

tested under an air-pump at Kew, when it was found to agree at every inch of pressure from the normal height down to 11 inches.

A similar difference was given by another aneroid that was sent up to the Thok-Jalung gold-fields; this was supposed to have arisen from some accidental fault.

Captain Basevi, when employed in the elevated ground in the south and north-east of Ladák, was supplied with a similar aneroid, and noted in his memoranda that the observations taken with it were quite unreliable at great altitudes, as he found that even by gentle tapping on the case the index varied its reading, and was always movable in that way no matter how long he remained at a point.

The only conclusion that can be come to, from the three trials referred to, is that in their present shape aneroid barometers cannot be relied on alone at great elevations until they have actually been tested; and they should always be supplemented with either occasional observations of an ordinary mercurial barometer or of a boiling thermometer, at any rate until some satisfactory proof of their reliability has been given, the errors apparently not showing when the aneroid was at rest, and kept at much the same temperature.

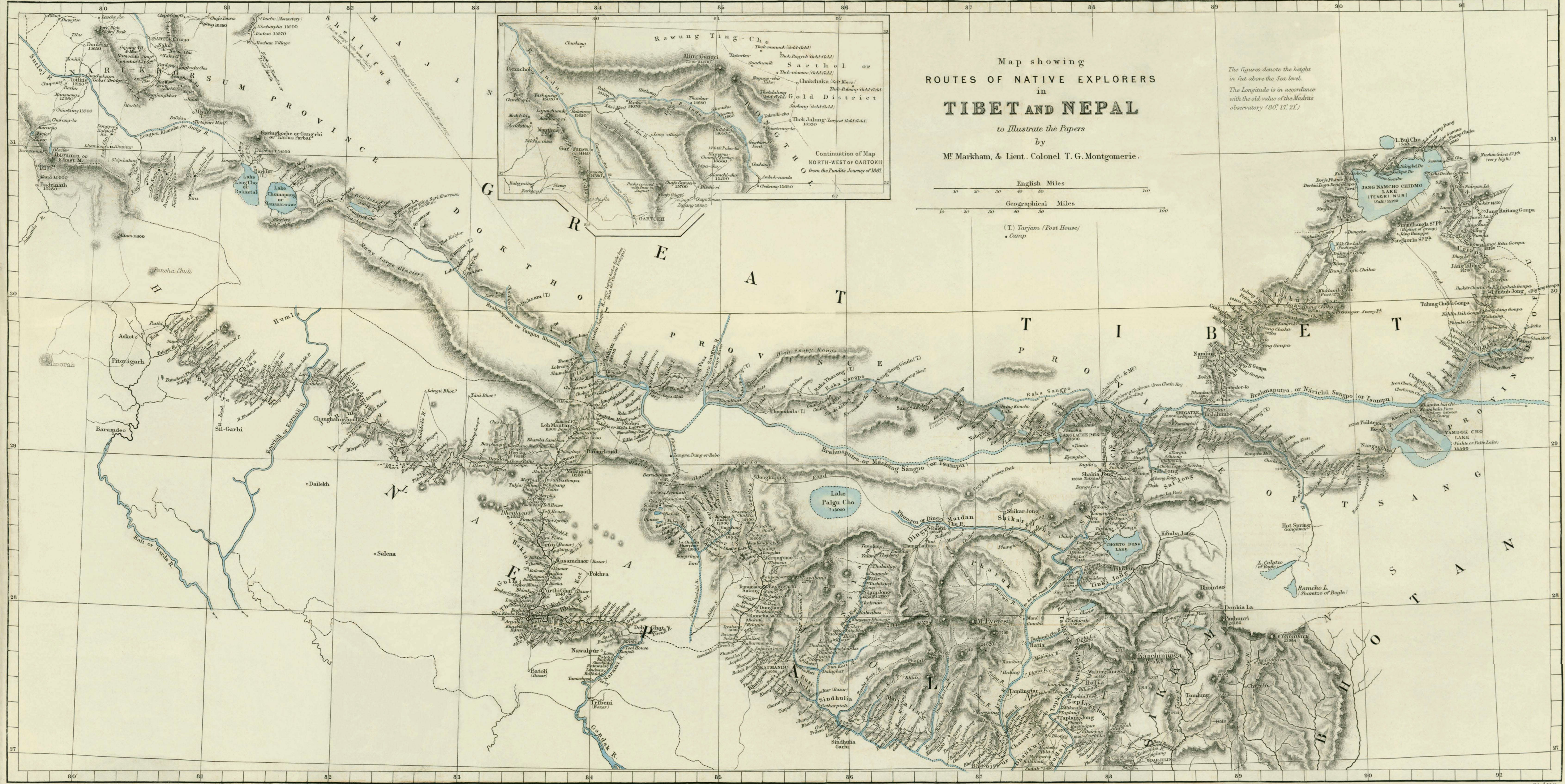
It will be noticed that the explorer actually went along a small portion of the great Brahmaputra river below Shigatze, thus adding to our knowledge of its actual course; no iron suspension bridge was however seen there, such as Turner supposed to exist near Shigatze. The explorer was much struck with the magnificent glaciers to the south of the Namcho, or Tengri Núr Lake, and they will no doubt prove to be very extensive, as the man is a good judge of their size, being well acquainted with Himalayan glaciers near India.

Altogether the explorer has done very good service, and in this first altogether independent expedition has shown a large amount of skill, observation, and determination. I trust hereafter he will still farther distinguish himself.

XII.—*Journey to Shigatze, in Tibet, and Return by Dingri-Maidan into Nepaul, in 1871, by the Native Explorer No. 9.*
By Lieut.-Colonel T. G. MONTGOMERIE, R.E., F.R.S., &c.,
Deputy-Superintendent G. T. Survey of India.*

THE native explorer whom I designate as No. 9, for one portion of his work, made his way from Dárjiling, passing through Sik-

