

in the year. My whole 70 acres will thus tide 1300 sheep over the average annual period of drought. The capital value of my sheep is 9s. per head; thus 1300 sheep represent £582. What will it cost me to save 1300 sheep, value £582, which would otherwise be lost? I have my doubts about getting labour for the tropical west at coast or southern rates, and I must reckon up the capital value of reservoirs, etc., but say that my 420 tons of fodder cost me, as I believe is about the average on the coast, 25s. per ton, or £525; the difference between that and the £582 is very small."

With reference to the above, Mr. Cox writes—

In putting such words in the mouth of the cold-blooded squatter, I admit that every one of the figures I have supposed him to use may be erroneous, because I have little practical knowledge either of pastoral or agricultural pursuits. In many cases, however, I believe the squatter knows very little more about agriculture than I do, and no doubt he will seek expert advice on that subject from the farmer. Personally, I should be delighted if, when the two lay their heads together, they find some radical error in my *data*—much as, for instance, that eight crops of lucerne can be cut annually in place of four, or that the cost per ton will be only half what I have supposed, or that some other crop will be more profitable than lucerne. Nevertheless, I assume that the squatter, like the sensible man he is, will reason on such lines as I have indicated. If, with the help of the farmer, with co-operation, and perhaps with the assistance of the Government, he can see his way to make irrigation profitable, the whole country will benefit, and the full value, in place of an infinitesimal proportion, of the generous provision of nature will be realized. It is difficult to contemplate the present waste philosophically.

I am pleased to find that so high an authority as Dr. Jack confirms my opinion as to the capabilities of the present outflow of artesian water in Queensland, and that there is, in his opinion, a means of practical irrigation from that source.

	Gallons per diem.
The present outflow is	351,295,000
Allow for non-irrigable water 10 per cent.	
Allow for soakage and evaporation per diem } 20 per cent. 70,259,000	
10 per cent.	
Water used per diem by maximum number of sheep	
(year 1892)—22,000,000 sheep at two gallons each	
per diem	44,000,000
	114,259,000
	237,036,000

1 inch of rainfall gives 22,622 gallons per acre.

20 inches per annum (allowing four waterings of 5 inches each) gives 543,485 gallons per acre; and 237,036,000 gallons per day would irrigate 151,191 acres with 20 inches of bore water per annum, or would irrigate at the rate of nearly 300 acres at each of the 532 bores treated upon.

THE RUSSIAN TIBET EXPEDITION, 1899-1901.

By Captain P. K. KOZLOFF.

In the spring of 1899 the Russian Geographical Society sent out under my direction an expedition to Central Asia and Tibet, organized with the money granted for that purpose by the Emperor. My

travelling companions were: Captain-Lieut. of Horse Guards, A. N. Kaznakoff, who for the first time undertook such a long and difficult journey; and B. Th. Ladyghin, who accompanied me for a second time. Kaznakoff undertook to make collections of insects and molluscs, while Ladyghin was to look after plants and butterflies; at the same time, owing to his excellent knowledge of the Chinese and Manchurian languages, as well as of the Turkish dialects spoken in Eastern Turkestan, he collected various ethnographical and historical materials, and was the intermediary in our relations with the Chinese authorities. Both could make surveys during the excursions which they undertook independently from the main caravan. I kept the geographical, meteorological, and natural history diaries, made the survey along our route, and determined the astronomical positions. At the same time I collected birds and mammals. In short, every one of us had his own sphere of activity.

The convoy of the expedition consisted of sixteen soldiers from different parts of Russia: eight grenadiers, one man from Omsk, six men from Transbaikalia, and one from Biysk. They were under the command of Sergeant Ivanoff, an experienced veteran who took part in three previous expeditions of Prjevalsky, Pyevtsoff, and Roborovsky. We had, moreover, two men from Transbaikalia who both had also accompanied Prjevalsky, one of whom was a very good taxidermist, while the other was an excellent hunter, and both could render some service as interpreters. For Mongolian, we had an interpreter from Transbaikalia, Tsokto Badmajapoff, who proved to be very useful in different ways. Beside their direct duties of looking after the animals and harnessing them, the men soon learned to help us in botanical and entomological preparations.

It was intended that the expedition should follow the Chinese or Eastern Altai from the Altaiskaya village to the eastern extremity of these mountains. Then it had to cross, wherever it would be possible, the eastern portion of the Great Gobi, and, through the province of Han-Su, had to enter Tsaidam, where further preparations would be made for the exploration of Eastern Tibet, which is known under the name of "Kam" (Kan-tsian by the Chinese). The return journey was to be made along the already well-known routes through the Alashan and *riâ* Urga to Kiakhta.

We all met in the Altaiskaya village of the province of Semipalatinsk at the beginning of July, 1899. The work went on with great energy. Ladyghin bought the camels, and all of us prepared the boxes and arranged our baggage. The men practised shooting, each man studying his own rifle. Scientific collections were also made, and we all burned with the desire to start on the great journey. We started on July 14 (26th N.S.), after a *Te Deum* had been sung, and I had read to my travelling companions the words of a telegram by

which the Emperor and the President of the Academy of Science bade God-speed to the expedition.

Our caravan, which consisted of fifty-four camels, fourteen horses, and a small flock of sheep, was divided into seven sections, and slowly began its journey up the Bukhtarma river, along the foot of the forest-clothed Narym range. We had splendid weather, and there was plenty of work for every one. On August 1 (13th N.S.) the expedition crossed the frontier of Russia by the pass of Ulan-daba, and here it divided into two portions. I followed the high-road to Kobdo, which had already been visited by General Pyevtsoff, while my comrades Kaznakoff and Ladyghin took a more southern route lying nearer to the main axis of the Altai, with the purpose of exploring the sources of the Kobdo river and the Alpine lakes, of which there is a profusion in this part of the Altai. They had also to explore the fauna and the flora of these lakes, and took with them for that purpose a small canvas boat, as well as dredges, thermometers, and other hydrological instruments. My comrades came to Kobdo four days after my arrival thither, and their excursion was quite successful. They could not, however, make much use of the canvas boat, on account of the strong winds which prevailed during these days. Soundings were made on the two Kobdo lakes, upper and lower, which give origin to the Kobdo river. After a few days' stay in Kobdo, we resumed our journey.

