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No. VII.—Memoranda on the Progress of the Trigonometrical Survey in Kashmir.



Memorandum drawn up by the order of Colonel A. Scott Waugh, Engineers, Surveyor General of India, F.R.S., F.B.G.S., &c., on the progress of the Kashmir series of the G. T. Survey of India, with observations on the late conquest of Gilgit, and other incidental matters, by Captain S. G. Montgomerie, Engineers, F.B.G.S., &c., in charge of the series.



During the field season of 1860 the triangulation of the Kashmir series has made good progress up the river

* FORT:	Indus, and the position of
Latitude, . . .	34-9-30. Leh,* the capital of Ladak,
Longitude, . . .	77-36-42.
Height above sea,	11,278 ft. has been finally fixed. Messrs.

Johnson and Beverley had to carry their work over some very difficult, rugged, and confined ground, no where under 18,000 feet, that separates the more open valley of the Indus, to the south-east of Leh, from the table land of Rupshu and Haule. This was effected in a most skilful and praiseworthy manner, though it twice involved the ascent of a station, by Mr. Johnson, of 19,979 feet, and by Mr. Beverley, of another, 19,958

feet above the sea, besides numerous other stations, all over 17,000 feet above the sea.

A trigonometrical mark has been erected on a point 21,483 feet above the sea, but, unfortunately, there was not sufficient space to put a theodolite on it.

Several points in China have been fixed, and, amongst others, the well known Gya peak is supposed to be included. The height of this peak, which I saw last year, appears to be from 23 to 24,000 feet above the sea. Further observations have been taken to the group of peaks seen at the same time in the Shayok direction. They average considerably over 26,000 feet in height.

Some progress has been made with the triangulation of Zanskar. In this work a very rugged and confined piece of ground, over 17,000 feet, has been crossed between the valley of the Indus, and the more open valley of Zanskar.

On the upper course of the Shayok river, (in the Nubra district), the triangulation has been commenced, and a good many peaks fixed.

The topographical work was first taken up in the Kishengunga valley, which, although drained by a large river, is really, for the greater part, little better than a chasm in the mountains. Throughout it is very precipitous; and, as Ahmed Khan, the chieftain of Kurna, said to me in reference to its rocky surface, "a

traveller must put on grass shoes if he wishes to visit the Kishengunga valley." It is, indeed, all but impossible for even the best pedestrians, without loads, to follow the river from Kurna to Gurais, and any one wishing to do so, would prefer going actually along the northern ridge of the Kashmir valley.

The Kishengunga valley, so difficult a piece of country at the best time of the year, had to be taken up when the snow was heavy, even at 9,000 feet. This added very much to the difficulties of the work; but, as the Maharajah's troops were shortly to cross the valley, *en route* to Gilgit, it was necessary to finish early. The work was fortunately completed in very good time, and the whole of the Surveyors were then transferred to fresh ground in Little Thibet and Ladak.

During the season topographical sketches were made of the whole valley of the Indus, from Skardo, the capital of Little Thibet, or Bulti, to Leh, the capital of Ladak; as well as the whole of the Sooroo and Dras vallies, the plains of Deosai, and a large part of the Shigar valley north of Skardo, with a portion of the Nubra or Shayok valley. This large tract of country, (in all an area of about 12,000 square miles), had been triangulated in previous seasons, and was found to embrace all sorts of ground, from an altitude of 27,000 feet, down, in a few cases, to 8,000 feet above the sea;

In Lieut. Melville's Sections, Area measured.	} sq. miles. 198.
Captain Austen's. Es- timated,	} 150.
Do. in other Sections,	} 50.
Total,	398.

though seldom under 10,000 feet. It included, at least, 350 square miles of glaciers, for the most part of the larger kind. Those glaciers already surveyed, to the north of the

Shayok, have proved to be quite as large as the ones previously measured in 1858 and 1859, by those very able and energetic topographical Surveyors, Captain Austen and Lieut. Melville, of the Kashmir series, near the Kun and Nun peaks, in the Wurdwan and Sooroo districts.

Captain Austen's ground, in one part, rose to nearly 27,000 feet, and one of the glaciers, in the highest ground, is about 11 miles in length, and from $\frac{3}{4}$ to 2 miles in breadth. In Lieut. Melville's work the peaks ran up to nearly 24,000, and under Kun, the highest peak, one of the glaciers is about 10 miles long, and from $\frac{1}{2}$ to $1\frac{1}{2}$ miles broad. Glaciers are, in fact, in this section of the Himalayas, very much larger and more numerous than in any part of the Himalayas previously surveyed. Possibly this is in some measure due to the latitude, as all these glaciers lie between latitudes 33 and 36 degrees north;—but it must also be partly the result of the immense heights of the peaks generally, as, with the exception of those of Nepal, they exceed all other parts of the Himalayas that have, as yet, been measured.

