

of geographers from the earliest ages, and before the days of Goetz and Marco Polo. We have had an excellent monograph on the subject from Sir Henry Rawlinson, whose decease we have had on more than one occasion to deplore. Two years afterwards, we had another exhaustive report from Sir Henry Yule, and I cannot but take the opportunity of mentioning that Sir Henry Yule had the same appreciation of Lieut. Macartney as Mr. Curzon. He mentioned that Macartney, with regard to certain points, was still far ahead of all modern writers. The attention devoted to the subject by these great geographers proves the importance of Mr. Curzon's paper. We must also appreciate the difficulties he overcame from cold and want of supplies, and the obstacles in the way of obtaining information, and I am sure I can appeal, with certainty of an appreciative answer, to those assembled here for a hearty vote of thanks to Mr. Curzon, for the charming way in which he delivered his address.

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## A JOURNEY THROUGH THE TAKLA-MAKAN DESERT, CHINESE TURKISTAN.\*

By Dr. SVEN HEDIN.

THE centre of the western part of the Gobi desert, which occupies nearly the whole of the Tarim valley, with the exception of a narrow strip of cultivated land along the base of the mountains, as well as the banks of the adjoining rivers, was never visited by any European traveller; and as we had no information as to the real character of those regions, I made up my mind to make an investigation. My plan was to cross the Takla-Makan desert from the Yarkand Daria to the Khotan Daria, being of opinion that such a journey would not meet with unsurmountable obstacles, as I intended to travel along the south-westerly line of the Masar Tagh, where the sand-mounds were low, and where we might find water and grass. At the base of this mountain range, which, according to Prjevalsky, should go straight through the desert, I even hoped to find remains of an ancient culture which might throw light upon the older history of Central Asia. I intended to cross the desert and continue to Keria, and during the summer investigate the plateau of Northern Tibet. Great care was therefore taken in the outfit of the expedition as far as instruments, clothing, and provisions were concerned.

With four servants I left Kashgar, February 17, 1895, and arrived at Maralbashi February 23. After having made a short trip to that part of the Masar Tagh which lies between the Yarkand Daria and the Kashgar Daria, we proceeded on March 2, *viâ* Shamal, Aksak-maral, Alagir, and Meinet (Menut), to Lailik. From the latter point I rode to the holy grave of Ordan Padishah, which was faithfully described by Bellew when he visited this place twenty-one years ago. On returning to Lailik we proceeded on March 19 to Merket, on the right bank of

\* Dated "Kashgar, October, 1895."

the Yarkand Daria, where I stayed for twenty days on account of the difficulty in getting camels, which, however, my servants at last succeeded in getting in Karghalik. According to the latest maps, the distance between Merket and the woodlands of Buksem by the Khotan Daria is 180 to 200 miles, and we ought, therefore, to be able to finish this trip in twenty days, even if the road should be somewhat difficult. As we should probably be unable to find any water, we had to prepare for this emergency, and brought with us a supply for twenty-five days. The water was kept in four *tyellek* (iron tanks), containing in all about eleven gallons, and six *tullums* (goatskin bags), containing in all about three and a half gallons. For the camels we brought with us oil and *kindserek* (an oily substance which is left after pressing the oil out of the Kundshut fruit), which not only gave the most nourishment in the most concentrated form, but also took up the least space. For ourselves we brought along a supply of rice, four hundred loaves of bread, *talkhan* (scorched flour), *goman* (macaroni), honey, butter, and potatoes, all bought in Yarkand. Besides this, I had a good supply of preserved food; and lastly we bought three fat sheep (which faithfully followed the caravan till they in turn were killed); eleven fowls, including a cock, which always used to wake us in the morning. Three of the servants that I brought from Kashgar left me here in fear of the desert; only Islam-Baj, of Osh, who had already served me faithfully for two years, was as usual not afraid, and followed me gladly.

At Merket I employed (1) Muhamed-Ikhah, sixty-five years old, of Yarkand, who thoroughly understood how to handle camels; (2) Kasini-Akhun, sixty years, of Yangi-hissar, who for six years had made trips on foot into the desert, in search of gold, always starting from Merket, where he was well known as a daring desert man; and (3) the forty-years-old Kasim-Akhun, of Yarkand. Altogether I had now four men. The caravan consisted of eight big camels—all males, and strongly built—of the kind which are used only on the level, and never in the mountains. The youngest was one and a half year, three were two years, one four, one eight, and one fifteen years old. The last mentioned died first; the eight-years-old one, a pretty white camel, and one of the two-years-old were the only ones that came through; the other six died of thirst, and all the other animals—dogs, sheep, and fowls—as well.

Early in the morning of April 10 the caravan was ready for the start. Water-tanks, boxes, provisions, tents, and all other requisites were placed on the camels, and I mounted one of the largest ones, called Boghra. Over all these various boxes containing instruments, etc., blankets, fur coats, and cushions were spread, covering the camel's humps, thus forming a complete bed, on which we felt very comfortable as soon as we got used to the camel's waddling walk. Even for transporting chronometers the camel is the best carrier I ever tried, and their

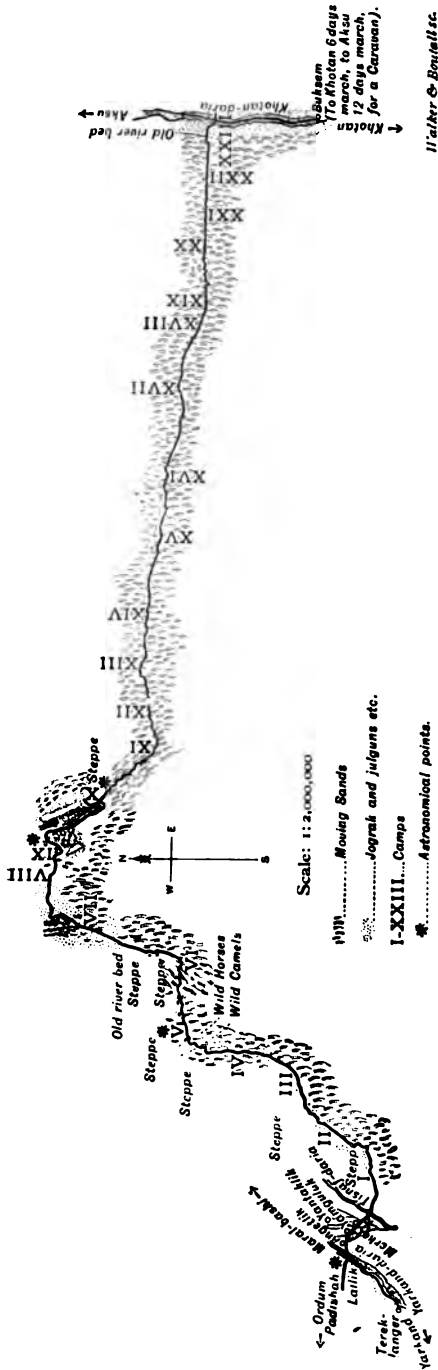


FIG. 1. DR. SVEN HEDIN'S ROUTE THROUGH THE TAKLA MAKAN.

regularity was only very slightly disturbed by the movements of the animal.

After scarcely an hour's ride we reached the Tisnap Daria, whose bed being 260 feet wide, and lying only 6 feet below the surrounding land, was at this time of the year completely dry. Whatever water comes here later on runs to a so-called *arık* (or meadow), which furnishes the fields round Merket, as well as the other towns, with water. In the summer-time the river-bed is full of water, the main part of which goes in a north-easterly direction, and runs out into the desert without ever reaching the Yarkand Daria. During our ride we passed many scattered groups of houses, all belonging to Merket; they are all surrounded by cornfields and groups of trees, and the whole land is irrigated by innumerable canals, all coming from the main *arık*. The camels had now had a good rest and sufficient food. They were, as usual on the first day of march, very wild and hard to manage. On reaching an open space, the younger ones galloped away, tore their bridles, and shook themselves free from everything they carried. With great loss of time we had to reload them, and even patch up a leak in one of the water-tanks. After this each camel was led by a man, for we were still followed by a good many of the townspeople. In half an hour from the Tisnap Daria we were out of the town, and continued on a steppe covered with

kanrish\* and scattered bushes. On this steppe we found the first indication of sand-mounds. These mounds are quite rudimentary, but show distinctly their northerly and southerly direction. It ought, however, to be mentioned that at Merket there stands an isolated mound of considerable dimensions—12 to 18 feet high—from which a splendid view of the town may be had. After marching over 10 miles in an east-south-easterly direction, we camped on the edge of a shallow ravine, 15 to 20 feet broad and 5 feet deep, covered with *kamish* and bushes. My men dug a well in the bottom, and found brackish water at a depth of  $3\frac{1}{2}$  feet, where the temperature was  $50^{\circ}$  Fahr., the air at the same time being  $76.5^{\circ}$ .

Kasini-Akhun from Yangi-hissar told me that seven to eight days in a north-easterly direction there was a mountain called Chakmak-tagh, which extended in the direction of east by south-east; the eastern part of the mountain was called Akchok. Ten days further east a big lake was said to exist, into which a river formerly had run. Along the shores of this lake pastures and "tograk" (poplar) were found, as well as an old ruin called "Eski-Shahr" (the old city). From this point there was said to be only one day's march to Masar-tagh, and then only a short trip to Khotan Daria. To the north of the Chakmak mountain there was supposed to be a path which, passing a mile-post or *yagach-mishan*, led to an old ruin by the name of Kish-Kishlak (the winter town). This place was, of course, not inhabited, as, indeed, it was not inhabitable. In the southern part of the Takla-Makan there was supposed to exist many ruins of ancient towns. The desert man's story was not confirmed by facts during my journey through the desert. He seemed, however, so positive on this occasion, that I really believe he told the truth. It is not impossible that we may have passed an isolated mountain range without noticing it when the air was filled with sand and dust.