Thanks to our good relations with the local Chinese authorities, they endeavoured to help the expedition in all possible ways. Our intention was to explore the Eastern Altai by means of a number of detached excursions which were to be made by my comrades, while the main body of the caravan would move along the northern slope of the Altain-Nauru. The Mongol inhabitants of this region were consequently warned beforehand by the Kobdo authorities, and they quite willingly gave us experienced guides and even transport animals for this purpose.

Soon after we had left Kobdo, and were near the temple Tugurynghen-ryure, situated on the Tsenkyr-gol river on the northern slope of the Altai, I sent out my comrade Ladyghin for the exploration of the southern slope of the Altai, parallel to the line of my journey on the northern slope. He had, besides, to explore the river Bulugun and ascertain whether beavers are still found in this locality, or only lower down on the Urungu river. My comrade brilliantly accomplished that commission. He crossed the Chinese Altai twice, explored the Bulugun river, and followed the southern slope of these mountains as far as the meridian of Lake Khulmu-nor, where he joined the main caravan, after having made 300 miles of survey. The eastern portion of the southern slope was explored by Kaznakoff, who crossed the route that was followed by Prjevalsky from Urga to Alashan, and afterwards went round the eastern extremity of the Altai, so as to meet me while I

PART OF EASTERN TIBET
 Showing routes of Cap^t. P.K. Kozloff's expedition



was following the northern slope. As to myself, I followed the northern slope of the Altai, making at every step new discoveries, while we took advantage of the opportunity, which we did not foresee, of exploring the western part of the Gobi as well, and Ladyghin was sent out to cross the great desert in its western part, in the meridian of Ulyasutai and Su-ohu.

The Eastern Altai has a general direction from north-west to south-east. On the meridian of Kobdo it must be divided, however, into two parts, widely different from each other. The western part is high, contains masses of glaciers and of snow-clad peaks. It is very rocky, covered with forests, and receives large quantities of rain and snow. To the east of Kobdo the Altai assumes a quite different aspect; it becomes low, and rarely reaches the snow-line with its high summits. Such summits are met with only on the meridian of Lake Khara-usu, and further east they become very rare. The main summits are Tabyn-khumustu, Khara-atsyrga, Ikhe-bogdo, and Baga-bogdo. The first is in the meridian of Kobdo; the second in the meridian of Lake Sharghin-tsagan-nor; the third is nearly in the longitude of Lake Orok-nor; and the fourth of Lake Tatsyp-nor. All these lakes are situated on the northern slope, and I passed them on my route.*

Owing to the dry winds coming from the south, i.e. from the Jungarian desert and the Gobi, the eastern Altai has but few forests and alpine meadows; nevertheless, the Mongols keep here large herds of sheep, cattle, and horses, and some camels. The gentle slopes of the mountains on the northern side are covered with excellent grazing-grounds, while on the southern slope, which is covered with a mixed vegetation, characteristic of both the prairies and the deserts, one finds very good pasture grounds for the camels, which are the chief means of livelihood of the Mongolian natives. Neither of the two slopes of the Gobi-Altai, as I name the Chinese Altai, may be said to be rich in rivers. The tree-vegetation of these mountains is poor as a rule, and only the slopes of the Baga-bogdo are a little better off in this respect. In the gorges of these mountains we found a considerable quantity of the Euphrates poplar (*Populus euphratica*), and three or four different species of bushes, as well as some thickets of willows. As to the animal life, we did not find a great variety of species, but considerable quantities of wild sheep were seen. In the valleys of the northern slope we found large flocks of antelopes (*Gazella gutturosa*, *G. subgutturosa*, *Saiga tatarica*). Very often we saw also large quantities of wolves, foxes, and hares.

* This part of the journey was described in letters published in the *Izvestia* of the Russian Geographical Society (*Geographical Journal*, January, 1900, p. 56). The main point of interest, for the geographer, of this part of the journey is in its having established the *border-range character* of the Sallughem range.—P.K.

At last we reached the wells of Chatseringhi-huduk, where we stayed for some time for the arrival of Kaznakoff, and the preparation of the collections which had to be sent back to Russia, together with reports on the work of the expedition and correspondence. Kaznakoff soon joined us, after having most successfully accomplished his journey. He had covered nearly 600 miles with his survey, which he connected in two places with the surveys of Prjevalsky, and he had passed round the eastern extremity of the Altai. In this way the Gobi-Altai was explored all round, and crossed several times by the members of the expedition. Altogether, we had covered nearly 2900 miles with our surveys, and made rich collections in natural history, ethnography, and the archæology of this part of Mongolia.

We had now to explore those parts of the Great Gobi which had hitherto not been visited by any European, and were considered almost entirely inaccessible. In the western portion of the great desert, Ladyghin was already making his explorations, in those parts of it which lie between the route of Potanin, *viâ* Etsin-gol to the Altai, and the imperial route from Hami to Su-chu. Kaznakoff and myself had now to explore its eastern portion.

We left Chatseringhi on December 1 (13th N.S.), 1899. For many hundreds of miles we had before us the renowned desert of the Gobi, the unknown parts of which have been recently narrowed more and more under the invasion of the Europeans—surveys having already been made on its western and eastern, northern and southern borders. I took for our main caravan the meridional route leading to Lan-chu, while Kaznakoff went at the same time in a diagonal direction—first towards the lakes which are formed by the Etsin-gol river, and thence to the encampments of the Alashan prince. He had thus to explore the most difficult central part of the Gobi. This bold journey could only be accomplished after we had collected much information about the character of the region, and owing to the excellent relations which we had formed with the Mongolian princes and their subjects, who did their utmost to help us in our difficult enterprise.

