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in the early years of the eighth century; occupied the Indus valley; stamped out the remnants of Greek influence, and imposed a dynasty (or succession of dynasties) on Multan which lasted for three centuries. They entered by a route which is not at all coincident with that followed by Alexander in his disastrous retreat to Persia. The latter is not well shown in the illustrative map at p. 288, for it fails to give point to one of Alexander's great strategical blunders, viz. that of attempting to make his army a base of supply for his fleet. Another blunder was his selection of a route the geography of which was unknown to him. As far as Makran he had had Greek pioneers to guide him, but here he made geographical assumptions, which, like all such assumptions, led to certain grief.

Mr. Maguire's book is a most useful work of reference both to the military student and the public at large. It is packed full of "wise saws and modern" (as well as ancient) "instances" from end to end of its 350 pages, and it possesses an excellent index. If we echo Sherman's cry for an atlas in further and fuller illustration of the geographical references, it is with the admission that it would be quite impossible to introduce anything like complete map illustration of so comprehensive a strategical survey within reasonable limits of space.

NARRATIVE OF A JOURNEY TO THE LAKES RAKAS-TAL AND MANASAROWAR, IN WESTERN TIBET, UNDERTAKEN IN SEPTEMBER, 1848.*

By Lieut.-General Sir RICHARD STRACHEY, R.E., G.C.S.I., F.R.S.

September 8. Halt at Tisum.—The thermometer, which at 6 a.m. stood at 30°·8, rose by nine o'clock to 54°, and at ten o'clock to 67°, after which the wind got up, and it became rather cloudy. It may be conceived that a change in the temperature of the air such as this, of 36° in four hours, was rather unpleasant. Inside the small black yak-hair tents used by the Tibetans, however, the change is still greater than this, and I have seen a difference of 42 degrees between 5 a.m. and 1.30, and that at an elevation of 18,400 feet.

As W. was still unwell, we halted to-day to give him a rest, and I went out in the afternoon to do something in the way of survey. I started off nearly south from *Tisum*, on the plain between the *Chaldu* and *Chirchun* rivers, and at a distance of about 4 miles came to a slight rising ground, from which I got a sight of the great snowy mass south of the *Manasarowar* lake, marked in our map as *Gurla*, the summits of which range from 21,800 to 25,000 feet. It was a good deal covered up in clouds, but still enough could be made out to see that it was a grand mountain. The Juharis called it *Mandhata*, after the name of a personage in the *Mahabarat*, but I don't think they could produce any authority for doing so. From

* Continued from p. 170. Map, p. 204.

the place where I stood, looking to the north, snowy peaks were seen in only two or three directions, and those were very distant, possibly none of them being within 150 miles. To the south-west was the *Balch* range, with very little snow upon it; everything beyond it was quite concealed by clouds. The plain, over which I looked for some 10 miles, appeared of a uniform pale brownish-yellow tint; the hills that rose from it inclined to shades of red, and the effect was anything but cheerful. The only sign of animal-life that I observed in this desert was a large cricket, *Gryllus*, with blue wings, that took short flights, making a peculiar quick, sharp chirrup as he went. Early in the morning, however, wolves had been heard, apparently hunting somewhere near our tents, and a young hare was run down in the course of the day by two of our men. During my absence, Winterbottom, in examining closely the herbage near our tent, found one or two novelties, and among them a curious little leguminous plant, with a remarkable four-cornered and winged prickly pod, which proves to be a new genus near *Eversmannia*. Mr. Bentham named it after me—*Stracheya Tibetica*, the real discoverer, W., having positively declined to allow his name to be perpetuated in such a way. Among the other new plants here met with may be mentioned the following: *Alyssum canescens*, * *Stellaria graminea*, * *Potentilla anserina*, *Saussurea glanduligera*, *Crepis glomerata*, *Parnassia ovata*, *Scopolia præalta*, * *Salsola kali*; and a few grasses—*Stipa purpurea*, *orientalis*, and *sibirica*, *Festuca valesiaca*, *nitidula*, and *sibirica*, *Elymus sibiricus*.

A little excitement was produced at our camp early in the day by the report of the approach of a party of travellers. They turned out to be only some Juhari Bhotiyas returning home from *Kyunglung*, at which place our friend of *Topidhunga* had arrived, and had reported our intended visit to *Hundes*. But there had been no definite knowledge of our actual presence in Tibet. The chief civil authority of the place, the *Kharpun*, they told us, viewed the report with much philosophy; the entrance of foreigners into Tibet was notoriously prohibited, and what more was wanted to satisfy the Justice Shallow of *Kyunglung* that our threatened invasion was impossible? We took the opportunity of sending back letters to Kumaon by these Bhotiyas.

At night, 9 p.m., the thermometer was at 36°·5.

September 9. *Tisum to the Satlaj*, 15 miles.—The morning was cloudy; at 6 a.m. the thermometer was at 40°·5, and it rose nearly to 50° at 8 a.m. Our route lay down the *Jankum* river to the grazing or encamping ground called *Shib-chilam*, the ravine gradually getting deeper as we went on, till at that place, where the *Chirchum* river joins it, the bank is some 800 feet high, forming a steep cliff cut up into singular shapes, looking like ruins of towers and Gothic buildings. The deposits of gravel and sand, of which the plain was composed, might here be seen resting nearly horizontally on schist or shale, black and very rotten, that dipped at a highish angle to the north-west. These rocks are cretaceous, or possibly nummulitic. Between the two rivers, *Jankum* and *Chirchun*, on a tongue of land which hardly rose 100 feet above the water, were the remains of a village which had once existed here. Close by, also, the high-road from *Daba* to *Kyunglung* crosses the united streams by a bridge, said to have been built by a Juhari. On the opposite bank a cave was pointed out to us, where a man exercising the functions of a rural policeman was said to be posted by the *Kyunglung* authorities. These caves—for there are many of them in the alluvial banks—are commonly used as winter residences and storehouses by the nomadic Huniyas. A robbery was said to have taken place the year before of goods and chattels deposited in one of these caves, and to prevent the repetition of such outrages, the policeman had been posted here. During the whole of our journey we were continually hearing of

certain gangs of robbers, said to prowl over these parts of Tibet, and known by the Bhotiyas under the name of *Khampa*. This name, which appears at first to mean simply a man of the province of *Kham*, is, my brother, Captain Henry Strachey, informs us, an ignorant corruption of the word *Kyampo*, which signifies "nomad," and is applied by civilized Tibetans to the wilder races that exist along the northern part of the tableland abreast of the provinces of *Nari* and *Utsang*. Our Juharis were in constant terror of these marauders, who plunder tents and carry off cattle, when they dare, and we were told that some of them had just robbed a Bhotiya or Kumaon at *Darchin*. I received also long details of a raid made by the *Kyampo* two years back, on cattle belonging to the people of *Dungpu*, a village about 20 miles west from *Shib-chilam*. To avenge this, a considerable party of Juharis, who happened to be near at hand, combined with the villagers to hunt down the robbers, whom they appear to have treated as so many wolves, firing upon them without the least compunction. Five or six *Kyampo* were killed, some being shot in the capture by the Juharis, and the rest being summarily disposed of by the Huniyas, to whom such prisoners as were taken were made over by their allies. One or two of our party were present on this occasion, and evidently considered it rather good sport. The Juharis several times repeated to me that in *Hundes* the life of a man is looked upon as about of as much importance as that of a goat; their own civilization is sufficiently advanced to make the difference perceptible.

The constituted Tibetan authorities do not seem much superior to their subjects in matters of this sort, and I was told that one of their regular modes of execution was to smash with a sledge-hammer the thigh-bones of their prisoners, who were so left to die. In this manner, it is said, they murdered an officer of Golab Sing's *Dogra* army that invaded this part of *Nari*. When beleaguered in the Sikh fort at *Kardam*, he foolishly went out to treat with the besieging Tibetan force, when he was instantly seized and treated as I have said, though, with exceptional politeness, they ended by cutting off his head, a distinction not bestowed on ordinary culprits, who are left to perish as they may. No one will be surprised to hear that this brutal treachery and cruelty is accompanied by the basest cowardice.