The glaciers in the neighbourhood of the Nanya Parbut and K2 have not, as yet, been explored. They will, undoubtedly, be large, and those of the latter, at any rate, are, from all that has been seen and heard, likely to prove even larger than the ones already measured. From 3 to 4 marches are occupied in crossing the glacier at the head of Brald's branch of the Shigar river.

The whole of the country sketched was of a very difficult character, testing both the physical and artistic powers of the Surveyors to the utmost, both in moving about and in delineating the country. Circumstances permitting, the whole of the glaciers in the neighbourhood of the Nanya Parbut, and of K2 will be explored during the next field season, as well as those of Zanskar and other places.

There is hardly any portion of the upper valley of the Indus without glaciers, but they are largest and abound most near the great Himalayan and Karakoram ridges.

The plains of Deosai are, perhaps, the most curious topographical feature of the country sketched during the season. These plains consist of about 580 square miles of gently undulating ground, averaging at least 14,000 feet above the sea, surrounded on all sides by rugged mountains running up to from 16,000 to 17,000 feet. The drainage, escaping through a not easily distinguished gorge near the Katasiri station, falls into the

Dras river above Kirkitchoo. This tributary of the Dras river is called the Shigar, and sometimes the Shingo river; it brings down gold with its water, and gold washing is carried on just below the junction. The Indus itself, and several other of its tributaries, are also known to produce gold. The gold washing is said not to be valuable, but it does sometimes give as much as 1 or 2 small rupees a day to a man, though a most barbarous method is employed in washing the earth. This earth is taken from the detritus, which, I think, now generally lies above the highest flood line. After two or three washings, a black, heavyish kind of sand is left, with the pieces of gold scattered here and there.

As far as my own experience goes I should say it was not a profitable business, for, after half an hour's washing, I only got five very tiny nuggets, hardly worth an anna, and I had, at the same time, the benefit of the assistance of an Australian gentleman. This gentleman, however, thought that something might be done by investing in a cradle and apparatus. He said that a substance like the black sand mentioned above had proved valuable in Australia.

When crossing the Himalayan range the plains of Deosai were a great obstacle to the progress of the triangulation; for, although the depression of the Himalayas in that part gave a most extended view from very high points, still, there being no habitations

for the distance of 7 or 8 marches, and no village of any size for 11 or 12 marches, the operations were carried on under very great difficulties. In the plains the only firewood to be had is got by digging up the juniper roots, and from very thin stunted willows; but, on the mountains above, there was absolutely no firewood to be had of any kind, the stations being all from 16 to 17,000 feet in height. It was absolutely necessary to reside for several days on these stations. Provisions had, at all stations, to be brought from places 4 to 7 marches distant. The people of the country were, moreover, not very willing to enter the plains from the Kashmir side. The operations could only be carried on during the rainy season, and at that time there are but few breaks in the clouds, which rush through this depression in the Himalayas into the valley of the Indus, and across the Karakoram mountains. With the greatest difficulty the signal men who worked the heliotropes and lamps at the various stations were fed, and on two occasions the main party were fairly starved out, and had to retreat, in consequence of protracted cloudy weather.

Stations over 16,000 feet above the sea are not the most agreeable places for residence at the best of times, but when enveloped in clouds, they are unmistakably unpleasant, though there is some slight compensation in the grandeur of a break up, or when the upper level of the clouds falls, as I have several times seen it fall, be-

low the station on which I was pitched, leaving the camp on an island surrounded with a level sea of clouds, from which the peaks of the various ranges stood like other islands, and the waves of clouds surged backwards and forwards across the lower ridges between. In clear weather the views were really magnificent, and proportionately appreciated after the cloudy weather. The atmosphere was at such times wonderfully clear at those elevations. It was across the plains of Deosai that I took the first observation to the peak K2, (28,287 feet above the sea), at a distance of 136 miles, the side of one of our largest triangles. Notwithstanding all the difficulties, the triangulation was successfully carried over the plains during one season, without relaxing any of the rigorous rules of the G. T. Survey of India.

With reference to my last memorandum on the great flood of the river Indus, I have not as yet been able to obtain any further information, as to its origin, though the expedition against Gilgit has succeeded as I anticipated it would.

The Maharaja has directed every enquiry to be made, and I hope to be able to give a correct account of the origin of the flood when I return to the Maharaja's territories next year. Meantime the expedition has confirmed several important points in the geography of the countries near Gilgit, and a short account of the expedition itself may be interesting.