On April 11 we woke up during a heavy storm from the north-east, which filled the atmosphere with dust. We started, however, and proceeded as much as possible in an easterly direction. Our compass was the whole time our most important instrument. Just after leaving the camp the sand became very heavy, and the mounds, being from 16 to 20 feet high, were all lying north by south. At the same time we found here and there *tograks* † and *juglun*, ‡ with branches hard as glass, that broke with a sharp sound as the camels passed. Further on, the mounds became irregular and more like waves. The same physical law which makes the waves grow considerably higher in meeting others coming from a different point, seems also to apply to the sand. For instance, if two currents of sand produced by opposing contrary winds should cross

\* Kanrish = *Lasiagrotis splendens*.

† *Populus diversifolia* and *Populus balsamifera*.

‡ *Juglun-tamarisk* = *Tamarix laxa* and *Tamarix elongata*.

each other north by south, or east by west, the mounds grow to a considerable height, and, at the intersection, often take a conical shape.

The sand was now getting very hard—my men called it *kattick-kum*—leaving no traces of the footsteps of the camels, but greatly facilitating their march. After a while the sand became so heavy that we were obliged to take a turn to the north, but afterwards we again found a clear road. If we had continued in an easterly direction we should, within a day (according to Kasini-Akhun from Yangi-hissar, after this called "the desert man"), have reached a part of the desert in which the sand was so deep that we should have been forced to turn back. The ground was level for only a short distance. Very soon we met small mounds 6 to 10 feet high, and they were sometimes covered with a very loose and finely distributed sort of dust, into which the camels stepped as if in water. Very often we had to take several turns to avoid these mounds (*beles* in the native language).

The north-easterly wind continued until six o'clock, and the atmosphere was all day so filled with dust that the sun was invisible. During the following days I noticed that the north-east and east wind carried along the dust even when not blowing very hard, while the atmosphere under north-westerly and westerly winds always remained clear. After a strong easterly storm this dust remains in the air for a couple of days, but as soon as a westerly wind comes the dust vanishes. Towards the end of our day's march we passed *tograk* growing sparsely here and there, and immediately on our right hand we had heavy sand. In camp 2 we found water at a depth of less than 2 feet, the temperature of which was 50°. We had travelled 13½ miles in an easterly direction.

On April 12 the mist continued, although there was no wind. We started, as usual, at an early hour, the packing of the camels generally taking an hour and a half. We tried in vain to work towards the east. The mounds to the right, however, forced us in a north-easterly direction. We found a *tograk* here and there. These trees always grow on the top of a conical mound, and the roots help to hold the loose and dry sand together. These cones are 6 to 10 feet high, and are very much like those we saw on the way from Kashgar to Maralbashi. Their existence may be due to the opposing contrary winds, although I should think that the dust which constantly falls would at last hide them. In some places the ground was slightly damp, and covered with a dry, salt crust, which crashed beneath the camel's hoofs. These damp spots made an impression in the ground, and water could no doubt be found at a depth of 5 feet.

We passed another stretch of *tograk* before reaching the next steppe, which was scantily covered with *kamish* and bushes. This steppe we had on our left-hand side, while on our right we had still heavy sand. The mounds pointed straight northwards, but were only a few feet high, and had a very broad base. We met to-day again the same kind

of soft sand into which the camels sank knee-deep, and only proceeded with difficulty. There we also found signs of animal life. We saw a rabbit, which instantly disappeared, and further on we found a path towards the south-east made by deer (Marals). The "desert man" thought that this path probably led to a lake or an oasis (Yeilan). At camp 3 we found brackish water at a depth of  $5\frac{1}{2}$  feet ( $50^{\circ}$  Fahr.). The animals drank this water with delight. Distance covered, 15 miles north-east. To the south of our camp there was said to be a lake called Yeshil-Kul (the green lake). None of my men had ever seen the lake, and I did not believe in its existence.

On April 13 we passed several small stretches of *tograk* and sand-mounds, from 65 to 160 feet wide and 6 feet high, all pointing northwards. The steep sides of these mounds face westwards. Very often the mounds were convex towards the east. To-day we met for the first time green *tograks*, with light green leaves; these were eagerly consumed by the camels. The last part of the day's march brought us into heavy sand formed into irregular mounds, sometimes crescent-shaped and sometimes circular, with the steep side towards the south-west. At camp 4 we found water at a depth of  $3\frac{1}{2}$  feet (temp.  $50^{\circ}$ ). Distance covered, 13 miles; north  $21^{\circ}8'$  east. Lizards, spiders, and moths were the only living creatures to be found. The fact that we always found water at a small depth, and the direction we followed, led me to believe that we could not be very far from the Yarkand Daria. The "desert man" tried to make me believe that we had gone so far from the river that it would take four to five days to reach it. I had found out, however, that all his reports up to this time had been unreliable, so that this one was probably of the same kind.

On April 14 the desert had the same character as before, with *tyong-lu* (high sand) to the right; here and there we passed *tograks* between the mounds. During the two following days I noticed that as soon as we came out of the sand and on even ground the *tograks* disappeared. From this I was, however, not able to draw any definite conclusions; I merely record the fact. The formation of the mounds near the stem of the *tograk* is very changeable. Sometimes the mound seems to leave the *tograk* alone and to go round it, and sometimes the tree is wholly embedded in sand, only the branches being visible. I suppose that this is due to the fact that the *tograk*, being entirely dependent on the water in the ground, grows in small hollows invisible to the eye where the water is nearest. Maybe these elevations of the ground to some extent owe their existence to the phenomena of capillarity. Shortly afterwards the character of the desert completely changed. The brown ground was as level as a floor, and so hard that the camels' hoofs only made an impression of one-fifth of an inch. There we saw a few scattered sand-mounds very sharply distinguished, 3 to 6 feet high, and standing on a broad yellow-coloured base. They resembled small wooden blocks placed on

a smooth mahogany table. We tried as much as possible to avoid the mounds and ride on the hard ground, thereby being forced more northwards. In the open spaces we found many small pieces of a very hard shell-shaped flint, round pieces of porphyry, and the same minerals I had found in Ashur-tag and Turnshuk-tag (on the road to Aksu), in the mountain range at Masar-Alldi; these small minerals we afterwards found in Masar-tag. All these small isolated mountains, the outermost standing on the left-hand bank of Khotan Daria (six days' march to the north of Khotan), are ruins of an ancient mountain chain which stretched through the present Takla-Makan, and seems to have been parallel with the eastern part of the Pamirs. Later on I shall find an opportunity of speaking of the great importance that attaches to these hollow-ground pieces of stone, which have clearly obtained their shape in running water. I may here mention that such a piece of land as this, level hard ground covered with stones, is called in the native (Turkistan) language Sai; the same name is also used in indicating the dry, stony bed of a river.

After a couple of hours' ride the loose sand was decreasing, and to the left we again saw the steppe covered with bushes. Here we made an unexpected discovery—we found the first sign of the wild camel (*yavatuysi*). The footprints which we observed went in the direction north-north-west and south-south-east, and seemed to indicate that the animals came out on the steppe to find food, afterwards returning to the desert. Possibly this might tend to prove that a lake (Yeshit-Kul?) surrounded by pastures really existed in the south. Shortly afterwards we found marks of the wild horse (*khulan*). I was very much surprised by making these discoveries, for, as far as I remember, I have never, in any description of Eastern Turkistan, seen these animals mentioned. The "desert man," however, said that their appearance was general, and that he had often seen them himself; not seldom they would come down in herds to the banks of the Yarkand Daria in search of water and food. I heard afterwards that they even come down to the Khotan Daria, and that they sometimes come from the east of the desert, and, passing the river, proceed to Takla-Makan. At Aksu I was told that in the town of Shak-yar, by Tarim, there was a number of daring and clever men who made a living by hunting the wild camel and the tiger; the skins they sold to the merchants and tanners in Aksu.

On reaching the steppe, my men discovered a herd grazing, but before I got my field-glass adjusted, and before we were able to decide whether the animals were camels, wild horses, or deer (*marals*), they disappeared northwards in a cloud of dust. Our dogs, that always kept in the shadow of the camels, disappeared here suddenly, and when they returned in about an hour, to our surprise we discovered that they had bathed. We continued, however, in the same direction, and by a mere chance we came to a lake containing clear fresh water. This lake was

about 250 feet long and 12 feet wide. The water was about 3 inches deep, and at the bottom, which was muddy, there grew some water-plants. Water-spiders and beetles were numerous, and were eagerly devoured by the fowls. In this connection, I may mention that all my collections of insects—principally beetles—and plants made during the first thirteen days were lost through the disaster that afterwards befell the expedition. By a mere chance, however, my collection of minerals and sand samples were saved. The little lake seemed to me so delightful, that I resolved to camp here. One could plainly see the water coming up from small holes in the bottom, as from a spring. The temperature of the water was 70°, and of the air 78°, at 5 p.m. By 9 p.m. the temperature had gone down to 59° in the water, and 60° in the air. On April 16, at 7 a.m., the temperature of the water was 49°, and in the air 55°. Distance covered, 11½ miles; direction, north 14.4° east. Still the air was so full of dust that the sun could not be distinguished 20 degrees above the horizon. All the time we had tried hard to get towards the east, but, on account of the high sand, we had been forced in a north-easterly direction. We had very little knowledge of the character of the desert we were coming through and of the chances of finding water, so we decided to camp here.

April 15.—The camels and the other animals now had a chance to get all the water and grass they wanted. Our water-tanks were also refilled. It was a curious incident that the fowls on this day of rest laid four eggs; hitherto I had only got one a day. To-day we killed a sheep. During the night our dogs barked continually towards the road on which we had seen the footsteps of the camels; undoubtedly the herds seek the water after sundown. At 1 p.m. the temperature in the sun was 165° (82.8° in the shade); one hour later the temperature of the sand was 112°.

