

SOME ACCOUNT OF THE SURVEY OF THE NORTHERN
TRANS-INDUS FRONTIER, FROM PESHAWUR
TO DERA ISMAEL KHAN, IN 1849-53.

BY LIEUTENANT WALKER, *Bombay Engineers.*

This account will be divided into two parts. The first a narrative of the manner in which the Survey was executed. The second a description of the country over which the operations were conducted.

Part I.

On the manner in which the Survey was executed.

1.—On the annexation of the Punjab, in March, 1849, Brigadier General Dundas, (now Lord Melville,) Commanding the Peshawur Division, directed a Military Survey of the country, within a ten-mile radius, of the city of Peshawur, to be made by Lieutenant Walker, Bombay Engineers, and Lieutenant Garnett, Bengal Engineers.

2.—It was commenced in the month of April, the portion first brought under Survey, being the West of the Road which runs from Shubkudr to the Kohat Pass, taking a direction nearly parallel to the Meridian of Peshawur.

3.—This portion of the valley, though small, is important in a military point of view, because it commands all the passes to Afghanistan, and is contiguous to the most troublesome hill tribes on the frontier. At the commencement of the survey, these tribes, awed by our recent victories, were better disposed towards us than they have been since. This was more particularly the case with the Momunds, who, though of late perpetually engaged in hostilities against us, were then peaceful and submissive; and, instead of opposing a reconnoissance of their villages, acquiesced, though somewhat sullenly, in the project. Advantage was consequently taken of the lull that existed around to commence operations, so as to survey as much foreign territory as possible, simultaneously with the British. That this was then done, proved fortunate, for a year later it would have been attended with greater risk and difficulty, and might, in some parts, have been found impracticable.

4.—The first season's field work was completed by the middle of June, shortly after which, Lieutenant Garnett was ordered to Kohat, and has never since been engaged on the Survey; a loss much to be regretted, because his powers, as a military Draughtsman and Topographer, are of the highest order. Lieutenant Allom, of the Bombay Artillery, was appointed to succeed him, but had only been a few days at work, when his sudden death caused Government the loss of a young officer, whose great ability and zeal gave every promise of future success. Since his death, no other officer has been appointed to the survey. In September, 1850, two native surveyors were sanctioned, but as trained men were not procurable, four Moonshees were successively entertained on trial; of these, one eventually answered, by name Mirza Sajad, a native of Persia, who remained in the survey throughout the last two field seasons, and rendered valuable assistance by traversing the banks of rivers and ravines, which could not otherwise have been laid down with so much detail. But he was incapable of field sketching, or computing, the whole of which, after the death of Lieutenant Allom, devolved on Lieutenant Walker, who may thenceforward be considered to have worked single-handed.

Survey, by whom
eventually executed.

5.—In December, 1849, Government directed the survey, thus commenced, to be extended over the whole of the Peshawur valley, including Yoosoozaze, and in October, 1851, when this was completed, further authority was received for its extension through the Khutuk hills and the Kohat district, so as to include the whole province of Peshawur.

6.—By the 1st of March, 1853, this also was completed, together with the adjacent portion of the Bunoo district, as far south as the Koorum river; for it was found that the two districts so overlap each other, that a map of the former would be incomplete without part of the latter.

7.—During the remainder of the field season of 1853, opportunity was taken to connect a survey of part of Bunoo, done in 1851, by Lieutenant Miller and Doctor Lyell of the Guide Corps, and to continue the whole as far south as Dera Ismael Khan. This latter portion of the work being beyond the province of the survey, was executed with much less minuteness, and is only intended to answer present wants, until a Revenue, or other more detailed operation, can be undertaken.

8.—The survey was constructed throughout on triangulation, which originated at a base line, measured on the plain, north of Peshawur Fort, and was duly verified in its progress over the valley by a base in Loondkhwar, and another near the Indus. These were measured with a steel chain, 100 feet in length, the error of which was first determined from the best Gunter's scale at hand. The verifications thus obtained, were then necessary as tests of general accuracy. That, however, was prior to the extension of the Great Trigonometrical Survey to Peshawur, after which, to exterminate the inaccuracies of the original net work, the triangles were arranged in series between stations of the Grand Trigonometrical

Original Survey extended over the Peshawur valley, and thence through out the whole Province.

Afterwards through a portion of the Bunoo district.

And finally as far south as Dera Ismael Khan.

Survey constructed on a net work of triangulations starting from its own base line,

but eventually connected with the Grand Trigonometrical Survey.

Survey, each series being corrected by the Ray trace system of computation. Further bases of verification were rendered unnecessary as the work proceeded, for it was made to connect with the Grand Trigonometrical Survey.

9.—The system of net work, once abandoned, was never resumed; the remainder of the survey, in proportion about three-fourths of the whole, being based on a series of quadrilaterals and polygons running along the Indus, from a side of the Grand Trigonometrical Survey near Atok, to one near Kalabag, and thence to Shekh Boodeen, the southernmost mountain in the British Trans-Indus territories.