Want of space will not permit me to describe in more detail the Gobi, the character of which has in reality nothing in common with what we find in earlier descriptions. The Gobi was usually represented as a flat land covered with sand, showing no signs of hills, except in its western parts, where it was crossed by Potanin, and where mountains running eastwards and south-eastwards were represented on our maps. It appeared, however, that all the northern part of the Gobi, for about 200 miles southwards, on the routes of both Kaznakoff and myself, represents a country which is crossed from west to east, and from north-west to south-east, with more or less high

mountains, undulations, and ranges of hills, in the valleys and gorges of which one finds—not frequently, of course, but still occasionally—nomad Mongols with their herds of camels. This part of the Gobi is everywhere easy of access, and is traversed in all directions by routes provided with wells which contain sweet or slightly brackish water.

The southern part of the Gobi, on the contrary, represents indeed a barren desert, covered with masses of sand, and only occasionally intersected with low ranges of hills, of which the highest on my route were the Yebarai hills. The crossing of the Badan-chirin sands cost me a good deal, because all our riding-horses died one after the other from want of grass and the fearful cold, although we had taken with us some corn to feed them. We were thus compelled to ride on camels, and consequently suffered at the outset from giddiness; in fact, we preferred to walk and thus keep ourselves warm.

The central part of the Gobi, which was explored by Kaznakoff, is also hilly in its northern portions and sandy in the south; but my comrade succeeded in crossing it quite successfully, thanks to the Mongols, who willingly gave them the very best camels, and helped them to support the fearful cold and other difficulties.

The western portion, which was explored by Ladyghin, also proved to be very interesting. He had to cross a still higher hilly tract covered by ranges of mountains, large and small, having as a rule a south-eastern direction, and separated from each other by broad dreary desert valleys covered with gravel. He found no sands at all; only when he was already near to the cultivated region upon which the town of Su-chu is situated, he had to cross a narrow strip of sand bakhans (dunes), named Narin-hulusu, covered with low hard rushes; this belt of sands stretches for a long distance further east. Nearly in the centre of the desert he crossed and explored a fairly high mountain range, which is known to the Mongols by the name of Aty-bogdo and Koku-tomyrty. It is a high and narrow range of hills, which, notwithstanding its position in the centre of the desert, proved to be rich in animal and vegetable life. In all the gorges of its northern slope there are small streams, springs, and wells, round which one sometimes finds thickets of *tograk* wood (*Populus euphratica*) together with various bushes, of which the tamarisk and one species of willow, both covered with clematis, succeed best. The *Nitraria Schöberi*, and various species of *Lycium*, *Myricaria*, roses, *Salsola*, *Glycyrrhiza*, *Poa*, *Panicum*, *Amaranthus*, *Centaurea*, *Lactuca*, *Statice*, *Saussurea*, *Polygonum*, several *Chenopodiaceæ* and *Orobanche* also appear in quantities. Besides, in all the gorges one finds thickets of rushes, and on the slopes of the mountains certain species of rhubarb, much liked by the Mongols, while the steppe-grass (*Stipa orientalis*) attracts every year a number of Mongols from the Ederen region.

The animal life is also fairly varied and richly represented. One finds here in the valleys the *khulan* (*Asinus onager*), the wild camel (*Camelus bactrianus*), gazelles (*Gazella subgutturosa*), and in the mountains plenty of foxes, wolves, argalis, roebucks, and even some bears. My comrade, however, did not meet with any of the latter, although he was told that they live in this neighbourhood and feed upon rhubarb roots, which are also considered a delicacy by the Mongols, who bake them in hot ashes. In the thickets of the valleys my comrade found the *Uklik* (*Oaccabis chucar*), the Bearded Titmouse *Panurus biarmicus*, a species of the *Alandula*, some Saksaul sparrows, and so on. He was told that formerly bears were also found in this neighbourhood, but had disappeared.

After having thus completed the exploration of the Gobi, which was crossed in three different directions, so as to leave no unexplored region in the great desert, the members of the expedition hurried to the meeting-point, which was the Buddhist monastery Chortan-tau, situated near to the town of Sinin, on the Dai-tun-ho river. In this monastery, which is located in a beautiful, picturesque, and woody gorge, my great teacher, N. M. Prjevalsky, stayed on several occasions, and during his fourth journey I visited it as well. I expected to meet with a good reception in this monastery from the lamas, who so highly respected my late teacher, and I was not mistaken. Ladyghin came to Chortan-tau one month before me, and as soon as the lamas learned that he was a member of an expedition conducted by a pupil of Prjevalsky, and that the expedition would soon reach their monastery, they very kindly managed to set apart certain buildings for our reception. Both myself and my comrade, Kaznakoff, as we were passing through the town of Lan-chu, had the pleasure of making the acquaintance of the members of the China Inland Mission, Messrs. Belcher and Fiddler, who were extremely kind to us, and helped us in different ways. When I reached the above-named monastery, the Ghegens received me most cordially, and vied with each other in inviting me to dinners and to divine services, and in showing me their temples. Taking advantage of our stay at this spot, I made large collections of birds and mammals, and left here part of my baggage.

In the mean time I sent Ladyghin, and afterwards also Kaznakoff, to Sinin, to the governor of the province, to have a talk with him about our further journey, to settle all details, and especially to get the mail from Europe. At Sinin Ladyghin could not refuse the hospitality most kindly offered to him by Mr. and Mrs. Robinson, members of the China Inland Mission.

At last, leaving part of our collections with the lamas in the monastery, I left this place and went with my caravan to the town of Dan-gher, where we all met. The Governor of Sinin gave our expedition all necessary orders and letters of introduction to the local

Tibetan princes, who are under the Sinin governor. He also aided Kaznakoff in sending a caravan with provisions to Tsaidam. In Tsaidam we stayed at the monastery Barun-tsasak, and in the expectation of spring, we prepared everything for our Tibet journey. A meteorological station was built, and part of our collections was left at this depôt, as also all our camels. Four men from our convoy, under Sergeant Ivanoff, had to remain at the depôt, and Sergeant Muravioff was entrusted with the meteorological observations.