Leaving the lake on April 16, we again met mounds 10 to 13 feet high, north by south. The sand was soft and most difficult to get through; we had to ride zigzag up and down the sand-hills. After a while we came to an open space, where we again found *tograks*, *julgus*, and *kamisk*. Here we passed another lake, and soon afterwards a third one. My men thought that this was Kuldenezagi, or the end of the big lake; but, as all these lakes went in an east-north-east direction, and lay in the same line, I concluded that they had formerly formed parts of an old river-bed. Round the last lake we found numerous marks of wild camels and horses. Mounds now appeared again, sometimes as high as 16 feet, and for a short stretch they lay east by west; however, they soon again took their usual course, north by south. Open spaces became now more frequent; *julgus* and *kamisk* appeared. To-day we covered 15 miles; direction, north 87° east.

April 17.—At 4 a.m. the sky was perfectly clear, and the stars shone brightly. At 7 a.m. the sun was hot, although a westerly wind was



blowing. The wind had cleared the air, and, thanks to this, we discovered in the distance a large mountain range, with smaller extensions both right and left. The "desert man" believed it was Masar-tag, and I resolved to investigate it. After having passed a stretch of sand 12 feet high, we came out on a plain that seemed to lead right to the foot of the mountain. Here and there we passed scattered mounds, and both *julgun* and *kamish*. Further on we again found mounds of considerable height, sometimes up to 20 feet. The ground now became more uneven, and we passed a small salt-water pond, and afterwards one containing fresh water. I became more and more convinced that these ponds were the remains of an inundation from Yarkand Daria in the spring of last year. I discovered to-day that the water not only creates these small lakes near the rivers, but even, through natural canals, finds its way into the deserts. We passed a 125-foot wide and 6-foot deep river-bed which went from west to east, and where still a little water was left. The bottom was sandy, and *kamish* grew on the banks. Over half a mile further north we could see a river-bed similar to the first one, and clearly distinguishable. In the spring, when the Yarkand Daria carries enormous quantities of water, the overflow is bound to find an outlet, and undoubtedly it flows eastwards into the desert through selfmade channels in the lower ground.

Any one who has seen the Yarkand Daria will know that this river carries along a good deal of *débris*, sand, etc., which remains in the river-bed as soon as the swiftness of the current abates. In this way the river-bed constantly grows higher, and the water has to seek new outlets. As a matter of fact, this moving of the river-bed goes in an easterly direction, and I have particularly noticed this on the western side of Yarkand Daria, between the river and the holy grave of Orden Padishak, where two old river-beds, running parallel with the present river, can be distinctly seen. The two dried-up river-beds recently mentioned also show that there is a tendency towards the east.

The air was clear all day. During our march we had noticed in the far distance a dark cloud, which we now found was due to the vapour coming from the river-beds. Similar vapour-columns, but much larger ones, we also saw the following days, towering high above the Yarkand Daria banks, the dry atmosphere rapidly absorbing the vapour. We proceeded over an uneven ground with scattered mounds, where a few *yantaks*\* were growing, and again met *tograks*, which were so plentiful that it looked like a regular forest, or *yangal*. Here we rode between high mounds for one hour, direction north-north-east; sometimes the mounds were as high as 30 feet, and their west sides were very steep. We crossed a few mounds before we camped between a couple of old *tograk* trees. Distance covered, 17½ miles; direction, north 18° east.

\* *Yantaks* = *Althagi camelorum*.

April 18.—To-day we had strong gales from the north-east, and the air was as usual filled with dust. The heat during the day was less oppressive on account of the dust, but the temperature higher than usual at night. The mountain to the north could not be seen through the mist and the forest. The trees had still that same yellow-greyish colour, and only in a few places we saw some green *tograks*. Here and there between the trees mounds were seen, but the land had altogether lost the character of a desert. The mountainous desert had been succeeded by a marsh covered with trees and *kamish*. We had often to take a roundabout way on account of the marsh, which gradually took the form of a long lake, that became wider northward and had many creeks, and even contained small islands covered with bushes and *kamish*; on the shores were plenty of ducks and geese. We followed the eastern shore northwards through *tograks* and mounds, and reached another lake just like and parallel to the first one. Both lakes, which probably form parts of a big lake in the north, run out southwards between the sand-hills and follow their outlines. Alongside the last-mentioned lake we rode on a sand-hill of considerable dimensions between the trees. At the foot of this sand-hill there ran a dark stripe of faded leaves and branches of trees, showing that the surface of the lake at high water was 20 inches higher than now. The small islands covered with *kamish* showed that the water could not be very deep. To see the clear, deep-blue water through the fresh green leaves was a sight late to be forgotten. The water in the lake is fresh and clear. In my mind, there is no doubt that these lakes have been created by the yearly inundations from the Yarkand Daria. When the overflow ceases towards the summer, some of the water evaporates; when the winter comes, the remainder freezes, melts again in spring, and gradually gets less; in May or June the new supply comes, and the lake reaches again its maximum.

Leaving the lakes on our left, we now took an easterly course, and came through such thick *kamish* that only those who rode could have a full view in front. Later we came out on a long plain, where the finest grass was growing; here and there were scattered groups of trees. But the forest grew thicker, and at last got so thick that we had to use axes to cut our way through. At last we were out of this forest near the Yarkand Daria, and reached the open steppe, where in east-south-east we discovered another mountain. In the dusk we camped on an isolated mound, where we found a great many scorpions. Distance covered, 16 miles in constant turns; direction, north 50° east.

April 19.—The mountain first seen could now be faintly discovered to the north. This is the mountain that stands on the right bank of the Yarkand Daria, and is a continuation of the Masar-aldis mountain, which I early in the spring had visited. We decided to steer our course towards the small mountain in east-south-east, which could be easily

seen through the mist, and consequently could not be far away. We had to pass some very uneven ground, often interrupted by damp ravines, which we had to go round. To the right there is a stretch of marsh land, and to the left grows a number of *tograks*—young, green, and fresh looking, where many crows had gathered. A small range of mountains, completely separated from the main mountain chain, was now our destination; but, coming nearer the base, we found that a lake lay between us and the mountain. This lake went in a northerly direction, where it had an outlet. We therefore turned towards south and east, between the lake and the big mountain. At the base of this were many mounds, which went right up in the clefts of the mountain. We found now that the lake was divided into two parts by a narrow swampy isthmus; *tograks* and *kamish* grew on the banks, and there were also indications of the water having been higher. The water was clear and fresh, and geese and ducks were numerous as usual. The eastern half of the lake disappears in a swamp, and a number of ponds stretch far northward. Between these and a mountain range pointing northward we continued our march, and finally stopped by a small lake, along the shores of which were plenty of *tograks* and *kamish*. I decided to stay in this delightful oasis the whole day of April 20. Besides, I wanted to take some astronomical observations and make a geological excursion. As to the result of the latter, I will refrain from saying anything before the specimens I brought back have been analyzed; suffice it is to say, that the minerals were of the same finely grained and hard kind that I found in the small mountains near the Kashgar Daria conjunction, and that in several places I found veins of porphyry. From the top of the mountain lying to the south of our camp I had a splendid view of the neighbourhood. To the south-west I could see the two small lakes with their clear water, in which could be seen the surrounding mountains as if in a mirror. Straight westward I could see the little isolated mountain with high mounds at the north-eastern foot, which had dammed up the marshland. To the west  $320^{\circ}$  north, I found the large mountain we first of all discovered, and which cannot be any other than that near Masur-aldi. Of my investigations round this last-named mountain I do not find time to speak now. Between our camp and this mountain, as far as north  $30^{\circ}$  east, there is an even plain covered by marshes and ponds and fertile vegetation. This swamp and all these ponds, no doubt, form one great lake at the time of the inundation. It is, however, a curious fact that the deepest parts of these depressions are found round the foot of the mountains, where the largest quantities of water remain, although the *débris* from these fast-crumbling mountains ought to add to the height of the ground. I may also note that all these small ponds lie in a westerly direction from the mountains and their extensions, which is clearly shown in Fig. 2. In the first instance, we may conclude that the sand and the atmospheric dust leaves only a very small quantity

(or next to nothing) at the mountain's south-western base; that is to say, to the leeward of the prevailing north-easterly and easterly winds, and that the ground here consequently would become proportionately lower. When we the following day went round the whole complex of mountains, I received full confirmation of the conclusion above arrived at. Towards north-east and east all the extensions were covered with mounds, but as a rule parallel with the length of the mountains, and all very irregular in shape; on the western and south-western extensions not a trace of sand could be found, the ground being either hard or

*Swamps extending to Yarkand Daria*

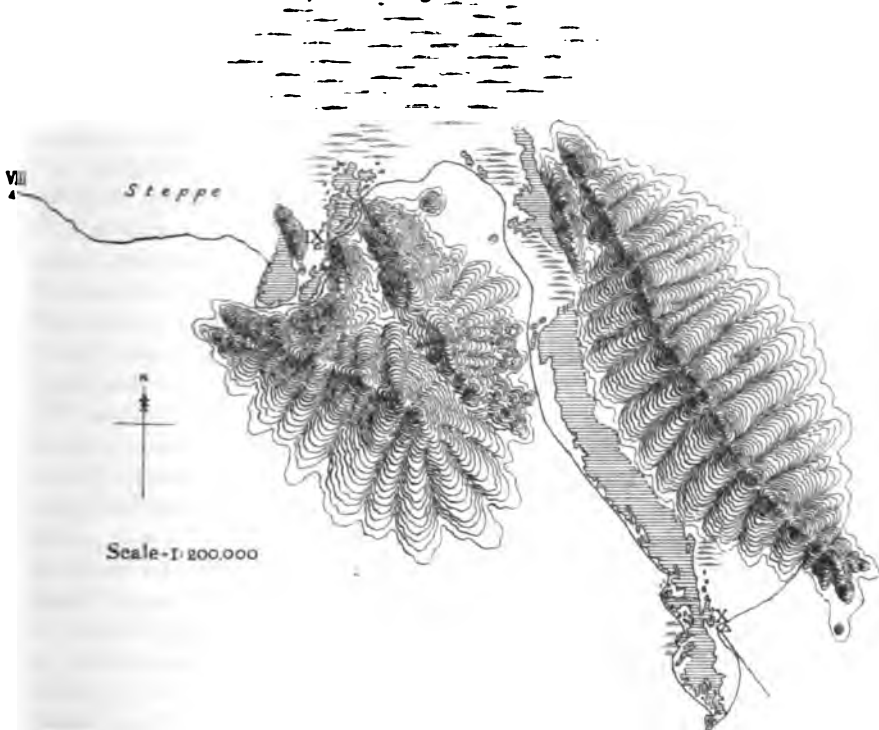


FIG. 2.

covered with gravel and *kamish*. It is, however, quite natural that the sand, carried along by north-easterly and easterly winds, must find a barrier in these mountains. In their formation the mounds have been disturbed at the base of the mountain, and get thinner the higher they get up; they do not, however, reach the top.