10.—The net work triangles, in the Peshawur valley, were measured with a four and a half inch Everest theodolite, the only instrument then available. Afterwards, the Surveyor General, (Colonel Waugh,) kindly supplied a seven-inch instrument, with which the series down the Indus was measured, the angles being observed from two zeros, face left, and a like number, face right, and all three verniers read. The whole of the signals observed too were opaque; luminous signals, such as lamps and heliotropes, requiring constant attention, were not adapted to a country, where small detached parties in charge would certainly have encountered opposition and annoyance. A few station marks on low ground, and very difficult to be seen, were plastered with chunam, and thus rendered clearly visible from a distance.

11.—Secondary series were projected from the primary, to fix minor points required for field sketching; these include the triangulation of the Bungush hills, which formed the basis for determining peaks of the Soofed Koh, and other distant mountains.

12.—The outline of the British Boundary, along the Trans-Indus frontier, is, in some parts, very irregular. Between Peshawur and Kohat it retrogrades almost to the Indus. In upper Meeranzaee, it

Net work system discontinued, and that of series adopted.

Nature of the instruments used and signals observed to.

Primary series circuitous, and why.

stretches to the longitude of Jelalabad, and is eighty miles from the Indus. This irregularity made it impossible to carry the primary series, in its natural course, direct from Peshawur to Dera Ismael Khan. A considerable detour to the east was necessary, and one flank was taken for some distance along the left bank of the Indus. In consequence, Peshawur and Kohat, distant only thirty miles, are connected by a circuit of 150, while Kohat and Bunoo, distant sixty-four miles, are connected by a circuit of 180.

13.—The triangulation has all been calculated and registered according to the formula of the Grand Trigonometrical Survey. If placed in the hands of Officers on the frontier, it will furnish them with data, on which to base the local surveys that are occasionally required to be constructed on a large scale; and thus, instead of being isolated performances, they may be made available for incorporation into a second edition of the map of the frontier.

The triangulation is still available for future surveys.

14.—The field sketching has not been done uniformly throughout, but three methods have been employed, successive improvements being suggested by additional experience.

Three several methods, tried for the field sketching.

1st.—The compass.

First.—At the outset, the compass alone was used in the manner laid down in books on Military Surveying. All the tupas of Peshawur proper were done thus.

Secondly.—The theodolite took the place of the compass, to fix all villages and points of importance; the observations taken being noted in a field book. This method was practised in Yoosoofozaee, where there are numerous high mounds, peculiarly well adapted for station points.

2nd.—Theodolite.

Thirdly.—The remainder of the province, (the three-fourths alluded to in para. 9,) was sketched on a plane table. In this case, the rays were taken, not as usual with a sight rule, but with a theodolite, and afterwards recorded

3rd.—Plane table.

in writing, because the rapidity of the survey, and in certain cases its danger and difficulty, necessitated occasional observations to objects so distant, that some time would elapse before the final intersections could be completed; and so the rays first observed required a more permanent record, than the mere pencil line of a sight rule. While sketching in the field, as much was done as possible, even to the brush shading of hills, the coloring of cultivation, &c. This third and final method was as near an approximation as circumstances would permit to the system laid down by Colonel Waugh, Surveyor General, in his pamphlet on Topographical Surveying.

15.—The scale of the survey was, from the first, left to the discretion of the Surveyor. The Western portion of the Peshawur valley, (as defined in para. 2,) was done in the field on the scale of two inches = mile, and mapped on half that scale. There were then two officers employed, but when the survey devolved on one alone, the field work and map were both executed on the scale, of one inch = one mile, and finally reduced in the Surveyor General's Office, Calcutta, to that of half-inch = one mile, on which the lithographs are now published. This practice obtained for the country north of latitude $33^{\circ} 25'$. It was afterwards found preferable that the maps should be executed on the identical scale adopted for the lithographed copies, thus leaving the computing office nothing but the labor of making a *fac-simile* of the originals, instead of having also to reduce them. The maps, therefore, of the country between latitude $33^{\circ} 25'$ and the Koorum river, were constructed on the half inch scale, though the field sketches were done as formerly on the whole inch. The district, south of the Koorum, being altogether beyond the province of Peshawur, was surveyed in the field on the half-inch scale, and incorporated into the map without further reduction. All information of what lies beyond the British boundary, is likewise given on the same scale, if within the limits of the map. Beyond those limits, there is to the west of Bunoo a large tract which is shown by itself in a map on the quarter-inch scale; the knowledge obtained being of a meagre description, but yet sufficiently useful to justify publication in a separate form.

