

lower layers. The dew effects observed upon the dunes are very remarkable, even when there has been no rain for weeks, and but for the rapid evaporation in the day, one is tempted to think that dew-ponds might be formed, as on the porous chalk downs in England. Such moisture consolidates the lower part of the dune, but, readily evaporating at the surface, allows the top layers to be redistributed by the daily breeze. If strong and continuous winds remove the dry and loose surface too rapidly, erosion forms are produced in the compacted underpart. Thus from several points of view the relation of blown sand to moisture is worth studying:

4. I desire to draw attention to the exaggerated effect of certain storms in transporting sand, and even apparently of holding the finer particles in suspension. This may probably be due to an electrified atmosphere. I have found by experiment that sand, though heavy, is readily and violently moved by electrification, on account, I suppose, of the smallness of the particles. I have not myself gone much further into the interesting but difficult question of the effect of electricity upon the transport of sand. It may be that such winds are responsible in some deserts for much of the transport of sand, whilst the ordinary breezes do most of the modelling of the sand-dunes.

5. The rate of movement of dunes is, of course, interesting, but unfortunately a traveller can seldom deal with it.

Finally, whatever is to be described should be photographed, and the photographs should, whenever possible, be taken in a low morning light—a low light for shadow and relief; the morning, in order to avoid the sandy haze of the later day.

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## THROUGH EASTERN TIBET AND KAM.

By Captain P. K. KOZLOFF.\*

### INTRODUCTION.

ON Captain P. K. Kozloff's return to Russia in 1901, after his prolonged absence in Tibet, he put the finishing touch to his exploration work by compiling a most valuable scientific report on the lands through which he had passed. The following pages are a translation of that part of his narrative which deals with the expedition's adventures from the time of its leaving the Tsaidam on the journey south till it reached Chjerku.

During March, 1900, it made its way westwards along the northern bank of the lake Koko-nor, and, crossing the eastern Tsaidam, reached on April 14 the fortified post of the Baron-Dsassak (longitude and latitude  $36^{\circ} 10' 55''$  and  $97^{\circ} 21' 47''$ ; height, 9380 feet above sea-level). Here a depôt was formed to serve the purpose

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\* Translated by Captain A. B. Lindsay, 2nd King Edward's Own Gurkha Rifles. In the *Geographical Journal*, vol. 19, p. 576, is a summary account of this Russian Expedition, 1899-1901, also by Captain Kozloff.

of a base while in Tibet, and here camel transport was abandoned. The journey onwards is related by Captain Kozloff as follows.\*

*Narrative.*

With the expedition's arrival at Tsaidam the curtain may be said to have come down on the first act. For a whole year we had lived amongst Mongols—for the most part peaceful and good natured—learning about their country, studying their mode of life, and for transport using camels, an animal which Russians soon became accustomed to on the line of march, especially if commanded by experienced officers. We were compelled to part company with these animals here, and in their stead to possess ourselves of bull yaks, or khainiks.† These beasts live in the mountains and high tablelands of Tibet, where exist nationalities as different in their manners and customs to the primitive Mongols as their fierce and obstinate yaks are to camels.

Savage by nature, the bull yak, when on the line of march, in camp, or when grazing, is always trying to find an opportunity of goring his neighbour, regardless of whether the latter be a bull like himself, a horse, or a human being. The worst characters among them are easily recognizable by the broken points of their horns. Across mountainous country they are slow travellers (from 3 to 3½ versts an hour, sometimes less), while they carry only half the load of an average-sized camel. As, in addition to this, yaks are more subject to epidemic diseases than camels (plague, khas,‡ etc.), they often prove to be a more expensive mode of transport. The difficulties of travelling with them are infinitely greater than when using the far-famed—and deservedly so—"ship of the desert."

As a transport animal, the bull khainik stands considerably higher. It is more gentle and tractable, more used to narrow footpaths, and to a certain extent is dignified. Consequently it preserves its strength throughout the day's march instead of wasting it when leaving camp, as a yak usually does, by uselessly plunging about from one side of the road to the other. The khainik is, of course, much more valuable, costing about thirty roubles, while a transport yak can generally be bought for ten; that is to say, it is three times as expensive as the yak. A camel caravan can be loaded up more expeditiously than a bull caravan, as the men of the escort, divided into pairs, can work independently, and soon get the caravan ready. This is impossible with bulls. Each animal has to be held by one or two men, while its load has to be lifted up high at the same time § by at least four, two on either side. The loading of obstinate animals takes quite five minutes, and requires double the usual number of men, while the baggage suffers in proportion.

Having left the bulky and heavier loads at our Tsaidam depot, we packed our Tibetan baggage, reduced to the smallest limits, in small boxes, bags, and wallets. The ideal load for a yak is a pair of ammunition boxes weighing, including the felt lining, 5 poods. But even after reducing our allowance to the utmost, we found ourselves with thirty-five loads, to carry which we took forty bull's, the majority of them being khainiks. Besides myself and my immediate assistants, the *personnel*

\* 1 pood = 40 lbs.; 1 verst =  $\frac{2}{3}$  mile approximately; 1 sajen = 7 feet; 1 rouble = 2s. 1d. approximately.

