

by some superior race possessing an intelligence which is simply marvellous.

The lecturer, by means of plans and sections of four distinct ruins, showed the methods adopted by the ancients for fixing times and seasons; and later, by means of a large number of magnificent photographic views thrown on the screen, conducted the audience on a tour of the Great Zimbabwe ruins, pointing out features of ancient architecture, and explaining many matters of great interest, including the numerous prehistoric relics discovered by him during his recent explorations at these important ruins.

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Before the paper, the PRESIDENT said: It is now upwards of fifteen years ago since our lost friend Theodore Bent read us a paper on the interesting subject which will occupy us this evening. I have great pleasure in introducing Mr. Hall to the meeting, who has devoted many years to these researches, and will give us, I am sure, a most interesting account of them. I will now call on Mr. Hall to read his paper on "The Great Zimbabwe and other Ancient Ruins in Rhodesia."

After the paper, the PRESIDENT said: I am afraid it is too late in the evening for us to enter into a discussion, but I am sure it has been a great satisfaction to all of us to hear from Mr. Hall how accurate and how useful have been the labours of our old friend Theodore Bent. Of course, as we have seen and heard to-day, Mr. Hall has done much more, having been many more years at work, and I think what has struck me most, and probably has struck the meeting, is how history may be written without any books. By a careful and accomplished investigator, like Mr. Hall, we are informed simply by the studies of these ruins how in most ancient times a colony from Asia established itself in the centre of Africa, and how a great oceanic trade was continued for several centuries. We have been able from these ruins to learn the method of building of these colonists, their style of art and of ornamentation, their system of drainage, their system of constructing aqueducts, the character of their religious rites, and even the age in which they were established, the chronology, and the fact that they departed suddenly—all this we learn, not from any books, but from the studies of ruins by an able man like Mr. Hall. You will all wish to pass a very cordial vote of thanks to him for the way in which he has explained to us the history and the story of these ruins by his illustrations and by his very lucid account of them. I have much pleasure in proposing a hearty vote of thanks to Mr. Hall for his interesting paper.

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### EXPLORATION OF WESTERN TIBET AND RUDOK.\*

UNDERTAKEN BY CAPTAIN RAWLING AND LIEUT. HARGREAVES, OF THE  
SOMERSET LIGHT INFANTRY, IN 1903.

By Captain C. G. RAWLING.

THE expedition into Western Tibet, undertaken by Lieut. Hargreaves and myself during the summer of 1903, had for its chief object the extension of Captain Deasy's survey made in that direction in 1896.

Every assistance was given us by Colonel St. G. Gore, Surveyor-

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\* Map, p. 480.

General of India, including the loan of all necessary instruments. A sub-surveyor, Ram Singh by name, was also lent to the expedition, and proved himself a clever and painstaking draughtsman.

Leh, the chief town of Ladak, formed the base from which the expedition set out, and here the caravan men were engaged, and the ponies, to the number of forty-three, bought. Over sixty yak were hired from the town of Tankse, for the purpose of carrying grain for the ponies. The expedition consisted of Lieut. Hargreaves and myself; Babu Ram Singh, sub-surveyor; Abdal Khalik, the caravan bashi (a well-known man who had been formerly employed by Captains Bower and Deasy); four Kashmiris, six Argoons, and seven Ladakis.

On June 3 the expedition left Phobiang, the most easterly inhabited spot in Kashmir territory, following the usual route taken by former travellers, over the Marsi-mik La into the Changchenmo valley, and from there over the Lanak La into Tibet. From the eastern side of the pass we descended into the Sumjiling plain, which Captains Bower, Deasy, and Wellby had also traversed, and marched along it in an easterly direction to the large fresh-water lake of Arport Tso. This part of the route is already well known.

The hired yak, being slow movers, were directed to follow us to this lake, and here Lieut. Hargreaves remained some days, in order to bring on the expected grain.

In the mean time I set out in a south-easterly direction on a route lying at first to the south, and then to the north, of that taken by Captain Bower in 1890. I then turned due north, and struck into Captain Deasy's track at Antelope plain, the furthest point east reached by him. Here Lieut. Hargreaves and I had arranged to meet, but on the second day after reaching the place, messengers arrived from him with the information that twenty out of twenty-five of his ponies had been killed by a blizzard, which had raged for four days. They also stated that he had attempted to reach our pre-arranged meeting-place, but that at Yeshil Kul the five remaining animals had broken down, and that he was now encamped at that lake, unable to move backwards or forwards.

On hearing this news I hastened to join him, travelling by the route which Deasy had followed, and found him encamped on the shores of this lake. The reason for his being left in this plight proved to be that the hired yak-drivers, whom we had trusted to follow us, had thrown away their loads of grain, and had deserted with their yak, not one having arrived at Arport Tso as agreed upon.

Previous to this meeting, however, my party had explored a district unknown to the European. After moving south for 4 miles along the western shore of Arport Tso, the road led up a narrow arm of the plain into the heart of the Arport Tso mountains. These mountains are conspicuous by reason of the contrast of colour; they resemble piles

of coal-black stones, and are covered by a field of snow, from which glaciers pour down each valley, the contrast being very conspicuous and picturesque.

A moderately easy gradient leads up to the Lungnak La, 18,650 feet. On the summit of this pass, extending for a distance of 3 miles, is a level stretch, the soil of which is composed of partly disintegrated granite, and infiltrated with water. The descent on the far side is easy, and leads into an immense plain lying north and south. Crossing this plain from west to east, one short march further on, the road turns south to the shores of Shemen Tso. This lake, which is over 100 square miles in extent, is bitterly salt, and in shape very irregular, with numerous rocky promontories running into it from east and west. At some former date it evidently occupied a much greater area. The shores slope gradually, and are covered with grass. The northern shores and neighbouring valleys are frequented by enormous numbers of wild yak, antelope, gazelle, and kiang. To the east and south the hills are of a light colour and barren, while to the north and west they are dark and fertile. But one stream runs into the lake, and that from the east. About half a mile from the shores of the lake, at a spot where the camp was pitched, an area of about 5 acres in extent was covered with ice, over which lay a thick layer of loam, upon which grass grew luxuriantly. At various spots on the surface the ice had melted to a certain depth, forming holes, some of which were full of fresh water. In the others, which were dry, wolves had taken up their abode, and had lain in wait for antelope coming to feed or drink, as was evidenced from the fact that in and around these lairs the remains of dead wolves and of their victims lay in large quantities.

Our road had brought us out at the north end of the lake, from which point the caravan struck east across a ridge of mountains into a plain, to which was given the name of Kiang plain, on account of the immense herds of these animals to be found there. To the north and east of the plain lie the Largot Kangri and Aru Tso ranges. Of these two magnificent ranges of snow-clad mountains, the Largot Kangri runs roughly east and west; and from the east end of that range the Aru Tso mountains run south.