16.—Although general accuracy has been attended to, throughout, extreme refinement was held subordinate to rapidity of progress as well in the triangulation as in field sketching. The former, being the basis on which every thing depended, required at each station, a certain and indispensable amount of careful observation, which, however, rarely caused detention, being always taken when most convenient with regard to the general operations, and in any state of weather, that did not absolutely preclude visibility. It is very possible that, by a more rigorous system of observation, to luminous instead of opaque signals, and by waiting for a favorable state of the atmosphere, greater accuracy would have been obtained, even with the small instruments used. But refinement was less valued, than the time it must have cost. Moreover several stations were in too dangerous proximity to hostile tribes, to allow of more than a hurried visit. Therefore the amount of rigor, which might have been introduced into some triangles, could not have obtained uniformly throughout all, and the value of the series would only be that of its weakest portion, where all possible accuracy has already been attained. The error of the work, with the four and half inch theodolite, was found by comparison with the grand Trigonometrical Survey, to average three feet, while that of the seven-inch theodolite averaged one foot per mile.

17.—In the field sketching, the villages were all laid down as carefully as possible. The banks of rivers, and large ravines, were traversed by Mirza Sajad, who was instructed to work on initial and terminal points, fixed at distances from four to eight miles apart. To eliminate the error of the chain, or perambulator, over ground that was generally very rough, the following lines were traversed:—The Indus from Pihoor to Dera Ismael Khan, the Kabul river, from Naoshera to the Indus, the Kohat Towy, from Hungoo and the Teeree Towy, from Teeree to the Indus; the rivers Koorum and Goobmeyla, from their entrance into the plains, to their junction, and thence to the Indus; also the great ravine in the Khioura valley, the Soumali pass into Khutuk, and Chichali pass near Kalabag.

Refinement not studied.

All villages fixed carefully.

Banks of rivers, certain ravines traversed.

18.—The summits of all hills, both within and beyond the boundary, were fixed with precision trigonometrically. Their minor features, (including ravines,) have been laid down, with more or less accuracy, according to circumstances, because some parts of the province being much safer than others, could be surveyed more leisurely and carefully ; so, as a general rule, wherever there is most detail, there the accuracy is greatest, and *vice-versa*. The valley of Loondkhwar, in Yoosoozæe, was done more minutely than any other early part of the survey. The inhabitants on its border being ill-disposed, it was thought advisable to acquire more careful information of their immediate vicinity than was necessary elsewhere. The valley covers an area of 180 square miles, the whole of which was surveyed on the scale of two inches = one mile, or double that of the general map. The Officers of the Guide Corps took a prominent share in the operations, and afterwards prepared a plan on full scale for submission to the Board of Administration.

Hill summits fixed with precision.

The survey of the Loondkhwar valley.

19.—All boundaries shown on the map are called approximate, because they have not yet been clearly demarcated. The British boundary has not been even given approximately, but to supply its place, in some measure, a line has been drawn to distinguish villages belonging to independent tribes from those paying revenue to the British Government. It is indicated by a red shade, running along the foot of the hills, or following the outline of water-sheds and water-courses, which may be considered natural boundaries, and are generally acknowledged as such by the natives themselves. A like method has been adopted to distinguish the great tribes inter se, but no attempt has been made to trace approximate boundaries for their numerous sub-divisions. To do so would have involved much uncertainty, and confused the map with a multiplicity of detail. In order, however, to give all possible information, each sub-division is surrounded by a dotted line lightly shaded. This is generally drawn straight from corner to corner of the outside villages, to prevent any misapprehension of its being a surveyed boundary. Thus, though

All boundaries laid down approximately.

with considerable sacrifice, as far as the appearance of the map is concerned, all necessary information is given in the manner least calculated to convey an impression of greater accuracy and minuteness than was actually obtained.

20.—It only remains to state how the districts, commonly known as Yaghee, or independent, were laid down on the map. To do so succinctly, it will be better to take each in succession from Hazara to the Khaeber pass, and thence to the Tukht-ee-Sooliman, which is the southernmost point of the survey.

On the survey of Yaghee, or independent districts beyond the boundary.

21.—*First.*—The upland valleys among the southern spurs of Mahaban, occupied by the Gudoon, and Khoodo-khel tribes. The only one of these valleys into which access could be obtained, was Punjtar, the Khans of which were of old favorably disposed to Europeans, having treated Conolly and Stoddart with great attention, when their travels led them to Yoosoozaee. The hills surrounding Punjtar are not sufficiently high to command an extensive view; consequently the information gained from their summits was of a purely local character. It happens, however, that most of the Gudoon villages, being high up the slopes, and spurs of Mahaban, are visible from the low hills, near Narobi, Mainee, and Gundup; they were, therefore, fixed by direct observation, from these hills, and the remainder by native information. Here it should be stated that the Gudoons alone, of all tribes around the Peshawur valley, offered no opposition to the survey. They never appeared alarmed at the *unusual* sight of a European riding through their fields, and getting up their hills. This absence of opposition was, in a great measure, owing to the good will and services of Ismail Khan, of Khilabut, who, being on friendly terms with the Gudoons, was able to calm their apprehensions, and thus render valuable assistance to the survey. The position of the villages of this tribe, along the right bank of the Indus, from Moonjakote to Kubul, having been already fixed by Lieutenant Robinson, in his survey of Hazara, were copied from his map; due acknow-

1st.—Of the Gudoons and Khoodo-khel.

ledgment of which should have been made in the notes to the Trans-Indus frontier map, but was accidentally omitted by the compilers.