In the valley down which we had come the vegetation was meagre, but I mention as deserving of notice, **Salsola Kali* and **Triglochin palustre*. This *Triglochin* I afterwards found again at *Hoti*, growing with **Triglochin maritimum* also at an elevation of about 15,000 feet. In addition to these plants, I should mention as being found in other parts of Tibet, and often associated with salt plants, *Salsola*, *Eurotia*, and the *Triglochins* already mentioned, a *Crambe*, *C. Cordifolia*, not greatly differing from *Crambe maritimum*, and *Glaux maritima*. With these are commonly seen many common northern forms of *Potentilla*, *Ranunculus*, etc., so that, strange as it may appear, we here often have at these great elevations, and in the middle of the continent of Asia, an assemblage of plants which may any day be found growing together on the sea-coasts of Northern Europe. It has been suggested with some reason that this curious feature of the Tibetan flora may be attributed to the immigration of the saline types of the Caspian. But considering that a coast-line certainly existed along the northern base of the Himalaya as late as the Cretaceous period, and the probability of the alluvial deposits of Tibet having been originally laid out beneath the ocean, it is not a very wild speculation to suppose that this marine flora may have been diffused along a former coast-line in the past ages of the Earth, and subsequently raised, by the general elevation of the surface, to its present position.

Early in the morning we had sent on two men as videttes to see that the high-road, which we here had to cross, was clear; on arrival at *Shib-chilam*, they reported that a beggar with a few goats constituted the only danger visible, so, he having been

voted contemptible, we proceeded to cross the *Chirchun* river. The water is muddy and dark-coloured, partly perhaps from its rising in glaciers, but partly also from the rotten black shale which here forms its bed. Having forded the stream, we ascended the high bank and again stood on the surface of the great plateau, which was here somewhat narrowly circumscribed by hills of bold outline. The road, or rather track, to *Kyunglung*, which place was now about 12 miles distant, could be seen for a mile or two in a north-easterly direction over the plain, and then, entering the hills, was lost to us. On the west we saw the track to *Dungpu* to a somewhat greater distance, winding between two low rounded lines of hills, the northern of which abuts on the *Chirchun* river near *Shib-chilam*.

TIBETAN BEGGARS.

Judging from their deep red colour, these ridges may probably be composed of igneous rocks, which are abundant in many parts of *Guge*. The bed of the *Satlaj* was not yet visible, but some low ranges due north of us were pointed out, some of which, we were told, lay on this side, and some on the other side of that river. The coast seeming to be clear, we kept on down the *Kyunglung* road, but before we had got far the alarm was given of a party of strangers coming towards us. An attempt to make out more exactly what they were with a telescope proved fruitless, in consequence of the mirage or haze, which utterly distorted all distant objects seen over the surface of the ground, for the sun was already beginning to show himself in earnest. After some consultation, during which we were quickly

approaching the strangers, our people, influenced no doubt by their wishes, declared that they must be Bhotiyas, and not Tibetans, since some of them had on white clothes, which shone out brilliantly in the sun, whereas the habitual dress of the Tibetans is of a dark colour, either naturally or with intense dirt. So we went without hesitation, but to the horror of every one, when it was too late to get out of their way, they turned out to be a party of Huniyas. W. and I instantly tried to sneak off unobserved down a ravine near which we were moving, but the effort was evidently futile. The enemy, however, was plainly not dangerous in point of numbers, the party consisting only of two; so our people, having nearly ten to one in their favour, went on to meet them with great heroism. We soon saw that an amicable arrangement had been come to, and the combined forces, after a short conversation, came to the spot where we had posted ourselves. The Tibetans were two inhabitants of *Dungpu*, one dressed in white, one in black, with square-cut caps, Tartar physiognomy, very dark complexions, and long pigtailed, and were well known to our people. They approached us making many polite bows, and, taking off their caps, presented the cloth of ceremony, as was becoming from inferiors to superiors. This is a form which is universal in Tibet, and extends into China, though I do not remember ever to have heard an explanation of the custom. The cloth we received was of cotton, badly woven, but of a fine texture, about the size of a small handkerchief, but so dirty as to show that it had frequently performed similar offices of civility before. The more wealthy classes employ silk instead of cotton cloths, the legend, "*Om mane padme hum*," being commonly woven in damask at each end. The sale of these cloths of ceremony, I was given to understand, constituted a Government monopoly in this part of Tibet. I made out that the strangers felt, or affected to feel, great alarm at having seen us, fearing the vengeance of their rulers, should it be discovered that they had become accessories to our felonious inroad into Tibet. They seemed, however, to have a preponderating respect for our friends the Juharis, with whom they had commercial dealings, and in whose favour the balances of trade were said now to be rather heavy. They were, in short, poor creatures who evidently were neither capable nor desirous of doing us any harm, or of opposing our advance; and after some talk they showed us how we might go straight down to the *Satlaj*, by a ravine near the head of which we then were, and so get out of the public road and at once avoid all risk of further notice. Assurances that they had only to keep their own secret, and a few rupees which we gave them, soothed them considerably, and we parted excellent friends. Before they left, however, we heard from them that nothing was known of us at *Kyunglung*, beyond the old reports that we were coming.

At 2.30 p.m. we stopped at the head of the ravine down which we were to go to the *Satlaj*, to put up the barometer, and the surface of the plain here proved to be 14,820 feet above the sea. The thermometer was 53°, but slight rain was falling, a storm accompanied by a strong wind having just swept longitudinally over the plain from west to east. The sun had been very hot in the morning, and the usual wind from the south hardly blew, which the Bhotiyas told us was a sign of rain. We here found growing on the dry surface of the plain, which was as barren as ever, *Chamærhodos sabulosa*, a Siberian plant; and an aster, *A. molliusculus*, with a rather handsome purple flower, was also common. A few more grasses were also seen, *Deyeuxia compacta*, *Stipa Eversii*, and *mongholica*, *Oryzopsis æquiglumis*, *Lasiogrostis mongholica*.

The ravine we followed took us gradually down among more vigorous vegetation, and some hares and partridges that we saw showed that the locality was better suited to support animal-life also. The partridge is, I believe, the same species (*Perdix Chukar*) common in the lower parts of the outer Himalaya, and in Kumaon

called *Chakor*, but why he should reappear here in a climate so very different is more than I can say. Our people deliberately set to work, and without difficulty ran down three of these birds, which I understand are common throughout Tibet. The hare, *Lepus Emodius*, is also frequently seen all over the plain of *Guge*, being probably the most common of the creatures we observed. It is remarkable for its white tail, and its stupid habit of squatting close to its human enemies.

In passing along the ravine, I noticed that in the proximity of calcareous rocks that were seen to underlie the alluvial deposits of which the plain is composed, the boulders, gravels, and sands are frequently cemented together by carbonate of lime,

RIVER SATLAJ AT CAMP OF SEPTEMBER 9 (LOOKING EAST). ELEVATION, 13,350.

forming a thoroughly solid rock. This appeared to be precisely the same as the matrix which may often be noticed adhering to the mammalian fossil remains that are brought from these regions, and there can be little doubt that it is from some parts of the finer of these conglomerates that the fossils have been obtained. In the conglomerates, caves such as I have already mentioned are likewise common.

As we continued to descend, the horizontal alluvial beds were at length again seen to rest on shales and shaly limestones, which dipped at a high angle most commonly to the north-west, but much shattered and varying considerably in their precise dip and strike. The ravine, which had at first been straight, open, and with smooth sloping banks, now that it entered the solid rock, became much

narrower and more tortuous, and ended in an extremely narrow gorge with highish cliffs on either side, from which we had the satisfaction to emerge at about half-past four, on the edge of the *Satlaj*, close to which we encamped.