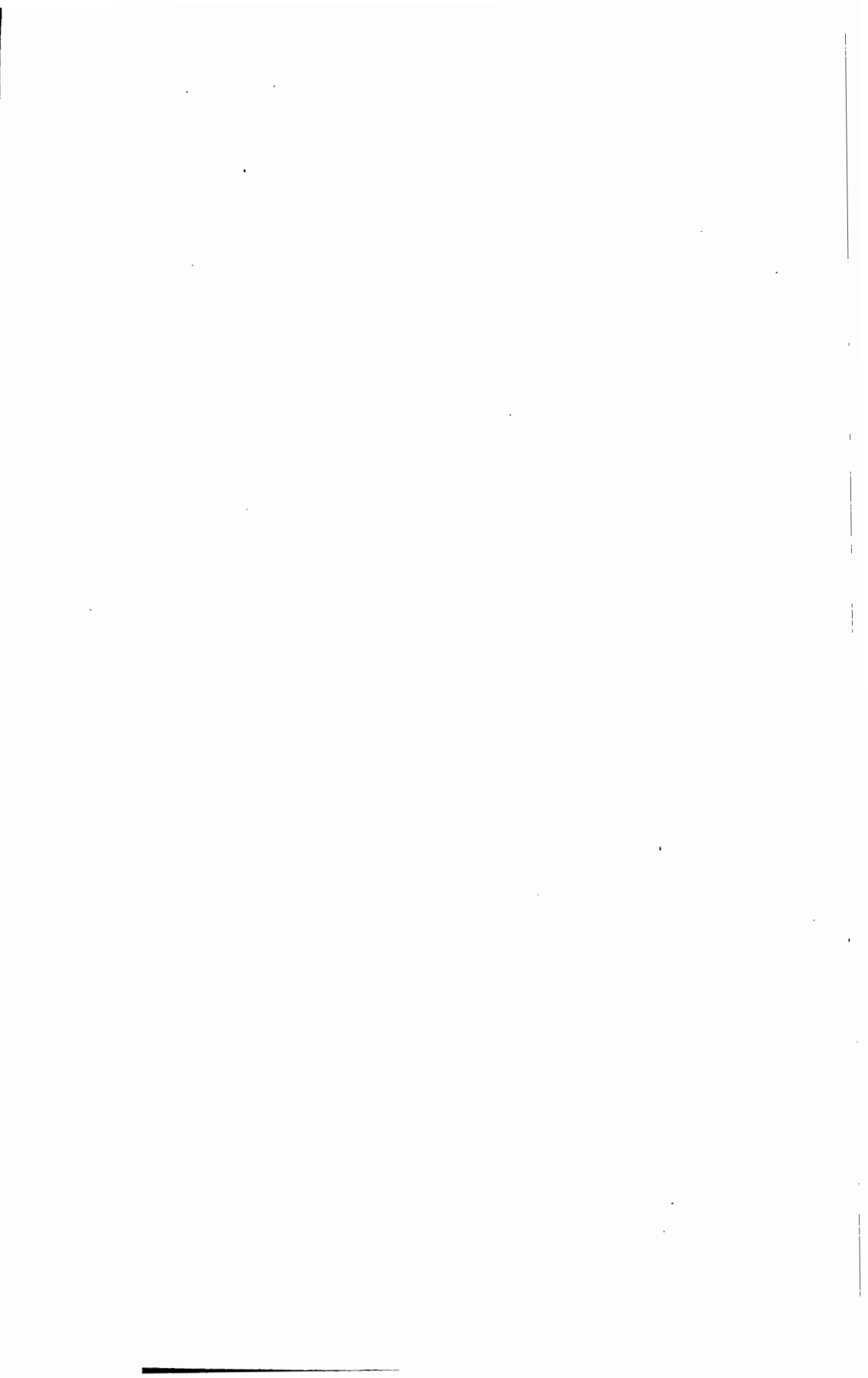
Our road took us into the angle between the two, where, on one of the lower spurs, we encountered a family of Tibetan nomads. These people were here for the purpose of hunting, and obtained their living by drying the flesh of the animals slain and selling it in the villages to the south. After spending a night in their neighbourhood, we, the next morning, marched north-east, and, crossing a snow-clad ridge, entered the upper end of a narrow valley, down which ran a small mountain stream. As we travelled down the valley the rivulet grew rapidly into a rushing torrent; the rocky mountain closed in on either hand; marching became more and more difficult, until late in the



KIANG PLAIN.



ALUNG, KANGU RANGE IN THE DISTANCE, 24,000 FEET HIGH.

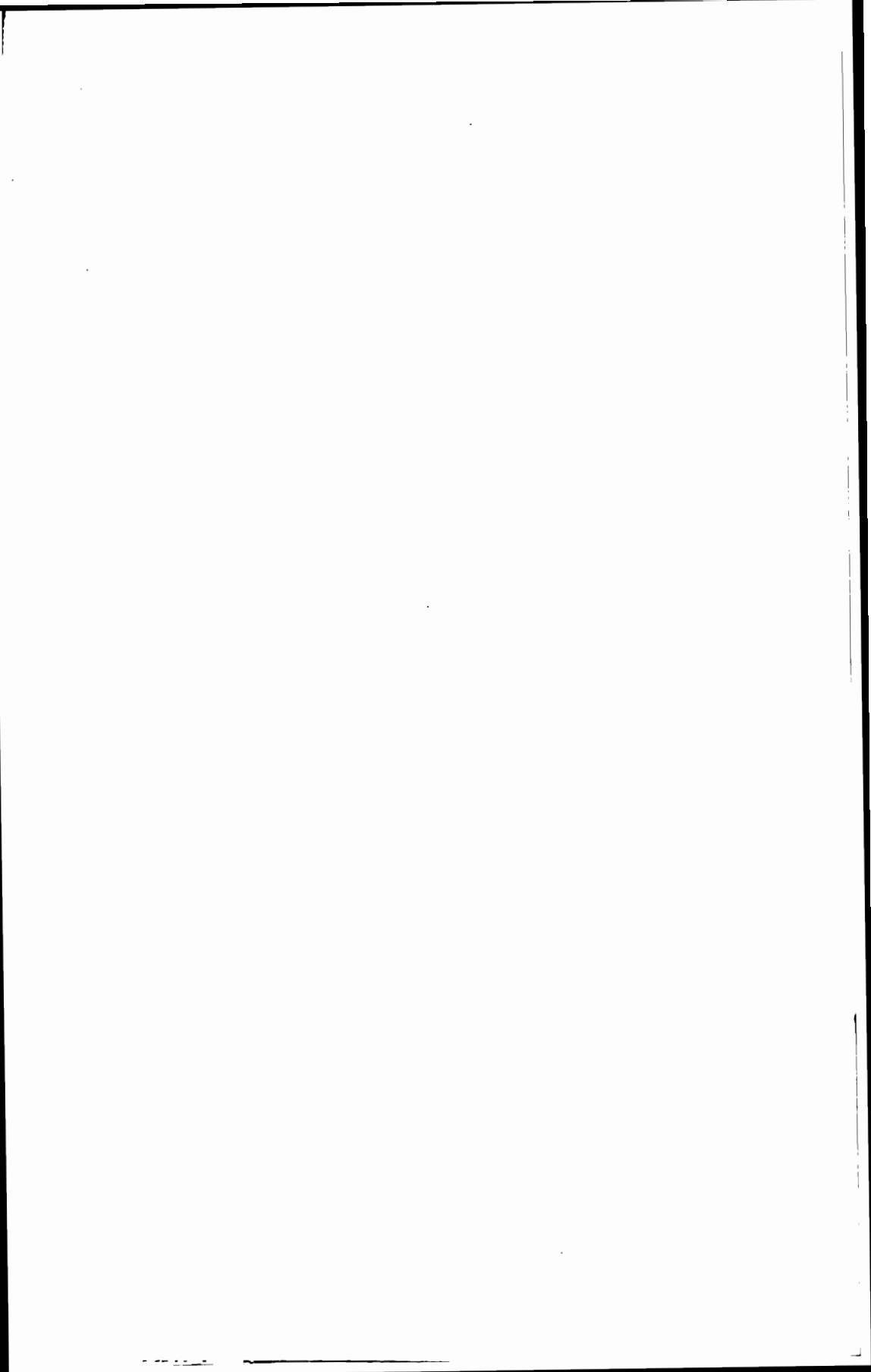




WESTERN TIBET SCENERY.