The enclosed rough plan is the general result as to the geography of the country annexed, and also shews a portion of the neighbouring countries.

The Maharaja laid in a large supply of food at the forts of Astor and Boonjee during the summer of 1859. Hitherto, one of the greatest obstacles to making a successful attack on Gilgit has been the difficulties of getting supplies. The natives are in the habit of using the old expression to the effect that a small force going against Gilgit was sure to be defeated, and a large force to be starved. To obviate this, a hundred ponies were put at each of the 17 halting places between Kashmir and Boonjee, via Gurais and Astor, and whilst the weather permitted 100 loads of grain were delivered daily at Boonjee.

In June—July of this year several detachments of sepoy were moved upon Gilgit, mustering finally at Boonjee to about 4000 men, under Colonel Devi Singh and Colonel Dooloo Singh. The whole body then advanced upon Gilgit, crossing the Indus by means of a boat; further on they crossed a tributary river by a wooden bridge. No opposition was met before reaching Gilgit itself, and there the Gilgities got inside their fort and held out for a short time, during which there was a little firing on both sides, ending by the Gilgities surrendering: the Maharaja's force losing one man by the bursting of a gun, and the Gilgities leav-

ing one dead man in the fort, supposed to have died a natural death during the siege.

Having settled affairs at Gilgit, the force advanced further up the valley to Shirni (or Shirwat) fort, where there was some slight resistance, ending as before in capitulation. The force then advanced on Yasseen, which is on the Gilgit river, and not on a separate tributary of the Indus. Yasseen fell into the hands of the force, and the son of the Goraman, who had held Gilgit in addition to Yasseen, made his escape over the mountains to the west and on into Badakhshan. The Goraman himself died during 1857. He was well known in the whole of the country between the Indus and Cabul, and was generally called an Adamkhor, or man eater, from a habit that he had of catching all strangers that he could for the purpose of exchanging them for the large dogs so much prized in that part of the world. The Goraman and his son had till this year held Yasseen, and for a short time Gilgit also, though once or twice driven out from the latter by the Dogras. In addition to the main body of the Dogra force advancing from the south, an armed body of Baltis advanced through Shigar, and thence by the Nagar and Hoonza vallies threatening Gilgit on the east.

Another force was to have advanced from the west under the instructions of an agent from Dheer and Chitraul, but it was not apparently in time, though possibly

the mere talk of it made the Goraman's son unhappy at to his line of retreat.

This conquest, which may be said to have been made without loss of life, is highly creditable to the Maharajah, and his officers who planned and carried it out. The effects are, in some respects, likely to be very salutary. In the first place, the mere fact of having a force in Gilgit overawes and keeps in check the robber clans of Nagar and Hoonza, who have for years infested the roads between Balti and Ladak on the one side, and Yarkund on the other ;—and, latterly, to such an extent, that those roads in their immediate neighbourhoods, though the shortest, have been almost completely closed to anything in the shape of a merchant. Keeping possession of Gilgit during the cold weather, when all communication with Kashmir is closed, has always been the most difficult business. The Maharajah has, however, left nearly 3,000 men in the valley, and, consequently, in future it is to be hoped that they will hold their own, and that the traffic from Skardo direct to Yarkund will again be resumed.

In the second place, this successful expedition has had a very wholesome effect on all the petty tribes lying between Gilgit and the Cabul territories, and, ultimately, may be of assistance in keeping the Swat valley in check,—Swat being still one of the recusant tribes on our north-west frontier.

At the Durbars of the Maharajah during this season, men from Chitraul, Dheer, Swat, Kholi, Palus, &c., were in attendance, as well as those from Chilas, Nagar, and Hoonza, who have been constant attendants for some years.

At the last durbar held by the Maharajah, Colonel Devi Sing made his salaam, having just returned from the Gilgit expedition. Some of the Yasseen men were introduced at the same time. One long brass gun, of about 3 lbs. bore, accompanied the Colonel, his sepoy having taken it from the Goraman's son. This gun seemed to be well cast, and had a Persian inscription on it, to the effect that it was made in Budakshan, or had belonged to that place. Among the minor results of the expedition was a great influx of presents to the Maharajah, from all the chiefs between Gilgit and Kafiristan. Perhaps the most valuable in the eyes of the Curator of the Asiatic Society's Museum, would have been a splendid live male specimen of the Markhor, the greatest prize of Himalayan sportsmen. This animal was introduced into the full durbar, guided by four men with guy ropes. It was really a handsome animal, of a light fawn color, with a capital pair of horns, and a fine long beard. The top of the Markhor's head was, perhaps, $5\frac{1}{2}$ feet from the ground, the horns towering up above all the men in attendance. The keepers of this animal evidently held him in the greatest respect, though he

had been a captive for at least two months. This Markhor was a present from the chiefs of Kholi, Palus, on the Indus.