KOZLOFF MAKING ASTRONOMICAL OBSERVATIONS WHILE WINTERING IN KAM, EAST TIBET.

The spring was, however, slow in coming. The neighbourhood of Barun-tsasak was very dreary, and only in the valleys of the northern slope of the gigantic range of Burkhan-Budda some signs of reviving nature could be detected by the end of April. Kaznakoff was perhaps the most successful in making his collections.

On May 17 (30th N.S.), 1900, we at last left this depôt, and, carrying our baggage on yaks and hainyks, we began our journey by crossing the Burkhan-Budda range along the Nomokhun-gol river. This was done

successfully, and in June, after having slowly crossed the two great ranges of Burkhan-Budda and Amnen-kor, we reached the shores of Lake Russian, pitching our camp at the place where the Hoang-ho flows out of this lake. As we were crossing the Amnen-kor I obtained several specimens of the very pretty Fringilline bird, *Leocosticte roborowskii*, which was described by Prjevalsky, who possessed, however, but one single specimen. Two days after we had reached the lakes of the upper Hoang-Ho, we saw coming large parties of the N'Golok robbers, who were returning from Lhasa with their prince, Hombu-rinchim-shiam. I tried to enter into relations with them, but this was of no use, because their prince, although he had given a solemn pledge at Lhasa never to fight more, said quite frankly that he could not answer for his men, who were sure to attack the expedition as soon as it appeared on their territory. As I did not want, on my very first entry into Tibet, to make use of arms for the conquest of scientific discoveries, I preferred to change my direction and to go straight southward, so as to cross the territory of the N'Goloks on my return journey only.

After having explored with Kaznakoff the northern shores of the lakes of the upper Hang-Ho,* we went along the isthmus which separates Lake Russian from Lake Expedition (Orin-Nor and Jarin-nor; also Hoharamtso and Hnora-mtso), and crossing the river which connects both lakes, we entered the valley of the river Jaghyn-gol. In order to cross the great watershed between the Yellow and Blue rivers, we followed the course of this river, and on the summit of the watershed we found a marshy, open depression in the mountain range, the altitude of this pass reaching 14,700 feet. From this pass we saw to the north of us the high plateau of Tibet stretching north and west in a succession of gigantic waves, and to the south of us we had the deep gorges and the sharp snow-clad peaks of the Gatu-ju group of mountains.

The plateau of Tibet, upon which lie the sources of the mighty Yellow and Blue rivers and the Mekong, covers with its massive structure an immense area. In its eastern portion, to the east of a diagonal line which runs south-west to north-east, it falls under the influence of the monsoons from the Indian ocean, and is consequently rich in atmospheric precipitation, which feeds these rivers; but to the west of this line, where the plateau attains a still greater height and has a still more even surface, the dryness of the climate progressively increases, and, instead of a covering of grass, we find only a gravelly desert, which was so truly described by M. V. Pyevtsoff as "dead land." In proportion as one moves further east from this diagonal climatic line, and the rivers which flow this way become mightier and

* Ladyghin made soundings in Lake Russian for several miles from the outflow of the Hoang-Ho; they gave depths up to 15 fathoms.

mightier streams, the plateau appears more and more eroded, and assumes the features of an Alpine region.

Deep river-valleys and narrow gorges alternate with the high crests of the water-divides. The roads, or the footpaths, as the case may be, either descend to a great depth or climb to a great relative and absolute height. Here a mild, and there a rough climate; belts of luxurious alternate with belts of an extremely poor vegetation; spots occupied by man, and lifeless summits of the grand mountain ranges—all these alternate in rapid succession before the eyes of the traveller. Most beautiful panoramas of mountains unfold at his feet as he gazes towards the remote horizon, and soon after everything disappears as he stands between the narrow sides of the rocky gorges, where he hears the roaring of the blue and foaming waters, while on the high levels only the howling of the storm fills the air.

As soon as we entered the basin of the Blue river we felt the surroundings to be of a milder character. The roughness of the climate which we had experienced heretofore had been left behind on the last mountain pass. With every step down the gorge it became warmer and drier; the eye rested upon pleasant landscapes. Our herbarium and our entomological collections rapidly increased, as we saw everywhere carpets of flowers, with butterflies, and all sorts of insects fluttering about. Only, owing to the presence of man, we did not see any more representatives of the great mammals which we used to find in such numbers on the plateau.

We soon entered into friendly relations with the first Tibetans, of the Hoshun of Namtso, whom we met, and this friendly intercourse helped us in our further journey southwards. With the aid of the old prince, Namtso-Purzek, and his sons, we found no difficulty in crossing the Blue river, and, going next over a high mountain range, we reached on its other slope the I-chu, a tributary of the right bank of the Yang-tse-kiang. Continuing our journey up this tributary, we reached at the beginning of August the shores of Lake Rhombo-mtso, round which are the settlements of Tibetans from the Dett Hoshun. The elder of these, as dirty as his companions, made his appearance at our bivouac fire, quite frightened. With trembling hands he brought me some presents, and had difficulty in pronouncing his greetings on account of the shaking of his voice. It soon appeared that the cause of this fright was that the Tibetans were saying among themselves that Russians have come at last to revenge the death of their murdered comrade, by whom they meant the well-known French traveller, Dutreuil de Rhins, who perished here from the hands of the Tanguts of the Dett Hoshun.

The expedition soon reached the monastery of Jarku, which was also visited during our stay there by the embassy from the Governor of Sinin, which visits this country once every three years to collect

the tribute. It is interesting to note that our stay in this monastery was precisely at the time when the Boxer uprising broke out in China, but neither ourselves nor the Chinese authorities knew anything about it. We spent our time in mutual invitations to dinners and to fishing-parties in the river, on the shores of which we had our encampment.