ARPORT TSO.



afternoon we reached the brink of a waterfall 15 feet high, that barred all further progress. On either hand rose enormous precipices, and it became evident that it would be necessary to retrace our steps for a considerable distance before a way of escape could be found. The caravan had hardly covered one mile on the return journey before darkness came on, and the camp was pitched in a narrow barren ravine on the right bank of the stream. On the very brink of the waterfall which had barred our progress, above what appeared to be the highest limit of the rise of the stream, were found the bones of two ponies, and at the foot of the waterfall were lying the skeletons of two others. The surprising thing about these skeletons was that each of them still had on its hoofs shoes of a pattern common in India, but quite distinct from the type used in Tibet. No remains of harness or equipment could be seen, and how these animals came here is still an unsolved problem. A fresh attempt was made at daybreak to escape from the trap we had walked into. The caravan continued up the nullah where we had camped for the night, and entered a promising valley with a considerable stream running in the required direction. The spirits of all rose at the prospect of once more reaching the open plain. One mile further on we entered a gorge similar to the one which had barred our route the previous day. The route, half an hour's weary travel, was found to be absolutely impossible for man or beast. Great ridges of limestone lying at an angle of 45° rose on either hand, while the bed of the stream was filled with immense boulders of concrete. The track of a wild yak was observed, skirting along the mountain-side, and, though hazardous, we determined to make every endeavour to follow this path and to avoid any more *détours*.

Half an hour's severe struggle, and the ponies reached a narrow ledge of shale. The path was all but impracticable, lying as it did in and out of ravines, round precipices, up and down slippery slopes of rock, and over great boulders. However, caught like rats in a trap, we were ready to welcome any chance of escape. Loads were removed dozens of times, ponies were pushed and pulled up places nothing would have tempted them to try by themselves, and the baggage was carried on the backs of the willing drivers. Fortune favoured us, for though many animals fell, but one was lost.

At six in the evening the tired men and animals reached the plain of Memar Chaka, the march of 3 miles having taken twelve hours to accomplish. Snow had fallen daily since we had left Arport Tso, and this had added much to the difficulty of crossing the range.

Memar Chaka, the bitterly salt lake which we had now reached, has an area of about 50 square miles. The plain all around has a width of about 5 miles, the soil being rich and fruitful. Signs were plainly visible of the lake having been at some remote period about 80 feet higher than its present level. But few animals and birds were to be seen.



The country to the east changed considerably in character as compared with that which we had just left behind us, for now low rolling hills took the place of the former rugged precipitous ranges.

Entering these hills, we met more nomads, who called their valley by the name of Pallo Letok, and who said that they were the first arrivals of the year from Lhasa, and had come for the purpose of digging for gold. Many men, they declared, were already at work in the neighbouring nullahs. The valley in which these people were found was filled from end to end with old diggings, most of which, however, were carried to a depth of only a few feet. It was evident that the spot was rich in the precious mineral, but no information as to the amount of gold to be found could be obtained from our Tibetan friends.

Beyond this undulating range of hills lay a lake entirely frozen over, and having an area of nearly 20 square miles. As the nomads appeared ignorant as to its existence, it was named after the late Surveyor-General of India and called Gore Tso. Round its shores, piled into great ridges, lay a snow-white mass of carbonate of soda and sulphate of magnesia. The outline of the lake was regular, and the shores flat, no vegetation growing within half a mile of the water. On these shores, otherwise destitute of game, I shot a splendid antelope with 27 $\frac{1}{4}$ -inch horns. Leaving the lake behind and continuing to travel to the east, we found that though grass was plentiful, yet that game remained scarce.

One march further on another salt lake similar in size to Gore Tso was seen, and then we arrived at an unoccupied goldfield, the entire valley for miles being a mass of pits and piles of rubbish. In all probability this field had been worked during the previous year, for the water runs and dams were clear and sharp. From this goldfield we entered an immense plain, along the skirts of which the caravan travelled. Deasy group lay directly to our north, a mighty mass of rock and snow rising to a height of well over 21,000 feet. The passage of this range was one of great toil and privation, two ponies succumbing on the road. The crossing took two days, Antelope plain being reached on July 9.

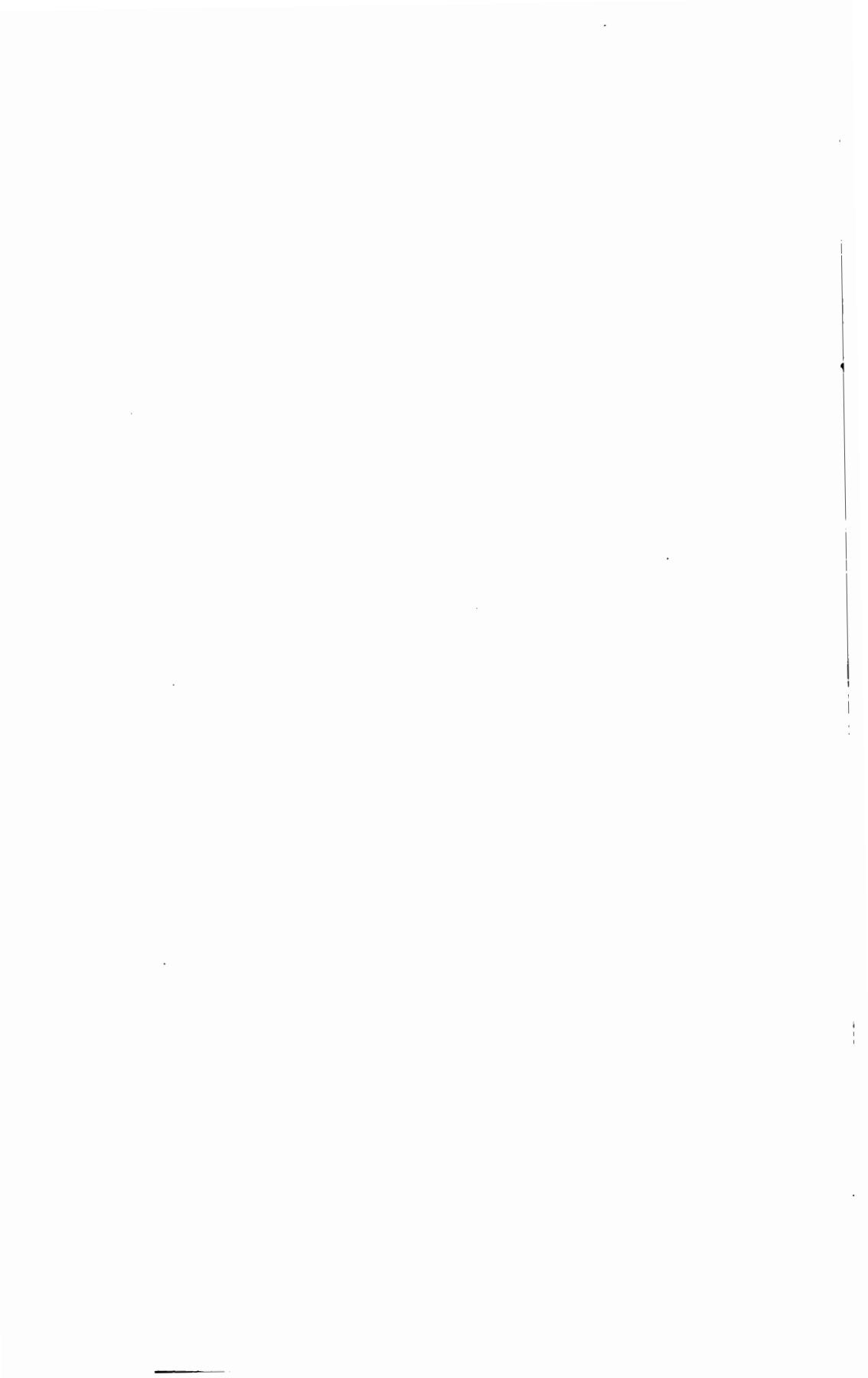
During the march it was found necessary to climb a peak of Deasy group 20,000 feet in height, in order to find a practicable road. From the summit a glorious panorama was visible. To the north, distant about 60 miles and stretching to the east as far as the eye could see, lay the mighty Kwen Luns, an endless range of snow. At a distance of perhaps 150 miles rose a snow mountain of regular outline, overtopping the remainder by thousands of feet. This great peak we were unfortunately unable to fix, as it was never seen again. To the east and north-east appeared an endless barren plain, while to the south-east and south rose ridge beyond ridge of rugged ranges with open plains between.