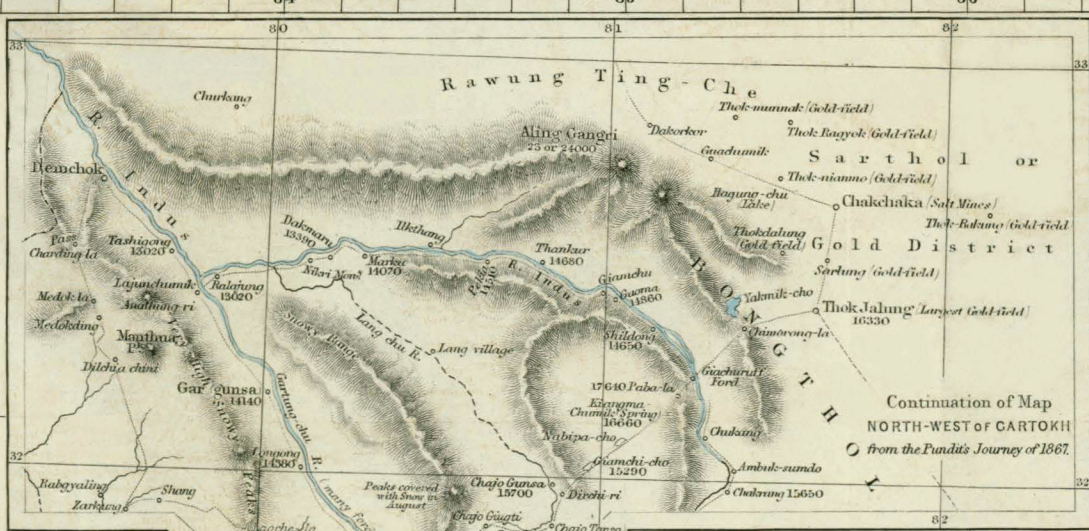
* *Vide* Map, p. 299.



Map showing
 ROUTES OF NATIVE EXPLORERS
 in
TIBET AND NEPAL
 to illustrate the Papers
 by
 M^r Markham, & Lieut. Colonel T. G. Montgomerie.

The figures denote the height
 in feet above the Sea level.
 The Longitude is in accordance
 with the old value of the Madras
 observatory (80° 17' 21").

English Miles
 0 10 20 30 40 50 100
 Geographical Miles
 0 20 30 40 50 100
 (T) Tarjam (Post House)
 • Camp



kim into Great Tibet; it is not, however, necessary to refer to his journey in detail until he got beyond what Dr. Hooker called the Wallangchoon Pass, as up to that point Dr. Hooker has already given us an admirable description of the country.

The explorer, on trying to pass into Tibet, was, as usual, stopped, and told that he would not be allowed to proceed farther, as he was not known to any one, nor able to give any satisfactory evidence as to his being what he stated. He was consequently rather in despair, but was fortunate enough to ingratiate himself with the chief official of a large Sikkim district whose wife happened to be very ill. I have always made my explorers take a supply of medicines with them, mostly of native kinds, with only a few ordinary European sorts to present to people on their journeys. In the present instance, the explorer had also provided himself with a Hindi translation of a treatise as to using these drugs, and, when he heard of the woman's illness, he offered to give her some medicine if he was allowed to see her and hear as to her sufferings, &c.; his offer was at once accepted, and the explorer having seen her, searched his book until he came across some disease with the same symptoms as she had, and he then boldly prepared the medicines directed and gave them to the woman according to the instructions, and awaited the result in not a little trepidation. In a few days' time the woman became wonderfully better, and eventually a cure was effected, very much to the astonishment of the amateur practitioner. The explorer was treated with marked kindness and hospitality from the day the woman began to improve: he then again urged his request to be allowed to pass into Tibet. The headman said he would be glad to give him permission, but that it would be of no use, as he would be again stopped by another official before he advanced very far, unless he had some one to answer for him. The explorer, however, continued to urge his point, and at last the official said he would himself be his security, and he finally sent one of his own men with the explorer, who passed him through the places where he was likely to be stopped.

The explorer consequently marched on without any further interruption, except the ordinary ones at custom-houses, where his baggage was strictly searched; fortunately his instruments were so well concealed that they were never discovered.

From the Tipta-La—the Wallangchoon Pass of Dr. Hooker, probably so named from the village south of it, which the explorer gives as Wallungsum—he made his way in two marches to Tashirak. The road was a difficult one, the ground north of the pass being very elevated and barren, so that both food and fuel had to be carried on yáks for the use of the party.

The Tipta-La was covered with snow ; it is on the watershed of a very high range that runs nearly east and west, forming the boundary between Nepal and Lhása.

Tashirak is a large standing Bhotia encampment on a feeder of the Arun River, which rises in a glacier to the west, and not on the main stream of that river, as was formerly supposed ; it is 15,000 feet above the sea. Marching north, the explorer crossed the Nila-La Pass, and, passing a large Láma monastery, reached the Shara village of some 50 houses, which is under a Thánahdár of the Tinki or Tinka district, generally known as Tinkijong after its fort (jong). Here his baggage was very closely searched, and it was only by means of the man sent by the Sikkim official that he was able to advance farther. After many inquiries were made, he got a pass to travel to Shigatze, and, being fairly in Tibet, he was never stopped again. He made his way first to Lámádong, a village of 50 or 60 houses, arriving there on the 4th September. Before reaching this place the explorer had latterly seen no cultivation except that of Indian-corn in small quantities, but at Lámádong itself there was a good deal of wheat and peas, and round about several other villages could be seen equally well cultivated ; all these villages were on or near the banks of the great eastern branch of the Arun River, called the Khantongiri River, which comes from the east.

The next day he arrived at another small village with plenty of cultivation, all tending to show that he had again reached a warmer climate, Lámádong being 13,100 feet above the sea.

On the 6th September he crossed the Tinki-La Pass, and after a trying march reached the village of Tashichirang on the bank of the Chomto Dong Lake, which is a fine sheet of water about 20 miles in length by 16 miles in breadth, at an elevation of 14,700 feet above the sea. This lake has never been shown in any map that I am aware of, but we have notice of its existence in itineraries collected by Mr. Hodgson, Dr. Campbell, &c. The explorer found the water very clear and pure, and very good to drink : he and his party used it, and were told that the inhabitants took it in preference to that of the two or three streams which were seen to run into the lake. The explorer was unable to go completely round it, but he could see it fully as he passed along its northern shore, and yet could discover no signs of an outlet ; the inhabitants declare that it has none : the sweetness of the water, however, is against there being no outlet, and if so it must be somewhere to the south-east. The lake forms a portion of the boundary between Sikkim and the Lhása territories, the Sikkim territory lying to the east, and that of Lhása to the west of the lake. Several

very high snow-peaks were visible from the lake to the east and south.

On the 7th September he arrived at Nangji, a Sikkim village, which, though it has but 50 houses, boasts of a wonderful number of dogs, the explorer declaring he himself saw at least 200, and was certain that he never met with such a large proportion in a Tibetan village, where they are proverbially numerous.