The Chilasses sent in some very fine half domesticated goats, a part of which the Maharajah distributed amongst the European visitors to Kashmir. One of these goats, now in my possession, has a very fine pair of horns of the Markhor kind.

The country on either side of the Indus, between the British district of Huzara, and the Maharajah's valley of Astor, has hitherto been all but impassable. With Chilas, Kholi, and Palus, all under the orders of the Maharajah, a very slight pressure ought to open out the remainder, down to the Huzara district, which might tend to bring the Akhoon of Swat to reason. At the same time, opening out the whole valley of the Indus is, in itself, no small advantage, if it will enable travellers to pass along in safety.

Traffic will undoubtedly increase, and, moreover, the Punjab Government will have the means of getting full information, in case the Indus should again be blocked up in any part of its course. In the latter respect, the conquest of Gilgit, with Yasseen, Hoonza, and Nagar, is really very valuable, as it places under a friendly Native State the only great tributary of the Indus concerning which the British Government has hitherto been unable to get any reliable information. This tributary, more-

over, is, in my opinion, the one on which the late great flood of the Indus was generated.

If these countries are in thorough subjection to the Maharajah, such a calamity as the cataclysm of 1858 ought not again to befall British subjects on the Indus, without their having, at any rate, full warning, even if it were not possible to prevent or mitigate it by the scientific application of labor, as it most probably would be.

In my former memorandum I said that I thought floods might be generated in many parts, both of the Indus and its tributaries. Captain Austin has just forwarded me the following, which fully confirms that opinion :—

“ CAMP GOL, ON INDUS,
29th August 1860.

“ A flood occurred at Gol about 5 years ago, in the month of June. Very muddy water came down the ravine, slowly at first, and the people who saw it ran up the hill sides. Twelve old men, who could not run away, were drowned, twenty houses, and about 500 apricot trees were washed away. There was but little snow on the hills at that time, and the ravine is by no means a large one. The villagers go up it constantly, and yet were not aware of its being in any way dammed up, though the water must have been in considerable

quantity, as the flood altered the course of the Indus. It is a mystery to me, where sufficient water could have been collected." This account was given by Wuzzir Hussain, of Gol.—(Signed) H. H. G. A."

The Balti force that went from Shigar, *via* Nagar to Gilgit, had to cross a very large glacier. The route obtained by Captain Austen (attached to this), shews that it takes a man a whole day to cross it.

With reference to the Society's discussion about Kyangs—known generally as wild horses—a great many Kyangs have been seen by myself and others. I have watched a herd for a long time at a short distance with a telescope. I have not heard them calling; but Mr. Johnson, who caught a foal this year, says that they bray, and the natives with my camp say the same. I saw a very large skin of a Kyang, shot by Mr. Johnson this season, in Rupshu. There was a black mark all the way down the back, but not the least sign of any stripe on the shoulders. The skin of the tail was about 13 inches long, and the whole tail not more than $2\frac{1}{4}$ feet in length;—but this, I think exceptional, as some of those in the herd I examined had tails reaching nearly to the ground. The ears and tail struck me as being like those of a mule, and I thought them generally very high in the withers, and very much larger than any of the wild asses of the salt range that I have seen, though bearing a strong resemblance to them.

The season of 1860 has not been a favorable one, as far as the weather was concerned; it was, indeed, peculiarly unfavorable for the triangulation in the upper part of the vallies of the Indus. The late very heavy falls of snow in March were never thoroughly melted away. Before the triangulation party left, the whole of the smaller streams remained hard frozen during the day.

The kyangs, and even the geese, ducks, and other waterfowl, all left the neighbourhood of the Chomoire lake as early as the end of August. It was so cold, that even at the end of July I crossed over some snow bridges in Ladak, that in ordinary seasons disappear before the end of June.

The extremity of the Machaboy glacier projected further than usual into the Dras valley, and its extremity did not recede much till the end of the season. Bad weather set in early in September, and soon after all survey work was forcibly brought to an end.

It is to be hoped that we have no more such seasons. With favorable weather I think we may succeed in carrying both the triangulation and topographical work up to the Chinese frontier. The triangulation may, possibly, advance a little further, even as matters now stand; and, if the present war with China results in friendly relations, extending to all the provinces of that empire, we may hope to see a large traffic spring

up between Hindoostan and the eastern part of Central Asia.