LOOKING NORTH FROM DEASY GROUP.



BEACH-MARKS FORMED BY RECEDING WATER.



To the west and close at hand lay a glittering snowfield—truly a glorious scene.

The day after reaching Antelope plain, search parties were sent out to find Hargreaves' camp, with the result that two of his men were encountered. On hearing the bad news about the straits into which Hargreaves' party had fallen, an immediate return to render him assistance was decided upon. The road followed when rejoining this party was that taken by Captain Deasy in 1897, and as this route is known, nothing need be said about it, except that it passes through an arid salt and barren country.

Hargreaves, his party, and the remnants of his caravan were found and brought to a camp, where, in 1900, Captain Deasy, being unable to proceed on his intended journey across Tibet, had buried many pony-loads of stores. Two of our men, sub-surveyor Ram Singh and Soonam Tsering, had been members of his expedition, and knew the exact position of the hidden treasure, for such it was in the circumstances. This was now dug up, and was found on the whole to be in excellent condition. The waterproof sheeting with which the stores were covered had deteriorated, and water had recently soaked through it, partially ruining the Indian corn; nevertheless, much valuable grain in good condition was dug up, and on this the famished ponies were at once fed. Other valuable goods were also found, such as pony-shoes, rice, spices, and flour.

At this camp, which was in a sheltered ravine a few miles to the east of Yeshil Kul, we halted for ten days. During this period ten of the stronger ponies had been sent back to bring on the stores left behind by Hargreaves, while Ram Singh made a journey into the Kwen Lun mountains and along their southern slopes.

While waiting at this camp the country round about was well explored. Game was scarce, but sufficient antelope were found for the requirements of the camp. Borax was found in large quantities close to the tents. The surrounding country was impregnated with carbonate of soda and salt to such an extent that some of the streams were undrinkable. All of us suffered considerably from drinking the water which flowed past the camp, and it was not until a well had been sunk and fair water obtained that the ill effects left us.

On July 24 the ponies returned laden with stores; quite half of these goods we were unable to take on with us, valuable as they were, and so they were buried with Deasy's remaining stores in the old hiding-place. In this hole, and well covered in now, lie seven yalldan of tinned food, besides maunds of flour, rice, etc. I shall be very pleased to give an exact description of the place to any one who may be desirous of visiting this region at a later date.

On July 26 the whole caravan, with the exception of Ram Singh and his party, arrived at the standing camp on Antelope plain, which

was found just as it had been left. Here it became necessary to bury more stores, for tents and instruments had to be carried on, and at this point Ram Singh rejoined us, having done excellent work in the Kwen Luns. For the first few days after leaving us he had found water and grass in goodly quantities, but the face of the country gradually changed, until at last he was forced to return to us, as the ponies were unable to obtain any nourishment on the stony hillsides.

The weather had of late been very hot, on one day the thermometer having registered 70° Fahr. in the shade. Thunderstorms rolled across the plains daily, either rolling up from the west or forming on Deasy group, and generally accompanied with snow.

Fortune now smiled on our efforts to penetrate into the unknown regions to the east, for that which most affected us, namely, grass, sprang up like magic. Three varieties of grass only did we find. The coarsest had a sharp point to each blade, and contained comparatively little nourishment, while the finest was found growing usually in rings round the old root, and extremely rich in nutriment. The ponies, as a result of this good feeding, quickly improved in condition, no others dying during the next six weeks. This was fortunate, for their numbers were now reduced to twenty-four.

With every man and animal laden to the utmost, we left Antelope plain on July 27. When first sighting Antelope plain on July 9, not an antelope was then in sight. On July 27 small herds of from ten to twenty were seen tearing across the plain, coming from the north-east, though never more than one hundred were visible at one time. We naturally thought Captain Deasy must have exaggerated when he said that he had seen them in their thousands. However, one march further on, on climbing a ridge to the north of the camp, a marvellous spectacle met our view. As far as the eye could reach to the north and east, and up to our very feet, were tens of thousands of doe antelope and their young. All had their heads turned towards the north-west, and the animals were steadily trekking in that direction. The glasses only revealed fresh numbers arriving on the distant horizon. Many young ones of only a few days old were resting, but they were not allowed to do so for long, for their mothers continually urged them on. They moved either at a hurried walk or gallop. Where had they all come from, and where were they going to? Probably from some safe and now barren breeding-ground to pastures new in the west, where the young grass was growing rapidly. It was a beautiful sight.

Five marches to the east triangulation was commenced in full view of Deasy group and of the well-known peaks of the Kwen Luns. A good base of 1100 feet was measured, and from this one base the whole of the triangulation was done.

We were now camped on a great rolling grassy plain, but vegetation ceased 5 miles to the north of the camp. A rocky ridge running east

and west lay to the south of us, the Kwen Luns to the north, and Deasy group to the west. From this last group of mountains thunderstorms rolled up in rapid succession. These storms were accompanied by hail and snow and terrible squalls of wind, which at times swept us from our feet and lowered the tents to the ground. Theodolite work was carried on with the greatest difficulty; but after a four days' halt the caravan again moved on.