The spot on which we had thus almost stumbled was rather singular. The river flowed in a beautiful clear blue stream, in a deep and narrow bed, from the banks of which nothing was to be seen but the black shaly cliffs immediately overhead. The upper end of the gorge from which the river issued, seemed at first quite blocked up, but a closer examination showed a rent hardly exceeding 15 feet in breadth, through which the water came with a current that was hardly perceptible, proving the great depth of the channel, for the stream within 20 or 30 yards of its point of issue was already a sparkling rapid, some hundred yards wide, and by no means easy to ford. I thought I saw something like a trap dyke among

SATLAJ RIVER GORGE, ELEVATION 13,350 FEET (CAMP OF SEPTEMBER 9, LOOKING WEST).

the rocks in this chasm, but they were so steep that it was impossible to get at them. On examining the boulders and pebbles in the river, I found that the great majority were of the slates and calcareous rocks of the vicinity, but that a notable proportion were composed of porphyries, only one or two specimens of granite being seen. Similar porphyries have been brought to me from *Sansurga*, on the affluent of the Indus that passes *Gar*, and it is therefore probable that some at least of the intermediate mountains are composed of these rocks, a supposition which is rendered more probable by the fiery red colour of the surface which was remarked by Moorcroft, and which is confirmed by the accounts of the Bhotiyas, who are in the habit of going to the fair at *Gar*.

In the shales near the *Satlaj* I also found an *Ammonite* and *Inoceramus*, showing that these strata are either Jurassic or Cretaceous. We had here descended to 13,350 feet, the lowest point we reached during our expedition, and the vegetation was more cheerful, though still not much to boast of. The largest shrub was *Myricaria elegans*, a plant closely allied to the tamarisk, here growing to a height

of 5 or 6 feet, with stems often 3 or 4 inches in diameter. The dama (*Caragana pygmaea*) was more luxuriant than usual, rising to 3 feet or more. We here also found *Clematis graveolens*, greatly resembling *C. Flammula*; *Crepis glauca*, very like a form of the Altai mountains; two species of *Tanacetum*, *T. gracile* and *alternioides*; and several species of *Artemisia*, or wormwood, a genus largely developed in Tibet, of which may be mentioned *A. sacrorum*, *salsoloides*, and *Roxburghiana*; also *Christolea crassifolia*, a cruciferous plant which might have been added to the list of saline types before given.

We found our encampment on the Satlaj, after the discomforts of the preceding days, quite luxurious. The *Myricaria*, which they told us was abundant at Gar, also gave us admirable firewood, an article in which we were speedily becoming connoisseurs, while we were greatly sheltered from the wind, and quite concealed from inquisitive Tibetans.

September 10. *From the Satlaj to Ligchephu, or Likstephu, 16 miles.*—Thermometer at 5.30 a.m., 36°·4. Having thus happily accomplished the first part of our projected expedition by reaching the Satlaj without interruption, we now turned off eastward towards the lakes.

As we started to-day, a stray yak was seen on the hillside just over our tents; it was forthwith taken possession of, according to the custom of these parts. The owner, if he is discovered, gets the animal again by paying half its value, and I afterwards heard that this happened in the present instance.

From the bank of the Satlaj we at once climbed to the level of the plain, but, among the low limestone hills by which we found ourselves surrounded, the presence of any alluvial deposit was a little doubtful. The vegetation became as scanty as before. From this position we had a fine view of the Himalayan peaks to the south-west. The morning was splendidly clear, and there was not a speck of cloud to be seen. The mountains at the head of the Milam glacier, and Kamet with its dependencies, came out very finely. Two other very distant peaks were also noted, almost directly down the course of the Satlaj, probably *Porgyul*, rather more than 100 miles off, opposite to which this river makes its great bend to the south. We continued for some time among low hills, and saw many barhal. As we were now again approaching the Kyunglung road, it was necessary to be more careful in our proceedings than on the previous day. The village of Kyunglung was not visible from our road, as it lay among the ravines near the Satlaj; but, understanding that it was one of the highest places in Tibet where crops of grain are produced, we sent a man round to pluck some barley near the fields. He returned to our camp in the evening with several ears nearly ripe. This grain, *Hordeum vulgare*, is the variety, *H. nudum*, the spikelets in two ranks, and grain not awned. He also brought some curious concretionary pebbles, evidently formed from fine shingle encrusted with concentric layers of carbonate of lime, derived from the water of a hot spring that issues from the south bank of the Satlaj opposite Kyunglung. These little pebbles are of all sizes, from that of a pea to a pin's head. They were quite separate one from another, though in a second hot spring at Tirthapuri, on the Satlaj, some miles higher up the river, a compact rock is formed by the agglomeration of similar pisiform spheres. In the Tirthapuri rock, specimens of which are often brought away as curiosities by the Bhotiyas who visit the place, the grains are very uniform in their dimensions, much more so than the Kyunglung pebbles. Both these springs are said to be very hot, that at Tirthapuri the hottest, so that it is disagreeable to put one's hand in it. The Kyunglung spring, from the accounts given of it—and it is noticed by Moorcroft at some length—is no doubt charged with sulphuretted hydrogen, the offensive smell of that gas affording an easy means of recognizing it. I should add that the water of

this spring, besides coating the pebbles as above explained, forms a large bed of tufaceous limestone, which is remarkable for its pure white colour and its friable texture.

Our route now lay over very uninteresting, undulating ground, dry and barren in the extreme; there was no road or even track, and the sun meanwhile was getting intensely hot. We halted about noon to rest the cattle at a place called *Gam*, where there was a small spring, and sought in vain for some shelter among the stunted bushes or rocks, none of which, however, rose high enough to afford even a little shade for our heads. The exposure during the heat of the day had by this time completed the removal of the skin from our faces. The extreme dryness of the air, and the cold winds, combine with the intense power of the sun to produce this effect, which is exhibited on the blackened faces of the Tibetans themselves, the poorer classes of whom are nearly as dark as the natives of the plains of Northern India. All about the halting-ground at *Gam* were many small pillars, built of dry stone, which we were told were erected by the Huniya shepherds to scare away the wolves and leopards from their flocks. The last-named animal is the ounce, *Felis uncia*. He is characterized by his long tail and the obscure markings of his skin, which is of a dull ash-grey colour. He is not uncommon in Tibet generally, and descends as low as 10,000 feet among the Himalayan valleys, and, it is said, often makes much havoc among the sheep. The wolf, called *shang* by the Tibetans, and the same species, I believe, as the wolf of Europe, offers curious example of the reappearance in the open regions of the Tibetan plateau of an animal which, although quite unknown on the wooded slopes of the Himalaya, is very common in the plains of North-Western India, and shows how the conditions of surface affect the development of animal-life, no less strongly than those of climate and temperature.

On leaving *Gam*, we gradually ascended. I set up the barometer on one of the highest parts of the ridge, 15,940 feet, which we crossed on our way from the *Satlaj* to *Ligcephu*, and while so employed was overtaken by a violent hailstorm accompanied by thunder and lightning. We saw this storm, like that of the previous day, driving up from the west, looking very black, and it passed on over us towards the lakes. The regular south wind had been wanting to-day also, and this had no doubt made the sun's power seem to us so excessive. During this storm the temperature of the air was not below 46°.

We now began to descend towards the foot of the hills which here separate the *Satlaj* from the great plain of *Guge*. Our route first lay over a flat piece of ground, which looked like a portion of the alluvial deposits of the plain that had been pushed up a few hundred feet more than the rest.

The halting-ground—for it is nothing more—called *Ligcephu*, soon became visible, marked only by a patch of green, under some limestone cliffs at the edge of the great barren plateau below us, while some small pools of water beyond it showed the position of the river by which we were to halt. We reached our camp at about 6 p.m.; it was pitched near the half-dried-up river-bed, on ground which, though now dry, looked as if it were at times swampy, or even altogether under water.

