent that which, with an unbroken length of thirty-nine miles, forms the upper portions of the southern Hispar and west Biafo barriers.[1] Starting at the north-east head, it extends west three miles, then turns south-east and continues on fourteen miles to the Tarim Shehr affluent. Here it turns east and forms the north wall of the Tarim Shehr for seventeen miles to its sources, making a continuous, unbroken wall thirty-three miles long. The upper twelve miles of this wall is, and the remainder appears to be, a part of the main watershed between Turkestan and the Indus, and as such it probably continues on from the head of Tarim Shehr tributary to the Karakoram pass.

A second portion continuing around as the south wall of the Tarim Shehr glacier and extending west to the Tarim Shehr promontory, there turns south-east and forms the remaining portion of the north-east wall of the trunk to its end, having a length of thirty-four miles. Stated in another way, the north-east Siachen wall stretches from the north head of the trunk south-east

[1] Vide *Geographical Journal*, February 1910, p. 117; also *The Call of the Snowy Hispar*, W. Hunter and F. Bullock Workman, p. 216.



The Hawk, 22,160 feet. Telephotograph from Tarim Shehr, thirteen miles distant.

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in a nearly straight line for some forty-five miles, being pierced only by one small and two large affluents.

The south-west boundary of the upper half of the trunk can scarcely be called a wall. It consists of numerous mountains of irregular outlines, scattered about in an irregular manner, enclosing vast reservoirs of snow and ice that communicate with the main glacier by large secondary glaciers, the whole forming an ice-bound labyrinth that defies description. Still, the mountains and affluents stand in such relation to the main glacier that lines drawn from one headland to another suffice to mark the limits of its bed with sufficient accuracy. From the Peak 36 tributary to the tongue a fairly continuous wall exists, which is pierced by several large affluents.

The structure of these walls may be stated in general terms as follows: The mountains enclosing the Indira col and the Turkestan col, at the northern extremity, are composed of slates and shales, light and dark in colour, with, possibly, some limestones, thence down the north-east wall to within about four miles of the Tarim Shehr opening mostly of light coloured limestones and shales with some conglomerates and, at least, one igneous intrusion forming a promontory projecting into the edge of the glacier about a quarter of a mile south-east of Spur camp. The extent of this intrusion could not be determined. A specimen here collected belongs to the minette group. Limestones are strongly in evidence in the moraines fed by this section. The rocks are soft and the peaks and ridges broken and jagged in outline. From a point shortly north-west of Teram Kangri, the wall and its peaks, including that summit, quite to their tops, forming the north barrier of Tarim Shehr glacier to its end, appear to be almost wholly made up of black slate, with here and there foot-hills of lighter coloured shale or limestone.

The same is true of the visible rocks on the south side of Tarim Shehr glacier, though some of the ice-covered peaks at its upper end must contain granite and gneiss, as much débris of this character appears in the moraines of that side and, indeed, forms the chief constituent of the lateral moraines surrounding the Tarim Shehr promontory. The greater part of the promontory is composed of brown shale or slate, but at its extremity granite crops out over a considerable area. Here a large, smooth undulating granite-surface had been used by ibex as a resting place. Thence, beginning with Junction peak, 20,840 feet, rising above the promontory, ascended by us in 1911, down to the great bend, some sixteen miles, the mountains are of dark brown and black slate with occasional sections of lighter colour broken into jagged points and cleft by deep, ragged ravines. The only granite noticed *in situ* in the whole length of this wall was at Tarim Shehr promontory.

From our camps on moraines opposite this wall, the view towards it was most forbidding. The foreground was occupied by the huge, black hillock-moraine coming from the Tarim Shehr affluent, the towering hillocks of which, resembling vast heaps of coal piled up at random in a Cyclopean coal-yard, shut out from sight the white ice of the glacier beyond, while the background was formed by the succession of black peaks hard in outline and destitute of grace, rendered more desolate by contrast with the snow capping their tops, the whole constituting as sombre and depressing a landscape as could well be imagined, far eclipsing the most fantastic conceptions of Boecklin or Doré, and casting an uncanny shadow over the soul.

On the south-west side of the trunk a similar variety of formation occurs, but granite is more and limestone

Broad north-east face of The Hawk, 22,160 feet, seen from junction of West Source with Rose glacier.

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less in evidence. The last three peaks of the King George V group ending the massive mountain-tongue, interposed between the heads of the Baltoro and Siachen glaciers, which form seven miles of the upper south-west Siachen wall, appear to be mainly composed of granite and gneiss, though on an eastern spur and near its south-east extremity the granite passes over suddenly without discontinuity of outline into black slate.

South of this tongue at the entrance of the upper, western tributary into the Siachen, the Hawk, a graceful pointed spire of granite as seen from the south, and a long, curving, sharp ridge as seen from the north, soars from a circle of black slate peaks and ridges to an altitude of 22,160 feet. From this point downward for twenty-two miles to the great bend, the south-west wall is, largely, composed of sedimentary rocks, prominent among which are black slates. Just above the bend two elevations, the ends of spurs descending from Peak 8, have the appearance of granite. The ridge adjoining the north-west angle of the Lolophond-Rose junction, on which Camp 5 was situated, a considerable portion of which we visited, is composed of brown, much-splintered slate. The greater part of the south-west wall, as we observed it, does not, therefore, conform to the granite-structure assigned to it by Dr. Longstaff.

Ten miles west of the trunk the impressive granite-massif of the twin Peaks 35 and 36, 25,280 and 25,400 feet, overtopping all mountains of the region south of Peak 23 and forming a salient landmark, gives off the large Peak 36 affluent to the Siachen on the east and the Dong Dong glacier on the west. Granite and gneissoid rocks crop out, doubtless, at various other points of the Siachen basin that were not within range of observation. The granite series of rocks becomes more prominent and abundant as one passes westward from the Siachen to the Bilaphond, Sher-pi-gang, and Kondus basins. No conglomerates *in situ* were noticed.

Thus it will be seen that, while slates and shales constitute, perhaps, the greater part of the rocks of this region, they have mingled with them a very considerable proportion of limestone and conglomerates appearing in the moraines, and also of granite, gneiss, and crystalline schists. No single formation continues uninterrupted for any great distance. One mountain may be of granite and the next of shale or limestone, or the same mountain may consist of two or more rock-varieties more or less intimately mingled. This composite arrangement, as I have had opportunity to observe in an almost continuous line from the Siachen to Hunza, exists throughout the Karakoram. The opposing walls of its valleys, large and small, both those running east and west and those north and south, are often composed of different varieties of rocks, perhaps granite on one side and shale or other sedimentary rock on the other, or a given wall may vary at different points in the same manner. The various rock-formations, not only of the Siachen region but also everywhere that I have been in the Karakoram, are so distributed and intermingled that it does not appear to me possible to draw any reliable inference from them as to the existence of parallel ranges of dissimilar structure.

In the June 1910 *Geographical Journal*, p. 646, Dr. Longstaff states that the Duke of the Abruzzi's expedition discovered that "this [Broad peak] and the four Gusherbrums are composed of marbles and conglomerates." He adds: "The massif of Teram Kangri is a continuation of this [Gusherbrum] range; its base appears to consist of schists and slates, and its peaks of marbles and

Twin Peaks 35 at right, 25,280 feet, and 36 at left, 25,400 feet. Telephotograph from Tarim Shehr.

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calcites." After careful study of the published accounts of the expedition referred to, I have been unable to find any authorization for the statement that Broad peak and "the four Gusherbrums are composed of marbles and conglomerates." In the December 1910 *Alpine Journal*, p. 344, Dr. de Filippi states that moraines seen on the Baltoro "consist of beautiful polychrome marbles and conglomerates, originating from Hidden peak and the Golden Throne," but this is far from "discovering" that Hidden peak, as a mass, and still less the other three Gusherbrums, are composed of such rocks.

As already stated, the last three high mountains of the King George V group, ending the spur and interposed in direct line between the Gusherbrums and Teram Kangri, appear to consist mainly of granite and gneissoid rocks. We passed directly beneath and camped almost in the shadow of the high, vertical precipices of their eastern and southern flanks, of which we had a near view. Also the upper portions of the Gusherbrum peaks, as seen from the high Silver Throne plateau to the south-east, appeared to have the shape and general aspect of granite-peaks, though we were not sufficiently near them to distinguish their structure. However this may be, we saw nothing in their appearance to suggest marbles.

Regarding the massif of Teram Kangri, having passed three weeks, altogether, at various points near and in front of it during late summer, both in 1911 and 1912, when the snow was largely melted away, we had considerable opportunity to study it. As we saw it, it appeared to consist of black slate quite to its top, and no evidence of the existence on its peaks or on those of any of the adjoining mountains of "marbles and calcites" could be detected with a powerful field-glass. Dr. A. Neve, who accompanied Dr. Longstaff on his dash to this point of the Siachen, appears to hold the same opinion. In *Thirty Years in Kashmir*, on p. 294, he writes: "It looked to me as if the highest part of Teram Kangri might be slate." Further, no calcite or marble was found on moraines the origin of which could be traced to Teram Kangri, which does, however, throw off an immense quantity of black débris upon the glacier. Therefore the argument based on similarity of structure in support of the view that the massif of Teram Kangri is a continuation of the Gusherbrum "range," so far as can be judged from our observation, falls to the ground.

Discarding hypothetical suggestions of complicated possibilities of contemporaneous uplift and denudation in distant ages, which would apply with equal force to other neighbouring elevations, and confining the discussion to geographical features as they now exist, the topographical objection to this view is quite as strong, if trend and continuity of elevation are criteria in determining whether two mountain-sections are parts of the same range. The Gusherbrum "range," if the comparatively short south-east spur from which Broad peak, the Gusherbrums, and the three last peaks rise can be called a range, ends, in the direction of Teram Kangri, abruptly in the icefields of the upper Siachen, and has no connection above the ice with the north-east Siachen wall, of which Teram Kangri forms a point, being separated from it at every part by the whole width of the glacier.

On the contrary, the north-east wall continues on directly over the Indira col at the north Siachen head into Turkestan, with a precipitous drop of *circa* 6,000 feet at the col, running thence north-east as a line of pointed, ragged, sombre, slaty peaks, which form the south-east wall of the Gusherbrum glacier issuing from the

On Indira col, 20,860 feet, at north head of Rose glacier. Gusherbrum glacier descends from left between col and mountains in background, which, extending north-east from Gusherbrum peaks, form the north-west wall of Gusherbrum glacier.

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Gusherbrum peaks. This wall, taken as a whole, constitutes the eastern barrier of an Oprang-Nubra depression, of which the highest point occurs at the Siachen head on the watershed between the Indus and Turkestan, whence the gradient drops north-east towards the Oprang and south-east to Nubra.

The western barrier of this depression, beyond the Indira col, is formed by another line of serrated mountains extending as a direct prolongation of the three northern Gusherbrums north-eastward, and constituting also the west wall of the Gusherbrum glacier, the head of which occupies the interval between the eastern *contrefort* of Peak 23 and the three northern Gusherbrums.[1]

Following trend and continuity, the so-called Gusherbrum range extends, therefore, not *south-east to Teram Kangri, but north-east into Turkestan as a wall parallel to the prolongation north-eastward of the east Siachen wall* and separated from it by the large Gusherbrum glacier. In the face of such topographical formation how can Teram Kangri, a point over twenty-five miles to the south-east on a wall not directly connected with the Gusherbrums, be considered as a continuation of the Gusherbrum "range"?

The discussion by Dr. de Filippi in *Karakoram and Western Himalaya* of the structure of Broad peak and the Gusherbrums involves the, geologically, interesting and important question touched upon in the preceding pages of the distribution of rocks in this region. On p. 227 he says: "From an examination of the moraines that have their origin in the various mountains, we were able to ascertain that the whole chain of Broad peak and the Gusherbrums, including Hidden peak and the Golden Throne as well, is a sedimentary formation."

[1] *Vide* panorama facing p. 182.

Not having seen Broad peak or the north-western faces of the three northern Gusherbrums, which rise from the spur extending south-east from the north Baltoro wall and end among the upper reservoirs of the Siachen, I would not venture to assert that Dr. de Filippi's inference regarding their structure is not correct, but analysis of the evidence on which it is based does not appear to me to warrant so positive a statement as he makes.