22.—The reconnoissance of Buner and Chumla was more successful than that of any other part of the frontier. These valleys are close under, and well within view of the mountains bordering Yoosoofzaee, where the British boundary stretches further north, and over more commanding heights than any where else west of the Indus. To reach their summits was to view the whole of both Buneyr and Chumla. The Puja peak of the Sinawur mountain, and a peak over the hill village, Laloo of Chumla, were the stations chosen; the latter, being a little beyond the boundary, was somewhat hazardous to reach, but with the assistance of the Khans of Smaila, this difficulty was surmounted successfully, and without mishap, though with considerable personal fatigue. To verify the observations from these two stations, many attempts were made to ascend a third hill equally favorably situated; but there was none suitable to which a European could have gone, with a reasonable prospect of returning alive. The only alternative was to send a Native Surveyor, where he might take observations, without attracting notice. A persian, by name Mirza Abdoola, had been in training for some time for this purpose. Having long resided in Peshawur, and being familiar with the language of the country, there was little chance of his mission being suspected. Ascending the Surputi Peak, (west of the Mahaban,) whose position had already been fixed trigonometrically, he was able to obtain a number of useful observations with a compass, the only instrument that could be taken without exciting suspicion. All the chief villages were determined by observations at these three stations, while the remainder were interpolated by native information.

23.—For the valley of Swat there were but two points of view, the Puja Peak, above alluded to, and a hill north of Hurkai, a village of Amankhel. From neither of these, however, could the whole valley be seen, owing to the presence of high intervening ranges that intercepted much of the view. The upper portion of the Lurum range, and other mountains around

2nd.—Of Chumla,
and Buner.

3rd.—Of Swat.

being visible, their principal peaks were fixed, and, together with two or three points in the valley itself, formed the basis for filling in, by native information, all that could not be acquired otherwise.

24.—The valley of Raneezae was reconnoitered with considerable difficulty and danger. Its inhabitants were most
4th.—Of Raneezae. jealous of the approach of a European, and were further alarmed, and eventually instigated to hostility, by the Swatees. The survey had, therefore, to be made cautiously from distant stations, one of which was that above Hurkai hill, whence the whole valley was admirably commanded; the other station was a mound in the plains east of Shakote. At this mound some risk was incurred; for the Raneezae, supported by their neighbours, the Swatees, turned out, in considerable force, to oppose the advance of the Feringhees, into their valley, and, by opening a matchlock fire upon the party, brought the reconnoissance to an abrupt termination. In May, 1852, more than two years afterwards, the inhabitants of Raneezae were punished for repeated aggressions against the British; and then, while our troops were in occupation, the opportunity was made use of to complete what had been left unfinished in the first instance. Of the sister valley Totace, nothing has been seen, but the
 And Totace. tops of the surrounding hills. It has only three villages, and they are laid down approximately from native information.

25.—The Ootmankhel occupy the hills on both banks of the Swat river, near its junction with the Punjkora.
5th.—Of the Oot- Their villages on the outer slopes, towards Husht-
 mankhel. nugur, were almost all fixed by observation, while those in the interior, could only be determined by hearsay, for it was found impossible to get access to the summits of any hills so as to see beyond. The valleys Arung and Barung, of this tribe, lie at the foot of the Kooemohur mountain, a conspicuous fixed point, whence their positions were determined approximately.

26.—(Of the upper Momunds, it was only possible to survey the Michnee district in the Shubkudr Doab; any attempt to explore the hill tract beyond was hopeless, for the inhabitants were hostile, and
6th.—The upper Momunds.

would not suffer a European to have access to the only peaks whence a good reconnoissance might be made. Moreover, it was impossible, at the survey stations in the plains, to fix more than one or two points in the interior ranges, for they have no high prominent features, such as distinguish the hills of Swat and Buner, but are low, intricate and irregular, without a single peak that could be indentified and fixed. Consequently this portion of the map is wholly dependant on native information, and its details are not so ample and satisfactory, as is desirable for a troubled frontier of such importance. Lalpoora, the principal town of the Momunds, and residence of their chief, Saadut Khan, is on the extreme west of the district, too far away, for its position to be determind by these operations. Its latitude, ($34^{\circ} 13' 25''$) was, therefore, taken from the table of latitudes and heights of places in Afghanistan, given in Doctor Griffiths' Journal, and its longitudinal distance, west of Peshawur, from the Surveyor General's large map of the Punjab, and Trans-Indus Territory. Here it may not be out of place to pay a tribute of respect to the Journal of the late Doctor. Its geographical information appears to possess accuracy superior to that of any other work extant on Afghanistan. In every instance, in which a comparison could be effected, its deductions, though obtained with inferior instruments, and under manifold disadvantages, during the course of a rapid march, were found to differ very slightly from the result of this survey. The barometric heights, given by the Doctor, are especially good, for instance, he makes Peshawur 1,070 above the sea level, or sixty feet less than the G. T. S. value, whereas all other travellers have made it from 500 to 1,000 feet in excess.