To the east of the mountain extension where I had my look-out, is another one running parallel with the first one, and between these two there is a gently sloping valley covered with grass and *débris*, and with a network of dry canals, which are only filled with water after rain and when the snow melts, for of permanent ponds there are none. Generally,

these mountains are fast crumbling, which is a natural consequence of the enormous changes in the temperatures of winter and summer, and even between night and day. I calculate the height of this range at from 800 to 1000 feet.

On April 21, when we passed these two mountain extensions, we again encountered high mounds which blocked the north-eastern slope. To the left we had marshland with *tograks* and *kamish*, and in front of us we saw another mountain, higher than the one we had left. Here and there the *tograks* take the form of a thin forest, and here we also found a path, which the "desert man" explained was an old short cut to Khotan Daria.

We now took a more southerly course between the two mountain chains laying north-west to south-east. The *tograks* gradually disappear, and we are again on the steppe covered with *kamish*. To the left there is a very long lake, only in one place broken by marshland. As far as the eye can reach the lake goes in a north-easterly direction, and probably alongside the south-western base of the eastern mountain. To the right the mounds tower up on the north-eastern slopes of the western mountains, whose cliffs only here and there can be seen peeping out of the sand. The ground gradually gets hard, now and then covered with a little *débris*. At the northern end of the largest lake, where there stands a big isolated rock, we met to our surprise a man, who had come there from Maralbashi to get rock salt. The salt was found high up on the mountain, was perfectly clean, and looked very nice. This man, who had a couple of cart-horses with him, sells the salt to the bazaars in Maralbashi. He had no information of importance to give, but only confirmed what I had already noticed. To Maralbashi there was not quite a two days' march in direction west 330° north; to the south and east there was a sandy desert, but the man had no knowledge of this fact. To the left the long lake continues; there are no islands in it, but plenty of grass. Here and there the lake is surrounded by a swamp; otherwise the ground is very hard, does not even leave any trace of the camels' footsteps, and is absolutely void of vegetation. Even in this lake there were signs of the water having been higher; and the fine sand on the shore was just like finely-chiselled waves. The southern slopes of the western mountain chain sink gradually more and more, and at last are completely covered with sand; they continue towards the south in a long sand-comb. After having left the last mountain slopes, we had the boundless desert on the right hand.

It was my desire now to come nearer to the eastern mountain chain, but we were constantly obstructed by the lake, which, however, became more narrow towards the south. We were therefore bound to turn southwards, where the lake sends out long and narrow arms, just like fingers pointing southward. The ground here gradually rises, putting a stop to the further advance of the water. When we at last had come round

the southern point, we turned towards north and north-east, and arrived at the eastern shore, where we found grass for the camels, but no trees.

On April 22 we were in camp 10. The camels here had another chance of getting all they wanted to eat and drink. I made a trip to the south-eastern point of the mountain, which has the form of a cape, with a little rocky island in front. From this point I had a splendid view of the long lake, and I had a chance to verify my map sketches. To the north-east, east, and south-west is nothing but desert as smooth as the sea. Far away I could discern the first mounds. The day was exceptionally clear; highest temperature (black bulb) at 1 p.m., 180°, 92° in the shade (?). I had brought with me my strongest field-glass, and carefully examined the horizon, but not a mountain to be seen, only desert and mounds. When Prjevalsky in 1885 returned from his last journey, he followed the Khotan Daria northward, and discovered, about six days' march from Khotan, on the left bank of the river, a little mountain which extended northward towards the desert. The natives called it Masar Tagh. Now, Prjevalsky knew that there was one Masar Tagh by Maralbashi, and as the natives assured him that the one by Khotan Daria extended just in the same direction, as far as could be seen, he concluded that they belonged to the same mountain chain, and he marked them down on his map as lying straight across the desert of Takla-Makan. Mr. Carey, who together with the unfortunate Mr. Dalgleish, in the year 1885-86, also travelled alongside Khotan Daria, saw the same mountain, but laid it down on his map as an isolated mountain, which showed more caution, and no doubt also is correct. However, all the Russian maps of East Turkistan and the splendid map of "Tibet and the Surrounding Regions," published by the Royal Geographical Society, as well as several others, have a whole mountain chain across the desert. In Map 60 in "Stieler's Hand Atlas," there is, however, as a sort of precaution, only printed the name without further comment. It is evident that if a continuous mountain chain really existed, we ought to have discovered it just at the point where we now were, but neither here nor further on were we able to discover even a sign of a mountain. It is even less probable that Masar Tagh by Khotan should have the slightest connection with the first-mentioned apocryphal existence of Chak-mak Tagh and Ak-chok, because in such a case we would have passed them. I feel fully convinced that the one Masar Tagh near which we camped on April 22 is totally isolated, and that this is also the case with the mountain seen by Prjevalsky and Mr. Carey. The latter mountain I have not yet visited, but at Buksem (Khotan Daria) the hunters told me that it might be rounded in five or six days. At the top there is a holy grave (masar); hence the name.

When we started on April 23 and left the newly discovered mountains and lakes, I was still of the opinion that if we continued south-eastward we would again come to a mountainous region with lakes and

ponds. Not finding, however, any signs at all of mountains, we steered our course eastward (with a slight deviation towards east-south-east), in order to reach Khotan Daria by the shortest possible route. While resting ourselves, I and my men had a consultation. The "desert man" up to this time had been a very good guide, and his advice had been of considerable value in discovering the new mountain and the lakes, consequently we placed a good deal of confidence in him when he assured us that we had only a four or five days' march to the Khotan Daria. I may here add that on all the maps I had in my possession the distance between the point where we were and the Khotan Daria was given as between 70 and 75 miles. I gave strict instructions to fill the water-tanks for a ten days' march; further on, when it was too late, I found out that my men had only taken a four days' supply. The result of this negligence was the death of two men, six camels, and all the other animals.

As already stated, we left the camp on April 23. During the following two weeks we always sent our thoughts back to this little paradise on earth that we left behind. We steered our course south-eastward to look for the mysterious Masar Tagh. The ground was perfectly hard, and partly covered with soft dust, and now and then with bushes and kamish. Then again we passed cones and hills of clay. In this desolate place, however, there was no other sign of life than the footsteps of the antelope and other animals living in the desert. After an hour and a half's ride, we again met mounds 18 to 22 feet high lying north-west by south-east, and with steep inclines towards south and south-west. A single *yulgun* grew here and there; this *yulgun* is a typical desert tree, and does not appear near the lakes. After two hours' ride, the mountain we had left disappeared in the mist, and afterwards we did not see any trace of a mountain. The mounds made it now more and more difficult for us. For a while we followed in the direction of the mounds, but very soon we met another range of mounds crossing these, whereby pyramids of sand were formed often as high as 60 to 65 feet. During the latter half of our day's march, the sand-combs were as high as 80 to 100 feet. My men called this sand *chong-kum* (heavy sand), or *yaman-kum* (bad sand). As much as possible we rode on the top of these sand-hills to save the trouble of going downhill and then up again, but as a consequence we were obliged to take more turns, as we had to make use of the eastern sides of the mounds, which were more rounded. Once in a while we came, however, to the edge of a very steep precipice which we could not pass round, and here the camels went right ahead and slid down through the sand to the base of the mound, never losing their balance. Sometimes we had to use spades to work our way through the sand, where we also found the last bushes of *yulgun*. We tried to find water by digging, but, not finding any at a depth of 2½ feet, we gave it up. A few moths flew around my candle during the night; the next day even these insects had vanished.

(To be continued.)

regards that game of makalla, it is played on the shores of Lake Victoria, and may be said to be the whist of Africa. As regards the photograph of the hairdressing, it is said that when a young man wishes to marry, and meets a young lady, he says to her, "Do my hair." If she does it, she accepts him; if she does not, she refuses him.

The CHAIRMAN proposed a hearty vote of thanks to Mr. Bent.

## A JOURNEY THROUGH THE TAKLA-MAKAN DESERT, CHINESE TURKISTAN.\*

By Dr. SVEN HEDIN.