The evening was very fine, and the setting sun lighted up the mountains on the east and south-east most brilliantly, showing us very distinctly the towers at the place called *Lama-Chorten*, distant about 15 miles across the plain, close to which my brother passed on his visit to the lakes in 1846. *Lama-chorten* is the first halting-ground in the open plain of *Guge* on the way into Tibet from the Himalayan valley of *Darma* and *Byans*, by the passes of *Kach*, *Nyue*, and *Lankpyalekh*. The buildings called *chorten* or *choktan* by the Tibetans are votive edifices, which are described by my brother as “little towers of dry stone, stuck

about with flags." These particular chortens, I was told, are erected by the married women of *Darma* as a votive offering for their husbands' safe return home from their travels in Tibet, and it is a common joke that the young unmarried women also set up their chortens in hopes of getting husbands in whom they may take a similar interest. It may here be mentioned that the people of *Darma* and *Byans* are so Tibetan that they have not adopted the Hindu customs of marriage, which, however, prevail to a great extent amongst their neighbours of *Juhar*. The girls of *Darma*, accordingly, instead of being betrothed and finally disposed of when mere children, are not married till they are grown up, when their own views are more or less consulted.

The sight of these chorten towers, which they were enabled to see distinctly by help of a telescope, greatly amused the less instructed of our Bhotiyas, and they talked of it for days afterwards.

This day had been particularly barren of botanical interest, not a single novelty being added to our list. The elevation of *Ligchephu* is 14,950 feet. At 9 p.m., thermometer in the air, 44°; in the tent, with the help of the fire, 58°8. These figures will show the effect of the fire. In general we managed to keep the temperature inside about ten degrees above that of the external air, but only so long as the fire was burning, and in the morning there was generally but little difference of temperature between the inside and outside until the sun rose.

September 11. *Ligchephu to the Darma Yankti, 8 miles.*—At *Ligchephu*, at sunrise about 6 a.m., thermometer 28°5; at 7 a.m., air, 33°; earth, a foot below the surface, 50°. The river at *Ligchephu* is the *Chu-naku*, or Black river. The part of it which will be seen from the map to bend suddenly back below this place, flowing nearly in an opposite direction to its previous course, is locally called *Biphu Kula*, a name meaning "contrary-flowing," and the *Biphu Kula*, therefore, is not a distinct stream, as was supposed by my brother. There is a great difference between the rivers in the eastern part of *Guge*, from the *Chu-naku* inclusive, and those in the west. The latter all flow in deep ravines, the depression of which below the surface is often exceedingly great. The beds of the eastern rivers, on the other hand, are all shallow, and not sunk more than 25 feet or so below the general level of the plain. This difference, which gives a totally different aspect of the two ends of the plateau, is readily explained by reference to the gradually increasing depth of the bed of the *Satlaj* as it flows westward, combined with the circumstance of the channels both of the minor streams and of the *Satlaj* itself being more in solid rock in the eastern parts of the plain, and more in unconsolidated alluvial matter in the west, where the thickness of those deposits is very much greater. The *Chu-naku* was at this season but a small stream, broken up into several different channels, all very shallow, and evidently constantly shifting their positions.

Leaving *Ligchephu* behind us, but still having on our left, at a distance of a mile or two, the hills from which we had descended the evening before, we forded the river and struck across the plain. Its surface was almost perfectly level, covered with small shingle, and having quite the appearance of a dried-up lake. This continued with no variation to the *Gunda Yankti*, a stream somewhat larger than the *Chu-naku*, with a bed 200 yards wide, its water also flowing in several different channels, and sunk about 25 feet below the plain. This section shows nothing but gravel, finer, however, than that seen in the larger ravines near *Tisum*. On the banks of this stream grows a small *Hippophaë*, *H. rhamnoides*, a species found on the east coast of England, which we had before met on the edge of the Milam glacier. It was here covered with small yellow fruit, which was exceedingly sour, though of a pleasant flavour, and it was eaten most voraciously by the Bhotiyas as they passed.

Beyond the *Gunda Yankti*, about 4 miles more of the plain brought us to the

Darma Yankti, a stream still larger than the former, but quite similar in character. We here again approached the hills more closely, and finally encamped at an altitude of 15,230 feet, under a low ridge round which the river flows.

Our march to-day was short, and after our journey was over I attempted to make observations with the theodolite to determine the height of *Gurla*, which mountain was becoming a more and more prominent object as we approached it. But a cold wind, which did not subside till late in the evening, was blowing with great force all the afternoon, and made it very difficult to observe angles with any degree of nicety. From the point where I had taken up my position, I looked over the plain towards *Tisum* for not less than 25 miles, but the view was rendered very indistinct by the mirage, which was so great that objects near the horizon lost their true forms even at short distances, and became quite confused, appearing to quiver and flicker as much as ever I saw them do in India.

On our road to-day we again observed a wolf, and some small antelopes (*Procapra picticauda*), but too far off to come within range of Bachu's gun; many *Kyang* were of course seen. The vegetation was still most meagre, *Oxytropis Stracheyana* being the only novelty. In the evening we held a council to consider our route, and determined to go on *viâ Gyanima*, intending thence to turn up to the north of *Rakas tal*; a plan, however, that we next day changed for the southern route, which we actually followed. At 9 p.m., thermometer in air, 41°8.

September 12. *Darma Yankti to Gyanima*, 10 miles.—At 6 a.m., thermometer 28°; at 9 a.m., 53°.

Hugging a projecting point of the low hills on our left, or to the north, the summits of which barely reach a height of 15,400 feet, and leaving on our right two or three small detached hills that rise abruptly from the flat, we made directly for the so-called fort of *Gyanima*, or *Nima-khar*, the former name being a compound of the Tibetan words, *Gya*, "splendour," and *nima*, the "sun;" the latter of *Nima*, the "sun," and *khar*, "fort." The hill on which the fort stands soon became visible, though the lake at its foot did not appear till some time afterwards. The miserable slow pace of the cattle, the great power of the sun, and the extreme violence of the afternoon wind, made us heartily sick of this arid plain, which offered no novelties in any shape whatever to engage our attention during the hours we were crawling over it. At last we came sufficiently near to the lake to make us brighten up a little, for we knew that there would be Tibetans encamped with their cattle on the pastures along the water, and it was necessary to be careful where we went. The mirage, however, was so strong again to-day, that it was difficult to make out objects with a telescope any better than with the naked eye, and a solitary wild donkey standing in our way kept us on the *qui vive* for some time. When at length he was clearly distinguished, we went on with additional confidence, for his presence showed that men were still far enough away. By degrees, as we approached the water, the haziness became less, and we saw distinctly several encampments a mile or two off. There were clusters of small black tents, with cattle grazing near, and human figures were seen moving about them. We were so little elevated above the sheet of water that its form could not be made out, but we saw that it extended to the north-west many miles in length, and that its borders were fringed with vegetation, the dark colour of which contrasted with the pale bare surface of the plain beyond. On the opposite side of the lake rose fine-looking hills, bold and utterly barren; they are the highest between the Indian watershed and the *Satlej*, and yet we could only discern a single small patch of snow on one of the highest summits, which I afterwards determined to be 18,400 feet above the sea. Their rich reddish-brown tints made it probable that they were composed of some of the igneous rocks on which we were just entering.

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The plain over which we had been travelling for the last two days, its perfectly level or gently sloping surface covered with shingle, the mountain slopes which bounded it, and the detached hills that rose from it, presenting cliffs that sloop up abruptly like rocky coasts and islands, forcibly suggested that here was the dried-up bed of some great lake or inland sea, to which the effects of the mirage frequently gave a wonderful reality.

The hill of Gyanima is an isolated mass of eruptive rock, chiefly hypersthene or bronzite. The surface is much fissured, and the rock breaks up very readily into small fragments. Coatings of serpentine and siliceous matters are also common on the faces of the joints, and it weathers to a reddish-brown colour. The regular road lies through a depression in the middle of this hill, which our cavalcade therefore avoided, moving off round the south-east extremity, under the further angle of which our camp was formed.

TIBETAN TENT.