With due deference to the interesting and able treatment by Ing. Novarese of the material supplied by the expedition, although some of the geographical deductions based on it, such as placing the head of the Kondus east of the Gusherbrums, were shown by our later Siachen expedition to disagree with actual conformation, I would ask geological experts, whether a definite conclusion as to the structure of the great, inaccessible peaks far removed from direct inspection, forming the central and highest portions of the mountains mentioned, could be drawn from moraine-material lying at a distance on the Baltoro glacier? Might not the sedimentary débris here found originate largely or wholly in the lower, outer buttresses of the massifs, or in the outlying mountains between them and the Baltoro forming the immediate walls of the latter? Because such débris existed in moraines extending out from these peripheral elevations, does it follow that granite or gneissoid rocks can be excluded as components of the high, central uplifts beyond?

My reasons for asking these questions are the following:—

1. It is a fact which may be observed almost anywhere in the Karakoram, and nowhere more than in this region, that a mountain may be composed of

different varieties of rock, the central portion being, perhaps, of one variety and the peripheral of another or several varieties. This is well illustrated, in the very spur in question, by Queen Mary peak, Mount Hardinge, and the last peak ending it, which consist, apparently, chiefly of granite and gneiss with outlying sections of black slate; by the marble peak on the Baltoro opposite Broad peak, mentioned by Dr. de Filippi as rising from a mass of black rock in the midst of a granite region; and again a short distance south-east on the Siachen by the sharp, grey granite-crest of the Hawk towering above a surrounding mass of black slate-mountains.

2. It is also a fact, which I have noticed in various Karakoram localities, that a large surface-moraine may originate in a rock-shoulder or section intercalated in a formation of wholly different character, so that an opinion based on the débris found in the moraine might assign to a large massif a formation entirely foreign to that of its greater part and thus be wide of the truth. Moraine-débris, as such, demonstrates the existence of given rocks without indicating their location or extent. It can only have a positive value in determining the distribution of those rocks when traced to the sources from which it springs. The sedimentary débris found by Dr. de Filippi on the Baltoro moraines shows that sedimentary rocks exist in the mountains at the head of that glacier, but it does not indicate their exact location or limits, nor does it exclude the presence in these mountains of other rocks. His account does not make it clear whether these moraines do not contain also granitic débris, as would appear probable from Conway's earlier observations. The sources of these moraines seem to have been judged

of, chiefly, by their trend towards the bases of certain mountains, but it is evident that the débris on them was not and could not be traced to an origin in the central, highest peaks far behind. Further, in the above quotation he includes among the peaks, the structure of which he "ascertained" from examination of these moraines, Gusherbrum II and III, which, according to the map published with his book as well as those of Sir Martin Conway and the Indian Survey, have no direct connection with the Baltoro, and from which, therefore, no débris of any description can reach the Baltoro moraines.

3. Dr. de Filippi mentions the grey colour of the higher parts of Broad peak and the Gusherbrums as distinctive of limestone. The colour of the three last granite or gneissoid peaks of this spur is also grey. This colour, in the presence of Himalayan weathering, is, at least, as characteristic of granite as of limestone.

4. Also the broad strata of Broad peak, cited as distinctive of sedimentary rock, are very commonly seen in Himalayan granite, gneiss, and crystalline schists. The face of K2, asserted to be a granite-massif, presents in panorama E of *Karakoram and Western Himalaya* an appearance very like that of a banded formation.

5. Likewise, the forms of the compact pyramids or obtuse cones with smooth outlines of Peak 23 and the other three Gusherbrums, strongly resembling those of granite spires in the Bilaphond, Kaberi, and Saltoro regions, suggest granite quite as much as sedimentary formations, as do also the rounded summits of Broad peak as seen in the Sella panoramas. The summits of Broad peak parallel closely in shape those shown of its next northern neighbour, Staircase peak, stated by Dr. de Filippi to be granite (cf. panoramas C and G). As

granite appears to form the mass of the three south-east peaks of the same spur on the other side, according to Dr. de Filippi's inference Broad peak and the Gusherbrums are a high, sedimentary group flanked on either side by lower granite-mountains, the first exception, I believe, reported to the rule enunciated by the Indian Geological Survey that the upper portions of very high Himalayan peaks are of granite. Can this inference as to structure be accepted on the evidence given?

From these considerations, without expressing a positive opinion, I would suggest as an alternative proposition for investigation by future explorers, particularly geologists, who may have opportunity to examine this region more carefully, that the whole spur heading the Baltoro on the east from Staircase peak, so called, to its termination in the snows of the Siachen consists of a lofty, central vertebra of granite and gneissoid rocks flanked on both sides by lower, sedimentary slates and limestones, which last form the source of the limestone-débris found by Dr. de Filippi in the Baltoro moraines and of similar débris observed by our expedition in 1912 on the Kaberi glacier-moraines south of the Golden Throne.

CHAPTER III

SNOW-SUPPLY OF SIACHEN—SECTIONS OR STREAMS—CROWNING AND DISAPPEARANCE OF WHITE STREAMS—PECULIARITIES OF MORAINE-STREAMS—THREE PRINCIPAL MORAINES—JUNCTION OF TARIM SHEHR WITH SIACHEN—RESULTING PHENOMENA—TARIM SHEHR GIVES OFF TRUE BRANCH—LAKES CONNECTED WITH PROMONTORIES—COMPARISON OF FIVE LARGEST KARAKORAM GLACIERS—MELTING PHENOMENA—PRESSURE-SÉRACS—ICE-PINNACLES DUE TO PRESSURE AND MELTING—NIEVE AND ICE-PENITENTS—CHARACTER OF UPPER AND LOWER HALVES OF SIACHEN.

COMING now to the glacier itself, the great altitude of the mountains and ridges surrounding the initial reservoirs of the Siachen and spread over the region west of it almost to the extremity of its tongue ensures the accumulation of enormous quantities of snow upon them and in the labyrinthine recesses between. The whole region for many miles back from the main glacier constitutes a great reservoir, that sends forth its icy contents by affluent after affluent to build one large central trunk. The north-east wall, much less ice-clad than the south Hispar wall, contributes a relatively small quantity of ice to the trunk, but the ice-streams from it are loaded with a vast amount of rock-detritus from its crumbling crags, which deposited upon the glacier exercises an important influence on the glacier-economy. Through this wall, about midway between its ends, enters from the east the largest affluent, the Tarim Shehr, contributing to the main glacier ice from a wide eastern area.

Bird's-eye view of 30 miles of Rose glacier from Camp 10, 18,400 feet, on Junction mountain, showing white and moraine-streams, the narrowing of former and increase in size of latter as they descend, and deflection of both by affluent-pressure; also conversion of marginal into median moraines at junctions of affluents. At lower right hand corner Tarim Shehr affluent enters, turning through arc of 140 deg. around point of rock-promontory and flanked by black slate-moraine, which, bending in symmetrical curve, is converted from marginal into median moraine, descending in centre of Rose as such. High peaks indicated are mostly concealed by clouds.

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The ice thus poured into the main trunk is sufficient to keep it at a maximum volume so as to cover completely the floor of the valley it occupies, leaving no free space between it and the valley-walls. No passage exists by the side of the glacier or over the precipitous mountain-sides. The explorer is obliged to find his way over the glacier itself, an undertaking as arduous and dangerous as the ascent of high, snow-clad mountains, the nature of which is not appreciated by those unacquainted with Himalayan glaciers. In this respect the Siachen resembles the Kondus system of glaciers, but differs from the Biafo and Chogo Lungma, which do not fill their valleys. These last can be penetrated for long distances by the sides of the glaciers upon lateral moraines or over maidans and slopes covered with grasses and flowers.

A bird's-eye view of the Siachen trunk from Junction mountain above Tarim Shehr, 20,840 feet, shows it to be composed of a number of sharply defined, parallel, longitudinal sections or streams, some consisting of white ice, others covered with moraine-material, running side by side for many miles, the largest for above thirty, without intermingling. These I will distinguish from one another by the names *white* and *moraine-streams*, from their surface-appearance, and I will also apply the term *white ice* to those parts of the glacier which were comparatively free from detritus, without regard to the physical distinction between surface white ice and the blue or black ice of the glacier-body beneath.

These streams, which can be traced upward toward the ultimate sources of the trunk and affluents, are seen to represent the ice-masses contributed by the initial reservoirs compressed and narrowed into ribbon-like bands by the tremendous lateral pressure developed by the crowding of vast bodies of ice coming from different directions into the comparatively small space between the mountain-walls occupied by the trunk.

This lateral pressure is increased by the entrance of each successive affluent. Any affluent sufficiently large and powerful to add its own streams to those already existing in the trunk must do so by crowding the trunk out of its path over toward the opposite side of the glacier-bed and by inserting its own streams into the side-space thus created. This yielding of the trunk, which previously to the entrance of the affluent completely filled its bed, is an indication of an increase of lateral pressure proportioned to the size of the affluent, which must result in a further compression and narrowing of the trunk-streams. This is seen in the bird's-eye view to be exactly what happens to the Siachen streams, especially the white streams, which, broad and greatly exceeding the moraine-streams in width in the upper parts of the trunk, gradually become narrowed under lateral pressure until they finally die out and disappear at various distances from their sources.

Pressure is not, however, the only factor involved in this result. Descending to the glacier and crossing it at points above the Tarim Shehr junction, where its surface is fairly smooth, one finds the centres of its white streams in transverse section elevated considerably above their edges, and the streams themselves symmetrically arched or crowned so as to resemble a series of perfectly constructed, metalled, and crowned roadways placed side by side. So high is this crowning that, standing on moraine-ridges in the centre of the trunk, 20 to 40 feet above the adjoining white ice, I could not see the edges of the glacier on the sides, nor, perhaps, half-way to them.

This crowning is connected with the thinning and

White stream on Kaberi glacier narrowing under the combined influence of pressure of two converging moraine-streams and of melting.

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Extinction of white ice-stream by pressure of two massive, converging moraine-streams on Kaberi glacier. Dimensions of end of expiring white stream are distorted by position of camera on its central line. Its width beneath camera was 30 feet, and its length to point about 200.

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disappearance of white streams. Its presence indicates that the pressure which diminishes their width also crowds them upward without disorganizing their structure or causing them to mingle with one another, and that, the lateral pressure being applied on both sides, their ice yields most along the central line, which is thus crowded highest. Rapid ablation of the raised portions occurs through melting, which on this glacier is very marked in the course of a summer. Thirty feet is probably a conservative estimate of its amount. This diminishes the depth and volume of the stream, with the result that it becomes constantly less resistant to pressure and more easily compressed and elevated. The interplay of lateral pressure and ablation finally so reduces the size of the stream that it is unable to offer further resistance, and is strangled in the grasp of its more powerful neighbours (moraine-streams), disappearing henceforth from view.[1]

As the streams become thinner and weaker they are pressed up higher with more abrupt sides, and their tops are broken into superficial séracs, as occurs on the Tarim Shehr and lower portion of the Siachen. Symmetrical crowning here disappears. Crowning can, on the contrary, be traced upward into the reservoirs, where I observed it among the vast snow and ice expanses at altitudes of 21,000 feet. The greater the width and volume of streams and reservoirs the more generally are the effects of pressure diffused throughout the mass and the more gradual are the resulting curves In the reservoirs, crowning displayed itself in wide

[1] For a detailed consideration of pressure effects vide "Features of Karakoram Glaciers connected with Pressure," William Hunter Workman, *Zeitschrift für Gletscherkunde*, Band VIII, Heft 3, December 1913.

elevated ridges sloping gently away to lower levels, orienting at right angles to the direction of pressure. It is easy to understand how here vast masses of snow and ice descending the steep, opposite sides of a narrow valley and meeting at the central line would crown upward.

With moraine-streams the case is quite different. They, usually, first appear as small accumulations of débris at places where névé has melted mostly or wholly away, but they increase in size and height as they move down a glacier, till at length they exceed in volume the white streams between them. Those occupying the glacier-edges constitute latero-median or marginal moraines, but when, after coming in contact with affluents, they are pushed away from the edges toward the centre, they become median moraines, affluent streams being interposed between them and the sides of the glacier-bed. They increase in size not only through their mass below the surface being crowded higher by increasing lateral pressure, but also through union with them of marginal moraines of incoming affluents.