After having bade good-bye to the Chinese, who gave us for a few days an interpreter of the Tangut language, we left Ja-chu on August 21 (Sept. 3), 1900, and continued our journey up the river Bar-chu, which brought us to a broad wide valley, closed in the south by a mighty mountain range covered here and there with perpetual snow. This was the watershed between the Blue river and the Mekong. This yet unnamed range of mountains stretches as an immense wall from the north-west to the south-east, and is covered with excellent pasture grounds, visited by the numerous herds of cattle of the nomads. The pass Gur-la reaches 15,200 feet of absolute height, and when we were on its southern slope we were already in the basin of the Mekong. For several days in succession we continued our journey south-westwards, crossing several parallel chains of mountains and numbers of large and small rivers which were carrying their waters to the south-east amidst an imposing labyrinth of mountains. We crossed first the Je-chu, and next the Ja-chu rivers, which together with the Nomu-chu (a river which flows further south and takes its origin near Lake Tengri, in the north of Lhasa, where it is known under the name of Nak-chu) form the river Mekong. We stopped near the frontiers of the district of Lhasa, on one of the tributaries of the Nomo-chu, the Bar-chu.

It must be remarked here that the Ja-chu is considered as the chief branch of the Mekong, and in all probability its sources are situated much further in the interior than has been shown up to the present time on our maps. Another mistake of our maps was also discovered; it concerns the river Nak-chu, which is represented as one of the sources of the Salwen, while in reality the Nak-chu, which is known to the natives by the name of Ji-chu, and after its confluence with the Bar-chu as the Nomo-chu, is one of the chief tributaries of the upper Mekong. As to the upper Salwen, it represents, according to what I was told by the natives, an insignificant river, easily forded, the sources of which lie in the mountains, not far from the high-road to Lhasa.

From our encampment on the Bar-chu I applied to the local authorities for permission to enter the territory of Lhasa, and in expectation of the reply we stayed on the banks of this river for nearly a fortnight, completing in the mean time very successfully our collections of plants, birds, and animals. Finally we received the reply, which was negative; the authorities did not want to let us enter their territory. After having discussed our situation, I decided to change the direction

of our journey, and to proceed south-eastwards to Chamdo, or Tsamdo (a monastery situated at the confluence of the Nomo-chu with the Ja-chu), where I expected to discuss with the Chinese our chances for a further movement southwards, as also the question whether the Tibetans had the right to stop our movements in the Kam region (Eastern Tibet) when we had permission from the Tsung-li-yamen. I hoped that the higher Chinese and Tibetan authorities, whom we should find at Tsamdo, would help us in this respect. So we con-



A MONGOL OF TSAIDAM WHO WENT WITH THE EXPEDITION.

tinued our journey down the Bar-chu, and below its confluence with the Ji-chu we entered the dominions of the Se-chuan authorities. However, at the very first bridge—by means of which the road passes from the left bank of the river to the right, that is, into the dominions of Lhasa—we found a numerous military detachment of Tibetans, who declared that they were ordered not to let Europeans pass. Having no intention to fight, I continued my journey on the left bank, although the road on this bank was not so good as on the

other. I do not know how the Tibetans interpreted this second concession of ours, but I suppose they saw in it a proof of our weakness, and consequently next day, October 28 (November 10), we met on the road to Tsamdo another detachment, much more numerous than the former, and quite ready to begin fighting operations, as they were telling us that they came to drive us away, like dogs, with the fire of their rifles. There was nothing to be done but to accept the fight, and after a sharp engagement the Tibetans were thrown back and dispersed. The road was open. However, the Lhasa authorities immediately sent to us their representatives, who implored us not to enter the monastery of Tsamdo, which is one of the great sanctuaries of Tibet, the fourth in rank. I yielded to their representations. Instead of going south-east to Tsamdo, I turned east, with the intention of reaching the shores of the Blue river at its affluence with the Se-ohu, at the monastery of Derghe-gonchen. The plan of exploring Tibet was thus abandoned, and after having covered some 50 miles in an eastward direction, the expedition stopped to winter in the warm wooded valley of one of the tributaries of the upper Mekong, the Ra-ohu.

In the basin of the upper Mekong the plateau was still more eroded than it was further north. The expedition found here large forests of fir, and of a tree-like *Juniperus Pseudo-Sabina*, intermingled with birches, willows, wild apricots, wild apples, and a great variety of bushes. The rugged orags, covered with a rich vegetation of trees, bushes, and grasses, presented a beautiful harmony of colours. In the thickly tree-clad gorges we found quantities of the white-eared pheasants (*Crossoptilon tibetanum*), the green *Ithaginis geoffroyi*, the *Tetraophasis obscurus*, the *Tetrastes sewerzowii*, several species of woodpeckers, and a great quantity of smaller Passerine birds. During warm and bright days the naturalist, and in fact every person not insensible to the beauties of nature, could reap enjoyment both with eyes and ears. Flocks of pheasants walked about the little meadows, the eagles described their curves on the blue sky, and from the thickest of bushes, richly coloured by sun's rays, the songs of thousands of small birds could be heard. Of mammals which we did not see previously, we found monkeys, which were living in large and small colonies—very often in close neighbourhood to the Tibetans. Our hunting excursions after these interesting animals were successful, and enabled us to complete our collection with beautiful specimens of both males and females.

While wintering in this beautiful corner, we carried on our usual work. We made meteorological observations at a small meteorological station which we had established here, as also on the slope of the mountain, by the side of a small house where I was making astronomical observations. My men spent their time in hunting and in

collecting seeds of the wild grasses and berries, as also all sorts of materials concerning the history and ethnography of the Tibetans. My comrade Kaznakoff, together with Ladyghin, also undertook excursions up the Ja-ohu, and eastwards, as far as the monastery Derghe-gonchen. This last journey was accomplished very successfully in a short time, although my comrade had to pass localities the population of which was anything but sympathetic to us. I must also say a few words about the men with whom we so often stood at times in friendly and at times in hostile relations.