On the 9th September he reached Chajong (Tatápáni) hot springs, where he took latitude and thermometer observations, the latter making it 15,000 feet above the sea. Four reservoirs, each about 30 feet in circumference and 3 feet deep, have been built to catch the water of these springs, which appeared to be sulphurous, and have a high reputation for their curative properties, being visited by numbers of people. The place swarmed with Tibetan (Hodgsonian) antelope, which are quite tame, being never disturbed, as they are considered to be dedicated to the deity of the hot springs. The next day the party encamped in a ravine, and the day after crossed the Lagulung-La Pass, which has quantities of glacier-ice close down to it, being itself 16,200 feet above the sea. This pass forms the boundary between Sikkim and Lhása; the march terminated at the village of Thak. On the 15th September he passed the village and post of Sai-Jong, which is surrounded by cultivation, and has numerous other villages round about; encamped at Chota-Tápu or Darcha village on the banks of the Sai-Jong stream, which comes from a great distance, rising in Sikkim. The next day he crossed the Gyaling Mountains by a pass covered with snow, and reached the Bálu Koti village of 20 houses; this place has a good deal of cultivation, and numerous other villages are visible round about it. Passing thence through a level and well-cultivated country, the explorer reached Shigatze on the 17th of September.

The explorer paid the usual homage to the Láma of Tashi Lumbo, making an offering of two rupees. He found the city of Shigatze in much the same state as described by the chief Pundit; he, however, heard of the serious rebellion which had been raised against the great Láma of Lhása in April, 1871, during which hundreds of people were killed.

The explorer remained in Shigatze till the 29th of September; he then made his way south-westwards, towards the Dingri Maidán, resuming his route survey on the 30th September from a point he had previously visited. By evening he reached the village of Shimrang, and the next day crossed the Shabki-Chu River, which was 65 paces wide and 4 feet deep, flowing down into the Sang-po (Bráhmáputra); numbers of villages were seen on and off the road. The harvest was being reaped.

On the 2nd October he reached the great Shakia monastery (*Gonpa*), which is only second to that of Tashi Lumbo. The explorer was unfortunately not able to stop at Shakia to examine the place more closely. He says the Shakia monastery is on a low spur; it is inhabited by about 2500 monk Lámás, ruled by a great Láma, called Shakia-Gangma (king, or above all others); he is looked upon as a deity. His Lámás are the only ones in this part of Tibet that are allowed to marry; they are called *Dhukpás*, other Lámás who are not allowed to marry being called *Gálupás*. The town of Shakia lies at the foot of the monastery and is about half the size of the city of Shigatze. About fifty of the shops in the town are kept by Niwars from Nepal; all the other shops are kept by Bhotias. There is a large amount of cultivation around Shakia, though it is about 13,900 feet above the sea.

On the 3rd of October the explorer crossed the Dongo-La, and again got into ground drained by the Arun River, and on the 5th October reached the Chokuar village, on the left bank of the Phungtu or Dingri-Chu River, the great western branch of the Arun River.

Continuing westwards along the Dingri-Chu River, the explorer reached the Sakar-Chu River, a branch of the Dingri-Chu. The Sakar-jong (fort) is about 8 miles north of the junction, and is the residence of a Lhása magistrate. The Ghurkas in 1854 advanced as far as this point when they invaded Tibet.

On the 8th of October the explorer reached the town of Dingri, which is generally known as Dingri Maidán, from the large open plain in which it stands; it is also sometimes called Dingri-Ganga. The town has but 250 houses, supplemented with tents on occasions of fairs, &c.; it is 13,900 feet above the sea.

Five miles above the junction of the Shakar-Chu River, the explorer crossed the Dingri-Chu River by a wooden bridge, seventy-five paces in length—showing that even at that point this great eastern branch of the Arun is a very large stream, as might be expected from its draining the great Dingri tableland.

North, and quite close to the Dingri town, stands the Dingri Khar (fort), on a low isolated hill. A high Chinese officer, called a *Daipon*, who is the chief military and civil officer, resides in the fort; he has a small garrison of Bhotia soldiers, with but one gun.

From Dingri there is a very good road which runs north-west to Jong-ka-Jong, and thence by Kirong town to Katmándu. Officials are, however, the only persons who are allowed to

travel by this route, traders and all others taking the one followed by the explorer to Nilam, &c.

The explorer did not make any stay in Dingri, being afraid that he might be cut off from India by an early fall of snow: he accordingly pushed on as fast as he could. At first he passed through a wide all but level tract, and then getting into rougher ground reached the Thung-lung-La on the 10th of October; he found the pass covered with old ice and snow, it being 18,460 feet above the sea.

On the 11th of October he reached the town of Nilam, 13,900 feet above the sea, which has about 250 houses. It is ruled by a couple of *Jongpons*, the Lhása Government sending two there so as to be a check on one another. Nilam being the first Tibetan town on the road from Nepal, is considered to demand extra vigilance, and consequently the explorer and his party were very closely examined and their baggage was carefully searched before they were allowed to go on.

From Shigatze to the Thung-lung-La pass, the explorer had passed through a moderately level tract, though at a very great elevation, but from the Thung-lung-La, where he crossed the Himalayan watershed, he again entered on very rugged ground, much more difficult than even that south of the Tipta-La (or Wallungsum Pass).

Between Nilam and Listi Bhansár he followed the general course of the Bhotia-Kosi River, and though it is but some twenty-five miles direct distance between the two places, the explorer had to cross the Bhotia-Kosi River fifteen times, by means of three iron suspension, and eleven wooden bridges, each of from twenty-four to sixty paces in length. At one place the river ran in a gigantic chasm, the sides of which were so close to one another, that a bridge of twenty-four paces was sufficient to span it. This was just below or south of the village of Choksum. Near this bridge the precipices were so impracticable, that the path had of necessity to be supported on iron pegs let into the face of the rock—the path being formed by bars of iron and slabs of stone stretching from peg to peg, and covered with earth. This extraordinary path is in no place more than eighteen inches, and often not more than nine inches in width, and is carried for more than one-third of a mile (775 paces) along the face of the cliff, at some 1,500 feet above the river, which could be seen roaring below in its narrow bed. The explorer, who has seen much difficult ground in the Himalayas, says he never in his life met with any thing to equal this bit of path. It is, of course, quite impassable for ponies or yáks, and but very few sheep and goats even go by it, though it is constantly passed by men with loads.

There are several other smaller pieces of paths between Nilam and Listi Bhansár which are nearly as bad, but they are fortunately not continuous.