I myself went straight down to the lake, passing tolerably close to a Huniya tent, the people near which, however, took no notice of us. The ground at the north-west angle of the hill over which I passed is customarily occupied earlier in the season by the Jubari Bhotiyas, who encamp here, as I was told, this being one of the regular marts for the traffic between the Tibetans and the people of the upper Himalayan valleys, the former bartering salt and borax for grain or Indian or European commodities brought up by the Juharis. The soil was covered with green turf intersected by numerous small streams, and in some parts was even a little boggy. *Ranunculus aquatilis* and *Hippuris vulgaris*, or horsetail, both common English plants, were growing in all the pools; *Ranunculus cymbalariae*, a small creeping species with tridentate leaves, is common in all the valleys of Hundes, and widely diffused over Northern Asia and America; two *Gentians*, and a very small purple *Primula*, *P. Tibetica*, not exceeding an inch in height, were abundant amongst the herbage. In the streams, which were usually only two or three feet in depth, were many small fish. One of these we managed to catch, and our Bhotiyas said that when they are encamped here they get plenty of larger size. Men stand in the shallower parts of the streams with sticks, ready to strike at the fish, which are driven down from some distance by another party, who come along in the watercourses. I saw no large fish, however, and it was suggested that they had retired into the lake, as it was now getting cold again; and it is possible, for these small rivulets must cool down much before the general mass of water in the lake.

Not being certain whether or not there might be any one living in the remains of the old fort on the top of the hill, we did not venture to intrude upon it, but we were given to understand that it consisted only of the ruins of the walls. I did not gather that any historical or mythical interest was attached to the ruins. From the foot of the hill, however, we got a good view of the lake, which is a sheet of water 10 or 12 miles long, but nowhere probably much more than a mile in breadth. From its lower end, I was told, a stream flows off and joins the *Darma Yankti*, which soon afterwards unites with the *Gunda Yankti*, and the combined river then takes the name of *Chu-kar*. The upper end of the lake where we stood terminates in pools of water and swamps, a very small stream only flowing in from this quarter. The ground along the edges of the water was generally low, and many Huniya encampments were dotted along the banks, with immense flocks of sheep, herds of yak, and a few horses, all of which we saw very distinctly with our telescopes. Innumerable waterfowl covered the spits of mud that ran out into the lake at this southern end, and large numbers of birds were also collected about the pools and swamps. Of these may be enumerated a fine large grey bustard with black neck and tail, grey geese, ducks, teal, snipe, terns, sandpipers, curlew, a fishing-hawk, and small heron. The bustard refused to be shot, and walked off triumphantly as the sportsman approached; and a goose, anxious, I suppose, to support the reputation his family has earned, was the only victim of Bachu's arts. Sticking to one of the feet of the goose was a small leech.

The ground all about our camp was covered with the burrows of a small rat-like animal with a very short tail (*Cricetus songaricus*), a specimen of which I afterwards managed to catch.

Along the foot of the hill issued many copious springs, the temperature of which was $36\frac{1}{2}^{\circ}$. The open running water in the afternoon, about five o'clock, was 43° , and the temperature of the earth 9 inches below the surface, 47° . The surface of the lake was calculated to be 14,880 feet above the sea.

On returning to the tents after our short stroll to the point overlooking the lake, we found our company drinking tea in the Tibetan style. This is quite a different operation from the Chinese or European infusion system. The tea used is of the description known as brick-tea, which is tightly compressed into brick-like blocks. It is boiled with carbonate of soda and butter, flavoured with salt, and thickened with barley-meal, thus forming a sort of soup. To my taste this particular brew was simply nauseous. The compound, when concocted with proper materials and on scientific principles, is declared by competent authority to be good. I suppose, therefore, that as there certainly are differences in English teapots, so there are also in Tibetan kettles. Tea-drinking is a constant occupation for a Tibetan. In every tent and in every house the tea-kettle is always on the fire. The laws of hospitality bind all to present tea to their guests, and every Tibetan carries with him a wooden bowl of Himalayan maple by way of teacup. The universality of tea-drinking in Tibet is such that it would appear to offer a good market for the produce of the Himalayan tea plantations. At 8 p.m., thermometer 36° .

September 13. *Nima-khar to Jungbwa Tol, 20 miles.*—At 6 a.m., thermometer $23^{\circ}5$. This temperature may perhaps have been affected by radiation, but the cold had been rapidly increasing during the last few days, when the rainy weather on the Himalaya seems to have ended. At 8 a.m., thermometer 42° . Leaving *Nima-khar*, we crossed the plain at the head of the lake, here something under a mile in breadth, and came upon low rounded trap-hills, similar in their constituents to the hill of *Nima-khar* before described. A few isolated points also projected from the middle of the plain.

We had now reached the extreme eastern end of the great plateau of Guge, and entered a hilly country characterized by numerous valleys with perfectly flat alluvial bottoms by which it is intersected. Most of these were quite dry, small streams existing only in a few of them. This circumstance, added to the almost perfect horizontality of their transverse section, their general agreement in elevation with that of the great plateau, the abrupt rise of the rocky hills on either side of them, and their general uniformity of breadth for considerable distances, seems quite to preclude the possibility of existing agencies having caused them. They must, without doubt, have been produced by the action of currents in extensive bodies of water that have formerly been spread over large portions of the plateau, but I cannot say that there seems any decisive evidence to show how or when this action took place. I have elsewhere given my reasons for believing that the alluvial deposits of *Guge* were first laid out by the ocean. The valleys to which I am now alluding may either have assumed their characteristic forms before the elevation of the great plateau above the sea-level, or they may have been formed after some partial elevation, when lakes much larger than those now remaining still existed, the waters of which have been since drained off.

Crossing over a considerable spur from the high hills north-east of *Gya-nima*, we again descended into a broad level valley, which, by taking a more circuitous route, we might have followed the whole way from the lake. Up it we had, for the first time, a complete view of the grand dome-like peak of *Kailas*, distant from us about 35 miles. This valley, which is about half a mile wide, is called *Tara*. It had once been green, no doubt, but was now quite burnt up and yellow, and it is probably only in the spring, when the snow is melting, that the vegetation has any activity. A little further on we came to a stream in which we saw many small fish. We managed to catch a good many, but through the stupidity of one of my servants, they were unfortunately all thrown away soon after my return to Kumaon. They were of three species—the largest about 8 inches long, with scales, no doubt carp (*Cypridæ*); the others 4 or 5 inches long, with cirrhi and without scales (*Siluridæ*). The stream seemed nowhere to be more than three feet, and was generally only one foot deep, and during the winter it must certainly have been frozen into a solid mass, with all it contained. The question naturally arises, Do the fish live through the winter frozen up with the water? The only way of getting over the difficulty, if this be a difficulty to a fish, is by supposing that the stock is renewed every year from the lake at *Gyanima*, at a season when there is sufficient water to supply a continuous stream the whole way along. When we were there no such communication existed, and the bed of the stream was in many places dry, but while the winter's snow is melting off, the quantity of water may be larger. This valley we followed up for many miles. It was bounded on either side by trap hills covered with loose stones, and utterly bare of all vegetation. The diminutive stream at its bottom had green margins, which now afforded but scanty pasture, for the ground had been closely cropped by the flocks of the *Huniyas*. The valley was now abandoned, but we everywhere saw signs of their old encampments. After a long and tedious march, in which the previous labours of the sheep and goats rendered our herborization null and void, we passed the watershed, beyond which the drainage begins to fall into *Rakas-tal*. The division of the waters is hardly marked, the two valleys running into one another with hardly any interruption. The summit level is probably not more than 200 feet above the level of *Rakas-tal*, or 15,200 feet above the sea. We here, for a short distance, went over the same ground that was passed by my brother in 1846. He, however, ultimately turned off round the north end of *Rakas-tal*, while we made for its southern border.