On April 24 I woke up at 3.30 a.m. A storm from the west threatened every moment to blow away my tent. The tent was of an excellent quality, and had the usual Indian shape. Mr. Macartney, of Kashgar, had made me a present of it; formerly it had belonged to Lieut. Davidson, who died very young. The wind came down on the camp from all sides, but the western sky was, as usual, clear. To the north there was a high mound stretching west by east, and sloping towards the south at an angle of 31°. To the south there was another parallel with the first, sloping towards north at an angle of 10°. The fine sand which always covers the surface of the mounds here runs in small curly waves in a longitudinal direction. The "desert man" told me in the morning that he was certain that he would come to a region covered with *kamish* and other plants before nightfall, and that we would also find water beneath the surface; this water, he said, would be connected with the Khotan Daria. The whole day we marched on in the thick sand, and got deeper and deeper into the lifeless, unknown desert. The mounds were only 40 to 50 feet high, but they lay in less advantageous position—north by south, and north-north-west by south-south-east—forming what my men called *davan-kum*, or *beles-kum*, that is, sand with a pass running through it. Sometimes we passed small patches of ground that were brown, hard, and free from sand.

The strong westerly gale continued the whole day, driving in front of it clouds of sand. The sand followed the ground, and flew from one sand-comb to the other. Above us the sky was clear and blue; the horizon disappeared in an orange-coloured cloud. From the top of the mounds the sand flew into the air like a yellow spray; one could clearly see the grains dance in the air before they fell down and took, as if by command, the shape of small waves. This sand is very disagreeable; it gets into the mouth, nose, and ears (to protect our eyes it was absolutely necessary to use dark spectacles covered with a net of straw), and, penetrating our clothes, it went right to the skin. Islam-Bey was our

\* Dated "Kashgar, October, 1895." Continued from p. 278.



pilot through the mounds. The caravan followed straight in his path. Quietly and solemnly the camels walked in measured steps, and the bells of the caravan sounded regularly and monotonously. Often our pilot stopped on the top of a mound, took a look round, and walked back, saying, "Hetj joll jock" ("No way at all"), "Her taraf jaman kum" ("Everywhere high sand"), or "Kum tag" ("Mountain of sand"). My men all walked barefooted; they were quiet, tired, disgusted with the heat, and disappointed because the sand was so thick. They often stopped to take a drink of water, the temperature of which is 86°. Although the water was warm, they drank it to increase the perspiration, the breeze giving them temporary relief. The black iron tanks were covered with *kamish* to protect the water from the rays of the sun; but the camels now commenced to feed upon this herbage, thus consuming the last natural food available. We kept a sharp look-out from our higher points, but there was no change; only an indefinite sea of gigantic sand-mountains, seemingly standing still, but in reality moving west by south-west. Now and then we passed small hard patches of ground covered with white salt. Now this disappeared entirely, and again we had only fine yellow sand. Not the slightest sign of vegetation, not even a leaf as big as a finger-nail carried along by the wind disturbed this disconsolate and depressing silence of death. The mounds were longitudinal, with their steep side towards west, and as high as 100 feet. I generally used to calculate the height of the mounds when we came to an open space; I remained at the foot, while the caravan proceeded upwards. When the first camel reached the top I took the height, including the camel, and, knowing the animal's correct size, I afterwards calculated the height of the mound. The camels had hitherto performed their work admirably, although the desert was so difficult to get through, that any horse or mule would have died in a couple of days from exhaustion. At this point, however, the camels commenced to manifest signs of fatigue; they stumbled now and then, and especially when they were climbing up the steep side of the mound and had reached the top. When a camel falls, it is impossible to get him up on his legs again except by rolling him down to the foot of the hill, sometimes a distance of 60 feet. We made our camp 12 in a small open space. Distance covered, 8 miles; north 80° east. The place was just large enough for the caravan, and was surrounded by three mounds of irregular shape. The northern mound lay 26° south, the southern 10·5° north, the eastern 27° west and 16° east. The ground here consisted of clay, which was so soft that it formed into dust at the slightest touch. The ground was level, except at the northern end, where it was terraced. It is a question whether these terraces are remains of an ancient river-bed, or have they been formed in course of time in a Central-Asian sea, the bottom of which is now covered by sand? This question must be left unanswered.

During the night, April 25, the temperature went down as low as 46°.

In the morning the atmosphere was filled with sand, on account of the north-easterly wind. I found that our water-supply would only last for two days more, but I had no fear, as I firmly believed that we, before this time, would get out of the maze of sand and reach the Khotan Daria. In one way these flying particles of sand are of value, because they reduce the heat considerably; but at the same time it takes away our view. The sand-combs seem to rise out of the mist like giants, and, although they are quite near us, they seem to be far away. On account of this, one is easily deceived as regards distances and the size of objects. At this point the mounds lay in irregular squares, but still in a longitudinal direction, while those of a larger size still had their greatest width towards north-west by south-east (see Fig. 2). We now seemed to be right in the heart of the desert, everywhere sand, only sand; in front of us we saw whole mountain ranges and plateaus of sand. The mounds were as high as 160 feet to 200 feet. A big black



FIG. 3.—SAND MOUNDS.

camel—fifteen years old, the oldest of the lot—slackened his speed and dropped behind. I ordered a man to lead him, and tried to strengthen him with a little water and hay. The load he carried was divided between his comrades. Towards evening another camel dropped behind, and we had to stop for the day—camp 13. Distance covered, 9 miles; north  $80^{\circ}2'$  east. We gave the camels the rest of the day. A wasp, two mosquitoes, and a raven enlivened us a little. They had probably been carried along by the wind, or had perhaps been following us. During the whole of that day I had walked, and afterwards I always did.

*April 26.*—To-day the sand was more irregular; the steep side of the mounds lay often towards east. Just after sunrise I started out by myself. I took with me compass and field-glass. I walked 8 miles in an easterly direction. About noon the sun was so hot that I stopped to wait for the others, who wearily dragged themselves along in my

footsteps. Enormous mounds lay here north-east by south-west and east by west, thus covering the others. The height of the mounds were from 130 to 160 feet. Small open spaces appeared again, and for a distance of  $1\frac{1}{2}$  mile we walked on soft dust without any obstruction. This strengthened my belief that the sand would get easier towards the east. The steep sides of the mounds were always towards the east and south-east, thereby making our march easier. This shape of the mounds proved that at this time of the year westerly winds generally prevailed. In some places the ground is covered with red-coloured *débris* and pieces of stone; these *débris*-covered patches seem to have the same effect on the sand as oil on a stormy sea—the mounds do not come near them. Camp 14. Distance covered, 10 miles; east  $97\cdot3^\circ$  south.

Here we found many specimens of curious minerals, shell-formed pieces of flint, and a kind of stone just like pieces of thin pipe. We found fragments of a skeleton of the wild horse. From the size of the bones, I could see that they had belonged to a wild horse, because they were too big for an ass and too small for our domestic horse. It was a peculiar discovery right in the centre of the desert. An ordinary horse or donkey would not have been able to get through this sand. We could not find the skull or any other bones; the small pieces we found were so brittle that they fell into ashes as soon as we touched them. How long has this skeleton been here? This is a question not easily answered. It is a fact that organic remains, embedded in sand for a length of time, are wonderfully preserved. The skeleton we found to-day may have been here for a number of years. We made another discovery during the following days. We found small white shells, about one-third of an inch in diameter, and small pieces of oyster-like shells, which clearly proved that this part of the country in former years had been under water.

The two men that I had left behind in charge of the two sick camels arrived at the camp late in the evening and reported that the camels had died. All my men were now put to work to find water. About 6 feet below the surface the clay was moist. We had to insert candles in the recesses, and hoist the sand up in buckets. Three and a half feet below the surface the temperature was  $61^\circ$  (in the air  $83\cdot5^\circ$ , 6 p.m.); at a depth 5 feet below,  $55^\circ$ ; at 7 feet,  $52^\circ$ . Not finding water at a depth of 10 feet after three hours' hard work, we gave it up in disgust. All the animals had, as if by instinct, gathered round the well, waiting for the result. At night the camels received their last drink of water, a little hay, oil, and bread.

*April 27.*—In the morning we discovered two geese flying in the direction of south-east, their destination probably being the lakes. Small spots were often surrounded by mounds about 33 feet high. I noticed that the mounds here often had a round shape, which showed that the ground underneath was higher, and that these bare spots lay

on hills, where the sand had less strength than down in the valleys. These sand-hills, which may be likened to an enormous gathering of mounds, lay all in the direction of east by west. Very often the mounds had the shape of a crescent, with the convex sides towards the north and the steep incline towards the south. But although we marched on, keeping a steady look-out, we saw nothing but sand. My men told me that we were under the influence of witchcraft, and that we had to continue walking in a circle until we died.

Camp 15. Distance covered  $12\frac{1}{2}$  miles; direction, east  $100^\circ$  south. The western and south-western sky was dark and full of rain, but, as the wind blew in a southerly direction, we did not get one drop of it. In one of the tanks there was still a little water, and this we kept like a treasure. My men discussed our chances in that quiet way which is strictly Oriental and not without a touch of humour. They were positive that we should all die here in the desert, first of all the camels, and we afterwards.

*April 28.*—When I woke up in the morning, there was a terrible storm blowing from north-north-east. The air was full of dust and particles of sand. The tent had not been used, and as the whole camp was nearly buried in sand we had lost many of our things, which had to be found with the aid of sticks. We could not see anything in front of us, and therefore often marched right into big mounds. Thanks to the mist, the air was cool all day; at 1 p.m. the temperature was only  $65^\circ$ . We could only see two camels; the others disappeared in the mist. The wind howled and whirled the sand high into the air. Very often we had to turn round so as not to get choked. Sometimes it got as dark as night, and a dreadful feeling of the hopelessness of our position took hold of us.

At this point, when marching through a difficult pass in an enormous mound, the third camel dropped down, and although he was freed from his burden, two empty water-tanks, he could not rise, and had to be left behind. After a while I ordered a man to try to bring him back, but the man soon returned and reported that the camel was dying. I did not want to kill these animals which were left behind in this way, as I still had a faint hope that we would reach the woodlands of the Khotan Daria, when we could easily return and save them.