From Listi Bhansár the explorer's route does not call for any special notice, here being much the same as that in any other part of the mountains south of the Himalayan watershed, being rugged in the extreme for a considerable distance, and then becoming easy in the valleys or Dúns. It may, however, be noted that the explorer crossed the Indrawati feeder of the Kosi, which has five small tarns near its source, called Panch Pokri. The source is in the snowy mountains to the west, as shown on the map.

The lower ground, though not at all noteworthy in itself, had never been surveyed in any way previously, the only land marks being the few great peaks in its neighbourhood, that have been fixed from a distance by the Great Trigonometrical Survey, and I consequently consider the survey of it and other portions of the lower ground a very valuable addition to the geography of that part of the mountains.

On reference to the map, it will be seen that by this exploration the position of the great Himalayan watershed has been determined in three different places. In each case it proves to be far behind or north of the lofty peaks that are visible from Hindustán, such as Mount Everest, Kanchinjinga, &c.

The explorer, it will be seen, went completely round Mount Everest, but his route was so hemmed in by great mountains that he never got a view of Mount Everest itself; it seems to have been invariably hidden by the subordinate peaks which are tolerably close to it. Possibly it may have been seen, but never continuously so as to be able to recognise it again, and to fix it by bearings with a moderately long base. The Kanchinjinga and Junnu peaks were, however, seen from the west of Taplang Jong, but only a short base could be secured. The explorer was much impressed by Kanchinjinga; it is known to the natives near Taplang as *Kumbh Karan Langúr*. The people south of the Himalayas, in Nepal, call all snowy mountains *Langúr*, by which they mean the highest points. They call the peaks that have no snow *Banjung*, and the low ground under the said *Banjung* they call *Phedi*. The term Himalayas is not used by uneducated people, who only talk of the snowy mountains as "*Barfáni Langúr*."

Neither the Bhotias nor the Ghurkas seem to have specific names for remarkable peaks; the explorer asked all sorts of people, but with the exception of the case of Kanchinjinga, referred to above, he never got any name for a peak, though in a few cases they gave that of the nearest village.

Several of the other peaks fixed by the explorer were very lofty ones, covered with perpetual snow to a great distance below their summits; those north of Mount Everest and Kanchinjinga are perhaps the most interesting, as being beyond the Himalayan watershed. One to the north of the road, between Shakia and Dingri, the explorer thought was very much loftier than any others.

The explorer's route survey may be said in a rough way to give us a general idea as to how the mountain drainage runs between the Himalayan watershed, north-west of Kirong, and the point where Turner crossed it near Chumalári, up to the Bráhmáputra, or Sang-po River on the north from west of Janglache to Shigatze. The route between Kirong, Jong-ka-Jong, and Dingri Maidán is still a desideratum, as we are in the dark as to the size of the Palgu Cho Lake, which, however, it now appears will lie somewhat to the south of the approximate position which I gave it in my map showing the chief Pundit's route to Lhása.

A glance at the map at once shows what a large river the Arun must be, the area it drains being so very great. It is one of the few Himalayan rivers which has its source beyond the Himalayan range as seen from Hindustán, the others being the Indus, Sutlej, and Karnáli. The length of the eastern and western upper sources is very remarkable, extending on the one side to the north and east of Kanchinjinga, and on the other to the north and west of Mount Everest.

In the route survey made by explorer No. 9, from Dárjiling to Shigatze, and from Shigatze by Shakia, Dingri Maidán, Nilam, &c., to Katmándu, the value of his pace has in the first instance been derived from the differences of latitude between the various places at which star observations for latitude were taken. A mean value of pace, viz.: 2.45 feet, derived from a mean of the values of each section, was adopted, and this mean value was applied to the number of paces, showing the differences of longitude for each section, and the value of the same in degrees and minutes was deduced therefrom in the usual way.

Taking the longitude of Dárjiling at $88^{\circ} 18' 41''$, as determined by the triangulation of the Great Trigonometrical Survey, and applying the differences of longitude as determined above, the longitude of Shigatze, by Tatápáni, Chota Tápu, &c., vide map, *i.e.*, by the most direct route, would be $88^{\circ} 46' 44''$.

Taking the longitude of Katmándu at $85^{\circ} 17' 45''$, and applying the differences of longitude as above, between it and Shigatze, by Nilam, Dingri, Pil, &c., the longitude of Shigatze would be $88^{\circ} 32' 45''$.

On examining the map, however, it is at once apparent that

the longitude of Shigatze, as determined by a route survey from Dárjiling, is likely to be more reliable than that derived from Katmándu, because the difference of longitude, between Dárjiling and Shigatze, is but $0^{\circ} 21'$, while the difference between Katmándu and Shigatze, is $3^{\circ} 11'$, or in other words the longitude of Shigatze would be very much more affected by an error in the value of the pace in the latter case than in the former. I have consequently decided upon using only the value as determined from Dárjiling.

In my report on the chief Pundit's exploration to Lhása, I explained that the longitude of Shigatze was determined by the route survey which Mr. Turner made during his journey to Shigatze, combined with the route of the Pundit, Shigatze was computed to be in longitude $88^{\circ} 48'$, a very close agreement with the value as determined above independently by explorer No. 9, viz., $88^{\circ} 47'$. It may consequently be concluded that the longitudes of Shigatze and of Lhása, which depends on Shigatze, as given in my first map, are very close approximations, and it is gratifying to find that my reliance on Turner's route survey was not misplaced.

The explorer's work has stood all the usual tests satisfactorily, the average value of his pace, 2.45 feet as determined from the differences in latitude, is about what might be expected from a man of his stature. His latitude observations agree very well *inter se*, considering that he used but a small pocket sextant. His observations at Shigatze give much the same latitude as that derived from the chief Pundit's observations with a large sextant at that and other places.

His heights are the weakest part of his work, as, owing to the larger thermometers originally sent with him having been broken, he was reduced to take his boiling-point observations with a very small thermometer. The heights, however, are probably fair approximations, and give a good general idea of the great elevation of the upper part of his ground.

His bearings to peaks on either side of his road were more numerous than usual, and on the whole he was fairly successful in fixing the more conspicuous.

The exploration with its bearings, &c., opens out the geography of nearly 30,000 square miles of what has hitherto been in many portions *terra incognita* and in others nearly so; the indications on our maps having been of course mostly conjectural. The exploration more especially elucidates the geography of the basin of the Arun or Arun-kosi River, the great eastern feeder, if not the main source of the great Kosi or Kosiki River, which drains the whole of eastern Nepal. The courses of the upper feeders of the Arun have hitherto been a

puzzle to geographers. The explorer's work also defines the course of the great western tributary of the Kosi River, viz., the Bhotia Kosi, of which we had previously no survey.