Relatively to the white streams, their visible portion becomes also constantly greater from the fact that, being heavily covered with débris, ablation of their substance through melting is reduced to a very small amount, so that they practically retain the elevation and bulk they receive through pressure, while the rapid lowering of the surface and diminution in volume of the adjoining white streams through melting expose a still greater extent of their sides and actually add to the difference in height between the two. As a result, the moraine-streams, which at their points of emergence in the upper parts of a glacier may be on a level with the white, soon acquire a decided elevation above them,

Summit of débris-covered hillock in centre of Khondokoro glacier. No ice visible.

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which, lower down on the glacier, may become as great as 300 feet or over. Further, as the glacier-bed narrows, the moraine-streams under the influence of lateral pressure thus occasioned converge upon one another, occupying the space left vacant by the wasting white streams, till they come together and swallow up the attenuated remnants of the latter.

Where the last white streams finally disappear the orderly arrangement, which up to this point usually characterizes the moraine-streams, may cease, and the latter, crowded directly against one another, may mingle together, becoming converted into a confused mass of elevations and depressions, with which condition of its surface the glacier-tongue moves on to its extinction. The final disappearance of white streams occurs on different glaciers at different distances from the extremity of the tongue. According to my observation, the last white stream of the Chogo Lungma was blotted out at 9 miles, of the Hispar at 15 miles, of the Kaberi (first descended by our expedition in 1912) at 11·25 miles, of the Biafo at about 3 miles, whilst on the Siachen the central white stream persisted to within 1·5 miles of the end of the tongue.

A peculiar feature of the effect of lateral pressure on moraine-streams is, that it often presses them up into a series of rounded or angular elevations or hillocks covered with débris. These have a size varying according to the pressure and amount of ablation of exposed ice from a few to over 400 feet in height, and once produced they persist for a long time. This subject was mentioned in a paper by myself printed in the *Geographical Journal*, February 10, 1910; vide pp. 117, 121.[1] To moraines exhibiting this formation I have given the name *hillock*

[1] Vide also *op. cit.* on p. 249, note.

moraines. All the above characteristics and others besides are exemplified in the moraine-streams of the Siachen, which are remarkable for their size, perfection of structure, and arrangement, and constitute by no means its least interesting feature. Its trunk is banded by numerous streams of this kind, eight to ten at any point below Tarim Shehr, most of which originate in affluents, though some crop out near its centre, and one of the largest springs from the north-east wall. Among these the three largest deserve special mention.

1. *The black hillock-moraine.*—This, the most prominent moraine of the glacier, is an enormous hillock-moraine covered with black slate-débris, coming from the Tarim Shehr affluent. Gathering into its embrace detritus shed off, principally, from the northern black slate-barrier, though with some additions from the centre, and transformed well up the glacier into a hillock-moraine, it finally descends along the northern edge of the Tarim Shehr as a marginal moraine, turns with this affluent into the bed of the Siachen trunk, and, crowded by the enormous pressure well over towards the centre of the latter, with the Tarim Shehr white streams between it and the north-east Siachen wall, passes down the Siachen as its largest median moraine almost to its end. Its total length is over thirty-two miles.

At its line of first contact with the Siachen, its bulk is increased by the addition of a large, black slate-moraine and a smaller one issuing from gorges at the base of Teram Kangri. Below its junction with the Siachen, its width approaches 1,500 feet, and its hillocks, three and four abreast, reach huge proportions, rising over 300 feet above depressions at their bases. I saw a number the height of which appeared to be nearly, if not quite, 450 feet. Seen from the ice outside it, this

Great, black slate-hillock-moraine, coming from the Tarim Shehr, descending in the centre of the Rose glacier. Its hillocks rise from 300 to over 400 feet above general level of ice.

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moraine resembles a range of large black hills stretching down the centre of the glacier. Many of its depressions are occupied by lakes. It is the largest moraine I have met with in the Karakoram, and it does not appear likely that its equal can be found anywhere else on a valley glacier.

2. *The great limestone moraine.*—Beneath some orange-coloured peaks of the north-east wall, shortly below the extremity of the King George V ridge, where the névé of the north Siachen reservoir disappears in late summer, a mass of small rock-fragments presented itself to view, covering the ice for some distance from the mountain-wall. Part of this is, doubtless, brought down by the ice from the glacier higher up, and part is derived from the wall directly above. This, as it moves down with the ice, soon takes the form of an elevated moraine, which, under the pressure of the West Source glacier, or first western affluent entering opposite, is converted next the wall into a hillock-moraine and on its glacier-side into a raised moraine-shelf.

Receiving constant accessions of débris from small tributaries from the north-east wall, it gradually spreads out from the edge until it attains a width of, approximately, a quarter of a mile. This moraine is composed of small fragments of limestone, marbles, and breccias of various colours, some calcite, different-coloured shales, and conglomerates. Granite, if present, is very scantily represented. I find in my notes no mention of any having been noticed in the twenty-seven miles we followed its course. Comparatively few débris-masses were seen on it worthy of the name of boulders. The general colour of the moraine is grey.

Many limestone-fragments contain markings in white resembling ribs with articulating heads, and vertical sections of heart-shape representing two ribs joined by a vertebra enclosing a dark centre, as of some animal like a serpent or reptile. They probably represent the remains of some bivalve mollusc. They have diameters averaging 6 inches. They are intimately associated with the limestone and cannot be separated from it as fossils, and were only seen in transverse section. No actual fossils were found.

This moraine descends along the eastern edge of the trunk some eight miles to the entrance of the Tarim Shehr affluent, by the pressure of which it is then deflected westward nearly to the centre of the trunk-bed and henceforth becomes a median moraine. As it turns west, its volume is increased by the accession of a moraine of considerable size, elevated 20 feet or more at its centre, issuing from a nala lying behind a projecting shale-ridge of the north-east wall shortly above the base of Teram Kangri. This moraine consists wholly of a soft, grey limestone of a texture not sufficiently firm to merit the name of marble, mottled with black masses suggestive of fossil-remains, though distinct forms are not evident. Its central ridge is crowned by a succession of immense boulders of the same limestone.

At the Tarim Shehr–Siachen junction, the main moraine meets the gigantic, black hillock-moraine of the former, the two crushing out of sight a good-sized white stream caught between them, and descends side by side with it without intermingling to within a short distance of the glacier-end. Below the junction its hillocks increase in size till they rival those of the black moraine.

3. *The granite moraine.*—The third large moraine first appears high up on the south side of the Peak 36 affluent, in front of the granite-massif of that name, at the junction with it of a secondary affluent, as a line

Large, grey moraine-stream of Rose glacier, which above Tarim Shehr forms its eastern marginal moraine, crowded over by pressure of the Tarim Shehr seen entering on right to centre of Rose is converted into a median moraine. Adjoining it is great, black slate-moraine coming from Tarim Shehr glacier. In background King George V. group, and at left The Hawk.

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of discrete, oblong hillocks 12 to 25 feet high, their bases separated by ice-surfaces. As these move downward towards the Siachen trunk, they are pressed up higher by the increased pressure of other affluents, till their bases unite and they form a continuous hillock-moraine, which descends as a median moraine to the Siachen, where it is amalgamated by pressure with a marginal moraine, which has descended alongside it.

Still further reinforced by contributions from the south-west wall, it acquires a width of nearly 1,500 feet, and for the next three miles occupies the edge of the Siachen trunk. On meeting the Lolophond affluent descending from the Bilaphond La, its size is further augmented by junction with it of the north marginal moraine of that glacier, by which it is pushed strongly over eastward into the Siachen bed. From this point it passes far down the Siachen as a median moraine.

This moraine is composed largely of granite and crystalline débris mixed with shale. On its eastern edge great blocks of striped and variegated limestone were scattered about, the source of which was not evident. This was also the case with a smaller shaly moraine striking over from the centre of the glacier and joining it.

In the upper reservoirs and higher portions of the trunk and affluents covered by névé no signs of moraines are visible. One may walk over these for miles where the virgin-white expanse is unmarred by the presence of a single boulder or rock-fragment. This fact does not preclude the possibility of the existence of large quantities of rock-débris in the deeper portions of the ice, or the probability that the marginal portions are packed with detritus that comes to light in the moraines lower down.

As the Siachen fills its bed so completely and its enclosing walls rise from it so abruptly, there is little room for lateral moraines to be deposited, and they are only found here and there for short distances. Just above the Lolophond affluent, on the west edge of the glacier-bed, in front of Camp 5, a huge one exists, but only for a few hundred yards.

The larger Siachen affluents join the trunk at accordant grade at angles of 90° or over with its axis in the usual manner; but the junction of the great eastern affluent, the Tarim Shehr, involves phenomena especially noteworthy. Here probably the largest existing valley-tributary outside the Polar regions unites with the largest known valley-glacier. The Siachen just above the junction has a width of 2·75 miles and completely fills its bed. The Tarim Shehr, with a width of 2 miles and a length of over 17 miles, and falling nearly 3,300 feet from an altitude of 19,300 feet, impinges on the Siachen at an angle of 40° with its course with a force so great that the Siachen trunk is compressed and driven over towards the opposite side to an extent that permits the Tarim Shehr to turn around the pointed extremity of the granite and shale Tarim Shehr promontory through an arc of 140° and take its place as a constituent part of the trunk.

The width of the glacier-bed just below the junction is again 2·75 miles. The amount of pressure exerted by the oncoming Tarim Shehr on the Siachen may be gauged by the fact that two immense ice-bodies of unknown depth, together 4·75 miles wide, are crowded into a space only 2·75 miles wide. The plasticity of ice could not be better illustrated than by this result. The severity of the struggle incident to its accomplishment may be seen not only in the displacement of the vast

Two Lake camp, camp 12, 16,273 feet, Tarim Shehr, below extremity of short branch or offshoot of Tarim Shehr glacier, half of which is covered with black slate-detritus and half is broken into white séracs.

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Siachen ice-mass and its compression to less than three-fifths its former width, but also by the disturbance of structure in the affluent, the surface of which, as it turns around the pivotal promontory, is broken into a long line of gigantic séracs, and elsewhere rent asunder and twisted into a tortuous labyrinth of huge ridges and elevations surrounded by profound depressions, some of them occupied by large lakes. One wishing to acquire a knowledge of the difficulties and dangers of glacier-exploration could nowhere find a better opportunity than here in crossing the black hillock-moraine and pushing a couple of miles up the Tarim Shehr.

The periphery of the arc described by the Tarim Shehr in its change of direction is formed by its great, black hillock-moraine, that, as seen from Junction mountain above, sweeps around in a magnificent, symmetrical curve interposing a broad, black, billowy belt between the white streams on either side, from which it stands out in striking contrast. The view it presents fascinates the eye and excites the imagination, marking, as it does, the extent of the battle-ground covered in the struggle for supremacy between these two monster glaciers.

An anomalous and most interesting formation, such as in a wide experience in glacier-exploration I have nowhere else seen, occurs at Tarim Shehr promontory. About four miles above its extremity a sharp shale-shoulder projects like a ploughshare into the Tarim Shehr glacier. This shoulder intercepts the moraine-covered glacier-edge and part of an adjacent white stream, and turns them aside over the base of the promontory as an offshoot or *true branch* about a third of a mile wide, which descends towards the Siachen across the foot of Junction Mountain.

As a rule, from the conditions of its existence, a glacier-trunk occupies the lowest line of drainage or flow in a valley, and ice gravitates toward and not away from it. In this case, the tremendous pressure of the great affluent forces the two ice-streams intercepted by the shoulder to overleap their natural, lateral barrier and separate themselves from the main body. So great is the force exerted that the whole mass of the white stream, which impinges directly on the shoulder, is split up into séracs, which, pointed off by melting, descend the declivity of the promontory as a cascade of glistening, white pinnacles (sérac-penitente), forming one lateral half of the detached offshoot or branch. The other lateral half consists of the marginal moraine-stream having a smooth, dark, débris-covered surface.