It was now nearly sunset, and we were rapidly approaching *Jungbwa-tol*, where

camps of Tibetan shepherds were certain to be found, and, what was worse, Tibetans who knew our Milam people. One of them was known to have left Milam only a few days before us, and if our party was discovered, it would have been at once detected that we had no legitimate business here. Nobody knew the precise localities, so it was clearly desirable to come to a halt before dark, as otherwise our difficulties might have been much increased. Scouts were consequently sent on in advance, and we anxiously looked for water, without which we could not halt, but water there was none. Thus forced to advance, we very soon received a report that we were close to some Tibetan encampments, and, turning a corner, we looked through a side ravine into a most inviting green valley with plenty of water; but it was not for us, and we passed rapidly on. Hoping to get a better idea of the localities, or to be able to discover some place where we might get water, I started up the hill on our left, from the top of which I looked down into the valley we had just seen. It was wide and open like that of Tara, with a stream or succession of pools of water tolerably near; but it was fully occupied by Tibetans, and we could do nothing but go on. In coming down the hill, I descried some large flocks of sheep in the valley directly ahead of us, so it was evident that we must run the gauntlet of our supposed enemies. We went on, therefore, as boldly as might be, the Bhotiyas in a desperate fright, and, on turning a projecting point, we found that the valley along which we had come opened into another larger one, in which we saw, within a quarter of a mile of us, two Tibetan encampments on our right and one on our left. It was now dusk, and as turning back was out of the question, we went to what appeared to be a stream in the centre of the valley, but to our utter disgust it was quite dry. However, a halt had now become quite unavoidable, and, moreover, it was plain, as the Huniya tents were so near us, that water must exist close by. So here we encamped.

Boru, the Padhan of *Tola*, who by this time had shown himself to have far the best head of the party, was immediately sent off to reconnoitre. He fell in with an old woman who was driving home a flock of sheep, and soon came back and reported that the *dong*, i.e. pastoral encampments, belonged to shepherds from *Hortol*, a place the other side of *Manasarowar*, who were pretty certain not to know any of our people. Water was also pointed out in the bed of the stream close by, and matters appeared to begin to mend. By this time the night had set in, and the moon was shining brightly. Our tents were just pitched, when from one of the camps near issued a most alarming-looking horseman, who rode straight down towards us, the long dark shadows adding to the terrors of his appearance, but the spectre dissolved into nothing more than the reality of a boy taking home a stray pony.

As it was now getting dark, and every one was tired, Boru once more started with one other Bhotiya for the nearest Tibetan tent, to see how far our more pressing wants could be supplied without further exertion on the part of our men. He very soon returned with a large bundle of firewood, and a great copper pot of water for immediate consumption. Boru had most successfully imposed upon the Huniya, but it was, nevertheless, at once noticed, from his dialect, that he came from Juhar—a matter, however, which was of course instantly explained away. The other Bhotiya affected not to understand Tibetan, so that he could not have awkward questions put to him. The Tibetan, though most polite in most particulars, was firm on one point—he flatly refused to give us milk, although the money was produced. It was unlucky, he said, to sell this at night, but we might have as much as we pleased in the morning. On the whole, we seemed to have got well out of our scrape, though our scanty supply of wood sent us to bed miserably cold, and with a rather less luxurious supper than usual.

September 14. Jungbwa-tol to Camp south of Rakas-tal, 8 miles.—It had been

settled beforehand that W. and I were to start by daylight, leaving the rest of the party to follow a little afterwards, so that we might escape observation as much as possible. We had a cold walk for about a mile over low hills, still composed entirely of eruptive rock, and of the same rounded forms that we had met on the previous day. On getting to the top of a ridge which we reached before sunrise, we saw in the valley below us, and the direction it was supposed we ought to go, the smoke of another Huniya encampment. As the single Bhotiya we had taken with us knew no more of the country than we did ourselves, we thought it best to stop here till the main body came up, so that we might then go on together, for in such rugged ground it might have been difficult to find our party again if we had once diverged from the proper track. We sat on the top of the hill for a long time shivering in the cold, with the thermometer some four or five degrees below the freezing-point. The only thing that could be seen was the smoke curling up from the valley below in the faint grey light of the morning, and the silence was broken only by the barking of the dogs about the tents. At length the sun rose, and we found that we were overlooking a broad flat valley, the continuation of that in which we had encamped, which manifestly led down to *Rakas-tal*. The shepherds soon were stirring, and not long after we saw their flocks driven off to graze. The appearance of the sheep on these bare hills, which present no objects of known magnitude by which the eye can rapidly form a correct estimate of their distance, was most deceptive; even till the last, when among these barren wilds, I was quite unable to distinguish offhand, even at moderate distances, between sheep and white stones, or between dark objects, such as bushes and men. In the Himalaya, in looking across a deep precipitous valley where there is no gradation of distance, owing to the centre of the picture being unoccupied, I have often found it difficult in like manner to judge of magnitudes, and have consequently mistaken goats for cows, and *vice versa*.

Our people now soon came up, having left their ground without the least suspicion being raised. We all started again together, straight across the hills, nearly due west, over such ground as no beast of burden but a jhobu could have passed; at one time climbing rocks, at another floundering down infamously steep slopes covered with loose fragments of stone, to face which on the backs of our cows required some nerve even after the apprenticeship we had gone through in the previous part of our journey. This rough riding rapidly carried us clear of the pastoral Tibetans, and it was not very long before we were rewarded by a first sight of the sacred lakes. On turning a corner on one of the ridges we had to cross, we suddenly caught a glimpse of the beautiful blue water of *Rakas-tal* sparkling within a few miles of us. Through a depression in its further shore, a small portion of the lake of *Manasarowar* could also be distinctly traced as a small dark line, beyond which rose a distant range of purple mountains.

We stopped to breakfast in a ravine, near which many of the Sikh or Dogra invaders of this country were said to have perished in the winter of 1841-1842, chiefly from the cold. Their bones and those of their cattle, with remains of clothing, etc., were pointed out to us as we went along. What we saw were the remains of some of the less fortunate parties of fugitive Sikhs. The Sikh expedition has made so strong an impression on the Bhotiyas and the people of these regions, that the year in which it took place is invariably referred to as the *Singh Sal*, *i.e.* the Singh or Sikh year, when allusion has to be made to events that happened about that time.

Among these ravines the vegetation was a little more vigorous, and had been less disturbed by sheep or goats, and we added a few plants to our collections, of which I may name the small willow, *Salix sclerophylla*, not uncommon; *Rheum*

Moorcroftianum, a species of rhubarb very common in Tibet; a handsome gentian, *G. nubigina*; and *Lagotis glauca*, a plant of Northern and Arctic Asia; *Arenaria Stracheyi*, and *Pleurospermum Hookeri*. The rugged nature of the hills that here flank the southern shore of *Rakas-tal*, or, as it is called by the Tibetars, *Tso-Lanak*, *Tso* signifying "lake" in their language, obliged us to keep at some distance from the water's edge, and to ascend to a considerable height above its level. In crossing one of the ridges on our route, a magnificent view of the lake at length opened out to us, though it must be confessed that the frightful south wind, that had already begun to blow with extreme violence, rendered real enjoyment very difficult. The lake of the *Rakshasas*, or "Demons," is of a somewhat irregular form, about 20 miles in extreme length from north to south, and about 12 miles in extreme breadth across its southern end; its northern half, however, nowhere exceeds 6 miles in breadth. As I cannot improve on my brother's description of this lake,

Peak of Kailas, 22,000 feet.

LAKE OF RAKAS-TAL OR TSO-LANAK, 15,000 FEET.