The population of this region is divided into the settled, *Iba*, and the nomad, *Bok-pa*. The former have their houses and farms in the valleys and gorges, where the warm climate permits them to grow



BEGGARS IN KAM.

cereals up to an altitude of 12,000 feet. The others pitch their black tents in the region of the alpine meadows, the upper limits of which lie some 3500 feet higher than the upper limits of the agricultural zone. About these nomads I will not speak, because they have been well depicted already by Prjevalsky. As to the settled population, their mode of living is much better than that of the nomads. They make their houses of thin logs, or of wickerwork, which is covered with a thick layer of clay. These houses usually have two and three storeys. The lower one is used for the cattle, while the second and third are used either by the inhabitants themselves or for storing their grain, their straw, and their hay, and also the domestic utensils. The threshing-ground is usually made on the roof of the first storey, and the corn is threshed by means of a flail similar to ours.

The dress of both men and women consists in the winter of a sheepskin, and in the summer of a sort of woollen dressing-gown. The latter, however, is only worn by the richer folk. The skirt of the sheepskin is usually tacked high so as to make round the body a sort of sack, into which the Tibetan puts his cup, his oil, his tobacco, and so on. Of course, the sack is filled with all sorts of things on a journey. Then above the sheepskin, which I must say is usually worn without any underclothing, is worn a broad felt mantle. Trousers are seldom worn by men, and are quite unknown to women. As to the head-dress, it consists of a felt hat, or of a red scarf, which is wound around the head like a turban. The women decorate their heads with a string of big pieces of amber, similar pieces, as well as shells and discs of silver and white copper, being attached also to the dresses. The dirty hands of both men and women are covered with silver rings and bracelets, and in one ear they wear large-sized earrings. Their boots are made of woollen cloth of different colours. As the Tibetans never wash themselves, and always live in great dirt, almost never taking off their sheepskins, they diffuse an abominable odour.

They practise polyandry, several brothers often taking one wife. It also happens that after the death of his first wife, the father will marry the same woman to whom his elder sons are married. It seldom happens that a rich Tibetan has two wives. Good-looking women are very rare, and then only among the younger ones.

The winter in this locality is extremely mild. There is rarely snow, and the atmosphere remains transparent and dry. There is usually no wind at night or in the morning, but it systematically began to blow every day after midday from west-south-west. We had bright weather at the end of November and during all the month of December. January was rather cloudy, but in February the cloudiness began again to diminish. The lowest temperature which we observed was during the night of January 5-6 (18-19), when the thermometer fell to $-26\frac{1}{2}^{\circ}$ Centigrade. In December, at one o'clock, the mercury fell below the freezing-point only four times. The same was also in January, the lowest temperature at 1 p.m. being -4.8° C., which temperature we had after the above-mentioned low minimum during the night.

There was no ice at all on the river Ra-chu, but its tributaries, small streamlets, were quite solidified by the ice, although at midday in the sun's rays ice was thawing even during the coldest part of the year. Snow fell very seldom, and thawed as it fell or disappeared next day. In short, the southern slopes of the mountains were always free from snow, and only thin layers of it appeared on the northern slopes, as well as in the higher parts of the mountains. After each snowfall, the atmosphere, which was always very clear, became

still clearer, and the sky assumed a deep blue colour, especially before sunset.

In February the temperature began rapidly to rise, the mountain streamlets began to roar, the birds began to mate, the eagles began to rise to tremendous heights and send forth their love-calls—in short, winter was over. I now decided to move eastwards, and to pass through the districts of Derghe-gonchen and Khor, and, after having explored them, to move up the Ya-lun-tsian, and then to the lakes of the upper Hoang-Ho, and next to Tsaidam.

Leaving the warm valley of the Ra-ohu, we had once more to cross the cold plateau, as also the water-dividing range between the Mekong and the Blue river, of which the pass reached 16,000 feet, and was covered with snow.* Here, on the banks of the Blue river, which flows at an altitude of about 10,500 feet above sea-level, it was also very warm, and we saw already the first appearance of spring vegetation; the *Gentiana squarrosa* was in bloom, as also the buttercups, the dandelions, and so on. All sorts of insects and butterflies flew about. We also noticed the bank swallow (*Cotile riparia*). The Tibetans were busy in tilling the soil, and some of them had already begun sowing wheat and barley, while on the best fields we saw the first seedlings of wheat piercing the ground.

We stayed but a few days near the monastery, and resumed our journey by crossing the high chain of mountains which separates the Blue river from its left-bank tributary, the Ya-lun-tsian. We spent Easter—the last Easter during this hard but most interesting journey—at the village of Bana-jun, near the valley of the Ya-lun. We explored next the district of Khor, so far as it was possible on account of the time and the hostile attitude of the population, and I finally decided to resume our return journey. We consequently went up the Ya-lun-tsian, following its left bank, but were compelled to move rather slowly, because its banks were occasionally so steep as to compel us to go more inland. Still we progressed, and we soon had left behind

* This part of the journey of Kozloff is extremely interesting. On his way to the Blue river, he was compelled to cross once more the nameless range of mountains which separates the Mekong from the Blue river, and by this second crossing he determined the exact position of this important orographic feature. From the accompanying map, it will be seen that there are at least three different ranges of mountains which cross this part of the Tibetan plateau in a direction from the north-west to south-east. We may thus say that in all probability, instead of the fanlike ranges of mountains which we see on our present maps, radiating between the Mekong and the Blue river and their tributaries, under the 27th and 28th degrees of latitude, we have the same plateau, with ranges running in the same north-west to south-east direction, and very probably it will be easy to connect the Himalaya escarpment of the high plateau of East Asia with the Khingan escarpment of the lower terraces of the same plateau.—P. A. Kr.

the zone of cereal culture, and entered the regions occupied by nomads only.