The triangulation of the G. T. survey may be joined on to that of Russia, and thus accomplish the project of Colonel Everest, the late Surveyor General of India, who wished to measure the arc between Cape Comorin and Nova Zembla, an arc including nearly 70 degrees of the earth.

To accomplish this there at present remains a gap of little over 5 degrees of Chinese territory ; the operations of the Kashmir series extending beyond Latitude 36 degrees, and the Government of Tobolsk now coming down below Latitude 42 degrees. At any rate, if the war makes the Chinese officials on our north-east frontier friendly, we may succeed hereafter in fixing the geographical positions of some of the great cities of Central Asia.

T. G. MONTGOMERIE, *Capt., Engineers,*
1st Asst. G. T. Survey,
In charge Kashmir Series.

ROUTE FROM SKARDO *via* SHIGAR AND NAGUR
TO GILGIT.

No. of Marches	Distance in Miles.	Names of Halting places.	Remarks.
1	1	Skardo to	
1	18	Shigar.	A large village.
2	15	Kushumal.	A village.
3	16	Chutrau.	Literally hot water from a hot spring.
4	20	Arundu.	Village.
5	Each of these marches occupies nearly the whole day.	Yak Kote.	Very bad road, crosses a pass, and goes over a very long glacier.
6		Hai Hutun.	A bad road.
7		Hisper.	A village, march longer than usual.
8		Hoper.	
9		Nagar.	Do.
10		Pakher.	Do. a long march.
11		Nillit.	Do. Do.
12		Chaparote.	Do. Do. in Gilgit.
13		Naornul.	Do. Do. Do.
14	Gilgit.	Do. Do. Do.	

N.B.—The Hoonza river is very much smaller than the Shigar. There are three roads from Hoonza to Yarkand;—one that takes 12, another 8, and another no more than 4 days;—the last being only known to the natives of the country, and not to the merchants who go to Yarkund. The man who gave the above said he had gone by the Nagar and Gilgit routes.

ROUTE FROM KASHMIR TO GILGIT *via* GURAIS
AND ASTOR.

No. of Marches.	Distance in Miles.	Names.	Remarks.
1		Srinugur.	
2		Sinbul.	
3		Bundipoor.	
4		Trakbal.	
5		Jotkusu.	Cross the Kashmir ridge.
6		Kunzahoan.	
12		Gurais.	
16		Astor.	{ Cross Himalayan water shed during 3rd march.
22		Boonjee.	
22		Gilgit.	Cross the Indus by boat close to Boonjee.
Total, 22 Marches.			

T. G. MONTGOMERIE,

&c. &c. &c.

To

R. H. DAVIES, ESQUIRE,
Secretary to Government Punjab.

CAMP KULLALWALA, 6th March 1861.

Sir,

I have herewith the pleasure to enclose a copy of the memorandum that I promised to send the Government. It more especially refers to the progress of the Kashmir series during the last field season; but, as it was drawn up for the Asiatic Society, it contains other miscellaneous information, besides a short account of the last expedition against Gilgit, and some remarks connected with the Indus cataclysm of 1858.

The Lieut. Governor spoke to me about the Kashmir and Ladak road into Central Asia. I do not look upon it as a rival to the Cabul road, but as another useful opening road towards Central Asia, and more especially the eastern part of it, (it might, perhaps, be called a rival to the Eastern Provinces even now), to which it is the most direct route. The only thing that would give the Ladak road a chance of rivalling the Cabul one is, that in the former British influence can be exercised right up to the frontier of Yarkund and China generally—no independent state such as Cabul intervening.

A small traffic is even now carried on notwithstanding the existing difficulties and restrictions. The traffic is with Kashgar, Yarkund, Khoten, and other large and small towns on the Chinese frontier, with Thibet and the North-west of China generally.

Kafilas come every year to Ladak, both from Yarkund and Lassa.

The Kashmir and Ladak road is, perhaps, the only road by means of which the Himalayan Borax may be carried down profitably to the sea. Laden ponies can go along it even now. On all other roads on which the carriage—through our own hills—is by coolies, sheep, and goats, it has not been found worth sending to England, though the Borax is to be had in Ladak at 1 rupee per maund, and sells in England at about Rs. 33 per maund, (£95 per ton.)

A great quantity of Pushmeena is sent down from China by the Ladak road; but, being a more valuable article, the disadvantage of the other roads is not so apparent.

I have, &c.,

T. G. MONTGOMERIE, *Captain, Engineers,*
1st Assistant G. T. Survey,
In charge Kashmir Series.