After having marched 13 miles in the direction east  $96.3^\circ$  south, we stopped on reaching a bare spot. A couple of days ago we had left behind two overcoats, my bed, and a couple of boxes. In camp 16 we left a number of articles that we could dispense with, such as a fur coat, two rugs, two provision boxes, a stove, etc. The boxes were covered with rugs, and at the top of the nearest mound we planted a pole with a Swedish newspaper wrapped around it. We could see this pole at a long distance. My men were allowed to eat as much as they wanted of the preserved goods. I picked out those that were the least dry—lobster, sardines, raw mushrooms, English soups, etc. The camels

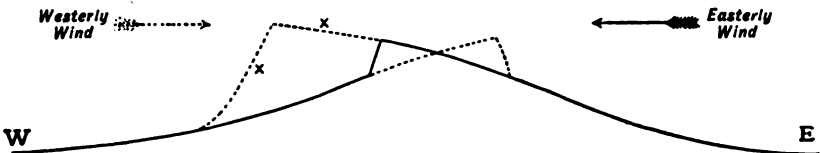
received a supply of hay. In the evening we had two quarts of water left in our iron cans. During the night one was stolen, and half of the other was equally distributed the next morning. The last pint of water, which I wanted to keep for the evening, was stolen during the day.

On April 29 we marched a long distance, but the sand remained the same. The mounds lay north by south as before, and with the steep incline towards west. These sides are generally covered with a steel-grey, bright-coloured dust, which, on inspection, was found to be leaves of shale. These little leaves are very light, and gather in heaps to the leeward. I made an experiment with pieces of paper, and found that these also gathered just in the same places. At this point we were subjected to a very disagreeable optical illusion. Looking east, the eye meets the steep sides of the mounds, which seem to rise above each other like steps; looking west, the eye meets the eastern slopes of the mounds; this leaves the impression that the sand becomes higher and more impenetrable towards east. Although the camels were tired, they kept on all day. They ate very little, and were daily getting thinner. We marched 17 miles; direction, east  $93^{\circ}9'$  south. It was mainly due to the north-easterly storm, which filled the air with such quantities of sand, that the temperature the whole day was so low (1 p.m.  $58\frac{1}{2}^{\circ}$ ), and enabled us to cover such a distance. In the evening we fed the camels with all that was left of the potatoes, butter, and onions, as well as with a quantity of hay.

On April 30 we looked in vain for a change in our situation. The sand was just as before; sometimes it formed into squares north by south and east by west. The following sketch will convey my meaning more clearly:—



From the above sketch, it will be seen that the steep incline (a) towards the top of the mound is very short. Both sides of the mound (b and c), however, slope at the same angle, which shows the sharp edge has been formed by the constant easterly and north-easterly winds. This formation of the sand also shows that at other seasons of the year north-westerly and westerly winds prevail. The steep incline (a) is thereby forced eastward, but the time is too short to enable it to reach any height worth mentioning; the height was generally from  $1\frac{1}{2}$  to 2 feet. The following sketch shows the alternate state of the mounds:—



If an easterly and north-easterly wind prevailed the whole year round, the mounds would have the shape indicated by the dotted line marked xx, just as in the western part of the Takla-Makan.

My men, as well as the camels, seemed now to be fast losing their strength. Kasim (the "desert man") was so weak that he dragged himself along in the track of the caravan, and only arrived at camp 18 the next morning. The sheep stood the exertion best of all the animals. Our dog Jolldash whined all the time, and scratched the sand with its fore feet. The other dog had already run away on April 23, when we left the lakes. To-day we found a faded leaf "jigge,"\* no doubt brought here by the wind—the only sign that we were approaching a forest. The day before we had found the skeletons of a bird and a rat. Both were found on the surface of the sand, showing that the animals had only been recently killed. The rat had probably been dragged to this place by some bird of prey, as it was clearly impossible for it to have come all the way out by itself. Distance covered this day, 12 miles; direction, east 112.6 south. As the camels simply refused to go further, we had to camp on the top of a mound.

May 1.—During the night the temperature went down to the lowest point hitherto experienced, 36°. The day was clear, and in the sun it was very hot. It seemed to me impossible to continue in this way. There is a limit even to great physical strength, and we were fast approaching the limit. In the morning my men drank the last of the rancid oil that belonged to the camels, and as I was suffering myself from thirst, I drank a little of the Chinese brandy which we used for our cooking-stove. The camels were a poor sight; their throats were white and dry, they gnashed their teeth and roared, and their breath filled the air with a terrible stench. We made but little progress; the caravan often stopped, and I dragged myself along far behind. After having marched 3 miles, the camels stopped again, and when I at last reached them I found the old Muhamed Ikhah lying on the ground, crying and praying to Allah to help him. I decided to look for an open space and try to find water by digging, but the camels refused to rise. The sun sent out a terrible heat, and it was impossible for us to move till after sunset. It was 10 a.m. when we pitched our tent for the last time. I lay down in the shade of the camels entirely undressed. Muhamed Ikhah and the "desert man" lay still in the same position where they fell. Towards evening the heat grew less, and with a heavy heart I gave instructions to kill our last sheep. The blood was, however, so thick and had such a bad smell that nobody would touch it. The bladder was emptied; it contained about a glass full of urine. My men mixed it with vinegar and sugar and drank it heartily, especially Islam-Baj, who afterwards vomited violently. The "desert man"

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\* Jigge = *Eleagnus hortensis*.

chewed a piece of the sheep's lungs, and behaved like a lunatic, always shouting, "Su, su" (water).

Nothing was left for us now but to try and save our lives. Consequently we left nearly all our baggage: our tent with rugs and cushions, my two European saddles, ammunition chest, eight cases containing clothing, books, medicines, two English cameras with more than a thousand plates (of which more than one hundred were developed), and numerous other articles. The following things we took along with us: instruments, diaries, sketch-books, minerals, sand specimens, plant collections, money, a few provisions, overcoat, blanket, tobacco, and, lastly, our guns and revolvers and a few cartridges. These few things were packed in "kurtjiner" (a kind of bag used by the natives), and at 7 p.m. we continued our march. Muhamed Ikhah and "the desert man" lay in the same position where they fell in the morning; I never saw them again. While writing this their families have not yet heard anything about them. The night was dark, and I walked in front with a lantern. By midnight we had marched about 2 miles in five hours. At this point Islam-Baj fell, seized with convulsions. He lay on his back with outstretched arms and legs, and could not speak or move. As we had a hot day before us, I could not afford to lose a single minute of the cool night, and decided to risk everything. I whispered a few encouraging words to Islam, and asked him to follow us as soon as possible (in fact, I did not believe he would live much longer). In company with Kasim, of Yarkand, I hurried along eastward. When we left the dying caravan, the lantern was still burning.

*May 2.*—We walked without interruption for two hours through deep sand, but by this time we were so sleepy that we had to lie down for a while. The cold night, however, gave us little rest, and we walked on till 9 a.m., when we took an hour's rest. A strong westerly wind made our walk cool and comfortable. At 11.30 a.m. the heat was so intense that I nearly fainted. Here we stopped for the day, and, taking off all our clothes, we buried ourselves in the sand. Our clothes we hung on a spade near our heads to protect us from the sun. The spade Kasim carried in case we should need it for digging; he also carried the hind part of the sheep. I carried two chronometers, a watch, compass, a box of matches, pen, paper, handkerchief, ten cigarettes, a box of lobster, and a box of chocolate. We lay buried alive in the sand till 6 p.m., when we continued our march eastward, very weak and very tired. With many interruptions we walked on till after midnight, when we fell asleep on a mound. We had walked  $16\frac{1}{2}$  miles in constant turns, to avoid the most difficult mounds.

*May 3.*—We started at 5.30 a.m. At daybreak Kasim discovered, in the eastern horizon, a thin streak of green bushes (*julgun*). We immediately laid our course towards this point. We had not been

deceived; it was really the first signs of "land." At 10.30 we met a similar plant. The fresh green leaves showed that the roots reached water. The heat at this point forced us to stop. At 7 a.m. we started again, and at ten o'clock we passed three green tograks, a heavenly sight. The ground was bare, and we started to dig a well, but nearly all of our strength had gone. We used the spade in turns, and even scratched away the earth with our hands. We were, however, obliged to give it up, as the clay did not even get moist. We gathered all the dry branches that lay strewn around and made up a big fire, hoping in this way to attract the attention of Islam, if he was still living, which I very much doubted. We also wanted to attract attention towards the east, in case anybody should happen to be travelling between Khotan and Aksu. We kept up the fire for two hours. We slept soundly near it, not feeling the cool night air.

*May 4.*—With fast-losing strength we continued at 4 a.m., but reached again a belt of deep sand without tograks, but here and there julgun. At 9 a.m. we were completely fatigued, and rested the whole day in some bushes of julgun. I was not able to move before 7 p.m. I dressed and called Kasim; he angrily hissed out that he was not able to get up. I started out by myself, and walked till 1.30 at night, when I fell down and made up a small fire. A little later Kasim appeared, and we continued till about 3.30 a.m.