On August 6 we reached the shores of Lake Markham (named after our President), the first view of which I had obtained on July 9 from Deasy group. Lying roughly north-east and south-west, Lake Markham has a length of about 17 miles, a width of from 4 to 5 miles, and an area of 70 square miles. It is regular in shape, and is bounded on the north by low rolling hills, and on the south by a rugged ridge. Its shores are composed of sand and shingle, and its banks shelve slowly. On its waters and along its shores breed in large numbers the Brahmini duck. No fish or shrimps were seen. A river with a strong current runs by many channels into the lake from the west. The water of the lake at its western end is fresh, but as one travels towards the east the water becomes more and more impregnated with salt, until at its eastern end it becomes undrinkable. At the time of our visiting Lake Markham there was no overflow, the surplus water being apparently absorbed by the soil, or lost by evaporation. There is, however, a narrow channel at the eastern extremity, which at this date was very dry, but which bore evidence that at some season of the year the water escapes by this channel and drains into the low-lying ground to the north, which is white with salt.

Leaving Lake Markham behind and travelling due east, we passed over the northern end of a rocky range running north and south. This range was ended by a fine mountain, from the summit of which triangulation work was carried out, a splendid view of the whole country around being obtained. Though the weather continued stormy, and many peaks were hidden by banks of clouds, yet most of the Kwen Luans could be clearly seen, still covered by a field of snow, and giving origin to numerous glaciers, which filled up and occupied the gaps between the more precipitous hills. The country to the north and east appeared a barren waste. To the east the desert plain stretched for 50 miles, only broken by scattered salt lakes and pans, and by rocky knolls and pinnacles rising abruptly here and there. Beyond this again rose low-lying ranges and rolling hills. All around appeared dead; no fresh water, no vegetation, and no animal life—a veritable Dante's Inferno. As the country could be so clearly seen and easily mapped, it only seemed waste of valuable time to continue our march eastward, so our direction was altered to the south.

The ranges here ran north and south, the valleys between being full of low undulating grass-covered hills. The mountains are composed

of limestone, which was much disintegrated. In the valleys deserted gold-diggings were continually seen. None of these were occupied at this time, but several showed by their fresh-water dams that they had been worked quite recently. Wooden bowls for washing gold, bits of cloth, etc., were also found on the deserted camping-grounds.

As we moved south the altitude lessened, the country improved in character, and game again became more plentiful and of greater variety. Yak, antelope, hares, wolves, marmots, ramchickor, and sand-grouse were seen daily. This change was partly accounted for by the marked increase in the number of small streams running from all the mountain-sides. These streams were not only appreciated by the wild animals, but were also welcomed by us, for during the last three weeks it had been necessary for us to dig daily for our water in the beds of the ravines. Generally speaking, we were successful in obtaining water within a few feet of the surface; at other times, however, only a muddy trickle would appear after an hour's steady work; while again, though never for more than two days in succession, our efforts were all in vain, and man and beast slept waterless.

On August 20 the direction was again changed, this time towards the south-west, the caravan following the line of least resistance. The country to the south-east consisted of great salt plains and jagged ranges. In the centre of these plains lay salt lakes, all of which had the appearance of rapid diminution in size. In some places, in fact, only salt pans remained. The low-lying land for several miles round the lakes was void of vegetation, but on the highlands grass grew luxuriantly and game was plentiful.

Three marches further on the caravan arrived on the shores of Huping Tso, a fine sheet of fresh water almost divided into two by a rocky peninsula. The shore on three sides was flat and boggy, while to the south it was bounded by a rocky range, down whose precipitous sides many small streams added their quota to the volume of water. The lake, however, was mainly fed from the distant mountains to the north, upon whose summits snow still lay. The water was absolutely fresh; nevertheless, no wildfowl were to be seen. In the lake weeds and shrimps abounded, but we were unable to see any signs of fish. A broad and sluggish river, flowing from the western end, carried off the superfluous water, which finally drained into the low ground and salt lakes to the south.

Two marches beyond Huping Tso, within sight of the fixed peaks of the Aru Tso mountains, triangulation was brought to a close. At every mountain-top from which theodolite work had been carried out a large cairn of stones was erected, and this, without doubt, conduced largely to the accuracy of the survey. From this point onwards fixed peaks were always in sight, in consequence of which plane-table work was continued uninterruptedly, until the village of

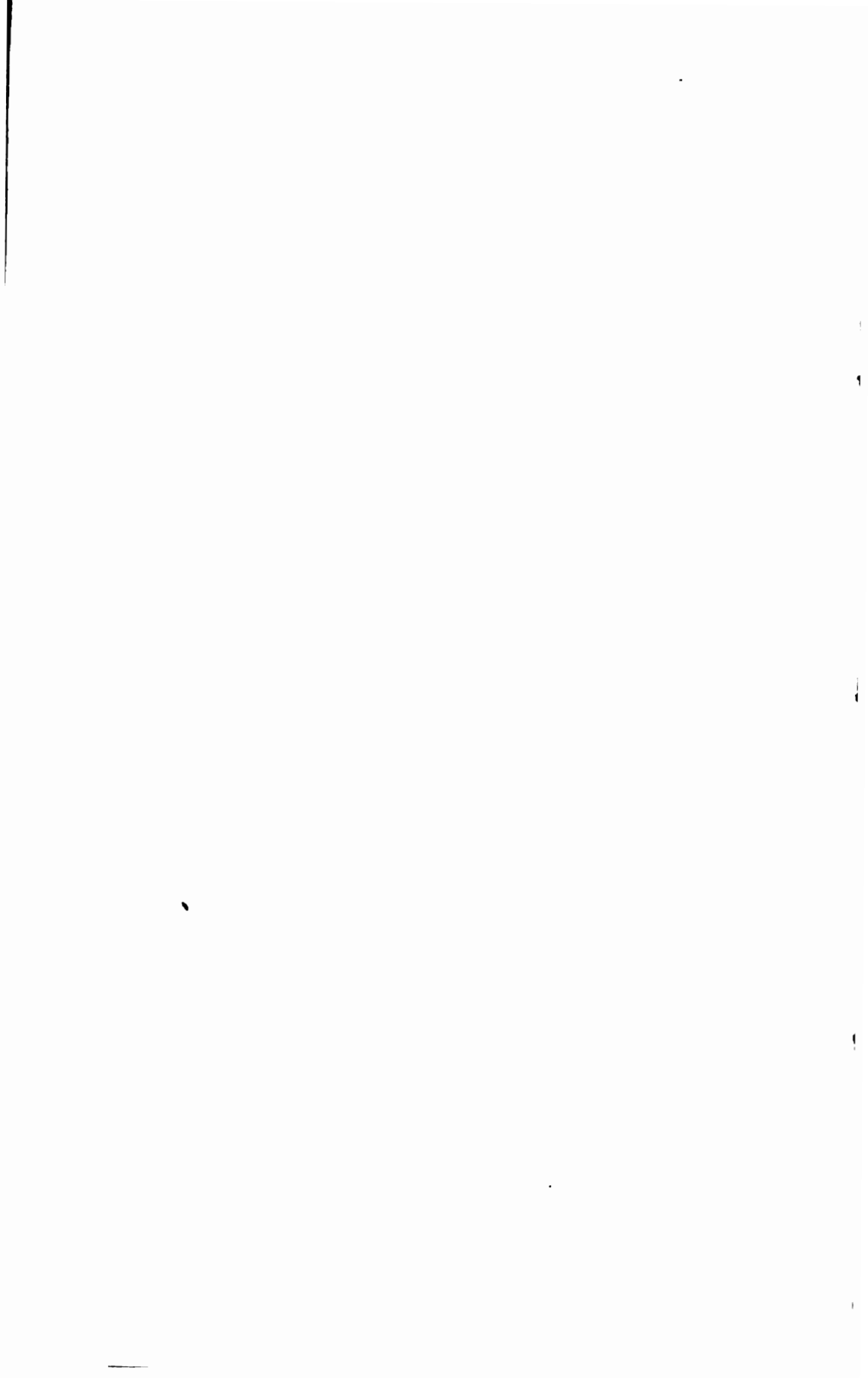


HUPING TSO.



