

SURVEY OF KASHMIR AND JAMMU, 1855 TO 1865

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IN 1855 Lieutenant Montgomerie of Engineers was given charge of a party of the Great Trigonometrical Survey for the survey of the territories of Mahārāja Gulāb Singh of Jammu.

Gulāb Singh, a Dogra chief, had been Rāja of Jammu since 1820 in the days of the great Sikh ruler Ranjīt Singh. He was ambitious and enterprising. After the British defeat of the Sikhs in 1846 he was granted possession of Kashmīr which had been a province of the Sikhs since 1820.

There had been many attempts to put Kashmīr on the map from travellers' tales, but the first serious contribution had been Trebeck's surveys between 1820 and 1823 when he accompanied William Moorcroft on his long journey to Bukhāra. Moorcroft had been held up for two years in Ladākh waiting for a chance of travelling through Yārkand, and when that eventually proved impossible, he made the journey down through Kashmīr and on by Peshāwar and Kābul.

Following the treaty of Lahore in 1846 a political mission was sent up to lay down a boundary between British territories and those of Gulāb Singh, and rough sketches were made by Alexander Cunningham of southern Ladākh, Spiti, and Lahaul. The following year he led another mission to determine the outer frontiers of Gulāb Singh's possessions towards Tibet and Sinkiang, and a rough map of the Ladākh area was made by Henry Strachey.

At this time also the Great Trigonometrical Survey had started a major chain of triangles along the lower hills from Dehra to Attock, and had formed a special party for the topographical survey of the mountainous area between Garhwāl and Chamba. Magnificent work had been done running chains of triangles through the deep gorges of the Sutlej, the Spiti, and the Chandra-Bhāga—or upper Chenāb—across the great ranges into Kulu and Lahaul, and across the Bāra Lācha La. After six years of strenuous work in the mountains the party was well keyed up for the survey of Kashmīr, with a grand team of seasoned signalmen and khalāsīs. Led by William Johnson, who had established himself

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as a bold mountain surveyor, the party marched up from Dehra Dūn to meet Montgomerie at Amritsar at the end of February, 1855. Gulāb Singh had already given his cordial assent to the survey and mapping of his territories.

Montgomerie had joined the Great Trigonometrical Survey in 1852 and had been on triangulation in the Punjab and on the measurement of two base-lines. His immediate task was to set out a chain of triangles starting from the main series about 20 miles east of Jammu, and to work it across the Pīr Panjāl range to the Kashmīr valley. The peaks of the Pīr Panjāl rise to over 15,000 ft., and carry a heavy crown of snow well into June. Fresh falls of snow were frequent, and the surveyors had to work in wintry conditions right through March and April. They had to camp several days at a time on each summit, building platforms and masonry pillars, and huts for the signal parties, and waiting for clear views.

After selecting the first stations himself, Montgomerie sent Johnson ahead to lay out the advance triangles whilst he and Douglas, who had only joined the survey within the past year, went back to start theodolite observations. Montgomerie decided to dump the large two-foot theodolite as being too cumbersome for work on the mountains, and he worked with a reliable 14-inch. Observations were taken to heliotropes worked by the signal squads camped on the surrounding peaks, and Montgomerie writes of the thrill of spotting 'the bright point of light shining from the apex of a noble snowy cone'. When clouds prevented the use of heliotropes by day, observations had to be made to lamps at night. He made a point of keeping his observations and angle-books with the most meticulous refinement, up to the highest geodetic standards.

Johnson had a stiff task on peak Munt Mal, 14,336 ft. above the sea, making his climb of over 7,000 ft. through heavy snow in one day with all his men. Most of them suffered from headaches and snow-blindness from the glare, in spite of shading their eyes with fir-tree twigs. They dug first through the highest crest of the snow without touching ground, but had better luck at a lower point where they found rock eleven feet down. Clouds came over charged with electricity which made their hair and clothes crackle and spark most unpleasantly. Snow had to be melted for all their water, whether for drinking or for mixing the lime mortar for the masonry pillar. Johnson had in all to spend more than two weeks on the peak, building platform and signaller's hut, and then taking theodolite bearings in the intervals between

clouds and snowstorms. He left a signal party of four men under Daffadar Moli, who did such noble work with heliotrope and lamp for the next two months that the peak was dubbed MOLI hill station on all the charts. His heliotrope was always to be seen so long as there was the faintest gleam of sunshine on the peak, and at night his lamp was always well trimmed and bright.