His route survey is 844 miles in length, of which 550 miles may be said to be over entirely new ground, and the remainder (though close to a line along which one European has travelled) had never been regularly surveyed before.

The explorer took latitude observations at 11 points upon which the work depends, and determined the height of 31 places. His work, I think, will prove a valuable addition to the Trans-Frontier geography of India.

LIST of POSITIONS of the CHIEF PLACES as determined from the ROUTE SURVEY of EXPLORER No. 9 in NEPAL and GREAT TIBET.

	Latitude.	Longitude.	Height.	Remarks.
			Feet.	
Dárjiling	27 2	88 19	7,253	From G.T. Survey.
Tatápáni	28 36	88 8	15,025	
Chota-Tápu (or Darcha village)	28 57	88 27	14,558	
Shigatze (Tashilumbo) ..	29 17	88 47	11,822	
Pil	28 37	87 54	13,259	
Dingri-Maidán town ..	28 35	86 40	13,865	
Nilam-Jong (or Kuti) ..	28 9	86 5	13,911	
Katmándu	27 41	85 18	..	From Crawford's to G.T.S. Peaks.
Kabiri River, bank of	87 33	..		No astronomical latitude.
Narharia (Naria)	26 26	86 45	..	
Dhankuta	26 56	87 21	2,927	
Lámádong	27 10	86 52	..	
Amtia on bank of Arun River	27 12	87 12	1,798	

The longitude of Shigatze is derived from Dárjiling by the route survey passing through Tatápáni and Chota-Tápu. In the map accompanying this memorandum, 88° 40' was assumed to be the longitude, using a mean between the values derived from Katmándu and Shigatze. In future compilations the positions as given on the map, will require to be corrected to those given above.

OBSERVATIONS FOR LATITUDES TAKEN IN NEPAL AND GREAT TIBET BY EXPLORER No. 9, WITH A POCKET SEXTANT.

No. of Observa- tion.	Astronomical Date.	Watch Time.	Station.	Object.	Double Altitude.	Index Error.	Deducted Latitude.	Mean Latitude.	Remarks.
	1871	H. M. S.			° ' "	' "	° ' "		
1	September 11	12 0 0	Tatápáni (chajong)	Fomalhaut ..	62 14 30	-1 0	28 35 44	} 28 35 33	On Meridian.
2	" "	13 0 0	" "	β Ceti ..	85 28 30	"	28 34 52		Ditto.
3	" "	12 0 0	" "	Fomalhaut ..	62 14 0	"	28 35 59		Ditto.
4	" "	13 0 0	" "	β Ceti ..	85 27 0	"	28 35 37	} 28 56 56	Ditto.
5	" "	15 12 0 0	Chota-Tápu ..	Fomalhaut ..	61 32 30	"	28 56 44		Ditto.
6	" "	13 0 0	" "	β Ceti ..	84 44 0	"	28 57 8	Ditto.	
7	" "	28 12 0 0	Shigatze ..	Fomalhaut ..	60 53 30	"	29 16 14	} 29 17 1	Ditto.
8	" "	13 0 0	" "	β Ceti ..	84 4 0	"	29 17 7		Ditto.
9	" "	29 12 0 0	" "	Polaris ..	61 23 0	"	29 17 44	} 28 37 16	Ditto.
10	" "	30 12 0 0	" "	" ..	61 24 0	"	29 18 16		Ditto.
11	" "	12 0 0	" "	Fomalhaut ..	60 54 30	"	29 15 44		Ditto.
12	October 4	11 0 0	Pil village ..	" ..	62 15 0	"	28 35 26	} 28 34 30	Ditto.
13	" "	12 0 0	" "	β Ceti ..	85 20 0	"	28 39 6		Ditto.
14	" "	7 11 0 0	Dingri-Maidán	Fomalhaut ..	62 18 0	"	28 33 55	} 28 34 30	Ditto.
15	" "	12 0 0	" "	β Ceti ..	85 28 0	"	28 35 5		Ditto.

OBSERVATIONS FOR LATITUDES TAKEN IN NEPAL AND GREAT TIBET BY EXPLORER No. 9—continued.

No. of Observation.	Astronomical Date.	Watch Time.	Station.	Object.	Double Altitude.	Index Error.	Direct Latitude.	Mean Latitude.	Remarks.
	1871	H. M. S.			° ' "	' "	° ' "		
16	October 11	11 0 0	Nilam or Kuti ..	Fomalhaut ..	63 4 0	-1 0	28 10 54	} 28 9 24	On Meridian.
17	" "	12 0 0	" "	β Ceti ..	86 17 0	" "	28 10 34		Ditto.
18	" "	12 0 0	" "	Polaris ..	59 1 0	" "	28 6 44		Ditto.
	1872								
19	January 3	11 0 0	Katmandu ..	Orionis Rigel..	107 50 0	" "	27 44 2	} 27 43 29	Ditto.
20	" "	12 0 0	" "	Sirius ..	91 30 0	" "	27 42 55		Ditto.
21	" "	17 11 0 0	Lamádong ..	Orionis Rigel..	108 58 0	" "	27 10 1	} 27 10 11	Ditto.
22	" "	12 0 0	" "	Sirius ..	92 35 0	" "	27 10 21		Ditto.
23	" "	22 10 30 0	Amthia village on bank of Arun River ..	Orionis Rigel..	108 54 0	" "	27 11 59	} 27 12 25	Ditto.
24	" "	11 30 0	" "	Sirius ..	92 30 0	" "	27 12 50		Ditto.
25	" "	29 10 0 0	Dhankuta Bazar	Orionis Rigel..	109 28 0	" "	26 54 58	} 26 56 23	Ditto.
26	" "	11 0 0	" "	Sirius ..	93 0 0	" "	26 57 48		Ditto.
27	February 7	9 0 0	Naria Bazar ..	Orionis Rigel..	110 42 0	" "	26 17 56	} 26 18 21	Ditto.
28	" "	10 0 0	" "	Sirius ..	94 18 0	" "	26 18 45		Ditto.

OBSERVATIONS OF THE BOILING-POINT TAKEN IN NEPAL AND GREAT TIBET BY EXPLORER No. 9.