SHEMAI TSO.





Noh, on the Tso me Gualari, was reached. During the month of September the sky remained free from clouds, and the annoying wind ceased to blow. In consequence of this, and as there was now no necessity for ascending the highest peaks, the length of the marches was increased. The direction of our route was still west. Before reaching the lake of Aru Tso, the caravan passed many salt ponds, and finally one small but bitterly salt lake. This lake formed the last vestige of what in olden times was a vast sheet of water, and it had without doubt been connected with Memar Chaka and Aru Tso. The old shores could be distinctly seen high up the mountain-sides. This lake must formerly have had an extent of over 70 square miles. A strong fresh-water stream runs into this salt pond from the south-west. On the banks of this stream the grass grew luxuriantly, and amid this moved great herds of antelope and gazelle.

Aru Tso was reached on August 29. On the shores of the lake the caravan halted, and here a most interesting and also important fact was noticed—the waters were fresh. Captain Bower visited this lake in 1890, camped upon and moved along its shores, and writes, "Like most Tibetan lakes, it is, of course, salt." Captain Deasy reached Aru Tso in 1896, and his report on the water was that it was drinkable—a term which, when used in reference to Tibetan travel, means that the waters are decidedly saline or foul. And now on our journey in 1903, at the end of August, the water was found to be fresh, absolutely fresh, without the slightest trace of salt or disagreeable mineral in it. This is certainly worth recording, if only for the reason that, as this change has been shown to take place in one great lake of the Tibetan plateau, it is quite possible that at certain seasons or periods other lakes may become altered in character. It is to be hoped that in course of time Aru Tso will again be visited, and its water carefully tested.

The caravan passed round the southern end of Aru Tso, crossing an almost endless number of streams, all fordable, but treacherous on account of the quicksands. In the plain to the south and on the slopes of the hills, game was seen in great variety and numbers. Female and young *Ovis ammon*, bushel, antelope, gazelle, and yak were seen everywhere; the place is a veritable sportsman's paradise. The Aru Tso mountains run north and south for many miles, the western shores of the lake lying close to the foot of the range. These mountains are rugged and precipitous, and their summits are clothed in perpetual snow. The range would be impassable were it not for two cuttings opposite the southern shore of Aru Tso, where two streams have cut their way from the west right through the range. The passage through these openings is easy, as the beds of the streams are almost on a level with the waters of the lake. On debouching from these ravines, both of which were traversed, we met a family of nomads living as usual in coarse cloth yak-hair tents. With them were a herd

of about 1500 sheep and goats, and a few yak. From these people we hired a few of the latter to assist our ponies; but no supplies of food could be obtained, for, except animals, they had no visible food with them; in fact, their first request to us was to know if we had any suttoo to give them. The elder of the two men accompanied us as guide and yak-driver.

Reinforced by this welcome addition of transport, the caravan travelled through an open undulating valley, teeming with wild yak.

On the third day we unexpectedly came upon and halted close to an old Tibetan, who was, together with his son or grandson, living beneath an overhanging rock. These two proved a curious couple, for the old man must have been between sixty and seventy, and the child about five. They were not at all concerned at our sudden appearance, and, after salaaming, continued cooking their meal without more ado. Their repast consisted of wild ass flesh, upon which, together with tea, they declared they had been living for the last six weeks, during which time they had been digging for gold. A pile of earth lay some little way up the river awaiting, for the process of washing the arrival of the remaining members of the family. The child deserves notice if only for the Spartan manner of living. Though only five years of age, flesh formed his only article of diet. He was clothed in a short cotton shirt, which only descended to his thighs. Though the thermometer at night-time registered  $18^{\circ}$  of frost, yet, on rising the following morning at daybreak, this child was seen in these rags preparing his father's breakfast, and apparently quite insensible to the chilly atmosphere. On the caravan moving off, he refused a mount on a pony, and waded cheerfully through the river, breaking the ice at every step. We had now parted from our late guide, and were handed over to the tender mercies of the old man and his son. The former told us that he had heard early in the season that we were in Tibet; also that the Rudok officials had received full information of our intended journey. The Rudok army (?) had been sent out in all directions, with orders to find us and turn the caravan back. These people had all returned to their homes within a fortnight, after a fruitless search, with the report that we had gone into Chinese Turkestan. Our new guide, therefore, when he saw us, guessed at once that we were this very party, and decided that we had not come to rob him.