Montgomerie and Douglas had similar trouble with electric discharges, and rigged up a portable lightning conductor from crowbars and other tools. When Douglas put up his umbrella to keep off some extra large hailstones there was an alarming crackling which changed to a terrific humming when he closed the umbrella again. The daffadar had his hair set alight and a lamp box was torn open. But there were fine spells when gorgeous views of the mountain ranges opened up, and the surveyors had the joy of recording the bearings of the great peaks, such as Haramukh, Nanga Parbat, and Nun Kun, or Ser Mer. From these first observations and preliminary computations Montgomerie made Nanga Parbat about 25,700 and Nun Kun 23,400 ft. and he was amazed to find them so very much higher than any of the earlier geographers and travellers had suggested. Both had till now been put down as about 21,000.

When they moved forward to Moli, they came in at once for a terrific hailstorm, with lightning and thunder on the very peak as it were. The small iron stove crackled in the most unpleasant manner, and the little dog's hair crackled and sparkled. But the heavy snow blocked up the slits of the tent and kept them warm at night. The next morning cleared with brilliant sunshine and a grand view of the Kashmīr valley and even a sight of the houses of Srinagar through the telescope. For more than a week they had to stay on the peak going backwards and forwards between their living tent and the observatory platform and observatory tent, having to cross a narrow neck of snow with just enough room for the feet, and a precipice on either side, especially tricky at night by the light of a lantern, with the trodden snow all frozen and slippery.

By the middle of July they brought the triangulation up to Srinagar where they took three weeks' rest before starting out once more. This time Johnson ran a minor series of triangles up the Lidar through Pahlgām into the land of glaciers and high peaks, and back to Srinagar down the Sind River. After several weeks' delay from the rain Montgomerie finished off his observations near Srinagar, and then took Douglas to explore the route down the Jhelum to Murree and back. During October and November the whole party marched back to Dehra, some travelling by the Pir

Panjāl Pass and others by the Banihal, and there they spent the cold weather months on computations and sketch maps, and in preparation for the coming season.

For 1856 three more assistants were posted to start secondary triangulation to provide points for half-inch detail survey. Shelverton, the only one with previous experience, worked northwards through Kishtwār on the eastern borders; Brownlow spent two months with Montgomerie before starting independent triangulation down the Jhelum valley, whilst Beverley took over as recorder on the main triangulation, relieving Douglas who started a branch series over the Zoji La towards Drās.

Three young military officers were posted for plane-table survey and after instruction by Montgomerie took up detail survey—half-inch scale—at the east end of the valley, Lumsden sketching part of the glacier area at the head of the Lidar.

In addition to some secondary triangulation Johnson laid out the forward stations of the main triangles northward towards the Deosai Plains, and after starting off all the various detachments Montgomerie himself completed observation of the main triangles at the west end of the valley across the Wular Lake. Observing from Haramukh in September he got rays to several peaks on the Karakoram Range, dubbing the two most conspicuous as K¹ and K². He did not get another view of the range that year, and it was not until July and August the following year, 1857, that Brownlow got intersections from three stations further north and found K² to be about 28,000 ft. above the sea, with K¹, or Masherbrum, some 3,000 ft. lower, though far more prominent from the south.

For season 1857 the topographical section was strengthened by four young survey assistants, and three new military officers posted in place of those of the previous season who had been recalled to military duty. Several weeks had to be spent at the beginning of the season on the instruction of all the newcomers, and before October they had all done useful areas of plane-tableing in and around the valley.

Johnson spent season 1857 laying out and preparing the stations of the main series across the desolate Deosai Plain to the north, fixing his forward stations astride the Indus River near Skārdu. Brownlow took over the main observations and carried them forward to just short of the Indus, getting successful bearings to the Karakoram peaks. On his work being stopped by winter conditions, he was released to military duty and hurried off to join the army at the siege of Delhi. His accidental death at Lucknow in the following March was a great loss to the survey. Another sad

accident occurred towards the end of the season when Douglas, a most promising young surveyor, was killed in a shooting accident at Srīnagar.