This branch at some former period crossed the entire base of the promontory and joined the Siachen, thus making a nunatak of the promontory; but it has receded 1,500 to 2,000 feet up the slope, leaving a large amphitheatre streaked by old moraines, dotted with weathered and lichen-covered boulders, and clad with grasses, burtsa, and flowering plants, a resort of ibex of gigantic size and other animals. This is the only vegetation-clad oasis in a wilderness of ice and rock extending for many miles in every direction, and, as affording a refuge to the wanderer from the rigours of the savage expanse around, it merits the name of Tarim Shehr (Oasis City) bestowed on it by the natives.

At various places along the course of the trunk and affluents where rock-promontories project into the glacier-bed, the glacier-edge opposite these consists of a smooth, vertical, or steeply slanting wall curving around to correspond to the shape of the promontory-end, and removed from it by an interval of 60 to 150 feet. The

Extremity of rock-promontory projecting into edge of Peak 36 glacier at altitude of 17,600 feet, with lake and steep, curving ice-wall hollowed out of ice by heat reflected from promontory.

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Making tent-terraces on rock-promontory at 17,602 feet. Peak 36 glacier.

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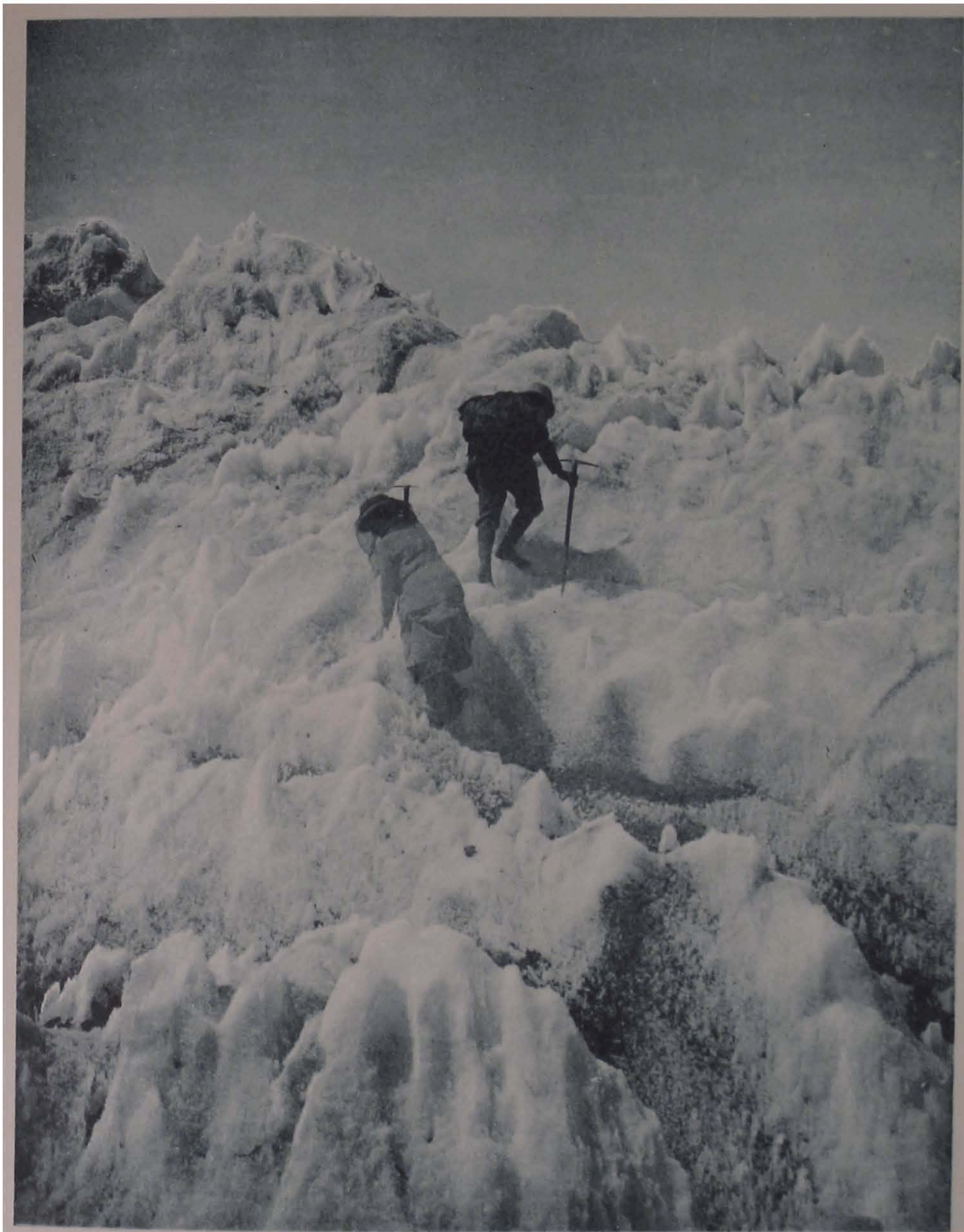
interval is occupied by a lake. This formation only occurs in connection with such promontories. It is caused, apparently, by the melting away of the glacier-edge by the heat radiated from the rock-surfaces, and the ice melts back until a high, smooth or fluted wall is formed, and downward until a deep basin is excavated, which receives and retains the resulting water.

Such formations were found near the heads of Peak 36 affluent and of the main trunk, at altitudes as high as 17,602 feet and 18,372 feet respectively. We were able to utilize three promontories giving rise to these for camps, in each case only after the coolies had worked two to three hours under our direction in building, with rock-fragments, retaining walls and terraces to support the tents. Although these promontories afforded but little elbow-room outside the tents, they served as most welcome situations for camps in regions otherwise deeply covered with ice and snow. Access to them was not easy. They could not be reached from the front on account of the steep, treacherous ice-walls and lakes. The only approach was by dangerous ice-slants some distance above their ends sloping sharply down to the lakes, where a misstep would precipitate one into an icy bath that would speedily prove fatal, unless one could be immediately rescued, which might not always be possible. In one such instance, prompt assistance undoubtedly saved a coolie's life. It was not safe to approach the edges of the ice-walls at any point, as during the day they became soft, and being often undermined, they broke away and slid into the lake below.

The following table shows the lengths of the five great Karakoram glacier-systems, the altitudes of the col, initial bergschrund, or highest glacier-surface, that may be considered to form their heads, altitudes of extremities of tongues, and their total and average fall in metres and feet, omitting fractions:—

	Length.		Head.		Tongue.		Total Fall.		Average Fall.
	Kil. =	*Miles.*	*Metres* =	*Feet.*	*Metres* =	*Feet.*	*Metres* =	*Feet.*	
Siachen ...	72 [1]	45	6,400	20,992	3,704	12,150	2,696	8,842	1 to 26
Chogo Lungma	48	30	5,854	19,200	2,926	9,600	2,928	9,600	1 to 16
Biafo	59	37	5,335	17,500	3,201	10,500	2,134	7,000	1 to 27
Hispar ...	58·5	36·6	5,335	17,500	3,353	11,000	1,982	6,500	1 to 29
Baltoro ...	57·6	36	5,072	16,637	3,353	11,000	1,719	5,636	1 to 33

[1] The length of the Siachen is somewhat difficult to define. If, as in this table, the Indira col be taken as its head, its length may be called 45 miles. It, however, extends upward on the flank of Peak 23 some three or four miles farther in a great, ascending snow-basin.



Ascending a séracked ice-ridge covered with ice-pinnacles in centre of Rose glacier.

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White ice-stream on Rose glacier broken by pressure into séracs, the tops of which are sharpened off by melting into pointed ice-pinnacles (sérac penitente).

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From this it will be seen that the Siachen trunk lies at a considerably higher level than the trunks of the other four systems, and that the average gradient of the Chogo Lungma is the sharpest. The gradients of all the trunks vary greatly in different portions, being steepest in the first few miles from their origin, comparatively slight for the greater portion of their course, and on some stretches of several miles practically level. It is scarcely necessary to add that all the trunks are fed from reservoirs lying at considerably greater altitudes than those assigned to their heads.

The gradient of the Siachen trunk and of most of its largest affluents below their sources is gentle and remarkably even. Their surfaces are not disturbed by ice-falls, certainly not by such as split up the Chogo Lungma in its upper third, extending across its whole width. The few ice-falls that exist are of small extent. On the contrary, crevasses in the upper parts are frequent and dangerous, being concealed by snow until late in the summer. The upper Tarim Shehr plateau for some five to six miles is seamed in every direction with great crevasses and openings, which were found so dangerous that we did not feel justified in attempting to penetrate it with coolies.

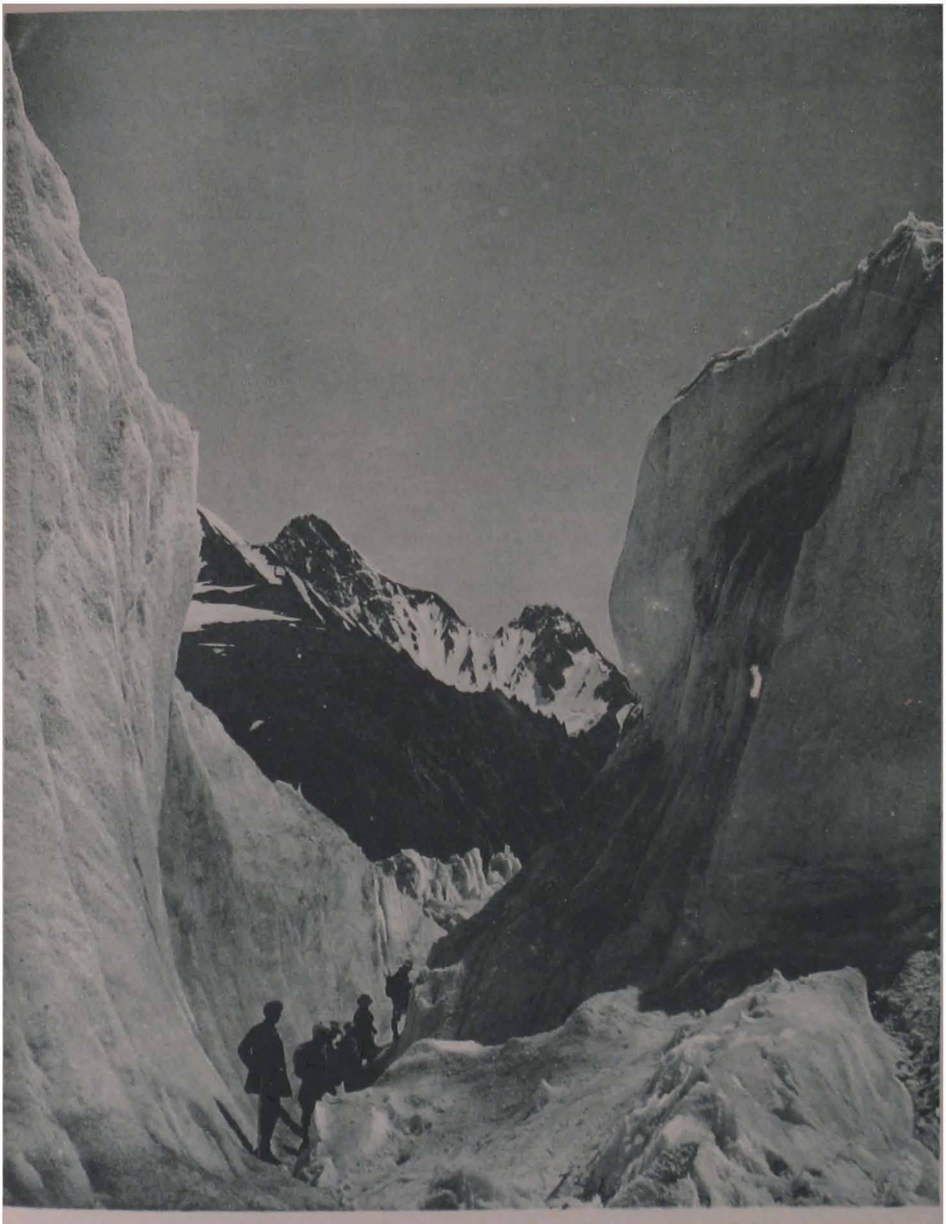
The amount of ablation of the white ice through melting during a summer is great. This is made evident by the large quantity of water bathing the surface. In the upper portions, where its free movement is hindered by the presence of névé, it lies in great sheets, as we also found it on the Biafo and Kanibasar glaciers. Its surface freezes at night into a slushy, sodden ice that furnishes a treacherous bridging to those compelled to cross such water-areas. They were mostly negotiated by crawling on hands and knees, but this apology for ice often proving too weak to support the weight of a man, even in this position, we were obliged to make detours to get around them.