I extract it entire: "The snowy mass of *Momanangli*, a name now replaced in our map by the more euphonious one of *Gurla*—and the authorities on which this last name rests must not be examined too curiously—was again conspicuous to the south-east, and from the base of the mountain a lofty range of hills, partially tipped with snow, stretched north-westward, separating the lake from the head-valley of the Karnali, and forming its south-western banks nearly parallel to the course of the river." Across the spurs on the north face of this range, I may observe, we were advancing, and though a little snowy when seen by my brother, it was at the time of our visit quite bare, excepting in very few spots in the most retired ravines; the snow that he saw having no doubt fallen during the bad weather that immediately preceded his visit to this part of Tibet. The highest points of this ridge rise somewhat more than 2000 feet above the lake, or say 17,500 feet above the sea. "These hills," continues my brother, "rose abruptly out of the water in bold rocky banks, with many deep inlets, promontories, and one or two islands of the same character. This part of the lake is altogether so irregular in outline, that it could hardly be defined without detail survey and close inspection

of every point. The eastern shore was bounded by shelving ground and low hills, the south end being a good deal recessed eastward into a deep bay, the middle part advancing further westward in a rocky bank of moderate height, and the north end sweeping round to the westward as far as could be seen, with a margin of green grassy plain, from the bank of which the *Kangri* mountains rose in dark steep slopes. The main peak of *Kailas*, now beautifully developed to its very base, was seen on the extreme left of the range (so far as visible to us), and over the low hills in the middle of the eastern shore, a streak of bright blue showed a distant glimpse of *Manasarowar*. The western shore of the lake was undulating ground or low hills, over which we had been travelling this morning, at the foot of steep and lofty hills here and there streaked with snow." The highest of these hills, I may again notice, our subsequent operations have shown to rise to 18,400 feet above the sea, or above 3400 feet above the lake. "The water of the lake was of the clearest, brightest blue, reflecting with double intensity the colour of the sky above, and the northern horn of the water, overshadowed by the wall of mountain rising above it, was darkened to a deeper hue, partaking of the fine purple colour that distinguishes the rocks of *Kangri*. Fresh breezes broke the surface of the water into waves that rolled upon the shore. The surrounding hillsides, though very bare of vegetation, were tinted with many shades of red, brown, or yellow, happily varied with the margins of verdant grass in other parts of the shore, and bright sunshine spread a warm glow over the whole landscape, entirely divesting it of the cold barren aspect that might be supposed inseparable from these intemperate regions."

We halted for the night at an elevation of 15,440 feet, in one of the ravines at about a mile and a half from the edge of the lake, any view of which, however, was prevented by the precipitous character of the intervening ground. The distance we had travelled was perhaps not much more than 6 miles in a direct line, but the extremely rugged nature of the country caused us to make long *détours*, which greatly increased the length of the journey. Thus far the rocks were entirely of the same eruptive nature as before, chiefly hypersthenic, and the surface was everywhere covered with loose angular fragments, generally of a dull red colour, and utterly barren excepting in the ravines.

A further consultation was here held as to our route. The Bhotiyas protested most vehemently against passing along the northern edge of *Rakas-tal*, under the Tibetan settlements of *Darchin* or *Tarzum*, excepting during the night—an arrangement that we thought would be highly objectionable, for we found the day marches quite sufficiently painful, and very little could have been seen at night to compensate for the discomforts we must have put up with. We determined, therefore, to continue our course round the south end of *Rakas-tal*, and to go up between the two lakes as far as *Ju*, at the north-west corner of *Manasarowar*, where the point of efflux of that lake was supposed to be. This we were anxious to see, for Moorcroft had denied the existence of any opening there, though my brother had crossed a large stream some miles to the west of *Ju*, which he was informed came from *Manasarowar*. We proposed to return from *Ju* to this place, and thence, crossing the ridge to the south of us, to proceed by the *Karnali* valley back towards *Tazang*; and we therefore here left behind us a depôt, only taking on with us eight men and ten jhobus, with supplies for five or six days. At 6 p.m., thermometer 28°.

September 15. Along the South Shore of Rakas-tal, 10 miles.—At 6.15 a.m., thermometer 28°·2; at 8 a.m., thermometer 29°·5. Close to our camp we came upon a direct track, said to be one of those leading from *Jungbwa-tol* to the valley of *Purang*. The road—a mere track for men and cattle, any approach to wheeled

carriages being utterly unknown in these regions—comes round this way, apparently out of the direct line, to avoid the high rugged hills along the flank of which we had been travelling yesterday, for the ridge becomes much rounder and less elevated at its eastern end. We followed this track for about a mile, and then, hoping to be able to keep along the edge of the lake, we turned down a ravine to the left, which we followed till we reached the water. We saw many wild animals as we passed through these rugged and secluded hollows—several herds of *Ovis Burrhel*, and, for the first time, a few of the larger wild sheep, *Ovis Ammon*; also a large colony of marmots. We got to the water's edge about noon; the altitude of the surface I have calculated to be just 15,000 feet—that is, about 750 feet lower than the summit of Mont Blanc. The temperature of the air was $45^{\circ}3$; that of the wet bulb, $33^{\circ}8$; and of the water of the lake, a little over 50° . The latter cannot, however, be taken as the general temperature of the lake-water, for the bottom was very shelving, and it was not possible to reach the deep water. On the following morning, at about 8 o'clock, the water was 37° , and the air 33° ; at 10 o'clock, the water was 45° , air 38° , and wet-bulb 29° ; and on our return to *Rakas-tal*, three days later, the edge of the water early in the morning was just frozen in some places for a foot or two from the shore, the air-temperature falling to $22^{\circ}8$.

We were, after all, disappointed in our hopes of being able to go along the edge of the lake, for steep cliffs shut in the little shingly bay into which we had come, and forced us to ascend again over the hills, which had now become so much less rugged that the ground was in parts almost level. At this time, the peaks of *Gurla* and *Kailas* being both quite clear of clouds, and the wind not having yet set in with much strength, I thought the opportunity might be taken to determine the heights of the two peaks trigonometrically. I therefore stopped to set up the theodolite at an elevation which proved to be 15,970 feet above the sea. But before the last angles were measured, the wind had become so dreadful, and we were all so utterly perished with cold, that I was on the point of giving it up as impracticable, and I was not surprised to find, on subsequent examination, that a mistake had been made in one of the angles. This, however, was of no real importance, as the more careful triangulation of the following year has made good the deficiency. The violence of the wind on this occasion may be conceived when I mention that a 100-foot tape, used for measuring my working base, had its ends successively torn off, one after the other, by the mere force of the wind, in the hands of my friend Mr. Winterbottom, while he was endeavouring to draw it straight.

While I was delayed at this job, all the rest of the party went on with the exception of two men and as many jhobus, one for me to ride, and the other to carry the theodolite; and I was only too glad to be off when the last angle was observed and the instrument put back into its box. By the time I came up to our camp it was very nearly dark, and as the tents were pitched in a rather out-of-the-way nook within a few hundred yards of the edge of *Rakas-tal*, and no one had remembered to look out for us, I was as near as possible passing on without finding them. Luckily, I saw a man's head appearing over the top of a hill, and on examination he proved to be one of our people getting firewood. The pleasures of a bivouac in the open air that night would have been questionable, for we found it most miserably cold in the tent, and, contrary to custom, the wind continued to blow nearly all the night. The thermometer at this time was not very low, for when I set up the theodolite at half-past two it stood at 47° , and it was probably not below 32° when I reached our tents; but no clothing will keep out these intolerable winds excepting furs or sheepskins, with which we had not provided ourselves, but which every traveller in Tibet ought to take with him, even in summer.

September 16. From Rakas-tal to Manasarowar, 14 miles.—At 6 a.m., thermometer 20°8. We started to-day over undulating ground slightly broken up by ravines, and were enabled accordingly to keep pretty near to the margin of the lake. The rock at the commencement of our day's journey was still the old hypersthenic trap, but we almost immediately came upon mica schists and fragments of granite. I cannot positively say whether we passed over any granite *in situ*, but *Gurla*, at all events, seemed in great part to be constituted of that rock. This mountain was now so close to us that the summit was possibly concealed by some outlying spur. The grey granite stood up strangely among the pure white snow, and the pale and spectral masses contrasted finely with the deep reds of the surrounding trap hills and the purples of the *Kailas* rock on the north. A long open slope brought us to *Lagan-Tung-kong*, a small ruined mud hut or dharmasala at the south-east corner of the lake; as we approached, a horseman left it apparently rather in a hurry, and went off rapidly along the road to *Purang*. He seemed as anxious to get out of our way as we were to avoid him, and in a country such as this, where there is no law, still less any police to enforce it, it is not wonderful that travellers are a little shy of making acquaintance with strange parties of men. We were by this time becoming aware of this fact, and began to calculate on not being very rigorously scrutinized by persons whom we might meet by accident on the road. We reached the water's edge at the extreme south-east angle of *Rakas-tal* about 10 a.m., and the wind now blowing lightly from the north, small waves were breaking on the shore. The thermometer was 38° in the shade.