No. of Observa- tion.	Month and Date.	Watch Time.	Station.	THERMOMETER.			Deducted Height above Sea in feet.	REMARKS.
				No.	Boiling Point.	In Air.		
1	1871 August 1	8 A.M.	Darjiling	7	201° 15	64° 25	} 7,253	West wind. A point in Darjiling 7170 feet, by G. T. S.
2	" "	" "	Ditto	10	201° 5	"		
3	" "	7 A.M.	Phalialung Lek	10	195° 2	55° 2	} 10,575	No wind and rain. Ditto.
4	" "	" "	Ditto	7	196° 0	"		
5	" "	6 P.M.	Suria Lek	7	198° 0	63° 0	9,190	South wind and rain.
6	" "	9 A.M.	Bank of Kabiri River	7	211° 0	78° 0	1,677	West wind.
7	" "	8 A.M.	Walungsangola	10	195° 3	60° 0	} 10,564	No wind. Ditto.
8	" "	" "	Ditto	7	196° 0	"		
9	" "	1 P.M.	Tipta-La	7	187° 0	46° 0	15,618	No wind.
10	" "	10 A.M.	Tashirak Village	7	188° 0	47° 0	15,025	North wind.
11	September 1	9 A.M.	Shara Village	7	190° 0	68° 0	13,983	Ditto.
12	" "	3 P.M.	Lámádong thanka	7	191° 5	67° 0	13,071	Ditto.
13	" "	7 A.M.	{ Tashichirang Village at bank of } { Chomto Dong Lake }	7	188° 5	48° 0	14,734	East wind.

NOTE.—Lek signifies a pass.

OBSERVATIONS OF THE BOILING-POINT TAKEN IN NEPAL AND GREAT TIBET BY EXPLORER No. 9—*continued*.

No. of Observer.	Month and Date.	Watch Time.	Station.	THERMOMETER.			Deducted Height above Sea in feet.	REMARKS.
				No.	Boiling Point.	In Air.		
	1871							
14	September 12	7 A.M.	Tatápáni or Chajong	7	188°0	47°0	15,025	East wind.
15	" 14	11 A.M.	Lagultung-La	7	186°0	44°0	16,201	South wind.
16	" 15	4 P.M.	Chota Tápú or Darciá Village ..	7	189°0	64°0	14,558	East wind.
17	" 19	11 A.M.	Shigatze	7	192°0	61°0	} 11,822	No wind.
18	" 23	7 A.M.	Ditto	7	192°5	62°0		East wind.
19	October 3	5 P.M.	Shakia near Tachuk	7	190°0	50°0	13,859	South wind.
20	" 4	7 A.M.	Pil Village	7	191°0	49°5	13,259	Ditto.
21	" 9	6 A.M.	Dingri Maidán	7	190°0	51°0	13,865	West wind.
22	" 10	8 A.M.	Thung-lung-La	7	182°0	30°0	18,460	South wind.
23	" 13	7 A.M.	Nílám or Kuti	7	190°0	57°0	13,911	Ditto.
24	" 15	5 P.M.	Tata Bhansár	7	205°25	66°0	5,002	No wind.
25	December 7	8 A.M.	Katmándu	7	208°0	..	..	..
26	1872 January 8	7 A.M.	{ Tribeni bank of Sun-kosi and Tumba-kosi River }	7	..	50°0	..	..
27	" 9	6 A.M.	Híla Lek	7	206°0	46°0	4,620	West wind.

OBSERVATIONS OF THE BOILING-POINT TAKEN IN NEPAL AND GREAT TIBET BY EXPLORER No. 9—*continued*.

No. of Observa- tion.	Month and Date.		Watch Time.	Station.	THERMOMETER.			Deducted Height above Sea in feet.	REMARKS.
					No.	Boiling Point.	In Air.		
	1872								
28	January	11	10 A.M.	Kanjia Lek	7	206°0	46°0	4,620	West wind.
29	,,	17	,,	Kumdia Lek	7	203°0	43°0	6,302	No wind and rain.
30	,,	18	7 A.M.	Lamakhu Village	7	206°0	45°0	4,622	North wind.
31	,,	,,	2 P.M.	Chakuwa Lek	7	202°0	42°0	6,869	Ditto.
32	,,	22	7 A.M.	Amtia V. on bank of Arun River	7	211°0	54°0	1,798	East wind.
33	,,	26	noon	Chuwa Lek	7	..	44°0	..	Data incomplete.
34	,,	28	7 A.M.	Sudab Village	7	208°0	50°0	3,493	South wind.
35	February	1	9 A.M.	Dhankuta Bazar	7	209°0	52°0	2,927	Ditto.
36	,,	3	7 A.M.	Barah chetr	7	..	55°0	..	West wind.
37	,,	7	7 P.M.	Naria Bazar	7	..	55°0	..	South wind.
38	June	19	noon	Masúri G. T. Survey office	7	201°75	75°0	..	
39	August	12	11½ A.M.	Ditto ditto	7	202°00	70°5	..	{ Mean of six. Cloudy and calm.

NOTE.—The preceding heights above sea-level are computed differentially from height of Masúri Observatory, taken at 6937 feet, to which the observer's boiling-point 201°83 and temperature 72°75 have been assumed as corresponding.

ROUTE SURVEY FROM DÁRJILING (Thánah) TO SHIGATZE
(Market Place).