27.—Bajour, lying to the north of the Momunds, and Ootman-
 khel, was consequently even less visible. It
 7th.—Of Bajour. has, however, one mountain of considerable
 height, the Kabul Supur Ghur, which, being a prominent object, was
 fixed trigonometrically. Its line of water-shed is the boundary on the
 N. W. between Bajour and Kooner, while its summit indicates the
 position of Nawaghæe, the chief town of Bajour, the mountain
 being sometimes called Nawaghæe Ghur, as may be seen in old
 maps.

28.—Beyond Bajour lies the Kooner valley, bounded on the north by a snow range, which is probably part of the Hindoo Caucasus. One peak of this range, is a very prominent object from Peshawur in clear weather, and has been fixed by the G. T. S. Though called Kooner Ghur by the natives of Peshawur, it is probably in Kufuristan, as the Kooner district does not extend so far up the slopes of the northern mountains. Pushut fort, Chugur Seraipayan, Chugur Ootipoor, and Kooner, all in this valley, are mapped from data given in Doctor Griffiths' Journal.

29.—The Afreedee Tribes having constantly been brought into collision with us during the Kabul campaign, naturally regard us with considerable alarm, heightened by the consciousness that they deserve punishment for numerous petty acts of aggression. They are so jealous of the approach of a European, that it was ever a matter of difficulty to reconnoitre their fastnesses, or make more than a distant and partial examination of even the slopes of their Hills nearest Peshawur. There was, however, one exception in the case of the Moolaghore Afreedees, who, shortly after the annexation, were persuaded by the Arbabs of Thâkâl, to take the surveyor to the summit of Tartara mountain, which commands a view not only of the Khaiber Pass, but of almost the whole Jelalabad valley. Unfortunately, it was afterwards found impossible to get stations on equally favorable positions, from whence to complete the set of observations commenced at Tartara, so that beyond a fair general idea of the surrounding country, little geodetical information was obtained, in comparison with what resulted from the expedition to the Yoosoozæe mountain.

30.—No attempt was made to survey the valley of the Khaiber, on account of the opposition that would certainly have been met with; but the necessity of having so important a Pass, shown accurately on the map, was such that numerous enquiries were made with the hope of finding that it had been surveyed from end to end, while occupied by British troops.

during the Kabul campaign, and that some detailed plan of it might be available for incorporation into this survey. No such plan, however, appears to be now forthcoming, and it is possible that none was ever made. Of a most important portion of the Pass, in the vicinity of Lundeekhana, a very beautiful pencil drawing was executed by Lieutenant Goodwyn, of the Bengal Engineers, and is now at the drawing-school at Roorkee. But the only sketch that could be found of the whole Pass, from Jumrood to Lalpoora, was a rough reconnoissance done by Major Leech, of the Bombay Engineers, on a small scale, and without much detail; it is in the possession of the Quarter Master General of the Bengal Army, who kindly permitted its incorporation into this survey.

31.—The Kookeekhel and Busseekhel Afreedees, are respectively located near the mouths of the Khaiber and Kohat Passes; their habitations are rarely walled and roofed, but consist merely of caves, burrowed into the side of a hill, or bank of a ravine, and generally invisible, except from their immediate vicinity. Only one building is usually met with in each settlement, and that a mosque of very moderate pretensions. Consequently there is little to show in maps of such a country, and in the present instance that little was obtained with considerable difficulty. Done at the commencement of the survey, when the British forces were still encamped on the plains near Jumrood, the operations of the surveyor were watched with great jealousy, and on three occasions had to be terminated abruptly, because the Afreedees turned out in numbers, and opposed all further advance into their country.

32.—The Kohat Pass was surveyed with a perambulator and compass in February, 1850, at the time of Sir Charles Napier's expedition. No opportunity has since offered to re-survey it with greater minuteness and accuracy.

33.—The Adam Khel Afreedees occupy the belt of Hills between Peshawur and Kohat, bounded on the east by the Akora Khutuk. This tract of country was reconnoitered from several points of view

of which the following are the chief:—the top of the low hills near Azakhel, the Jelela Sir, south of Peshawur; the Tooroo Sir, on the range between the Khwurra and Zeyra valleys, the Loondu Khy, Narai, and Tumbul Peaks of the range south of the Zeyra valley, and the summit of Goorgoorlote. The general position of the Adam Khel hills, their lines of water-shed, and principal valleys, are thus believed to have been attained very closely; and almost all villages were fixed by actual observation. The exceptions are those in the Boree and Ghurabeen valleys, which were concealed by intervening hills, inaccessible to Europeans, and were consequently fixed approximately with the assistance of guides from Azakhel, who were taken to the hill called Azakhel-ke-Turakai, and made to point a theodolite in the direction of the villages sought after. This they did so accurately, that when the villages were all seen for the first time, in the attack of Boree, in November, 1853, it was found that the positions, formerly assigned them, did not require to be materially altered.