Beyond this point the ground separating *Manasarowar* from *Rakas-tal* rises rather steeply to about 300 or 400 feet above the level of the lakes, being apparently altogether composed of alluvial deposits made up of pebbles, precisely similar to those now found on the beaches of the two lakes, of granite, mica schists, and quartzites, sometimes cemented together and forming conglomerates, but more commonly in the state of loose gravel. The general structure of this alluvial mass is so perfectly identical with that of the deposits of the great plateau that they must all be held to have had a common origin; but it is impossible to offer any opinion as to the probable time at which this particular portion assumed its present position relatively to the rest, whether before, with, or after the general movements that have elevated the whole. On this soil the vegetation was again a little more cheerful than on the miserably barren trap hills we had been passing over for the last three days, but still no novelty was seen. As we reached the summit of this ridge, we at length came into full view of *Manasarowar*, in honour of which event our followers did homage to the sacred lake by prostrating themselves at full length on the ground. All along the roadside—for we were now again following a well-beaten track—were a number of little piles of stones erected by travellers who have passed. A similar custom exists in India, and it has perhaps been introduced into Tibet by Hindu pilgrims. It is said to originate in the fancied sanctity attaching to the construction of a house at any holy spot, and those who are too poor to build substantial mansions get over the difficulty by setting up half a dozen stones one on another. Multitudes of such piles may be seen at *Hardwar*, raised by the devout Hindus in the bed of the sacred Ganges. The same thing is seen at *Badarinath*, at the point where the temple first meets the eye of the pilgrim coming from the south. These small piles must not be confounded with the larger cairns which the superstitious of so many nations, including the Hindus and Tibetans of the Himalayan regions, raise at certain spots, more particularly on mountain passes. To these every well-disposed traveller adds his contribution, usually a stone, though in some places shreds of rag are seen stuck on a bush, or the pile is made up of twigs instead of stones. Accumulations of all sorts of oddities are often found on

these piles, among which horns and skulls of wild animals, fossil shells, bits of crystal, or eccentric-looking stones invite the sacrilegious attacks of European travellers, and many of my specimens of ammonites are spoils of this description. The Bhotiyas have no scruple in assisting in such proceedings, and I may add that they generally appear to care but little, unless impelled by considerations of temporal expediency, for the superstitious practices of their Tibetan or Hindu neighbours. These votive cairns are by the Tibetans called *Lapcha*, though this word is perhaps more properly applied to a substantial tower built to receive votive offerings.

Manasarowar is the Indian name of this lake, which in Tibet is called *Mapham*. It is nearly rectangular in its general form, its shores extending from north to south and from east to west, about 12 and 15 miles respectively. Cliffs rise abruptly from the water only at its north-west angle; on all other sides it seems to be bounded by sloping banks or by a shelving beach. Though in form far less picturesque than *Rakas-tal*, it is, when viewed from the south-west corner, set off by a much finer background of mountains. Towards the east the ranges were difficult to distinguish, nor did I make out any visible depression of any importance for the passage of the road to *Lhasa*, though we know that such exists. The water is, on the whole, of the same intense blue as in the other lake, but some parts showed a quite sea-green colour, a circumstance also noticed by Moorcroft, and caused, I suppose, by shoals of yellowish gravel.

We kept for some distance along the top of the separating ridge, till a hollow that nearly cuts it through caused us to descend to the level of the lake, in doing which we met a party of Huniyas with sheep on their way to *Purang*, but we hurried by unnoticed. This depression in the ridge between the lakes marks the point where the unconsolidated gravel deposits, over which we had been travelling from *Lagan-Tung-kong*, give place to the stratified rocks which constitute the projecting headland on the east shore of *Rakas-tal*, and which are continued across to the cliffs at the north-west corner of *Manasarowar*. Where we crossed the hollow, which was close to the edge of *Manasarowar*, there were one or two small pools of water, around which the surface was muddy and covered with an efflorescence of some salt, which at a little distance gave the whole the appearance of being a solid mass of some white deposit. The outer edges of this mud were pretty firm, but in going on to it rather too far in search of some of the salt, I found, by suddenly sinking up to the knees, that it was soft enough below. Between this muddy flat and the lake is a raised beach of shingle, its top, I suppose, about 6 feet above the level of the water of the lake on the one side, and of the muddy flat on the other, between which it forms a complete raised embankment, having quite the appearance of artificial regularity, and in the middle of it has been built a small *Chorten* tower. Similar raised beaches are to be seen at many points of both the lakes, sometimes of larger dimensions, and sometimes having two or three external subsidiary lines of beach in front of them, indicating variations of level of the water-surface. These beaches are, no doubt, mainly produced by the action of the breakers caused by the violent winds that blow with such great regularity in these regions; but what is the exact reason that they are seen along particular portions of the shore only, I cannot say, nor can I further do more than suggest that their occasional great size may perhaps be in part dependent on the ice, which forms along the shores of these lakes during all the colder months of the year. Many of the lakes and rivers of Russia that are frozen over for several months at a time, are described as fringed with piles of rocks heaped together by the combined action of the waves and the packed ice, and some analogous process may go on here. The breakers formed against the cliffs on the shores of these lakes must be very heavy, as we saw their white heads distinctly at a distance of 6 or 8 miles.

I can now only regret that I have no specific note of their action on the rocks, nor of the size of the boulders they form, though my impression is that the gravel on the beaches was chiefly small.

(*To be continued.*)

A JOURNEY THROUGH ABYSSINIA TO THE NILE.*

By HERBERT WELD BLUNDELL.

APPENDIX.

NOTES ON GEOLOGY AND ANTHROPOLOGY.

By Dr. REGINALD KOETTLITZ.

I. GEOLOGY.

As the line of our route begins in Somaliland, I must not omit to mention some of the main features observed. At first the condition of the country we passed over was a sandy desert, forming a belt from the seashore for about 12 to 20 miles; this is marine formed, and gradually and imperceptibly rises inland. Much of this sand is composed of disintegrated coral, small and large masses of which lie loose on the surface. Here and there, some 10 miles from the coast, rising through the desert sand are isolated rocky hills, one of which I examined cursorily. It was apparently a granitic boss which had pushed up and displaced the overlying, hard, compact, marbled limestone, which also appeared to have been altered by the heat of the granitic mass. The country then becomes rough and rocky. Gneiss, granites, syentites, and quartzites are the exposed rocks; these are intersected in every direction by veins and dykes of biotite, quartz, etc. Flat-topped hills, more or less isolated, rise on the northward of our route, which are capped with basalt of compact and also vesicular type. A chalky kind of rock was also met with, and the surface occasionally is strewn with loose chips of flint and chert. Here and there, as at Jubuli, a quartzite sandstone, hard slaty rock, and schists occur, these being also permeated with veins of biotite and quartz.

A noticeable and remarkable feature of the country are the extraordinarily deep, but dry river and water cuttings. These sometimes intersect the land in a bewildering manner; they are often broad and deep, with perpendicular sides. This even occurs through granitic rock *in situ*, the rock having become so disintegrated by atmospheric action as to allow the water to thus quickly cut through it, for they are evidently caused by torrential rains. Further inland we passed over considerable plains which were almost flat, and from what I observed I am inclined to think are basalt plateau surfaces which have not been raised like the hills around.

For some distance before we arrived at Jig-jigga, as well as at that place, a chalky limestone appeared very frequently through the surface in an anomalous manner. This I frequently found contained fragments of quartz, sanidine, and quartzite embedded in it. This same substance, or similar, I also found filling up fissures in the basalt, not only on the flat, but also on the sides of hills with the basalt *in situ*, and in a position where it cannot have been recently washed into them, and where it must have been when the basalt I saw it in was first exposed, as at Sobolo. It had all the appearance of having been plastered in, like mortar.

* Continued from p. 121. Map, p. 308.