No. of Station.	Name of Station.	Bearing to Forward Station	Distance in Paces to Forward Station.	REMARKS.
1	Dárjiling	294 30	13,963	
2	.. ..	275 30	4,152	
3	Kainchalia	334 30	7,279	Thánah.
4	.. ..	285 0	2,350	
5	Hamaphong	281 30	10,340	Village.
6	.. ..	292 0	15,100	
7	Phalialung Lek ..	274 0	2,871	
8	.. ..	240 0	8,100	{On boundary between British and Nepal Territories.
9	.. ..	285 0	13,010	
10	Nablang	297 0	9,580	Village.
11	Suriabhanjan ..	320 30	5,425	Hill.
12	Suria Lek	299 0	7,085	..
13	Shikárpur	290 30	15,140	Village.
14	Kabiri	340 0	4,566	Stream.
15	Phuwa Village ..	311 0	13,850	200 yards from.
16	Taplang Jong ..	17 30	16,807	Village.
17	.. ..	42 0	6,608	
18	.. ..	66 30	3,859	
19	Tabkia Thok ..	35 0	11,150	Village.
20	.. ..	66 0	17,097	
21	Ebangkhola	301 0	7,270	Stream.
22	Tambra	11 0	8,511	River, on bank of.
23	.. ..	18 30	11,800	
24	.. ..	320 0	8,010	
25	.. ..	335 0	18,001	
26	.. ..	360 0	5,938	
27	Tashírak Chu ..	21 0	10,200	Stream, on left bank of.
28	.. ..	345 0	12,100	
29	Nila-La	20 0	9,910	Hill, on top of.
30	Shara	40 30	34,030	Village.
31	.. ..	90 0	4,700	
32	.. ..	65 30	28,539	
33	Tashiehirang ..	270 0	2,288	Village.
34	Chomto Dong ..	22 30	2,500	Lake, on bank of.
35	.. ..	67 0	21,225	
36	Nangji	358 0	6,065	Village.
37	Chajong	67 30	5,450	.. Latitude observed.
38	Tinki-La	75 0	6,684	Hill, on top of.
39	.. ..	35 0	20,104	
40	Lagulung-La ..	345 0	11,670	{Hill. Boundary of Sikkim and Lhasa.
41	.. ..	16 30	18,194	
42	Ruksum	0 0	8,955	Stream, on bank of.
43	.. ..	53 0	7,715	
44	Chota Tápu	26 0	8,010	Village. Latitude observed.
45	Gyaling-La	67 30	5,000	Hill, on top of.
46	.. ..	25 30	6,393	
47	.. ..	35 30	9,600	
48	30 0	16,896	
49	33 30	12,000	
50	Shigatze	{City. The Market Place. Latitude observed.

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FROM CHANGMA (Village near Shigatze) to KATMÁNDU.

No. of Station.	Name of Station.	Bearing to Forward Station.	Distance in Paces to Forward Station.	REMARKS.
1	Changma	0 / 30	14,765	Village—10,996 paces from station No. 48, on the line from No. 48 to No. 49 of foregoing numbering.
2	.. ..	252 30	10,850	
3	.. ..	235 0	4,300	
4	Nangla	225 0	15,125	Hill, on top of.
5	Sab-Chu	280 0	1,280	River, on right bank of.
6	Lingbochen	175 0	6,800	Temple.
7	Puksum	235 0	11,383	Stream, on bank of.
8	.. ..	212 0	12,095	
9	Chong-La	266 0	13,790	Hill.
10	.. ..	200 0	2,500	
11	Ata-La	270 30	11,350	Hill.
12	.. ..	194 30	6,500	
13	.. ..	224 30	7,500	
14	Dongo-La	212 0	11,100	Hill.
15	Sinas-Chu	183 30	19,880	Stream, on bank of.
16	Pil Village	206 0	13,300	Latitude observed.
17	.. ..	230 0	9,118	
18	.. ..	215 30	14,712	
19	.. ..	280 0	13,000	
20	Chaiokor	295 30	30,760	Village.
21	Phungtu	267 0	7,600	River, on bank of.
22	.. ..	275 0	6,500	.. ..
23	.. ..	270 0	10,294	.. ..
24	.. ..	250 0	9,690	
25	.. ..	265 0	17,400	
26	Chakor	260 30	25,100	Village.
27	.. ..	279 30	11,235	
28	Dingri Jong	232 0	32,016	{Town at entrance to. Latitude observed.
29	.. ..	294 0	6,500	
30	Thungla	269 30	17,181	Hill.
31	.. ..	225 0	8,500	
32	.. ..	204 0	7,870	
33	Palgu	235 30	4,050	Stream, on bank of.
34	.. ..	205 0	5,820	
35	Thakialing	195 30	21,921	Village.
36	Nilam Jong	210 0	4,800	.. Latitude observed.
37	Kosi River	135 0	5,170	On right bank of.
38	.. ..	190 30	3,200	.. ..
39	.. ..	176 0	3,540	On bridge. ..
40	Choksum	184 30	2,870	Village.
41	.. ..	195 30	12,197	
42	.. ..	152 0	2,775	
43	.. ..	209 0	13,017	
44	.. ..	207 0	4,045	
45	.. ..	215 0	6,182	
46	Kanglank	230 0	3,800	Hill, on top of.
47	Listi	252 0	3,325	..
48	Listi Village	190 30	8,725	
49	.. ..	215 0	2,600	

FROM CHANGMA (Village near Shigatze) TO KATMÁNDU—*continued*.

No. of Station.	Name of Station.	Bearing to Forward Station.	Distance in Paces to Forward Station.	REMARKS.
50	Bisinkhar Lek ..	255 30'	4,942	
51	.. ..	240 30	5,480	
52	Balefi	200 0	5,470	Stream, on bank of.
53	.. ..	248 30	3,210	
54	Banspati	241 30	3,600	Village.
55	Choutra	228 30	3,425	„
56	.. ..	231 30	5,900	
57	Ghetar	271 30	3,360	„
58	Sipa	241 30	4,065	„
59	Jherkola	260 30	3,826	Stream, on bank of.
60	Dhankola	271 30	7,100	„ „
61	.. ..	251 0	9,310	
62	Chautaria Lek ..	226 0	2,300	Hill, on top of.
63	.. ..	221 30	3,890	
64	.. ..	270 0	5,635	
65	Kalitar	252 30	8,210	Village.
66	Chabeli	225 0	6,170	„
67	Katmánda .. ..	..	..	{ At Indar Chaok (centre of city).

FROM KATMÁNDU (Asan Tol) TO TAPLANG JONG (Station No. 16 of Route from Dárjiling to Shigatze).

1	Katmánda	112 0	7,575	{ Asan Tol. Latitude observed on this line, 1025 paces from starting point.	
2	Dimi Village ..	110 0	2,250		
3	.. ..	106 0	3,710	
4	.. ..	115 0	6,300	
5	Bist Village ..	103 0	2,335		
6	Burapa „ ..	129 0	4,060		
7	.. ..	113 30	5,660	
8	Nabna Lek	126 30	4,700		
9	Dabchia Village ..	122 0	3,230		
10	.. ..	118 30	4,850	
11	.. ..	66 30	2,500	
12	.. ..	123 30	4,415	
13	.. ..	135 30	6,825	
14	.. ..	112 0	5,200	
15	.. ..	110 0	4,910	
16	.. ..	127 0	7,800	
17	Jhangajholi ..	105 0	4,786		Village.
18	Mulkotar	127 30	6,400		„
19	74 0	2,415		
20	144 0	5,500		
21	Tribeni	92 0	7,200		Junction of two streams.
22	Bedana	110 0	3,950		Village.
23	100 0	5,700		
24	Hilia Village ..	32 0	3,000		
25	35 0	3,500		
26	112 0	2,000		

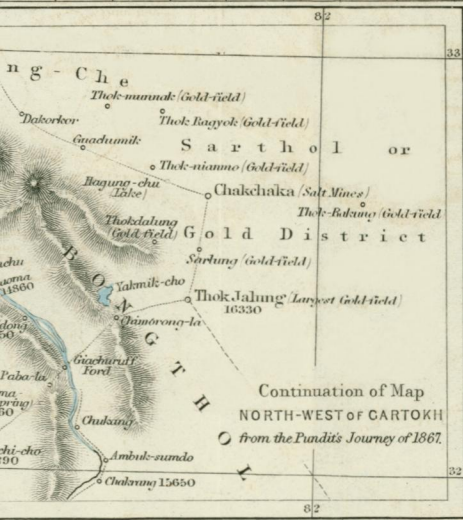
FROM KATMÁNDU (Asan Tol) TO TAPLANG JONG—*continued*.