34.—The remaining Tribes of Afreedees are mixed with Oorukzais, with whom they share the upland valleys of Bara, Teerah, and Khankec (or Alesherezacc as it is sometimes called) among the southern spurs of the Soofed Koh. These spurs project perpendicularly from, and afterwards take a direction parallel to, the main range. They are of considerable height, presenting to the Trigonometrical stations on the Bungush hills, many conspicuous points, which, once fixed, sufficed to determine the course of the principal lines of water-shed, and general configuration of the respective spur ranges. The valleys of Teerah and Khankec were sufficiently near their villages to be determined by the process (described in the last paragraph) that had already been applied to Boree, and succeeded so well under similar circumstances. It was, however, inapplicable to the more distant valley of Bora, the villages of which were consequently laid down solely from native report. On the southern slopes of Sumana, the mountain that lies between the Khankec valley and Bungush district, many towers and hamlets were fixed by direct observation. Some villages in the Zwaymukht valley, south of Zawa Ghur, were likewise fixed, and the remainder interpolated by

The remaining Tribes of Afreedees mixed with Oorukzacs.

information. In the latter case, notes of interrogation indicate the uncertainty of positions so determined.

35.—Fourteen peaks were fixed on the crest of Soofed Koh at distances averaging four miles apart. The observations for this purpose were taken from the summits of Swanai and Soortung, near Teeree, and of Kulwat, and Dumbaro, near Kurboga. These four stations form a quadrilateral figure, admirably adapted for fixing distant points, as it invariably gave two, and sometimes six, bases for each of the objects intersected.

36.—The mountains of the district held by the tribes of Tooree, Khost and Wuzeer, were also observed from the stations of this Quadrilateral, which, though further off than other stations of the survey, were more elevated, and gave good unbroken views that could not be obtained elsewhere. The valleys occupied by the tribes were not seen, being concealed by intervening spurs from the surrounding ranges. The Tooree villages are on the banks of the Koorum river, which rises among the southern slopes of the Soofed Koh, in the vicinity of the Paiwar Pass, whose summit was determined approximately by observation, and served as a terminal point, between which, and other fixed points, the villages on the banks of the river were interpolated by native information. In the Khost valley, there are only one or two large villages, but there are many small hamlets, and isolated houses, each cluster of which belongs to a distinct clan. The positions of the clans, therefore, are shown on the map, as derived from report. The Wuzeers live in tents, and have no villages, nor settled places of abode; they are divided into numerous clans, each claiming a sort of right to the locality over which its name is printed in the map.

37.—The valley of Dowur was reconnoitered from the low hills west of Bunoo, near the gorge through which the Tochee river passes before entering the plains. A great many villages were seen, and their bearings observed, but as it was impossible to obtain access to a second equally favorable

point of view, the positions of the villages could not be determined by intersection, and are, therefore, partly dependant on native information.

38.—South of Dowur, a few small hamlets are to be met with but only two large villages, Kaneegorum and Mukeen. They are among the spurs of the Peer Ghur and Shewey Ghur, high mountains which connect the Soolimanee-range, with that of the Soofed Koh. The hill country between Dowur and the Tukht-ee-Sooliman. These mountains and the Tukht, together with a number of peaks on their water-sheds and spurs, were fixed from the survey stations between Maidan, and Shekh Boodeen, the Tukht being the southernmost point to which the operations of the survey have extended. The information obtained of this region, is very meagre because the whole district, as far west almost as the longitude of Guznee, consists of a wilderness of barren and unfertile mountains, with few intermediate valleys, so that a village, or even hamlet, is rarely met with in the course of many days' march. The district, moreover, is inhabited by hostile tribes of Butunees and Wuzeerees, and is, therefore, inaccessible to Europeans.

39.—Here the operations of the survey were brought to a termination ; they would have been extended further south, to embrace more of the Derajat and the Soolimanee-range, but that they had now reached a dead level plain, very well suited to chain-measurement, but very ill-suited to rapid reconnoissance. Hitherto, though large plains had been surveyed, there were always hills at hand, which gave good points for triangulation, and extensive prospects for sketching ; with these facilities, the work proceeded rapidly ; without them, the whole modus operandi must have been changed, for a system slow and laborious, necessitating a number of additional surveyors, and altogether beyond the means of this survey.

Conclusion of the survey.

40.—Before concluding this description of the practical details of the survey, it will be necessary to state the area of country embraced, the cost incurred, and the general accuracy attained.

Final remarks on the practical details.

41.—The operations have extended over 8,970 square miles of British Territory, and about 10,970 miles of yagee or independent. The latter has been delineated in detail, varying in quantity and quality, (as described in para-20-38,) never equal to what was obtained within the British Territory, and sometimes very meagre in comparison. It is difficult, therefore to assign a proper relative value to this part of the work, which in a calculation of cost must not be entirely left out of consideration, because it was attained with considerable labour, requiring, in some cases, as much time and attention as an actual survey. The numerous secondary points formed a basis, in the absence of which native information could not have been embodied and connected, with any hope of accuracy; but they involved a considerable amount of labour in extra computation; moreover; it was chiefly this part of the work that met with opposition, necessitating careful arrangement to avoid collision with the frontier tribes, and entailing much toil, and still more anxiety. It is presumed, therefore, that its area of 10,970 miles may be fairly considered equivalent to at least one-eighth of that amount, or 1,371 miles of British Territory. This added to 8,970, gives a total area of 10,341 miles, on which to strike the rate.