Montgomerie himself was kept at headquarters at Srīnagar right through the summer looking to the needs of his numerous detachments. The Mahārāja was dangerously ill, and died on 2nd August, and Montgomerie was greatly relieved to find that his son Ranbīr Singh was just as friendly towards the survey. The situation was particularly uncomfortable because of the mutiny that had broken out at Meerut in May, but it all seemed very far away, and the Kashmīr survey went forward without any interference. It was during this summer that Montgomerie sketched the magnificent coloured panorama of the Pīr Panjāl viewed from the Takht-i-Sulaiman at Srīnagar. The party reassembled at Dehra Dūn in December for the short recess that was fully occupied by computations and mapping.

The three military officers were the first to start out again, and in February, 1858, they took up detail survey in the lower country round Jammu, moving to higher ground for the summer months. Good progress was made in the eastern areas adjoining Chamba that Shelverton had triangulated.

Away in the north the main triangulation was extended up the Indus from Skāndu, Johnson taking the approximate series forward to Leh, and Shelverton following up with the final observations. Further shots were taken to K², and Montgomerie reported its height to be 28,287, overtopping Kānchenjunga and second only to Mount Everest. The main series was brought to a close just beyond Leh by Johnson in 1859.

By the end of 1858 the half-inch survey of the whole of the Kashmīr valley had been completed, and the fair map, largely the work of W. H. Scott and the draughtsmen at Dehra, was despatched to Calcutta at the end of May, 1859, and won enthusiastic praise in Calcutta and also in London where it was sent for publication.

Early in 1859 the few remaining gaps in the Jammu area and on the upper Kishanganga to the west were cleared up, and then the whole party was diverted to the triangulation and quarter-inch survey of Baltistān and Ladākḥ to the north. Whilst Johnson carried observation of the main series up to Leh, Beverley, Scott, and Neuville extended minor triangulation up the Indus and its tributaries to the south to provide points for the plane-tablers. Melville and Ryall, the only assistants available for plane-tabling this season, were sick for several months, but spent some of their

time at headquarters making a large-scale survey of Srīnagar town. Montgomerie himself made a long tour through southern Ladākh to inspect the triangulators at work. During July and August he reconnoitred the highlands of Rupshu as far as the Cho Morari Lake, 'a splendid sheet of water, perhaps twenty miles long . . . Rupshu consists of a series of lakes or the beds of what have . . . been lakes. From these, which are generally at or over 15,000 ft., mountains with tolerably easy slopes rise . . . to some . . . 19,000 ft. The lakes have become more or less salt. Fuel gets scarcer and scarcer towards the Chinese frontier . . . Near the Chinese frontier nothing except cow-dung was to be had, and the greatest care was necessary to select a place for encampment where Tartars had formerly been'.

For season 1860 there were fourteen assistants, six for triangulation, the rest for plane-tabling. One of the latter was Godwin Austen, who had been employed on plane-tabling in the lower country from 1857 till he had left in April, 1859, to rejoin his regiment in England. He now returned at his own request and spent 1860 and 1861 on plane-table survey of the western Karakoram, sketching the precipices and glaciers northwards from Skārdu up to K² itself, and then westwards down the Indus and up the Baltoro and Biafo Glaciers. He was a great mountaineer, and a beautiful draughtsman with an eye for ground. One of the large glaciers now carries his name on modern maps, but suggestions to give his name to peak K² have always been officially rejected though it is shown on many unofficial maps. Godwin Austen took no part in the fixing of the peak or the discovery of its great height. At the same time Ryall sketched the Shyok and Nubra gorges of the eastern Karakoram, and Bolst, the plains of Deosai.

