

second class. Another pound would pay a third-class ticket to the station on the Irtysh opposite Omsk. But even these low fees will be reduced under the new zone-tariff which is going to be introduced.

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### DR. SVEN HEDIN'S TRAVELS IN CENTRAL ASIA.

[WE have received the following communication from Dr. Sven Hedin, dated from Kashgar, November 9, 1894:—]

I have just returned from Mustagh-ata, . . . and send you a short account of the work done during the past summer. On June 21, 1894, I left Kashgar and proceeded by way of Yangi-Hissar and Ighiz-yar to the valley of Gedyek, and thence to that of Kinkol. Having crossed the passes of Chichikli, Kichik, Khatta, and Kokmamak, I reached Tagharma, and advanced by Ulugh-rabat to Su-bashi (July 8). At the latter place there is a Chinese fortress, situated at the western base of Mustagh-ata. Along the whole route I made a topographical map, collected specimens of rocks, and made geological observations which will complete those of Bogdanovich. I regularly made meteorological observations thrice daily with three aneroids and a boiling-point thermometer, and on every opportunity took photographs and studied the mode of life of the Kirghiz.

From July 12 to 25 my camp was situated at Little Kara-Kul and at Bassik-Kul. The whole of this neighbourhood was surveyed with great care, in order to serve as my base of operations for the whole country. Geological, climatological, and other investigations were continued, and numerous excursions made in all directions. Little Kara-Kul is an obstruction lake dammed by the moraines of a glacier which has long since retreated, and is now represented by several small glaciers in the upper slopes of the Mustagh-ata. The moraines of this old glacier, however, still remain, and have blocked the valley of Sarik-Kol in such a way that the water issuing from the glaciers further south accumulates and forms a Lake. Hence Little Kara-Kul is also a settling basin for the river; the glacier water entering at the south end carries in large quantities of glacial mud, while the little stream that issues from the northern end is quite limpid. The alluvium accumulated at the upper end, where it forms an abrupt slope to the deepest portion of the lake. Availing myself of a boat made of skins, I measured the depths at 103 different places. The maximum depth of 78 feet is found in the southern half; the centre in general varies in depth from 50 to 65 feet. The water is clear, fresh, and excellent to drink. Several springs enter the lake at the foot of the crystalline rocks which rise on the eastern and western shores. The stream of Kara-Kul falls into the Ike-bel-su, a river of considerable size during summer, but almost dried up in winter. It forms the upper course of the Gez-daria.

Bassik-Kul (north-west of Kara-Kul) consists of two basins separated by very low ancient moraines. During summer a little stream from the lower basin joins the stream from Kara-Kul. It is a curious fact that there is no visible communication between the two basins of Bassik-Kul, in spite of the two streams which fall into the upper basin. Probably some subterranean communication exists, or the water filters through the materials of the moraines.

Between July 25 and August 19 I visited eleven glaciers on Mustagh-ata, of which six in particular have been very well explored. On three different occasions our camp was pitched at a height of about 14,000 feet. The Kirghiz have no special names for these glaciers, but I have made use of those of the springs, or of the streams found in the little channels of the valleys. The principal glaciers are—Gorumde (towards the north), Sarimek, Kamper-kishlak, Yam-bulak, Tyal-tumak, Tergen-bulak, Chum-kar-kashka (toward the west). Kok-sel, Sar-agil and Shweragil (towards the south-west) are less considerable, the two last-mentioned being almost inaccessible owing to their great height and the gigantic moraines which bar every approach. The most considerable to the north-east is Kok-sel (II.). The Kirghiz say that there are glaciers to the east also, but that they are very small. The eastern slopes of the mountain are almost inaccessible owing to the spurs covered with ice. I tried to surmount these obstacles from both sides, from the south by the valley of Tegerman-su, and from the north by those of Tur-bulung and Kara-Shilga, but was not able to proceed. The motion of even the largest glacier is so slow that I was able to detect a very slight movement during the month of September only by using the most delicate instruments. The greater number of glaciers melt at heights varying from 13,800 to 14,500 feet.\* The glaciers were formerly of enormous size, as can be seen from the moraines of gneiss and crystalline rocks which surround the foot of the mountain. Whenever it was possible, I marked on the map the position of the vestiges of ancient glaciers. Even at Bassik-Kul I found erratic blocks of 30,000 to 40,000 cubic feet in size, which were derived from Mustagh-ata.