*Sunday, May 5.*—We started at 4.10 a.m. Kasim looked horrible; his cheeks were sunken, his throat was parched, the tongue swollen and white, lips blue, and he vomited constantly. At 4.45 we came to a "dara" (valley), stretching from north to south, where the tograks grew plentifully. We tried once to find water, but without success. Leaving the last belt of sand behind us, we reached at last, at 6.30, a thick forest. Our feelings may be easily imagined. How delightful, after this long march through the desert, again to be surrounded by green trees, to hear the birds sing, and to be able to lay down in the cool shade! At 7.10 we found old footprints of human beings and horses. For nearly two hours we marched southward, when the heat compelled us to stop. In the evening Kasim grew unconscious, and was evidently dying. I had, therefore, to start alone, taking with me the spade. I walked eastward through thick forest. After half an hour's march the forest suddenly came to an end as if cut off by fire, and towards the east the ground was an unbounded stretch of fine, hard sand and clay as even as a floor. Thanks to a few dry stems and branches of tograk which I found, and some winding furrows of sand, I came to the conclusion that this could be nothing else but the bed of the river Khotan Daria. I did not find a drop of water. The sand was just as dry as before. I had arrived during a season when the river-bed is completely dried up, and is awaiting the higher water of the spring.



I had learnt that these rivers had an eastward tendency, and therefore the encroachment on the right-hand river-bank is increasing year by year. In view of these facts I continued my march in the moonshine, and walked  $1\frac{1}{2}$  mile in a south-easterly direction, although the last few days we had marched straight eastward. I was sometimes of the opinion that if I followed the opposite bank towards the east, I would reach the river in a shorter time; but by some unknown power—hypnotism, or whatever you may choose to call it—I was constantly driven in a south-easterly direction. At last I saw the first signs of the woodlands along the right river-bank; only a few steps more, and I see a duck fly up in the air with a splash; and the next moment I am standing on the shore of a 120-foot-long lake of clear, cold, delicious water. It is not my intention to trouble the reader with further details of my travels in the desert. It may be sufficient to add that I the same night returned to my servant Kasim, following in my own footsteps. I filled my boots with water and fastened them to the spade-handle, which I carried across my shoulder. After he had drunk a little water and again become conscious, he was still so weak that he could not follow me when I, on May 6, 7, and 8, went southward. I followed the dry river, suffering from hunger, my only means of subsistence being leaves, grass, and frogs. During the march I found several lakes, the distance between each being, however, so large that I had to carry water in my boots, and walk barefooted. Towards evening on May 8, I suddenly came across a shepherd's camp on the right-hand bank (Bukseu), where I was kindly received, and where I enjoyed a good long rest.

That my faithful servant Islam was saved from certain death was the most remarkable thing that had hitherto occurred. After I had left him, he had recovered and continued the march, taking the camels with him, only one of the camels he had left behind dying. He had seen, and had been greatly encouraged by, the fire that we made up on May 3. He had even reached as far as the tograks, had cut a hole in the stem of one of the trees, and refreshed himself by the juice. The camels had eaten to their hearts' desire of the leaves. In the sand-belt to the east he had lost another camel; a third one ran away, taking the course towards the forest; a fourth one was left behind in a dying state near the forest; and with the last, a big white camel, he had ultimately reached the river-bed. His strength was gone, and the river was dry. In despair he lay down, awaiting death, the deliverer from all sufferings. Strange to say, a couple of traders happened to pass, coming from Aksu, and with Khotan as their destination; they found him, restored him to life with water and bread, and on May 10 he arrived with the camel at the camp where I was. Just imagine what this model of a servant had saved from certain ruin. He brought back all my money (Chinese jamber and Kashgarian tenges), all my astronomical and

meteorological instruments, all my diaries and sketches, and all the minerals from Masar Tagh.

After I had bought horses from a travelling merchant, I sent Islam and Kasim, accompanied by three hunters from Khotan, back to the desert; but they only found the camel that had gone towards the forest. There was no trace to be found of the other camels. I had now to give up every hope of getting back all my valuable instruments. I lost three aneroid barometers and a theodolite, and as I could not travel without this latter instrument, I decided to return to Kashgar *via* Aksu and Ich-Turfan, arriving there June 21.

As it was necessary to telegraph to Europe for all the articles I had lost, I was compelled to wait about three months. During this period I made a trip to the Eastern Pamir, and to the springs of Tagdumbash Daria and Amu Daria. I am greatly obliged to Consul-General Petrovsky and to Mr. Macartney for their kindness in lending me their aneroid barometers and several other necessary articles for the journey. At the same time I may take the opportunity to thank Baron von Richthofen, who had the extreme kindness to furnish me with new and first-class theodolites, which were forwarded to Kashgar.

This trip was a real recreation after the march through the desert. I even had the opportunity of spending a couple of weeks with the members of the boundary commission, who at this time were stationed at the intersection of the Mehman-yolli valley with the Aksu valley. Among these Russians I met several old friends and protectors, from my former visits to Turkistan and the Pamir. I had even the pleasure of forming friendships with some of the Englishmen, that belong to my dearest memories. My conversations with Colonel Holdich were particularly interesting and instructive, as this gentleman had a thorough knowledge of the geography of Central Asia and Tibet, and had rendered invaluable service to the scientific world as far as astronomy and trigonometry were concerned.

#### RETROSPECT.

During the twenty-three days of our march we had crossed the desert of Takla-makan, and covered a distance of 286 miles, or an average of 12½ miles a day. This course, which takes thousands of turns, and, besides, forms a considerable curve towards north, is much longer than the direct line between the points Yarkand Daria (between Lailik and Merket) and Khotan Daria (by Buksem).<sup>\*</sup> According to Map 60 of 'Stieler's Hand Atlas,' the distance is 175 miles; according to the R.G.S. map of "Tibet and the Surrounding Regions," 188 miles; and according to my own map (see Diagram No. 1), 190 miles.

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<sup>\*</sup> On all the maps I have seen published, the name of "Buksem" and nearly all the other names of places near Khotan Daria indicate forests, not towns, as one would imagine from the way the names are printed.

At present I am not in a position to give a detailed description of the geology of the desert and of the movements of the sand-mounds; to be able to do this properly, and to give a satisfactory answer to all the questions arising, it would be necessary to have more material from the southern part of the desert, which I now intend to investigate.

Several archæological discoveries from Lob-nor to Khotan (scientists will probably have heard of Consul-General Petrovsky's remarkable discovery at Borasan, near Khotan, of relics of an ancient Buddhist culture), further historical facts and legends (see Grigorieff's Russian translation of Ritter's book, 'The Eastern or Chinese Turkistan,' the best book written about these districts), and, lastly, the threatened destruction of the southern and western desert towns and plantations, on account of the movements of the sand, all seem to prove that it constantly keeps moving in a south-westerly and westerly direction under the influence of the north-easterly and easterly winds. To this rule there are only a few exceptions, and mostly in the eastern half of the desert, where the mound had the steep side towards east. This would seem to show that the mounds, at least during the last few years, had been under the influence of westerly winds; we found that this latter appearance of the mounds was merely local and temporary.

When we came to the small mountain range laying north-west by south-east, the mounds followed the same direction during our whole day's march towards south-east. Otherwise the mounds lay usually north-south, with a single exception north-west south-east, or north-west south-south-east. At the same time we noticed, in the eastern half of the desert, large series of mounds composed of a number of smaller ones. As aforesaid, I think this is more due to the formation of the ground than to the wind.

From my meteorological observations, it is seen that on our march through the desert we had mostly north-easterly winds; the storms we encountered came also from the same direction. Consequently, the mounds ought to lie north-west by south-east, which, however, is not the case. At the same time, we must not forget that the wind at some other time of the year might be different. The observations also show that we sometimes had north-westerly winds. If this latter wind was just as strong as the north-easterly wind, the direction of the mounds would be exactly longitudinal. We found, however, that they lay mostly north-west by south-east, or north-north-west by south-south-east (see Fig. 3). That the north-easterly wind really is the strongest is clearly shown by the fact that the steep edge of the mounds nearly always lay towards west or south-west, and also thereby that the more or less crescent-shaped mounds usually had the convex side towards east.

During the whole march from the mountain to Khotan Daria (150 miles), we passed mounds sometimes as high as 190 to 200 feet. Every

second or third minute we passed a sand-comb (making a total of 1200 during the whole journey), or four or five mounds on each mile; the distance between the mounds was, therefore, on an average of 600 to 620 feet.

The word "Takla-makan," well known all over Eastern Turkistan, means, in the native language, that part of the desert situated between Yarkand Daria, Khotan Daria, and the road between Yarkand and Khotan. The etymological meaning of the word is still a mystery waiting to be solved. Mr. Petrovsky believes that it is a Chinese translation of "Tukhara," the name of an ancient tribe that lived between Tarim, Khotan Daria, and Lob-nor. (It is a well-known fact that the Chinese people pronounce *r* as *l*; it is impossible for them to pronounce the consonant *r*.) In some places I heard the name "Dekken-dekka" (1001) being used, as it was generally believed that one thousand and one cities were buried beneath the sand. The word "Gobi" is here often used for a desert; usually, however, it is called "dasht," or simply "kum" (sand). There are many curious tales in circulation among the people living on the border of the desert; some of them relate that the sand hides ruins of old cities containing enormous treasures of gold and silver. A great many people make long excursions into the desert in search of these treasures.

During my stay in the forests of Khotan Daria, and while trying to find the things I had lost, I employed a man of the name of Achmed, a hunter from Tavek-kel. This man and his two sons made a living by hunting marals, selling the horns to the merchants at Khotan. On one of these expeditions he had gone in an easterly direction from Tavek-kel towards Keriya Daria. The sand was not very deep, and after six days' march he had discovered what seemed to him to be the remains of a former city, consisting of small one-story clay houses. In these houses he had seen about two hundred corpses, of which, however, only the bones and some rags of clothing (of the Chinese kind) were left. Several of the women wore jewels, in the shape of bracelets and necklaces. He was afraid to touch anything, as he thought he would be punished by some evil spirit. Some of these people had apparently died in a sitting position; others, again, had died while working. I made arrangements with Achmed to accompany me to the place, which he said he would be glad to do. If this story is true, it seems to be clear that this town had been buried in sand by a similar catastrophe to that which laid Pompeii in ashes.