Lower down, where water can flow unhindered, it courses over the surface in rivulets hurrying to escape by the lowest passages. Owing to the crowning of the white streams, the rivulets run off transversely from their centres towards the sides, ever increasing in size by coalescence with others, till they reach the lowest line of the longitudinal, angular depressions formed by the opposed edges of contiguous ice-streams. The water accumulated here from the combined rivulets forms powerful torrents which, cutting channels 6 to 30 feet wide and often over 30 feet deep along the lowest levels of the furrows between the ice-streams, rush seething downward to perform their mission in the scheme of glacier-evolution.

Torrents of this kind are a feature of the Siachen, and are met with in nearly all the longitudinal furrows mentioned. Some eight to twelve have to be passed in crossing the central portions of the trunk, which, as they are often impassable except where covered with névé-bridges or at points where the channel-walls approach sufficiently near each other to permit of leaping over them, offer a serious obstacle to the exploration of the glacier. One coolie lost his life and several others were injured by falling into them in 1912.

Séracs are a common feature of the steeper parts of most large glaciers, being usually associated with ice-falls. They are, in most cases, due to the splitting asunder of the ice under tension caused by the bending of a glacier over sharp increases of gradient in its bed. The resulting projecting ice-masses, whitened by exposure to heat, give the surface the appearance of ice-cascades.

Only a few unimportant sérac-areas due to this cause



Passage between two gigantic séracs on Rose glacier, formed by the bursting asunder of the glacier-surface under pressure.

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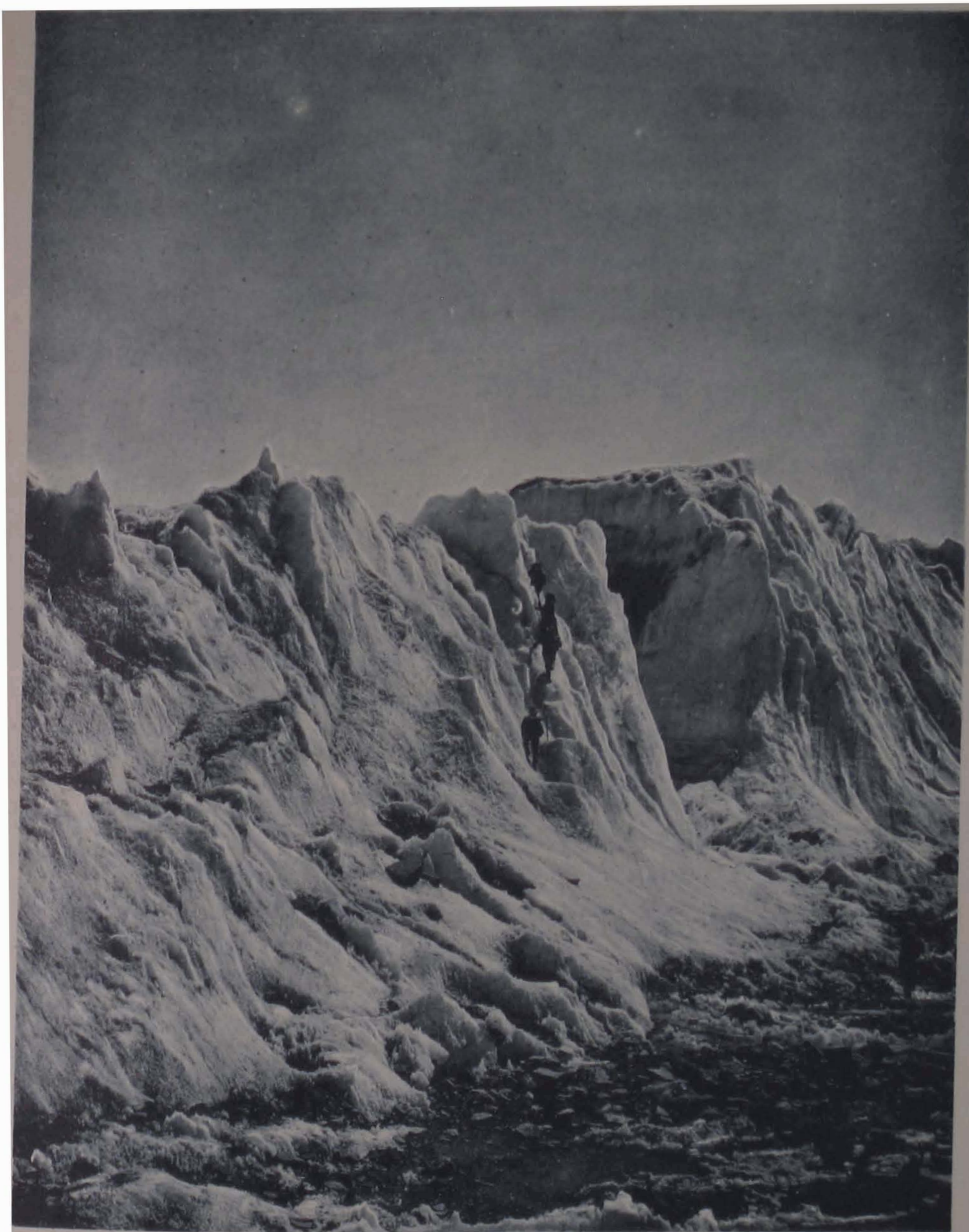

Pressure séracs in centre of Rose glacier opposite Tarim Shehr, showing vertical ice-strata orienting in direction of movement of the ice-stream.

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exist on the Siachen and its larger affluents. There are, however, extensive sérac-areas on the Tarim Shehr and on the Siachen trunk above and below their confluence, that are formed under entirely different and exceptional circumstances, where the glacier-bed is smooth and the gradient gentle. The cause of these is the enormous pressure developed around the junction, which forces the white ice-streams strongly upward and fractures their surfaces into large fragments or sérac-masses 40 to 100 feet high, separated by intervals of greater or less width. These intervals, which take the form of crevasses and gullies, are superficial, extending only to the bases of the séracs, the deeper portions of the glacier remaining in solid contact, thus differing from intervals between tension-séracs, which, usually, penetrate the glacier-substance below what may be termed the sérac-bodies. Large numbers of these séracs are sharpened by melting into pointed pinnacles, constituting what I have classified as sérac-penitente, of which they form beautiful examples.

Another variety of pinnacle analogous to the last, which, from the fact that its final shape is chiefly determined by melting, may be regarded as a gigantic form of ice-penitente, is seen at places, usually at the central and lower parts of glaciers as well as also in the upper portions of low-lying glaciers, where moraine-streams greatly overbalance the white, and where the latter, having become much attenuated, are about to disappear. At these places pinnacles 20 to 60 feet or more high of white ice, having the form of pyramids, wedges, or crested combs, with steep sides, and standing almost touching one another or some distance apart, project upward in lines from smooth, moraine-covered surfaces free from crevasses, their glistening, white forms contrasting strongly with the dark moraine-surfaces around them.

They appear to be developed as follows. The lateral pressure, which farther up the glacier, where the white streams have greater volume, only causes them to crowd up in the centre, here, where they have become reduced by pressure and ablation to slender filaments, crowds them up between the converging moraine-streams as high, narrow, white ridges with more or less broken summits and vertical or steeply slanting sides. Melting then causes the softer and thinner portions to disappear, leaving the more massive and resisting ones standing detached from one another as the ice-pinnacles in question. Sometimes these pinnacles are at such distances apart that relationship between them is not obvious at first sight. In other words, resisting centres being present in the elevated ice-ridges, the formation of pinnacles or gigantic ice-penitente from these occurs on exactly the same lines as that of penitente-pinnacles of any other variety. The presence at various points on the surface of the ridges of thin débris-deposits, which rapidly melt their way downward through the ice, accounts for a great deal of the segmentation that divides the ridges into detached pinnacles. This débris is usually seen covering the ice between the bases of the latter. This variety, while resembling sérac-penitente in some particulars, differs from it in that its pinnacles are not separated by crevasses, but are surrounded by smooth moraine-covered surfaces. They are also more regular in shape, and rise less abruptly.

Such pinnacles were met with on the lower portion of the Siachen near the central line and at several places on the Kaberi glacier, at the points of disappearance of expiring white streams, also in great size and perfection on the low-lying Gusherbrum glacier at about 15,000 feet. Here they ran in two parallel lines, one on each edge of a

Pinnacles 36 feet high formed by melting of ice-mass forced up by pressure (pressure penitente) on Tarim Shehr glacier.

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Group of ice-pinnacles in centre of Kaberi glacier, the last remnants of a white ice-stream disappeared shortly above.

To face page 264.

central moraine-stream. The ice-pinnacles mentioned by the various explorers of the Baltoro, the origin of which none of them has adequately accounted for, though Dr. de Filippi's suggestions accord with what I regard as the correct explanation above given, and seen in Sella's photograph opposite p. 21 of *Geographical Journal*, January 1911, and also in panorama N, on pp. 208–9–10, and opposite p. 288 of *Karakoram and Western Himalaya*, correspond to this variety, which appears to be strikingly represented on the Baltoro.

Large areas of the glacier-surfaces were covered with the smaller varieties of nieve-penitente above the névé-line and with ice-penitente below it, the pinnacles succeeding one another as closely as wavelets upon water ruffled by wind, and making, even, level surfaces difficult to move over. The most numerous, and, in many respects, interesting, were those of the *thin débris* or *pocket*-variety, Var. iv. of my classification. These pinnacles of all kinds, by breaking up the surface and greatly increasing the amount of it exposed to heat, contribute materially to the ablation of the glacier. Many new features were observed regarding penitente-formations, or surface-projections due to melting, which have been considered in detail elsewhere.[1]

The entrance of the Tarim Shehr affluent divides the Siachen trunk into two parts, an upper and a lower, which differ from each other in their features as essentially as might be the case with two separate glaciers. The surface of the upper portion, aside from its hillock-moraines, is smooth, and, except for pocket-penitente, watercourses at the lines of junction of its streams, and crevasses in the higher parts, is easy of ascent.

[1] Vide *Zeitschrift für Gletscherkunde*, Band VIII, 1914, pp. 289–330: "Nieve Penitente and Allied Formations in Himalaya."

With the lower portion the case is different. The compression of two great ice-bodies of a combined width of 4·7 miles into a channel 2·7 miles wide must effect changes in the arrangement of their constituent parts. The evidences of pressure now become more pronounced. All ice-streams, but especially the white, are narrowed and crowded higher. The regular symmetrical crowning of the upper, white streams disappears, and the ice is forced up into great ridges with high, abrupt, and, in many cases, vertical sides enclosing deep ravines, through which torrents rush seething downward with hollow roar. The great, white body of the Tarim Shehr is elevated considerably above the level of the rest of the trunk and its surface converted into a labyrinth of huge séracs towering to a height of 50 to 150 feet, separated by intricate, winding gorges.

The hillocks of the hillock-moraines, previously of modest dimensions, assume gigantic proportions, and lift their heads more than 300 feet above their bases. The depressions between them become more profound, thus adding to their height. The lakes occupying the depressions increase also in size. Notwithstanding these changes, the individuality of the larger ice-streams is not greatly disturbed until the general breaking up into chaos occurs, about a mile and a half from the end of the tongue.

In view of the great moraine-hillocks with dangerous precipices, enormous séracs spiked with ice-pinnacles, ravines, glacier-torrents, high ice-ridges honeycombed with water-pockets and bristling with pocket-penitente, locomotion on this part of the trunk is neither easy nor safe, especially in crossing the glacier. Its exploration demands an outfit adapted to its conditions, an intimate knowledge of icecraft, and fertility of resource.