During this time I thrice attempted to reach the summit of Mustagh-ata, but without success. I had previously made an attempt in April, but on that occasion we were assailed by a blizzard of snow at a height of 18,000 feet. On August 6 I climbed to 19,400 feet, but was then stopped by the unfavourable nature of the ground, which was covered with huge snowdrifts just ready to fall as avalanches. On both occasions we passed to the north of the glacier of Yam-bulak. On the third attempt (August 11) I chose the southern side of the glacier Tyal-tumak. At a height of 18,500 feet we again found ourselves in an

\* The figures in the manuscript are indistinct.

extremely dangerous position, where we narrowly escaped losing a Kirghiz and two Yaks that fell into crevices concealed by snow. There is no possibility of reaching the summit by this route, for the great protuberances of ice and the crevasses present obstacles insurmountable even by the most experienced mountaineers.

On August 16 I made the fourth and last attempt from Yam-bulak. As I had found that a single day would not suffice for reaching the summit, I decided to spend the night on the mountain. At 19,400 feet an improvised tent was pitched, and along with five men and eight Yaks I passed a terrible night in the rarefied air, which brought on severe attacks of mountain sickness. Next day a violent blizzard of snow forced us to return with all possible speed. We were half dead in the morning, and, even had the weather been favourable, I scarcely think we should have been able to reach the summit. It must be noted, too, that the slope of Yam-bulak does not lead to the principal summit. There are three peaks, the middle one being the true summit; but in my opinion it is quite inaccessible, not from its height, but from the nature of the ice. The northern summit should be accessible from Yam-bulak—at least, I did not observe anything unsurmountable. This peak is about 1000 feet lower than the middle one, which is about 25,000 feet. I hope some one will visit Mustagh-ata in a few years. It would be of great interest to observe the changes in the condition of the ice and the movements of the glaciers, which will have taken place by that time. But it will be absolutely necessary to make measurements of scrupulous accuracy, without which it would be impossible to come to any conclusions as to the climatic variations which had caused these changes. Bogdanovich visited the front of the Yam-bulak glacier and determined its height fifteen years ago, and I found his observations of great importance.

It is interesting to note that the lower parts of Mustagh-ata, on the north and south sides, bear the famous name of Kara-Koram. The word *koram*, or rather *goram*, signifies "stony ground."

On August 19 I visited the Russian fortress of Murghab, to replenish my stock of provisions. From there I made an excursion to Basar-dere, the Alichur-Pamir, and Yashil-Kul, a lake formed in the same manner as Little Kara-Kul. I returned to Murghab by the Neza-task pass, and proceeded thence to Sarik-Kol by the Sarik-tash pass.

From September 16 to 26 I examined the south-west, south, and south-east slopes of the mountain; thence returned to Kara-Kul and spent ten days there, taking the soundings of which I have already spoken. For our return to Kashgar I chose the difficult pass of Merke-bel, across a glacier nearly a mile wide, and after traversing the valleys of Merke and Chats arrived at my destination on October 19.

In addition to the observations already described, I obtained 170 specimens of rock, chiefly volcanic, a collection of plants from the

slopes of Mustagh-ata and of algæ from Kara-Kul and Bassik-Kul, and a fine collection of sketches and profiles of the glaciers. I am consequently not at all sorry to have changed my original plan of going straight to Lob-Nor. The suffocating heat of summer forced me to turn to the mountains. Throughout I was the only European, and I had none but Kirghiz servants and a Sart of Osh. I made some interesting observations on the migrations of the Kirghiz with the seasons.

I have excellent meteorological, hypsometrical, and topographical instruments, a theodolite by Pistor, a chronometer by Frodsham (8873), which was with Nordenskiöld on his voyage in the *Vega*, another chronometer by Wirén (154), two sets of photographic apparatus (Watson and Eastman) with 1000 plates remaining, craniometers, three guns, with plenty of ammunition, etc.

The fatigue of the past four months obliges me to remain for some weeks at Kashgar to rest, but I shall start for Lob-Nor on an early day in December. My intention is to follow the Tarim as far as the lake, and to try to find the true Lob of the Chinese maps, which Baron von Richthofen has admirably shown must undoubtedly exist. There are many important problems to be found in the Tarim desert, especially those relating to hydrography and archæology.

The expedition to Lob will require four months, and then I shall return probably by Cherchen and Nia to Kashgar. I cannot yet decide by what route to endeavour to enter Tibet; I should like to go by Kangut, but I have not obtained a permit. The ancient route by Kara-Koram is well known, so I must consider the matter further. I have decided not to think of Lhasa at all. It would certainly be a most interesting journey, but of little scientific value. There will always be tourists ready to attempt this adventurous journey. The object of my future research will be the geology of the Kuen-lun range. Above all, I intend to search for traces of the migrations of the Ugurs to Alashan and the southern parts of Gobi. Much remains to be done in Central Asia, and it is a great pity that the modern traveller who journeys for pleasure alone, and has had no scientific training, should not take a scientific man with him, who could give an exact account of the nature of the country traversed from his personal observations.