A comparison between Yarkand Daria and Khotan Daria will show that these two rivers are very unlike. There is only one thing they have in common—a narrow strip of woodland runs along the banks of both rivers. In the case of Khotan Daria, the vegetation is wilder and thicker. Along the banks of Yarkand Daria, the woodland is often interrupted by a steppe or by marshes, especially near the mouth.

The woodland along Khotan Daria is without interruption to the junction, and afterwards only for a very short distance. The land between Buksem and Khotan I have not yet investigated. As soon as the woodland along Khotan Daria ceases, the sand commences, without leaving any room for steppe or marshland. I found that the mounds commenced only at a considerable distance from the left bank of Yarkand Daria, or near the holy grace, "Ordan Padisha." From the right bank there is three days' march before deep sand (Chong-kum) is reached, although mounds of different sizes may be met near to Merket.

Yarkand Daria is the principal river of East Turkistan; Khotan Daria is merely an arm of the former. Yarkand Daria is full of water the whole year. In the winter-time it freezes, and the ice covers a considerable part of the land that was flooded during the summer. During the latter season the water rises to a considerable height. As late as September 27 this year, I found near Kusherab (about twenty-four hours from Yarkand), that the river carried as much as 5000 cubic feet of water per second, width 250 feet, and greatest depth 10 feet. In the month of June the quantity of water is considerably larger. On March 8 this year, I found that the river at Lailik carried 2400 cubic feet per second, width 190 feet, and greatest depth 6 feet. In the summer-time the water is of a yellow-greyish colour, and very thick. In March it is clear about 1.9 inch below the surface. At the two mentioned places the river has its greatest depth near the right-hand bank. This was even the case near the town of Tong (the river is here called Baskan Daria), where the water with considerable force rushes against the rocks on the right-hand bank. At this point it is difficult to cross the river. It is only by the aid of "tulums" (goatskin filled with air) that we were able to cross over on September 23.

On the way from Lailik to Ordan Padisha, I discovered two old river-beds parallel to the present Yarkand Daria. This circumstance, in connection with the fact that the river has a constant tendency to encroach upon the right bank, seems fully to prove that it is moving eastward, just as Ann Daria, Sir Daria, and several of the principal Siberian rivers (in accordance with the rules laid down by Baer). With this in view, I crossed the dry river-bed on May 5. On the right bank I found small impressions in the ground containing water. Parallel to the present river-bed, but on the western side, I found a like impression covered with *tograks*. This is, no doubt, part of an old river-bed, which is getting more and more covered with sand. The river-bed takes naturally a very long time to move, and the trees get time enough to follow. Far away to the west of the river we had found a single *tograk* at a considerable distance from the forest. It is not at all unlikely that the before-mentioned terrace-formed clay-hills and the round stones we found also are connected with this moving of the river.

All the year round there is plenty of water in Yarkand Daria, and in many places ferry-boats are used. This is not the case with the Khotan Daria. Only during the early part of the summer is there any water in the river worth mentioning; ferry-boats cannot be used except at Khotan. In the summer-time the traders and the caravans ride through the forest; in the spring, through the river-bed, which is as hard and even as a first-class country road. The flood comes by the end of May or beginning of June, but it takes a long time to reach the mouth. In the autumn the water falls quickly, leaving many ponds, which freeze in winter. The ice melts early in the spring, and causes a small flood, just as in the Yarkand Daria. This only lasts for about three weeks, leaving a muddy bottom, where water may be found at a depth of 1 to 2 feet. When the water gives out in the spring, there remain a number of small lakes in the river-bed, and, as a rule, in places where the current has made channels and formed whirlpools, and where the water has been very deep. In these lakes *tograks* are often found (swept down by the current), and *kamish* grows abundantly around the banks. These lakes may be found as far down as the mouth of the river. Here the caravans usually stop to water their animals. These channels in the river-bed are seldom more than 3 feet below the bed itself, on the right-hand side of the bank; on the left and in the middle the difference is about 1 foot. When the water is shallow the bed remains dry, and is covered with fine sand, not a single stone is to be found; the stream has not had power enough to carry stones as far as Buksem. On the other hand, we found much driftwood, whole branches of the *tograk* lay strewn around. The wooded banks are only slightly higher than the river-bed, and in the summer-time the water is said to extend far into the forest. The two rivers are chiefly different in this respect: the bed of the Yarkand Daria, as far as the junction with the Kashgar Daria, is sharply marked, and has the form of a deep channel; while the Khotan Daria's bed is shallow and wide, and can only be clearly distinguished when passing through the woodlands. The former river carries enormous quantities of water, and has consequently much more power, falling at a greater angle than the Khotan Daria, whose slowly running water naturally has less strength to make sufficient impression. The Khotan Daria also runs through the most difficult parts of the desert, where all the sand which is flying round increases the size of the bed. As the mounds chiefly move south-westward, and more and more fill the Takla-makan, it is also very likely that they are contributing their share towards forcing the river eastward.

From Yarkand to Terek-lenger there are many towns; between Lailik and Maralbashi there are only "otangs" (postal stations), consisting of a few houses and a Chinese postmaster. The high-road runs along the left bank of the river, and consequently this side is the most important. On the right bank lay only the district of Merket, a highly

cultivated piece of land with many houses. This partiality on the part of the people in building towns is certainly not casual, but may be attributed to the fact that the river is moving eastward. The towns on the left-hand side are also situated at a considerable distance from the river. Round the Khotan Daria there are only a few towns in the neighbourhood of Khotan, but not a single house to be found along the river-side. The few people who live here are mostly shepherds, who look after the cows, sheep, and goats belonging to the so-called "bayer" (rich people and merchants) in Khotan. We met a few of these shepherds about a day's march to the north of the point where we found the river, after coming out of the desert. On account of their trade, these people lead a complete nomadic life. They sleep where they find a chance, in the open air or in small huts built of branches and bushes. There are no cornfields along the river, and no Chinese mail is carried this way. Once in a while caravans travel between Khotan and Aksu-Kuchar. From the southern part of Khotan they carry dried grapes, apricots, and other kinds of fruit; also cotton and pats. They return with horses, mules, and Russian groceries. The communication is generally kept up by the aid of mules; I very seldom saw horses and camels used. The tradesmen had to provide themselves with food for the whole voyage, which takes from eighteen to twenty days. The traffic on this road is, however, merely of a local character. The trade of India, Russia, and China goes a different way, and does not touch this part.

A few words to explain the maps.

(1) Shows our march between the two rivers; scale 1 : 1,000,000. I am sorry to say that my astronomical daybook had already been sent home, and I cannot, therefore, make use of any of the five fixed points. I did not take any astronomical observations during the whole latter half of my voyage, because I had to use all my strength to save my life. Next winter, when I return to the Khotan Daria, I intend to take a few observations along the river, particularly at Masar Tagh, and, if possible, at Buksem. The maps are consequently based upon topographical material only. I used the compass from sixty to seventy times a day, which shows how the sand compelled us to walk in constant turns. In order to determine the distance, I measured every morning from a certain point 440 yards; then I noted how many minutes and seconds it took the camels to cover this distance. Every time I took a sounding I noted down the exact time. In the same way I continued during the seven days I walked, after the caravan had been destroyed. Having no astronomical observations to go by, it is probable that I shall have to revise these maps after my return to my native country.

(2) Shows the march between camps 11 and 12, a distance of 2·35 kilometers, scale 1 : 10,000.

I kept a meteorological daybook from April 10, when we left

Merket, and up to May 1, when everything had to be abandoned; consequently, there are no observations taken during the last four days' march. I always took my observations three times a day (7 a.m., 1 p.m., and 9 p.m.), this being the rule at the Russian weather bureau at Musgab, Margelan, Taschkent. To enable me to determine the absolute altitudes, I used a thermo-hypsometer and three aneroid barometers. This thermo-hypsometer, when tested in melting ice on February 19, 1895, showed a temperature of  $-0.1^{\circ}$ . My readings will therefore have to be reduced by one-tenth of a degree. On the same day the readings from Petrovsky's mercury barometer were—

Fuess, 932 = 649.9 mm.; temperature of instruments,  $14.7^{\circ}$ .

„ 764 = 648.0 „ „ „ „ „  $16.1^{\circ}$ .

The readings from his aneroid barometers (Negretti and Zambra) were—

10,843 = 650.0 mm.

10,004 = 646.5 „

The readings from my own three French aneroid barometers were—

(1) 638.0 mm.; temperature of instruments,  $13.6^{\circ}$ , and  $19^{\circ}$  in the air.

(2) 647.9 „

(3) 646.0 ..

## THE SEYCHELLES.\*

By Dr. A. BRAUER.

PRIVAT-DOCENT Dr. A. Brauer has recently spent a year in the Seychelles for zoological and geological researches, with the view of ascertaining the true zoo-geographical position of the group. With the assistance of the English government officials, Dr. Brauer was able to make a thorough examination of not only the chief island, Mahé, but of the more important of the smaller islands. The Seychelles, which lie between  $8^{\circ} 33'$  and  $5^{\circ} 35'$  S. lat., and  $55^{\circ} 16'$  and  $56^{\circ} 10'$  E. long., cover an area of about 102 English square miles, and include about eighty islands, only about eighteen being inhabited. The largest are Mahé, Praslin, Silhouette, La Digne, Curieuse, St. Anne, Frigate. The Seychelles, strictly so called, rise from a submarine bank covered by 10 to 40 fathoms of water, the depth increasing suddenly towards the Amirante islands to between 1500 and 2000 fathoms. In contrast to Mauritius and Réunion, which are of volcanic origin, and to the Chagos Archipelago further north, as well as the Amirante, Aldabra, and other small groups to the southward

\* Abstract of paper read at the Berlin Geographical Society, June 16, 1896.