Thin débris or pocket-penitente on Rose glacier. Water-pool or pocket at base of every pinnacle. Horizontal lines on faces are rigdelets of ice, the remnants of ice-coverings formed at night on surface of water in pockets, as they burrowed daily deeper into ice.

Séracs on Rose glacier dissected by heat, showing the complicated arrangement of compressed strata and columns of which glacier-ice is composed. Columns cross strata at various angles.

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CHAPTER IV

FEATURES AT KABERI HEAD—MORAINES—CHARACTER OF MOUNTAINS AND AFFLUENTS—SURFACE-ICE-PINNACLES—REMARKS ON EARTHQUAKE.

THE physiographical aspects of the Kaberi glacier may, perhaps, be best mentioned in the order in which they unfolded themselves to our view from the sources downward. When we first discovered its head on the last day of July from the Silver Throne Col, 19,614 feet altitude, it was evident that this lay at not far from 16,000 feet altitude. This could be judged, not only by estimating its distance below our standpoint, but from the facts that the névé had all disappeared from the surface of the ice and that the latter was considerably covered with surface-moraines from its upper limits. The vast expanse of virgin-snow unspotted by any visible rock-débris encountered at the Siachen sources, 4,000 or 5,000 feet higher, was wanting here below the initial reservoirs on the mountain-sides. A hypsometric reading taken later at the point near the highest portion of the Kaberi trunk where we first reached it after descending from the Sia La substantiated this judgment, giving 16,079 feet.

Such scanty rock-surfaces as projected at various places from the ice-covering of both the Silver Throne peaks walling in the Kaberi head on the east showed these mountains to be composed of intensely black slate, as was also the case with the line of jagged peaks projecting west from the lower Silver Throne and forming the south wall of the Sia La. This wall gives off a large, black slate-moraine broken into hillocks almost from its origin, which passes down the eastern side of the Kaberi as one of its two largest median moraines for eight or more miles, increasing in height and volume until it towers 150 to 200 feet above the last white ice-stream.

Another large, light-coloured moraine, occupying the centre of the glacier, comes from the Golden Throne, which forms the north-west boundary of the head. This moraine, besides shales, contains limestones of various colours, brescias, and a fine-grained, white marble in slabs with smooth, parallel sides, thus indicating that limestone of several kinds exists on the south as well as on the west side of the Golden Throne massif, in the moraines given off by which to the Baltoro they were found by the expedition of the Duke of the Abruzzi. This massif, evidently, contains a good deal of limestone, but in what proportion must remain a question for future investigation. Its southern face shows also dark slate.

Below the glacier-head several affluents enter on the west side, bringing in much moraine-material. This we did not inspect closely, but it appeared to include granite, slate, and shale. The pressure of these affluents compresses the ice-streams of the trunk and crowds them over towards the east side. This, with ablation from melting, causes the white streams to diminish rapidly in size and the moraine-streams to converge toward one another, occupying the space left vacant by the wasting white streams.

A short march down the glacier the large black and

Large, black slate-hillock-moraine, on right, at upper third of Kaberi glacier, rising high above white ice. Queen Mary peak beyond Kaberi head in background.

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grey moraine-streams above mentioned come together, crowding out of existence a white stream that somewhat below the glacier-head has a width of about half a mile. Six or seven miles down the glacier clear, white ice wholly disappears, and the entire surface is covered with moraine. As the glacier is descended, slate and shale are found to give way to granite-barriers, very steep, especially on the east side. From these short but sharply descending affluents, the ice almost hidden in rock-débris, crowd their way into the glacier-trunk, breaking up the hitherto regular moraine-ridges and forcing them up, together with the whole surface, into a confused mass of vast hillocks extending from wall to wall, those next the walls sloping so sharply that it is hazardous to attempt to descend them, the danger being increased by the constant slides of rocks from their crests.

These affluents also pour out upon the glacier immense quantities of gigantic, angular granite-fragments, which cover the hillocks, heaping themselves upon one another in the utmost disorder. Advancing over a surface of this kind is not only a slow and tedious but a dangerous process. One is constantly ascending and descending high, obstructed slants, jumping from boulder to boulder, turning from one side to the other, and often retracing one's steps to get around chasms and ice-walls too steep to traverse, so that an advance of four or five miles in direct line constitutes a good day's march. The lower fifteen miles of this glacier, with its bristling, chaotic surface shut in on both sides by steep, towering, jagged, verdureless mountains, forms a scene of grimmest desolation, and it was certainly the most difficult and arduous stretch of the kind to traverse that we have ever passed over.

At and just below the points where the white ice-streams finally disappear, many ice-pinnacles of the kind described on pp. 263–4 were seen, occurring both singly and in lines, pyramids, wedges, and cones rising white and glistening from the moraine-covered surface. They diminished in size through melting, as their distance from the points of extinction of the white streams increased, till at last they disappeared.

Some features of interest connected with the earthquake of August 25, 1912, in addition to those mentioned on pp. 215–16, were noted. It was much more severe and its effects more marked in the mountains than on the glacier. Had the latter been shaken to the same degree as were the mountains, it is doubtful whether we should have lived to tell the tale. We were camped at the central line of the glacier, here fully a mile wide. The different tents were spread over a considerable area, and the vibrations appeared to be felt more severely in some than in others. In my own tent they were so slight that I should scarcely have considered them as anything more than ordinary movements of the glacier, had not my attention been called to their real cause by the rattle of débris and resounding thunder of avalanches on all sides.

When I stepped out of my tent and looked down the nala, the air, as far as the eye could reach, was filled with clouds of dust, even where the nala was enclosed by bare granite-walls, which, with the avalanches, indicated that the mountains had been severely handled. The dust was perceptible in the air throughout the day, and, indeed, did not wholly subside for two days. The only reason that occurs to me for the difference in severity of the earthquake in the mountains and on the glacier might lie in the absorption or neutralization of the oscillations by the elasticity of the ice.

Typical view of the surface of Kaberi glacier. In many places it is even rougher and more broken.

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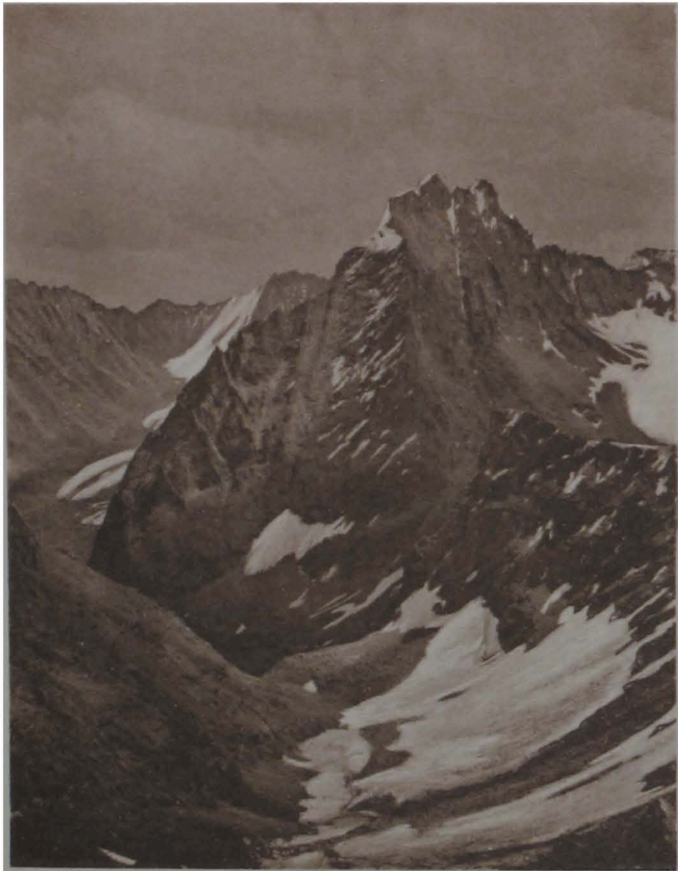
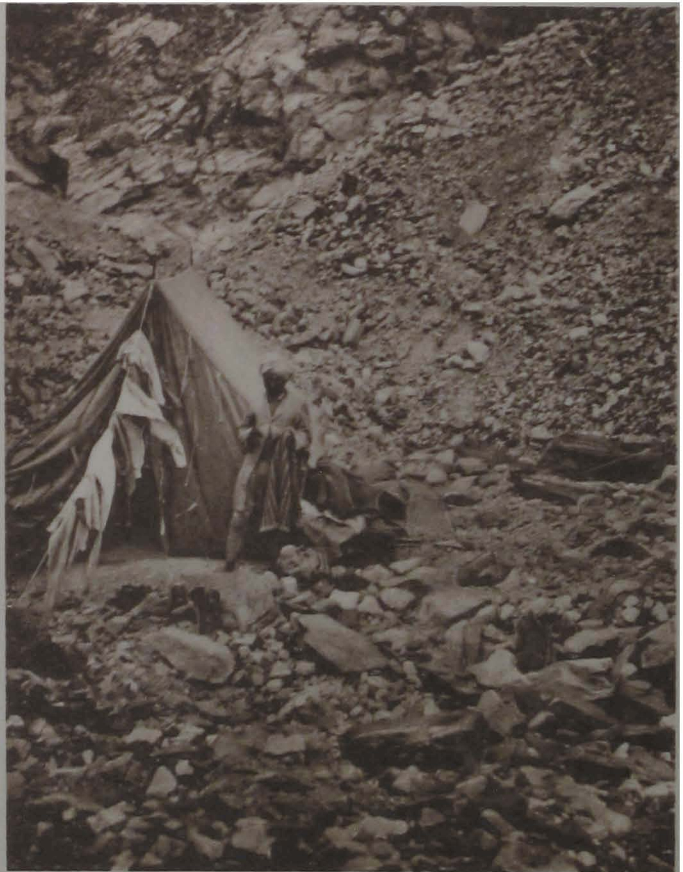
When we reached what we called the smoking mountain in the afternoon of that day, a large talus of rock and sand was observed at the base of its valley-face, which, if not wholly formed, was at least greatly increased in bulk by the constant stream of rocks and débris falling upon it. All along the return-route as far as Kapalu, six marches, the effects of the earthquake were visible. The mountains had everywhere been severely shaken. Massive ledges had been split up into fragments, which, with many boulders, had been dislodged and precipitated into the valleys below, tearing away or covering up paths, invading and overwhelming cultivated land. In many places we had to clamber over portions of the wide ruin thus occasioned.

Such an opportunity to witness the splintering—one might, perhaps, say the explosive—effect of earthquake brings home to one, as no exercise of the imagination can do, the power of this force to disorganize geological structure and to transform the face of Nature in mountain-regions. One can better appreciate how, affecting high, ice-covered summits, it can set in motion vast quantities of snow and ice, which, falling in avalanches, reinforce and add to the volume of glaciers beneath, while lower down it may in a few moments disrupt the structure of mountains and change their outlines to an extent that centuries of ordinary weathering might not suffice to accomplish.

What I saw in this connection suggests earthquake as the most likely agent in producing the shattered condition of the surface of mountain-slopes from bottom to top sometimes seen, as in the instance of Quartzite peak opposite Masherbrum. Such fragment-covered slopes could not well be considered to be tali, where no heights exist above them to supply the rock-débris of which they are composed, nor does such débris present the appearance of having been split out of solid rock-surfaces by weathering or by lightning—a rare phenomenon in this region.



View from Ganze La toward Kapalu.



A tent at Earthquake camp among moraine-hillocks in centre of Kaberi glacier.

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APPENDIX

I

NOTES ON THE ROCK-SPECIMENS COLLECTED BY THE BULLOCK WORKMAN EXPEDITION, 1911–12, ON THE SIACHEN GLACIER, EASTERN KARAKORAM

By W. CAMPBELL SMITH

THE rocks brought back by the Bullock-Workman Expedition of 1911–12 from the Siachen glacier represent only a few of the more interesting types of rock seen in the course of that expedition. The following brief notes on the specimens have been prepared, because it is important that all specimens brought back, often at great inconvenience to the explorers, from such little known country should be recorded. None of the rocks are fossiliferous, and the detailed descriptions are merely of petrographical interest.