42.—By reference to the accompanying statement of expences incurred, it will be seen, that the total cost has been Rs. 25,218-12-2, which, when distributed over the hypothetical area of 10,341 miles, gives a rate of about Rupees 2-7 per square mile, for the combined operations of field-sketching and mapping, or Rupees 1-5 for the former, and Rupees one-two for the latter. If the rate is struck only on the 8,970 miles of British Territory, it will become Rupees 2-13, or 6 anas more than what is above deduced; the difference, however, is not of much importance.

43.—Although a comparison cannot be instituted between the cost of this rapid Military reconnoissance, and the detailed surveys, that are being executed in the Punjab, and Bengal, still, the above rates may, in a measure be illustrated by those of revenue and topographical surveys, which being conducted in some respects, with much greater

rigor and minuteness, will serve to show what a really detailed survey must cost. The Punjab Revenue Surveys for the year 1853, varied between rupees sixty-three and twenty-nine, and averaged rupees forty-four per square mile ; while in Bengal, the average was rupees thirty-five ; these rates are exclusive of all extra expences, such as demarcation of boundaries, &c., which in Bengal, swell the total cost to above rupees seventy. The topographical survey of the Jelum, and Rawul Pindee Districts, by Lieutenant Robinson, of the Bengal Engineers, averaged upwards of rupees ten, while the reconnaissance of Hazara, executed by the same Officer, on a system somewhat similar to that of this survey, cost little more than rupees three, per square mile.

44.—With regard to general correctness, the map must not be supposed to be perfect ; the means available did not warrant an attempt to achieve that accurate delineation of subordinate features, which can only be attained by elaborate and systematic operations, requiring large establishments and ample resources of every kind. Any individual attempting, single handed, to execute a survey of 10,000 square miles of country, must either give little detail, and work quickly, or if accurate topography be his object, he must be prepared to spend a whole lifetime on his task. By a Law of mechanical science, what is gained in time, is lost in power ; and so it is in surveying, the relation between intrinsic value and rapid execution, is comprised within narrow limits ; and the ablest of men are physically incompetent to achieve much more than those, who, to moderate ability, join moderate perseverance. The present operations have occupied only four and half years, giving an average of upwards of 2,000 miles per annum, inclusive of every thing, from the first measurements in the field, to the completion of the fair copy maps, for the Surveyor General. All, therefore, that could be done, after the villages, and chief points had been determined with accuracy, (vide para. 17 and 18,) was to sketch minor features from the summits of commanding positions. Very rarely, indeed, perhaps not once in twenty cases, was a ravine followed throughout its whole course ; all that could be done in a country, whose intricacy is perhaps rarely surpassed, was to fix ravines in different parts of their course, without at-

tempting to follow each in detail, which would have been a never-ending undertaking. But to distinguish one from another, after having lost sight of them for some time, was no easy matter. To do so, it was necessary either to resort to native information, which might be erroneous, or to decide personally from a bird's eye view, which might be deceptive. Consequently it is to be expected, that there may be some few instances, in which the course of minor ravines has, by mistake, been shown inaccurately. Certainty could only be ensured by following each in detail from end to end, which was impossible. Some errors of this nature, were discovered by the surveyor himself, during the late operations against the Boree Afreedees, when the exigency of the occasion required a new and more minute reconnoissance of the field in action, which, in the proximity of our troops, was done leisurely and safely. A few errors were also brought to light by the Officers constructing the road between Peshawur and Atok, whose duties required them to sketch, with topographical minuteness, certain ravines and water-courses, that could only be generalized in the operations of the survey.

45.—Herein will be found an additional value of the triangulation on which these operations have been based, that it will enable all new information, collected in the course of special surveys, to be easily incorporated into new editions of the general map.

Triangulation still available for the incorporation of new surveys.

46.—The orthography of the map, has already been severely criticised, and is doubtless open to question. It is an attempt, (perhaps not so faulty as appears at first sight,) to spell Pushtoo names, so that those who do not class themselves among philologists, may catch the pronunciation of a language, whose guttural tones would have been considered idiosyncrasies at Babel itself. On the commencement of the survey, the scientific system of Sir William Jones was adopted, which, with careful accentuation, is doubtless sufficiently phonetic to express the sounds of any language whatever. But while few Englishmen are philologists, all have a natural inclination to give a short and sharp pronunciation to words of foreign languages, and utter their vowels with the sounds they represent in English. In consequence, the scien-

Orthography of the Map.