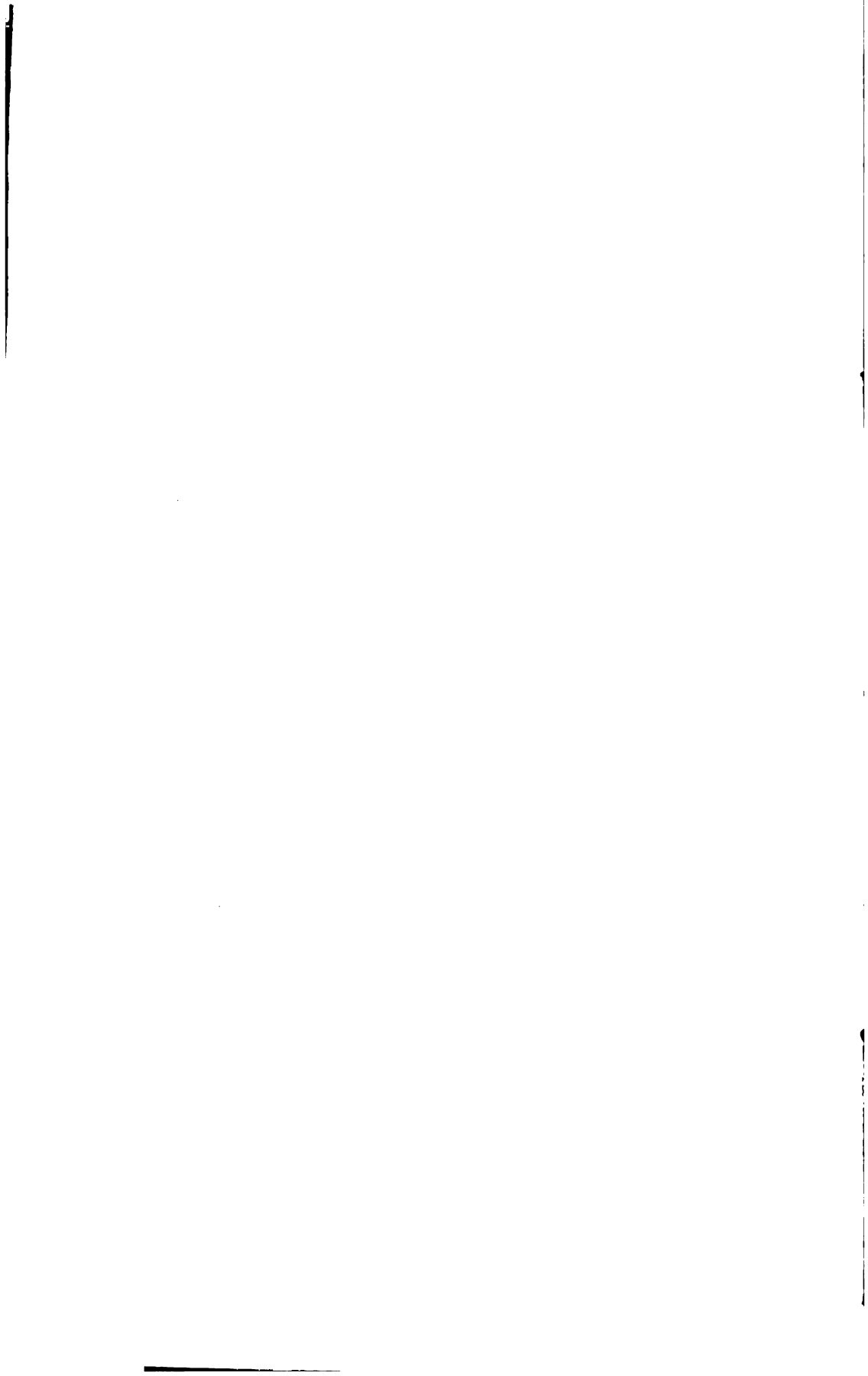
For two marches we bore south, traversing an extensive, stony, and almost waterless plain. The mountains on either hand were black in colour, those on the east being covered with snow, whilst immense herds of wild yak were to be seen grazing in all the valleys in this direction. At the south end of the plain, after an easy ascent and a sharp descent through a narrow gorge, the caravan debouched into a long narrow plain, which might almost be termed a valley. The soil of the pass over and through which we had passed was composed of



WILD YAK.



KHEO VALLEY ABOVE SOH VILLAGE.



sandstone, and appeared to be a home of the Tibetan sand-grouse. These birds were so ridiculously tame that even when fired into when on the ground they refused to fly, and continued waddling along quite unconcerned.

The valley we had now entered runs east and west, and deserves more than a passing notice, for it is well known to the Tibetans, and will become much frequented in years to come, since it forms one of the trade routes between Rudok and Lhasa. At its eastern end it is shut off by immense rocky mountains, black in colour, and covered by snow and immense glaciers. The whole northern side of the valley is bounded by a long range of low mountains of sandstone and shale, destitute of water, vegetation, and animal life. Ten miles from the eastern end of the valley the formation of the range bounding the southern side of the plain becomes similar to the northern. In the eastern plain itself and in the mountains near by grass grows luxuriantly, and here game abounds. Great numbers of old fireplaces proved what a favourite spot this is at some seasons of the year for nomads with their herds of sheep and goats. At the time of our visiting it (September 5) no Tibetans were to be seen, probably for the reason, as our guide informed us, that the shepherds were attending a festival near Rudok.

Travelling due west for three marches, the last two of which were along the banks of a fresh-water stream, we reached the shores of Bum Tso. Bum Tso has an area of about 5 square miles. It is a shallow lake, and is surrounded by flat muddy shores. The water is drinkable, but has a distinctly foul flavour. This without doubt results from there being no continuous overflow, though the lake is perpetually fed by the broad stream along which we had been previously travelling. In all probability Bum Tso overflows its banks at some season of the year; otherwise its waters would be salt. Geese, duck, and teal were seen on the water and on the shores in countless thousands, but, on account of the absence of cover and of the depth and softness of the mud, a near approach was found to be very difficult.

When we left this lake behind, a long and trying march carried us over an easy but barren and waterless pass to two fresh-water ponds, and close to a camp of three tents inhabited by Tibetans. Though much frightened at first, these people, nine in number, seeing that we were not a band of robbers, soon made friends, and brought us milk, fuel, etc. We were told by the oldest man that a famous goldfield lay distant 7 miles, on which five hundred labourers were employed. This place we determined to visit the next day for the purpose of obtaining provisions, for we were completely out of all food-stuffs with the exception of meat and tea.

Next morning, however, we were awakened early by an angry harangue outside our tents, and we soon learnt that forty Tibetans, armed with every imaginable weapon, from the gun to the bow and

arrow, had collected to bar our further progress. Persuasion and argument proving useless with them, we ordered the tents to be struck and the march to be resumed. This was apparently the last thing the Tibetans expected us to do, for they did nothing but converse amongst themselves, and, when we moved off, followed about half a mile in rear in a compact group. We advanced likewise in close formation, with the ponies kept well together in the centre. The enemy, however, was continually receiving reinforcements, for men appeared from all directions, springing out of nullahs as if by magic.

The numbers of our opponents soon swelled to between sixty and seventy, but though they closed round us, they could not make up their minds to attack until the arrival of a red lama. I must here mention that though some of our men were carrying carbines and guns, yet before leaving camp Lieut. Hargreaves and I had taken care that they had no ammunition with them, for we were determined that nothing would persuade us to fire unless we were actually fired upon by the Tibetans. This they seemed unwilling to do, but, urged on by the lama, they came to close quarters and tried to seize us. A running fight now ensued, not with guns, but with sticks, butts of rifles, hard knocks being given and returned. The noise was appalling, the Kashmiris, well in the centre and out of harm's way, shouting the loudest. The scrimmage was brought to an end by the Tibetans one and all suddenly dropping their guns and rushing in upon us. We were completely outnumbered, and so were soon in a powerless position, being held firmly by arms and legs. We then smiled upon our enemies and patted them on their backs, a thing which much astonished them and caused them to release us. The ponies, who had stampeded at the noise, and many of whom had fallen and were struggling on the ground beneath their loads, were then collected, and a pow-wow took place. No result was arrived at as to which direction we should proceed, but after two hours' talking it was arranged that we should return to our late camp, and there await the arrival of the headman of the district (who was reported to be on his way), while in their turn the Tibetans agreed to bring us the articles of food we were most in need of.

During the night fresh comers were continually arriving, and with them came the headman. We demanded an apology for having been insulted, and when this had been freely given, the chiefmen were brought into our tent, and the argument began afresh. As stores in the way of suttoo, sheep, ghoor, etc., had been brought during the night, the only thing we had to discuss was as to the route we were to follow. We insisted upon going straight to Rudok, and the Tibetans were determined that we should return by the way we had come. Finally, and after much talk, it was settled that we should move due north straight into the mountains, both parties having conceded an equal amount. We parted that day the best of friends, after having

obtained much valuable information, for they spoke freely on all subjects with the exception of the richness of the goldfields, about which we could learn nothing.