Owing to close intercourse with the robber bands of the N'Goloks, the local nomads, Ja-chu-ka-va, have become as bad as their neighbours. Especially one of their *hoshuns*, Lin-gu-ze, which does not recognize its submission to the Chinese, and also does not recognize the supremacy of the N'Goloks, is renowned for its wild robber instincts. With these robbers we had a serious conflict. Happily enough, our guides and carriers from the *hoshun* of Dunza, who are as much robbers as the former, seeing that we were always ready to repulse an attack, found it more profitable to bring us peacefully across their territory, but they warned us that we should be attacked in the *hoshun* of Lin-gu-ze. Their prediction was fulfilled. On the morning of April 25, on one of the numerous mountain passes of the basin of the Ya-lun-tsian (or, as it is named by the Tibetans, the Ja-chu), namely, the pass Bi-mu-la, the Lin people numbering several hundred men and occupying several mountain summits attacked us. As soon as our vanguard, which consisted of Kaznakoff, myself, and the Cossack Badmajapoff, appeared on this ground, they opened a sharp cross-fire from their matchlock guns. We had already noticed them for some time since, and consequently had settled our plan of action.

From time to time we advanced slowly forward, sitting down for awhile and shooting at the robbers. It must be remarked that we had to fight at an altitude of 15,000 feet above sea-level, where the rarefied air rendered us uncomfortable, notwithstanding our experience of such altitudes. As our caravan approached the summit of the pass, and as more men from it came to reinforce us in the vanguard, the shooting of the robbers became slower, and after an hour's time we had reached the head of the pass and cleared it entirely. The robbers were running away southward, to the Ya-lun-tsian. We quietly took our breakfast at the top of the pass, where we found considerable quantities of ice and fuel, prepared by the robbers while they lie in ambush, and then we began to descend on the other side of the pass, sending out our scouts in different directions. At a spot where the main gorge meets a side gorge coming from the left, the robbers, having received reinforcements of another hundred men, had taken their position with the intention of attacking us at the same time from two sides. Besides, part of them were standing upon the rocks on the sides of the narrow gorge ready to roll big stones down the mountain, so as to produce a panic in our caravan. Happily enough, this ambush was discovered in time by our scouts. So I sent six of our men to drive away the Tanguts, and myself continued to move slowly down the main gorge. The robbers did not expect an attack, and after a few shots from our scouts ran away, meeting, instead

of us, their own comrades, who had been taken by panic and were in full flight. Our main body did not pursue them, because just at this moment came several lamas to offer to conclude an armistice. After having settled the general conditions, I ordered one of the lamas immediately to gallop full speed after the runaways, and to order them never to appear more with their arms in the way of our expedition. This promise was strictly kept, and so we passed without any difficulty, although the robbers had intended to lay for us a third ambush.

After that, our expedition continued its journey without any other difficulty. Moving slowly north-westwards, towards Lake Russian,



SMALL TOWN, KUAN-GO-CHEN, IN THE HAN-SU PROVINCE, NEVER BEFORE VISITED BY A EUROPEAN.

we soon met a few natives, Ja-chu-ka-va, who knew the upper course of the Yellow river, and a few days later we met an old Tangut who knew Lake Russian, and who undertook for a good remuneration to be our guide. Guided by this old man and his three younger comrades, we crossed the most interesting localities of the basin of the Yellow and the Blue rivers; and on May 30 (June 12, N.S.), from the top of a pass, we made out the blue shining surface of Lake Russian. Nearly a year before we had left it from its western extremity. Now we had under our feet its south-eastern shore. In one or two hours' time we had reached it, and had our bivouac close by its waters. An excellent road runs along the eastern coast of the Orin-nor, and after a two days' march we reached our old encampment at the issue of the Hoang-ho

from the lake. Here I concluded the survey which I had made throughout our journey in Tibet.

The remainder of our journey to Tsaidam I shall not describe, because we went along a well-known road. Our comrade, Ivanoff, who had been left in charge of the meteorological station, met us in the valley of the Alyk-norin-gol. I had sent him notice by one of the Tsaidam Mongols, asking him to meet us on our journey, and to bring the letters which might have been received from Russia. We were delighted to find that everything in Tsaidam was in excellent condition. The very same day as we came thither we met also a Chinese interpreter, who had been sent by the Governor of Sinin to meet the expedition, and to bring it a bulky mail from Russia.

After having stayed during the hot season in Eastern Tsaidam in the mountains, we resumed our return journey on August 1 (14), and four months later reached the frontiers of our fatherland. Even this stay in Tsaidam was not lost, because we made frequent excursions in the mountains and completed our collections; but during one of these excursions we nearly lost one of our young men, Madaeff, at whom Tangut robbers had fired from an ambush. While I remained at the meteorological station, making astronomical observations, and bringing everything in order for the future journey, Ladyghin made an excursion for the exploration of the lakes Taso-nor and Kuzlyk-nor in Northern Tsaidam.

I will complete this short report on the work of the expedition by the following letter which I had sent from the extremity of the Eastern Altai to the Russian Geographical Society:—

“As you know already from my previous report, the expedition left Tsaidam at the beginning of August. The weather continued, however, to be hot, and, owing to heat, as also the horse-flies and the mosquitoes, we lost fifteen of our best camels, out of our herd of fifty head, so that we had to buy camels on the way from the natives. I made, with Ladyghin and two Cossacks, a side excursion to Sinin, while the main body of the caravan, under A. N. Kaznakoff, went along the straight route to the Cheibsen monastery. I considered it my duty to personally thank the Tsin-tsai-yu for all he had done to facilitate our sojourn in the Kam region. From our conversations with him, we learned that there was great anxiety in Russia about our expedition. ‘I have received three telegrams from Pekin about you,’ he said, ‘each one even more anxious than the former; but I knew myself nothing about you.’ . . . The good functionary took great interest in the Kam region and its inhabitants, and advised me not to go so far another time, and to avoid regions peopled with robbers. As to the Governor (Dao-tai) of Sinin, who had spent a long time in the Ili region, and knew there the late V. M. Uspensky, he, on the contrary, took great interest in knowing how much of the region remained unmapped, whether we had made good collections, and so on.