tifically spelt names, that first appeared on the map, were invariably mispronounced. Now in addressing a Pathan, to turn his long vowels into short ones, and run a number of his heavy and distinctly successive syllables into one sharp curt word ; to pronounce Matanee, for Mutinni ; Wyusam, for Weejoosum ; Ban, for Bunoo ; or Kuum, for Koorum, is simply to be unintelligible. To avoid such mistakes, the orthography has been Anglicised as much as possible ; not arbitrarily, but according to the following rules ; *a* long, except when final *i* and *u* invariably short, *ai* as *ie* in *pie*, *ay* and *ey* as in *ray*, *pray* ; *e* mute prolongs the sound of a preceding vowel, as in *Kote*, while in some words, a double consonant has been used, to give the full weight and characteristic expression of each syllable, as above in *Koorum*. A steady conformity to this rule has occasioned some asperities, which are to be regretted, though not to be avoided, as *Naosheyra* for the customary *Naoshera*. Had the spelling been arbitrary, geographers, ignorant of the country and language, could not have transcribed it into the Indian Atlas, and other maps, executed on the scientific system ; this any one may now do, by placing the grave accent over *a*, the acute over *i*, turning *ee* into *i*, *oo* into *ú* ; *u* into *a*, *ay* and *ey* into *e* ; also expunging double consonants, and *e* mute, though in some instances, this has already been done by the lithographers, who, faithful in all things else, could not so far overcome their repugnance to redundant letters as to follow the original in this respect.

47.—The map has been published in four parts ; the first of which, comprising the valley of Peshawur and Yoosoofzaee, was executed before access could be gained to the Khutuk Hills ; all in the vicinity of those hills, was, therefore, surveyed to great disadvantage, and would not have been incorporated in the map, but that there was much doubt whether a further extension of the survey would be sanctioned. When, however, authority to that effect arrived, the southern portion of the valley was revised, and incorporated into map 2. Lines of latitude and longitude have been projected on all the maps, but the first, for which there were no data available, as its triangulation could not be connected with the G. T. survey, until after the map itself had been lithographed. No. 2. was made complete in itself by the addition of all the information south of

Of the published maps, and their respective contents,

Map No. 1.

Map No. 2.

34°, that had already appeared in the first map ; it terminates at the parallel 33° 25' and includes the whole of the Akora Khutuk, the

Map No. 3. Afreedees and Oorukzaees, and great part of Bungush. No. 3 extends from latitude 33° 25' down to 32° 30' and comprises the Teeree Khutuk and part of Bungush, Sagree and Bungeekheli, Bunoo, and part of Murwut, and the district of Esakhel, and

Map No. 4. Kalabag. No. 4, continues the survey down to 31° 50', and gives the remainder of Murwut and the upper part of Derajat, including the Gomul valley, and tribe of Khusore ; also the

Map No. 5. towns of Tak, and Dera Ismael Khan. A 5th map is now in publication, which will give the countries south of the Soofed Koh, and west of Bunoo, namely Koorum, Khost, Dowur, and the Hill tract of the Wuzerees and Butunees.

48.—The hill shading of the first map is unsatisfactory, in comparison with that of Nos. 2, 3 and 4. The slopes of the maps. are not sufficiently prolonged into the plains, and having no breadth, nor generalization, they convey the idea of detached hillocks, rather than of mountain masses. In Yoosoofozaee, the upland valleys are scarcely distinguishable from the outside plains, with which they have little connection, being all but surrounded by hills. This inaccuracy of delineation was partly the fault of the original drawing, in which, from fear of conveying an idea of greater minuteness than was actually attained, the crest and foot of the hills, (all that could be accurately demarcated and vouched for,) were merely connected with a continuous shade, which, however, easy and expressive in brushwork, is impracticable in vertical penwork, such as obtains in lithography ; consequently a greater evil was introduced than that avoided ; the vertical strokes of the penwork were made to terminate half way down a slope, instead of at its bottom, and so in the foot of the hills, though accurately surveyed in the field, is most inaccurately delineated on the published map. The experience gained in this instance, sufficed to prevent the repetition of such mistakes in the succeeding maps, which are generally satisfactory, and executed with care and accuracy.

(Signed) J. T. WALKER, *Lieutenant,*
Bombay Engineers.

Surveyor General's Field Office,
Dera Doon, the 11th September, 1854. }

Table of areas to accompany Lieutenant Walker's Report of the Survey of the Northern Trans-Indus Frontier.

PESHAWUR PROPER.

Square Miles.

Including Hushtnugur,	396
„ Doaba,	96
„ Khuleel,	108
„ Lower Momund,... .. .	195
„ Daoodzaee,	89
„ Khalsa,	131
—	
Total,	1,015
—	
„ British Yoosoofzaee,	960
„ Akora Khutuk,	685
„ Teeree Khutuk,	1,657
„ Bungush,	719
„ Sagree,	140
„ Bungee khel,	185
„ Bunoo,	308
„ Murwut,	1,195
Niazis and Hinkes on the banks of the Indus, from } Kalabag to the Koorum River, }	415
„ Khusore,	173
Derajat, North of Latitude of Dera Ismael Khan,	1,309

As no boundaries have yet been demarcated the above areas must be considered approximate.

(Signed) J. T. WALKER, *Lieut.,*
Bombay Engineers.

5th July, 1855.