During this same season, 1860, Johnson first closed the main series near Leh, and then ran a minor series along the Zaskar range which he connected the following season with the 1853 work of the Himalayan party at the Bara Lacha La. The junction showed remarkable agreement, with discrepancies of 0.63 inch (about 64 ft.) in latitude—0.28 inch in longitude—and 1 ft. in height. It was on this triangulation that Johnson fixed points along the 21,000 ft. crest running north of the Spiti valley. Two or three of his single unproved intersections were wrongly passed by the computers a few years later, and one of them giving height 23,050 from a single ray was actually shown on the maps. The best of triangulators may have a number of such single intersections but does not accept them till 'proved' by a third ray or by two heights in agreement. The so-called 'Shilla Peak' was no fault of Johnson's.

Montgomerie records that in working east along the ranges south of the Indus 'Johnson twice observed at 19,979 ft., and Beverley at 19,958. A trigonometrical mark was erected on a point 21,484 ft., but unfortunately there was not sufficient space to put a theodolite on it'.

In 1861 the plane-tablers followed into these highlands of Rupshu and Hanle, and Todd now proved the Tso Morari Lake to be 16 miles in length and from two to three miles in breadth. The many lakes teemed with duck and geese, and the slopes surrounding them were scattered with herds of Tibetan antelopes and the *kyang*, or wild horse. Melville sketched the great snow range from the Zoji La to the twin peaks of Nun and Kun, and their glaciers.

In 1862 numbers dropped to three triangulators and six plane-tablers. Johnson and Clarke worked east from Leh, to the north of the Indus, into Changchenmo, with orders to 'cover all the Mahārāja's territories east of longitude 78° and north of latitude $33^{\circ} 45'$, and to fix as many points as possible in Chinese Tartary towards Ilchi, the capital of Khotan . . . You must be careful to prevent all collision with the Chinese Tartars on the common boundary'. The average height of Johnson's stations was over 19,800 ft., and he fixed several peaks on the Kunlun, the recognized limit with Khotan, one of them rising to 23,890 ft. They returned to complete this series in 1864, and on the return journey worked westward across the Shyok to reach the Yārkan road and the Karakoram Pass. Meanwhile during 1862 and 1863 Beverley extended triangulation westward to Astor, cutting in the peaks of the Haramosh range towards Hunza and Nagar. The surveyors were not allowed to visit Gilgit which had been occupied by the Mahārāja's troops from Kashmīr during 1859.

This western area was surveyed by plane-table during 1862 and 1863 by James Low at the same time that Godwin Austen and other plane-tablers worked east and completed the detail survey of Ladākh. Austen pushed to the furthest east, sketching the Pangong Tso and its string of lakes. In November, 1864, Montgomerie was able to report the completion of all survey 'of the dominions of His Highness the Mahārāja of Jammu and Kashmīr'. At the same time he asked that Johnson might be given one more opportunity to visit the north-east borders, to fix points and sketch detail 'in that vast terra incognita east of the Pangong Lake'.

Permission was given, and Johnson travelled up by Simla and Rāmpur to reach Leh on 17th July, 1865. There he received an invitation from the Khan of Khotan to cross the frontier and visit Ilchi. This meant crossing the British frontier, a breach of standing

orders, but he decided to accept the invitation without asking for permission which could not have reached him in time. An escort was sent to meet him, and on the way he climbed three of the peaks of the Kunlun, and sketched a wide area beyond. Unfortunately his board was wrongly plotted, and all his work was thrown out of position and had to be rectified on his return to Dehra. He stayed at Ilchi more than two weeks, making several excursions to the east, and then returned westward through wholly unknown country to cross the Karakoram Pass from the north, and reached Leh on 12th December. This remarkable journey brought an official rebuke, but was enthusiastically acclaimed by the Royal Geographical Society. Johnson was much disappointed at receiving no official reward and resigned from the survey the following year to take service with the Mahārāja of Kashmīr, who had offered him a salary of Rs.1,500 a month, or three times his survey salary.

The quarter-inch map of *Jammu, Kashmīr and Adjacent Countries* was completed at Dehra Dūn early in 1861. One copy was sent to London and lithographed in 1863 with the Srīnagar town map reduced to the one-inch scale as an inset. The Ladākh survey was published on the eight-mile scale at Dehra Dūn in 1868, and later included in the quarter-inch Atlas sheets.