No. of Station.	Name of Station.	Bearing to Forward Station.	Distance in Paces to Forward Station.	REMARKS.
27	.. ..	60 0	1,900	
28	.. ..	93 0	4,000	
29	.. ..	103 0	6,190	
30	Kuwapáni	72 0	4,770	Village.
31	.. ..	122 30	4,500	
32	.. ..	149 30	3,900	
33	.. ..	107 0	11,000	
34	Kanjia Lek	60 0	6,400	
35	Kanjia Village	87 0	6,615	
36	Bungnang	95 0	3,400	
37	Gahatiatar	42 30	2,200	Village.
38	.. ..	126 30	3,715	
39	.. ..	95 0	10,146	
40	Charkhu	74 30	5,870	Village.
41	.. ..	117 30	5,481	
42	Dudh-kosi	55 0	6,225	River, on bank of.
43	Rakola Pasal	120 0	9,680	Shop.
44	Kumdia Lek	45 0	4,726	
45	.. ..	117 0	6,500	
46	Nerpa Village	136 30	5,790	
47	Dorpa	85 30	8,500	Latitude observed at Lamá-dong Village 5600 paces from Dorpa on line from Dorpa to Station 48.
48	Lamakhú	100 0	7,025	Village.
49	Chakuwa Lek	77 30	5,900	Hill.
50	Dilpa Village	61 30	4,400	
51	.. ..	140 30	10,780	
52	Bhojpur Village	82 0	6,597	
53	.. ..	37 0	4,600	
54	.. ..	40 30	5,210	
55	Soria Village	57 30	5,425	
56	.. ..	48 0	4,600	Latitude observed on line 56 to 57 at Village Amtia, 2500 paces from Station 56 towards 57.
57	Arun River	74 0	7,290	On bank of.
58	Chainpur Lek	55 0	5,700	Hill.
59	.. Village	77 30	8,590	
60	.. ..	92 0	10,610	
61	Nundhakia	65 30	6,400	{ Pati. Small Bazar and Dharmśála.
62	.. ..	110 0	4,200	
63	Milkia Lek	87 30	4,410	
64	.. ..	70 0	8,625	
65	.. ..	62 30	13,645	
66	Taplang Jong .. ..	..	..	{ Same as Station No. 16 of Route from Darjiling to Shigatze.

FROM KABIRI DHARMSALA (Station No. 14 of Route from Dárjiling to Shigatze) TO NARIA BAZAR (Kotwáli).

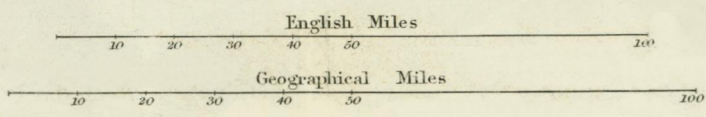
No. of Station.	Name of Station.	Bearing to Forward Station.	Distance in Paces to Forward Station.	REMARKS.
1	Kabiri	125 0	3,900	
2	Tamru River ..	199 30	7,310	On left bank of.
3	Chua Pahár ..	267 30	7,600	
4	Sambua	210 30	5,300	Village.
5	Tukma	135 0	2,700	Hill.
6	.. ..	216 0	7,520	
7	Majhwa	210 0	4,525	
8	.. ..	201 0	9,470	
9	Kalamati	225 0	4,597	Hill.
10	.. ..	172 0	2,000	
11	Sudab Hill ..	225 0	3,370	
12	.. ..	241 0	3,800	
13	Telia khola ..	201 30	7,820	Stream.
14	Hámjung Hill	249 30	8,315	
15	Dhankuta ..	187 0	6,660	Bazar. Latitude observed.
16	.. ..	246 0	5,670	
17	Tamru River ..	211 0	8,860	On bank of.
18	.. ..	241 30	4,370	
19	Dhárapáni ..	272 0	6,040	Village.
20	Barah Chetr ..	191 0	8,466	Worshipping place.
21	Chatria	215 0	23,400	Thánah.
22	Megjin	177 0	23,300	Ka Thánah.
23	Chapri Village	275 0	4,100	
24	.. ..	206 30	11,476	
25	Kotia Village ..	220 30	8,170	
26	Thakia ,, ..	261 0	5,210	
27	Sikrata ,, ..	251 0	5,676	
28	.. ..	272 0	10,085	
29	Dhánsia Village	267 0	6,650	
30	Aráha ,, ..	251 0	4,270	
31	Naria ,, ..	..	..	{Bazar, Thánah. Latitude observed.





Map showing
ROUTES OF NATIVE EXPLORERS
 in
TIBET AND NEPAL

to illustrate the Papers
 by
 M^r Markham, & Lieut. Colonel T. G. Montgomerie.



A

T

T

I



(T) Tarjam (Post House)
 • Camp

Kanchinunga Peaks

XPLORERS
EPAL

Montgomerie.

The figures denote the height
in feet above the Sea level.

The Longitude is in accordance
with the old value of the Madras
observatory (80° 17' 21")







TIBET AND NEPAL

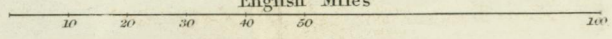
to Illustrate the Papers

by

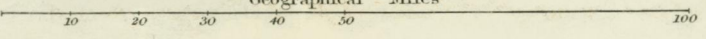
Mr Markham, & Lieut. Colonel T. G. Montgomerie.

Continuation of Map
NORTH-WEST OF CARTOKH
from the Pandits Journey of 1867.

English Miles



Geographical Miles



(T) Tarjam (Post House)
• Camp



86

87

88

Montgomerie.



31
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88 89 90 91