Many of the specimens from the Siachen glacier were collected from the "grey moraine" in the neighbourhood of the camp at 17,029 feet, on the left side of the glacier. Twelve specimens were collected on this moraine, and of these seven are fine-grained crystalline limestones of various colours, white, grey, pale yellow, and purple. Another specimen is a breccia of red and grey limestone fragments. These limestones are similar to those recorded by Ing. V. Novarese and R. D. Oldham from the Baltoro and Godwin-Austen glaciers.

Associated with the limestones are: a dull red calcareous sandstone, a dark purple mudstone, and two pale green altered mudstones with calcite veins.

The moraines of the Tarim Shehr affluent also yielded sedimentary rocks. The "black moraine," which appears to draw its material from the northern wall of the Tarim Shehr, contains abundant fragments of hardened black shale with curious brown oval patches ; associated with this are slabs of a pure white marble. Only one specimen was collected on the southern moraine ; this consisted of iron pyrites with quartz, evidently forming a vein about an inch thick in a black slaty rock.

It will be observed that the striking feature about the moraines of the north-east wall of the Siachen is the great preponderance in them of sedimentary over igneous rocks ; in fact, igneous rocks have been recorded at only two points along the north-east wall of the upper Siachen. One of these points is the Tarim Shehr promontory ; the only rock collected here was not *in situ*, but was broken from a boulder lying near the camp at 16,278 feet, and may have been derived from the head of the Tarim Shehr glacier. It is a much weathered and very friable biotite-granite, or gneiss ; the percentage of biotite is low, and it is scattered unevenly in very small flakes through the rock ; the predominant felspar is microcline.

The other igneous rock collected on the Siachen was broken off *in situ* at a point on the north-east wall about a quarter of a mile south-east of Spur camp at 18,400 feet. This is a pale grey rock containing numerous hexagonal plates of biotite about 2–3 mm. across. Microscopic examination shows it to consist of abundant dark brown biotite, colourless diopside, with some ægirine and abundant apatite, all idiomorphic in a ground-mass of orthoclase. The diopside is slightly altered, but otherwise the rock is remarkably fresh. The rock clearly belongs to the minette group, but it appears to differ from any minette yet described in containing ægirine and an unusual abundance of apatite. This rock no doubt occurs as a dyke, intrusive in the sedimentary rocks : it shows no signs of dynamic metamorphism.

It is interesting to note that Dr. Longstaff[1] recorded a badly weathered dyke rock (? minette), from the middle moraine on the Chumik glacier, associated with actinolite-schist.

[1] T. G. Longstaff, *Geog. Jour.* xxxv. (1910), p. 635.

II

NOTES ON THE ROCK-SPECIMENS COLLECTED BY THE BULLOCK WORKMAN EXPEDITION, 1911–12, IN THE BILAPHOND AND KONDUS BASINS, AND ON THE KHONDOKORO AND MASHERBRUM GLACIERS

THREE specimens were collected in the Ghyari nala below the Bilaphond glacier : two of these are white crystalline limestone containing a little tremolite ; the third is a serpentine (chrysotile). These were the only specimens actually collected.[1] Dr. Longstaff had previously recorded granite as abundant in the moraines.

Some interesting material was collected at the head of the Dong-Dong glacier. One is a coarse white crystalline limestone like those collected in the Ghyari nala. Another is a fairly coarse-grained white biotite-granite, with garnets reaching 4 mm. in diameter ; it is very poor in ferro-magnesian minerals, containing only a little biotite and a trace of muscovite. Quite the most interesting specimen from this locality is a fragment showing large plates of pale green actinolite : some of these show rough crystal outlines, the outer zone of the crystal being brown. They are associated with portions of finer grain consisting of diopside and tremolite, and some fragments of aplite are also adhering to the specimen. This rock is evidently a product of contact metamorphism due to a granitic intrusion.

Several specimens were collected on the central moraine of the north-east branch of the Kaberi glacier. Here occurred white, pink, and purple limestones similar in texture to those of the Siachen ; while a light coloured moraine at the head of the

[1] Compare statements on pp. 227, 228 of this volume.—W. H. W.

glacier yielded abundant slabs of white marble similar to that collected on the Tarim Shehr.[1]

With the limestones of the central moraine occur masses of tetrahedrite, with malachite and azurite, and a curious mass of black pisolitic concretions cemented and impregnated with pyrites and apparently passing into a kind of pisolitic ironstone.

The east wall of the Khondokoro glacier yielded a fine-grained hornblende-biotite-gneiss and also a typical felspar-amphibolite. From the moraines of the same glacier came a muscovite-biotite-granite containing small garnets and showing a tendency towards granulitic structure. This rock occurs as a fine-grained granite, but in some specimens the plates of muscovite may measure half an inch across. The garnets never seem to exceed 1 mm. in diameter. This type was also found by Sir Martin Conway in the Astor valley.

The Masherbrum glacier yielded four specimens: two are white fine-grained dolomite, one is serpentine, the other is an augen of quartz, apparently from a chlorite schist.

An interesting rock was collected at the junction of the Khondokoro and Masherbrum nalas.[2] It is a fine-grained granite-gneiss consisting of quartz, stained yellowish brown, oligoclase and some microcline, with fairly abundant patches of biotite. Sphene and epidote occur as accessories. The oligoclase frequently shows patches of inclusions of biotite and sphene, and also a secondary development of muscovite and epidote. There is some micrographic intergrowth with quartz at the borders of the felspar crystals, and in places a marked tendency towards granulitic structure.

February 12, 1914.

[1] Vide p. 268. [2] Vide p. 89.

III

NOTE ON CONSTRUCTION OF SIACHEN MAP

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 :—

$$\frac{\text{Peak 8}}{52\text{E}},\ \frac{\text{Peak 36}}{52\text{A}},\ \frac{\text{Peak 35}}{52\text{A}},\ \frac{\text{Peak 33}}{52\text{A}},\ \text{and}\ \frac{\text{Peak 23}}{52\text{A}}.$$

The area covered by this survey, about 600 square miles, is found 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. xxxv. p. 624).

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 were working on the glacier about nine weeks, having crossed the Bilaphond La on June 24th and recrossed on August 27th. 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 got 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 measure 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 Reeve'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 Tarim Shehr promontory, being a central position from which to make a rough reconnaissance.

The triangulation was carried out with a 5-inch transit theodolite, fitted with verniers reading to 30 inches, 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, $\dfrac{\text{Peak 8}}{\text{52E}}$ and the twin peaks, $\dfrac{\text{Peaks 35 and 36}}{\text{52A}}$.

A base was deduced from the two known sides, $\dfrac{\text{Peak 8}}{\text{52E}}$ $\dfrac{\text{Peak 36}}{\text{52A}}$

and $\frac{\text{Peak 8}}{52\text{E}}$ $\frac{\text{Peak 35}}{52\text{A}}$. Colonel Renny-Tailyour's solution from two fixed points was used (*Auxiliary Tables*, 4th ed., p. 85). The two values obtained for the side AB were 7,400·8 and 7,405·1 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 $\frac{\text{Peak 8}}{52\text{E}}$ and $\frac{\text{Peak 36}}{52\text{A}}$. The value obtained from 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; but certain circumstances prevented the carrying out of this plan. Owing to the 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 1 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 co-efficient 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 have been found to be as much as 600 feet in excess at trigonometrical stations (*Geographical Journal*, vol. xli. 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.

NOTE

WHILE it is not claimed for the map of the Siachen or Rose glacier that it is final and cannot be improved upon in some particulars in the future, it is to-day the only one representing with considerable accuracy the topographical features of the very important area which it covers.

The object of placing my full name in connection with the expedition on the map, is not because I wish in any way to thrust myself forward, but solely that in the accomplishments of women, now and in the future, it should be known to them and stated in print that a woman was the initiator and special leader of this expedition. When, later, woman occupies her acknowledged position as an individual worker in all fields, as well as those of exploration, no such emphasis of her work will be needed; but that day has not fully arrived, and at present it behoves women, for the benefit of their sex, to put what they do, at least, on record.

In stating this I do not wish to ignore or underrate the valuable co-operation on this expedition of my husband and joint worker, Dr. W. Hunter Workman.

FANNY BULLOCK WORKMAN.

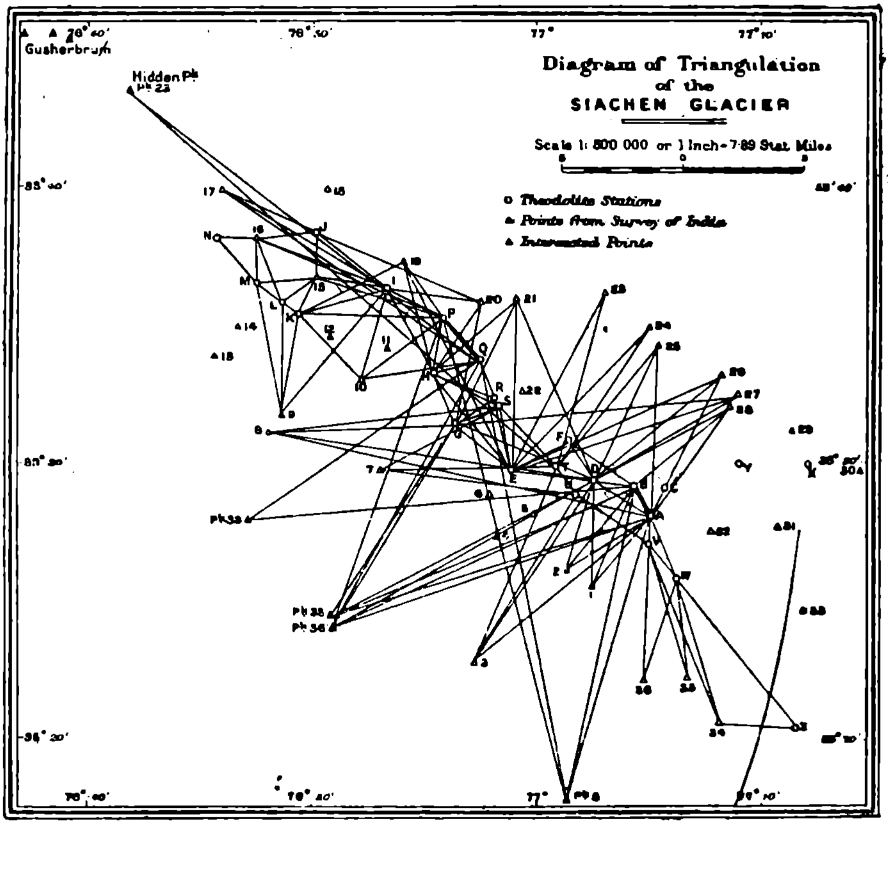


Diagram of Triangulation
of the
SIACHEN GLACIER
Scale 1: 500 000 or 1 Inch = 7·89 Stat. Miles
Theodolite Stations
Points from Survey of India
Intersected Points
Gusherbrum
Hidden Pk
Pk 23
77°
77° 10'
Pk 33
Pk 35
Pk 36
Pk 8

DETAILS OF SIACHEN OR ROSE GLACIER SURVEY

INTERSECTED POINTS.