“From Cheibsen we travelled along the same old route, of which I now made a survey. Continual rains which we experienced in the province of Han-su did not permit us to make many excursions in the mountains, which are so rich in vegetable and animal life. Our thoughts were also chiefly directed towards preserving the treasures which we had accumulated in Tibet, and we were quite happy to find that everything we had left with the lamas at the Chorten-tan monastery was in perfect order, and that the lamas welcomed us back so cordially.



ONE OF THE GORGES OF THE UPPER MERONG.

“We did not stay long at Chorten-tan, as we were in a hurry to cross the Gobi before the beginning of the great colds (the frosts already reached -20° C.). After having crossed the Chagryn steppe, we came to one of the most miserable Chinese towns, Kuang-go-chen, which had never been visited before by Europeans, but the authorities of which had already been warned of our arrival by the amiable Tsin-tai of Sinin. These authorities, as well as the Van of Alashan, helped us in crossing the Gobi. In short, on this return journey, as well as on our out journey, we met with no difficulties. We even chose this time a

new direction, and thus made a fourth traverse of the Gobi, between the eastern route which Prjevalsky had followed so many times and the route I had followed two years ago in the western portion of the desert. Here also, in proportion as we moved north, we saw that the country lost its character of a plain, and was intersected with ranges of hills and hillocks. We also considerably increased our geological collections, as, being on our way home, we could better follow the instructions which had been given to us by V. A. Obrucheff.

"Soon after we had left the residence of the Alashan prince, we were overtaken by a Taranoha from Jarkent, who had been sent by the Russian consul at Urumohi in search of our expedition; and it was only then that I understood the anxious telegrams of which I had been told at Sinin. We also learnt that here, too, in Mongolia, a Mongol and a Russian were vainly trying to get news from the expedition. We, too, were extremely anxious to get some news from home."

On November 22, 1901 (December 5), we were at last at Kiakhta, and in January following I was at St. Petersburg.

In conclusion, I will permit myself to enumerate the main results of the expedition. We have thoroughly explored the Chinese or Mongolian Altai, the Central Gobi, and that portion of Inner Tibet which is known as "Kam." The Altai has been explored all along its northern and southern foot, and has been crossed several times. The desert of the Gobi was crossed along four different routes in the winter—provisions of ice or snow being taken during these crossings. In Eastern Tsaidam, at the northern foot of Tibet, a depôt of the collections and the provisions was organized, and the camels were left, the journey in Tibet being only possible with oxen. At this depôt a meteorological station was organized, as had been recommended by the late General Tillo. Four men, under Sergeant Ivanoff, were left at the station, and the conduct of the meteorological observations was left to Muravioff, who had received the necessary preliminary training. The Tsaidam meteorological station has thus worked for fifteen months without interruption, the records of the instruments being taken thrice a day, and once every three months every hour for twenty-four hours in succession. This was the first time that such work was done in Central Asia, and the observations of the Tsaidam station will give a solid basis for calculating our altitudes in Tibet. It was also the first time that a canvas boat was used for the exploration of lakes in Central Asia—their depths and their flora and fauna.

We also used during this expedition, more frequently than before, the system of sending out separate excursions, which were made by my comrades Kaznakoff and Ladyghin, while I journeyed with the main body of the caravan. Owing to this system, we were enabled considerably to increase the domain of our exploration, as also the value of our collections.

We brought back with us—(1) about 8000 miles of survey; (2) the positions of forty localities determined astronomically; (3) geographical, historical, and ethnographical, as also commercial information about the regions visited; (4) more than 400 photographs; (5) meteorological observations which were made regularly every day; (6) and rich natural history collections—that is, about 1200 geological specimens; nearly 1400 species of plants (over 30,000 specimens); and the following zoological specimens: 300 skins of mammals, 10 skeletons, 1500 birds, 500 fishes and reptiles, and 30,000 insects. All these collections have already reached St. Petersburg in good order, have been arranged, and are already in the hands of specialists and different scientific bodies.

TRAVEL AND TRADE ROUTES IN NORTH-EASTERN RHODESIA AND ADJACENT PARTS OF EAST CENTRAL AFRICA.

OUR knowledge of the geography of North-Eastern Rhodesia has received considerable additions within the past few years from the journeys of members of the administration, who, in the course of their official duties, have had occasion to travel by new routes through some of the less-known parts of the territory. Through the courtesy of Mr. Robert Codrington we are enabled to give accounts of two such journeys through the region lying between the Loangwa and the Kafue, while Mr. Codrington himself sends us the account of a recent voyage on Lake Tanganyika, with instructive remarks on the present state and prospects of European enterprise on the lake and in neighbouring regions. Much activity has also been displayed by the French missionaries known as the "Pères Blancs d'Alger," who within the past three years have established themselves in the Awemba country, and have in some cases made good use of the opportunities afforded them of adding to our knowledge of the country. Some of the results of their journeys have kindly been placed at our disposal, and of these we hope shortly to give a summary. In the present number we confine ourselves to the work of British officials.

I. A VOYAGE ON LAKE TANGANYIKA.

By ROBERT CODRINGTON.

In June, 1901, Mr. Codrington embarked at Kituta on the German Government steamer *Hedwig von Wissmann* (*Journal*, vol. xvii. p. 430), which, like her sister-ship on Lake Nyasa, earns money by carriage of freight and passengers, besides being available for Government purposes. She carries a 4-centimetre quick-firing Krupp gun, and has a speed of 8 to 10 knots and a cargo capacity of thirty to forty tons. The first point touched at was the German military port of Bismarckburg—the headquarters of the "bezirk" of Ukonongo. There are eighteen European residents and a native garrison of ten Sudanese and a hundred locally