We now entered upon the hardest and most trying part of our journey. The country had originally been a plateau, but was now cut up by endless ravines with precipitous sides of sandstone, broken here and there by slopes of conglomerate. Mighty pinnacles rose in all directions, sometimes to a height of 200 feet or more. Water and vegetation were practically non-existent; nevertheless great herds of bushel were always in sight, living upon nothing so far as we could see. Men and ponies suffered much from the want of water, three of the latter succumbing during the first three days.

Survey work, however, was continued without a break, even under the watchful eyes of the old lama, who had insisted upon accompanying us, much against our wish. This lynx-eyed attendant failed, however, to keep up with Ram Singh and his pony when climbing hills, and we took care to load the riding-pony he had brought, in order to damp his ardour. Astronomical observations were taken nightly without hindrance. The Tibetans never objected to the use of the theodolite, though they showed great dislike to the plane-table. For the purpose of taking observations, we used a subterfuge as practised by Captain Bower in Western China. We showed them the instrument, and explained that it was used for saying our prayers with, and as such, when on its stand, was on no account to be approached by any Tibetans; also that such was its delicacy that not a word was to be said while it was in use. Though the theodolite was used often amongst a large collection of the natives, never once were we disturbed or questioned.

Crossing the dried-up bed of Tatar Tso, the caravan entered a practically waterless valley, bounded on either side by immense precipices, unclimbable by either man or animal. During the next five days we only discovered fresh water twice, whilst grass was conspicuous by its complete absence.

Tai Tso, a series of fresh and salt water pools, was reached on September 18. These ponds were reported by the lama, who had of late constituted himself our guide, to be bitterly salt. Being surrounded by mounds of snow-white chalk and sand having the appearance of salt, this statement at first sight appeared to be correct, but as the waters and shores were covered with geese and duck, we quickly proved that such was not the case. The shores for half a mile all around were entirely covered with the remains of ammonites and fresh-water molluscs. Weeds grew luxuriantly in the water, and amongst these weeds moved myriads of shrimps. All around were thousands of geese, pintails, pochards, and other ducks, while close by a woodcock and a snipe were bagged. A little further on, growing in the hollow of the valleys, were some dwarf shrubs, the first wood we had seen for over



four months. Here hares were met with in great numbers, forty-three being put up within ten minutes. One march beyond Tai Tso our troubles ceased, for we entered into a land of plenty on the banks of the Khio river. This beautiful river poured out from a valley to the east, through meadows of rich short grass. From 30 to 100 yards wide, with a current of 2 miles an hour, it steadily increased in size, being continually fed by springs rising on every side. The bed at times was stony and firm, at others muddy and treacherous, though everywhere weeds grew freely and trout moved fearlessly along.

On September 21 we met more nomads, tending large flocks of goats and sheep. As we very well knew that these people took the information of our approach to the people of Noh, we took the bull by the horns and sent a letter by our lama guide to the Zung of Rudok, with a request for provisions and transport. The following day we were met by a rather truculent band of Tibetans, led, as we afterwards found out, by the bully of the district. They again requested us to turn back, but this time we were determined to have our way, and consequently continued our journey the following day, passing close to, but not entering, the village of Noh, and camping on the banks of the river just beyond. Noh appeared to be a prosperous village containing a population of about five hundred, living in eighty houses substantially built of stone and bricks. There were two monasteries gaily bedecked with linen prayers, coloured rags, and bunches of shrubs. We here received a letter from the Zung of Rudok, saying that he had ordered supplies and transport to be given us. His men, with tsampa, grain, ghi, etc., were camped close at hand, and, I must say, made themselves quite agreeable. We obtained everything we required, though at exorbitant prices, and with the usual endless bargaining of the East.

Many Tibetans accompanied us for two marches to Pal, we will hope simply from friendly motives. The road was a good one and clearly defined; it lay along the shores of Tso Nyak and the twin lakes of Rum Tso. Exquisitely beautiful lakes they are, the water of crystal clearness, in which were myriads of shrimps darting amongst the weeds. The shores were sandy, and the banks firm. Wild rugged mountains rose all around, those beyond Rudok capped with snow. Game birds were plentiful, and the natives reported that the lakes were full of great trout. The Tso Mo Gualari consists of a string of five lakes 120 miles in length, the four most southern of which are fresh, and Pangong, the most northerly, salt. They are joined together by channels about 60 feet in width and 15 feet deep, the current running at nearly  $1\frac{1}{2}$  mile an hour. At Pal was another camp guard, placed there to prevent any one entering Rudok district from Ladak.

And now we entered known and accurately mapped districts. The country was barren and inhospitable, but we were again close to British territory, so difficulties and troubles were cheerfully overcome.

On October 3 we crossed the Kien La, 18,600 feet, then once again the Marsi mik La, and camped that night in Ladak. Tankse was reached three days afterwards, and Leh on October 12.

Altogether our travels carried us over 8000 miles of country, the greater part previously quite unknown to the European, while an area of 35,000 square miles was accurately surveyed.

The success of the expedition was mainly due to my staunch and cheery companion, Lieut. Hargreaves; to our ever-willing, hardy, happy-go-lucky Lavaki servants; and to Babu Ram Singh, the sub-surveyor, whose excellent work gained him the title of Rai Sahib.

To Colonel St. G. Gore, late Surveyor-General of India, to Mr. Eccles, of the Survey of India, and to Major Ray, Intelligence Branch, who most kindly gave us every assistance and advice, I take this opportunity of tendering our sincerest thanks.

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## PTOLEMY'S MAP OF ASIA MINOR: METHOD OF CONSTRUCTION.

By the Rev. H. S. CRONIN.

THE first condition of any study of Ptolemy's map is to disabuse our minds completely of the notion that we have in it a map which is accurate according to modern conceptions of accuracy, or which was constructed on modern lines. Such map-making, indeed, was beyond the means at Ptolemy's disposal—he had but few observations, none of those he had were strictly accurate, and he had no means of taking better ones. In any case, his map is not accurate. It is far too large. The distance from Issus to Rhodes should be 420 miles. Ptolemy makes it nearly 500. The distance from Rhodes to Chalcedon should be about 300 miles; he makes it over 400. Initial errors, so considerable as these, make themselves felt everywhere. They affect, for instance, the area; it is fully half the size again it ought to be. They affect the boundaries. Rhodes and Chalcedon being 100 miles too far apart, the whole western coast between the two has been pulled in towards the east. Ptolemy's western coast of the Troad is therefore about 70 miles from the line joining Rhodes and Chalcedon; it should be twice that distance. Again, this removal eastwards of the western coast has led to compression all along its course. Ptolemy's Cyzicus, for instance, is some 50 miles from his Nicæa—it should be 96 or 97—while the towns along the road which joins them are huddled together. Turning to the other boundaries, the northern is distorted, the southern is far too straight, and the eastern boundary for much of its course runs due north and south. In the interior of the map, places tend to move towards the centre. Compare, for instance, the positions of Laodicea, Antioch, and Amorium on Ptolemy's map and in reality.\* All this had to be to fill the map, and, without going into further details, we may note that the first principal and constant cause of Ptolemy's mistakes is this initial mistake, however he arrived at it, of making the area of Asia Minor so very much too big.

The second principal cause was the insufficiency and vagueness of the bulk of

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\* Cotisum is an exception only in appearance. It has moved south and east, but the western coast was also moving east.