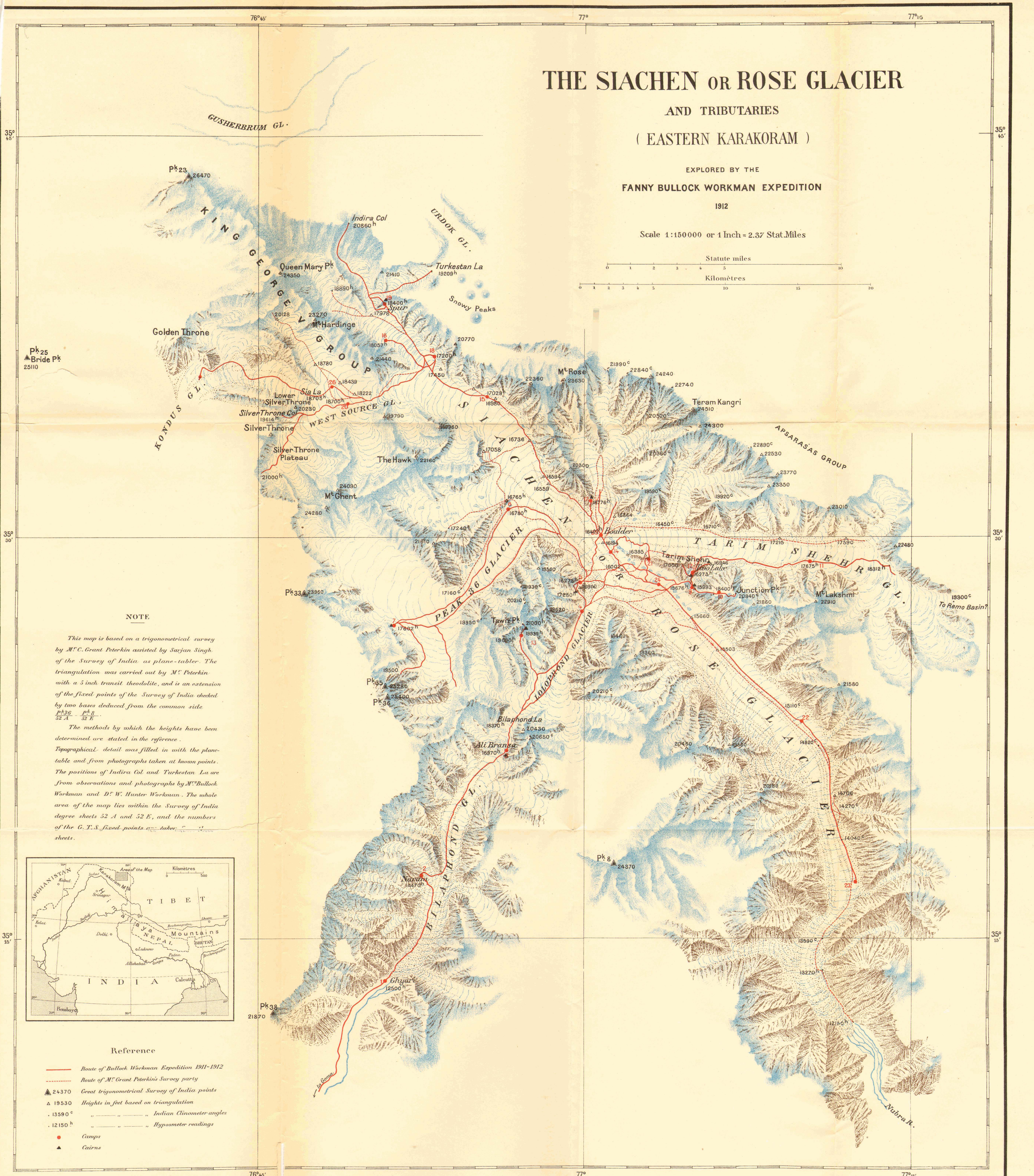
Station.		Latitude N.	Longitude E.	Height. Feet.	
Siachen No. 1	...	35° 25′ 32″	77° 02′ 26″	19,360	
,, 2	...	35 26 05	77 01 18	19,460	
,, 3	...	35 23 04	76 57 26	20,430	
,, 4	...	35 27 19	76 58 14	19,620	
,, 5	...	35 28 08	76 59 48	16,900	
,, 6	...	35 28 49	76 57 49	19,560	
,, 7	...	35 29 41	76 52 59	21,610	
,, 8	...	35 31 06	76 48 07	24,280	Mt. Ghent
,, 9	...	35 31 44	76 48 33	24,090	Mt. Ghent
,, 10	...	35 32 58	76 52 10	22,160	The Hawk
,, 11	...	35 34 07	76 53 19	19,960	
,, 12	...	35 34 31	76 50 44	19,790	
,, 13	...	35 33 47	76 45 36	—	Silver Throne
,, 14	...	35 34 55	76 46 38	20,230	Lower Silver Throne
,, 15	...	35 36 36	76 50 08	21,440	
,, 16	...	35 37 59	76 47 29	23,270	Mt. Hardinge
,, 17	...	35 39 51	76 45 43	24,350	Queen Mary Peak
,, 18	...	35 39 55	76 50 33	21,410	
,, 19	...	35 37 09	76 54 04	20,770	
,, 20	...	35 35 47	76 57 32	22,360	
,, 21	...	35 35 56	76 59 05	23,630	Mt. Rose
,, 22	...	35 32 36	76 59 23	20,300	
,, 23	...	35 36 02	77 03 00	24,240	
,, 24	...	35 34 43	77 04 54	24,510	Teram Kangri
,, 25	...	35 34 11	77 05 25	24,300	
,, 26	...	35 33 08	77 08 16	22,530	
,, 27	...	35 32 22	77 09 01	23,770	
,, 28	...	35 31 57	77 08 40	23,350	
,, 29	...	35 31 05	77 11 21	23,010	
,, 30	...	35 29 48	77 14 39	22,480	
,, 31	...	35 27 36	77 10 49	22,910	Mt. Lakshmi
,, 32	...	35 27 29	77 07 55	21,860	
,, 33	...	35 24 39	77 11 30	21,580	
,, 34	...	35 20 33	77 08 14	20,180	
,, 35	...	35 22 11	77 06 45	19,530	
,, 36	...	35 22 04	77 04 47	20,460	

THEODOLITE STATIONS.

Station.	Latitude N.	Longitude E.	Height. Feet.
A	35° 28′ 02″	77° 05′ 08″	15,993
B	35 29 07	77 04 26	17,003
C	35 29 01	77 05 48	16,946
D	35 29 21	77 02 37	16,395
E	35 29 41	76 58 56	16,314
F	35 30 45	77 01 27	16,364
G	35 31 20	76 56 25	16,765
H	35 33 13	76 55 22	17,058
I	35 36 17	76 53 22	17,450
J	35 38 17	76 50 05	17,978
K	35 35 20	76 49 22	18,222
L	35 35 43	76 48 43	18,439
M	35 36 26	76 47 33	18,780
N	35 38 06	76 45 43	20,128
O	35 35 37	76 54 54	—
P	35 35 11	76 55 52	16,980
Q	35 33 38	76 57 26	16,736
R	35 32 19	76 58 09	16,594
S	35 32 01	76 58 22	16,559
T	35 29 51	77 00 57	16,194
U	35 28 50	77 01 49	16,002
V	35 26 59	77 05 01	15,660
W	35 25 46	77 06 13	15,503
X	35 29 57	77 12 13	17,590
Y	35 29 58	77 09 05	17,215
Z	35 20 20	77 11 38	14,706

GREAT TRIGONOMETRICAL SURVEY OF INDIA POINTS.

Station.	Latitude N.	Longitude E.	Height. Feet.	
$\frac{\text{Pk. 23}}{\text{52A}}$	35° 43′ 30″	76° 41′ 48″	26,470	Hidden Peak
$\frac{\text{Pk. 25}}{\text{52A}}$	35 36 44	76 34 23	25,110	Bride Peak
$\frac{\text{Pk. 26}}{\text{52A}}$	35 27 45	76 34 44	22,750	
$\frac{\text{Pk. 27}}{\text{52A}}$	35 25 08	76 33 12	23,890	
$\frac{\text{Pk. 33}}{\text{52A}}$	35 27 54	76 47 07	23,960	
$\frac{\text{Pk. 35}}{\text{52A}}$	35 24 24	76 50 50	25,280	
$\frac{\text{Pk. 36}}{\text{52A}}$	35 24 01	76 50 55	25,400	
$\frac{\text{Pk. 38}}{\text{52A}}$	35 12 12	76 45 41	21,870	
$\frac{\text{Pk. 8}}{\text{52E}}$	35 17 46	77 01 23	24 370	



M. Chesneau del.


MAP OF
KASHMIR
showing the routes travelled by
FANNY BULLOCK WORKMAN
AND
Dr. WILLIAM HUNTER WORKMAN
during the summers of 1898, 1899, 1902, 1903, 1906 & 1908
1911-1912
Scale of Miles
10 0 10 20 30 40 50
74°
76°
78°
36°
34°
Hunza
Bar
Chalt
Nagyr
Hunza R.
Hispar
Biafo Hispar Watershed Pk
Hispar Pass 17475
Alchori Col
Pyramid Pk 24500
Mt Lungma
Mt Chogo
Yasin R.
Guldpur
Sinakar
Gilghit
Mt Haramosh 24270
Dokok
Mt Rachel
Arandu
Ganchen
Nangma Tapsa
Hoh
Braldoh R.
Askole
Hemasil
Gunto La
Tigstun
Koser Gunge
Mt Bullock Workman
Siegfriedhorn
Skoro La
Shigar
Korofon
Mustagh P.
K2
Baltoro Glacier
Pk 23
Indira Col
Turkestan La
Teram Kangri
Masherbrum
Bride Pk
Rimo Basin
Karakoram Pass
Depsang Plains
Bunji
Talich
Sazin
Tor
R. Indus
Gis
Rondu
Tiongo Pir
Basho
Molto
Bincha
BALTISTAN
Olmo
Nurhbuchung
Kande
Rango
Skardo
Abru
Kiris
Mataya
Thagas
Damsan
Kondus
Korkondus
Pk 8 24370
Goma
Worchi
Strongstel
Sassar
Murga
Ksilanger
Astor
Thak
Jalkot
Kotgali R.
Kotgoli
Nanga Parbat 26620
Bunnok La
Kohadas
Bobin
ASTOR
Matroli
13400
Deosai Plains
Parkutta
Bongul
Tolti
Shyok R.
Canse La
Ababan
Kustong
Kharmang
Thang
Chuar
Turtak
CHORBAT
Changlang
Tutilak
Tiksay
Pannamik
NUBRA
Chamshing
Tsati
Thirit
R. Nubra
Shayok R.
Gihar
Waitar
Sara Sanga P. 14200
Burzil
Stakpi La
Gidiazdo
Shiriting
Sunido
Khaigan
Sirdari
Shigar R.
Duria
Dundial
GURAIS
KUMRI
Minimarg
Bamachan
Handangsmin
Kanjalwar
Molgan
Shingo R.
Gudial
Gurais
Gultare
Hardas
Chanegund
Gurkhun
Ghanul
Kishenganga R.
Rajdiangan P. 11800
Tragbal
Kunar
Kargil
R. Indus
Pala
Shalura
Gujria
TILAIL
Tashgam
Wachan
Mirpur
Letsun
Laidoh
Kharchar
Muzzaffarabad 2455
Bandipur
Dras
Grantung
Tambis
Mulbeek
Domel
Woolar Lake
Sinnar
Sonamarg
Matayan
Suru R.
Tuinah
Kharbu
Fotu La 13446
Khalsi
Nurla
Shayok R.
Lhabap
Dulai
Sopur
Sumbal
Kangan
Gagangir
11300
Zoji La
Baltal
Kartse
Lamayuru
Saspul
Kardong Pass 17574
Kindar
Baramula
Ganderbal
Gund
Kangi
Nimu (Snemo)
Leh 11280
Shayok
Chikar
Jhelum R.
Mahadeo 13084
17839
Kolahoi or Gwashbrari
Purtik
Suru
Sumdah
Kohala
Chagoti
Urie
Srinagar 5765
Aru
Perkutze
Kangi La 17007
Pitak
Tiksay
Gulmarg
Sher Garhi
Pampur
Palgam
Bhotkol R.
Dunore
Bhotkol
Nun Kun
Gulmatunga
Gompa (Lama Serai)
Taxi Tonzas
Chiling
Shushot
Chilam
Murree
Dhara
Jhelum R.
Awantipur
Bhatkot
Rikingwas
LADAKH
Himis
Arpa
PUNCH
Punch
Chrar
Payech
Murhama
Lidar R.
Inshin
Wardwan
Chilung Pass
R. Zaskar
Hankar
Ispadok
Dhara
Islamabad 5288
Martand
Achabal
11600
Margan P.
Petgam
Abring
Hanomil
R. Khurna
Khurna Kur
Sakra
Hanjpur
Naubug
ZANSKAR
Zuzzar
Khurna
R. Indus
KASHMIR
SURU
M.C.

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