† Khainik, a cross between a bull yak and a domestic cow.

‡ With khas, yaks lose their appetites, saliva pours out of their mouths, and eventually their hoofs drop off.

§ Camels are loaded up differently. On the word "Tsok tsok" and a gentle pulling of the leading rope, they lie down, and the load need not be lifted high off the ground.

of the expedition consisted of twelve grenadiers and cossacks, to assist whom in managing the bull transport, to which they were unaccustomed, four local Mongols were engaged at the Tsaidam—two, Dadai and Chakdoor, from the village of the Dsun-dsassak, and the other two, Hardy and Jeroy, from the village of the Baron-dsassak. The first of our native companions, Dadai, had previously accompanied Prjevalsky as a guide and Tibetan interpreter, when returning from Lhasa to the Tsaidam on his third journey in Central Asia. In addition to these four Mongols, we commandeered a Chinaman called Li, who knew Tibetan. He was a fine-looking, powerful man, and, when not smoking opium, appeared well able to climb the mountains of Tibet. The Tibetan party was thus brought up to a strength of twenty men.

Besides the above, I also took Ivanoff (who was in charge of our depôt at the Tsaidam) as far as the lakes of the upper Hwang Ho and two selected Mongols to escort him on the return journey. I did this, feeling certain that, in addition to the boat, he would have to take back a large quantity of skins of mammals and whatever else we might collect, and I therefore took, besides the bulls, three transport camels and three ponies—one for each of them.

Meanwhile the rays of the spring sun were daily becoming more powerful. The shrub and grassy vegetation, coming to life again, beautified the bleak vale of the Tsaidam. In the air, which was fragrant with the aroma of fresh vegetation, the buzzing of insects and the twittering of swallows, soaring high above the mud-walled fort, never ceased for days together. We were all irresistibly attracted to the south, towards the mountains whose dark blue gorges were becoming more clearly visible. In one of those nullahs our Tsaidam hermits—Teleshoff and Afutin, who were in charge of the camels—had for some time past taken up their quarters. In addition to the Mongol shepherd engaged for the period of the depôt's stay at the Tsaidam, their paucity in numbers was supplemented by the dogs, which had been our faithful companions from the day of our start from Altaisk. To take the latter's place in the Tibetan caravan, I bought from a neighbouring Mongol a huge Tibetan mastiff called Garza.

By the middle of May we had completed our arrangements for the onward journey, and the 17th of that pleasant spring month was chosen for our start upon the long and little-known route. By daybreak we were all astir. Loads, bulls, and men filled the courtyard of the fortress, while Russian, Mongolian, and Chinese shouts intermingled to break the morning silence. In addition to those who were setting out, a large crowd of extraneous people had assembled, some of whom worked hard and were useful to us, while others chattered lazily and were a hindrance. The loading up of the bulls was commenced; but how different to dealing with camels! Several of the obstinate brutes lay down; others plunged about, and, having broken away from their attendants, never rested till they had thrown their loads. We spent a long time loading up in that narrow, confined space, and it was not till noon—the very hottest hour of the day—that we were at last able to leave the settlement and wend our way into the open valley. Then we were able to breathe more freely and look around us. After two or three hours' going, the caravan, divided into three sections, was maintaining proper order and moving steadily southwards. Looking back, we all took leave of the village, which seemed to us now so near and dear, and above which could be so clearly seen the meteorological station, as well as the Russian ensign fluttering in the breeze. Muravieff, who was doomed to many days of solitude, was standing on one of the flat roofs watching the fast disappearing column.

Beyond the rugged, flinty waste which rises gradually towards the hills, the Burkhan-Buddha range towers upwards, and in one of its nullahs—Nomokhun by

**PART OF EASTERN TIBET\***  
Showing routes of Cap<sup>t</sup>. P.K. Kozloff's expedition



\* This map was prepared for Kozloff's summary in vol. 19 of the Journal, which accounts for the different spelling in the present translation.

name—we had arranged to camp. Close to us a small stream wound its way, gathering strength on its onward journey from the bubbling, murmuring brooks which tumbled into it, and instead of dust and saline deposit, we trod underfoot soft patches of green grass, and began to hear the monotonous cry of the jackdaw, partridge (*Caccabis chukar*), wild pigeon, and other feathered creatures.

The name Burkhan-Buddha, adopted from the time of Prjevalsky's first journey, is the name given to the comparatively small (in extent) range\* bounding the southern end of the eastern Tsaidam. From this shut-in Central Asian basin, these mountains have the appearance of a solid uniform-shaped wall, supporting at a height of 17,000 feet a fairly flat summit (only in places does it reach the line of eternal snows), where the streams rise which tumble down on either side.

The foot of the hills on the northern side is 10,500 feet above the sea, but on the southern side it is nearly 13,500 feet, though measuring scarcely 12 versts from the top. On both sides the nullahs are stony, wild looking, in places very narrow and dark, and, thanks to the scarcity of water, bare and bleak. A few tiny rivulets, on issuing from the hills, bury themselves beneath the surface of the ground, appearing again at the bottom of the nullahs as springs or wells after their subterranean journey. These hills are composed of clear granite, with an admixture of plagioclase, quartz, bisilicate, and epidote; also of tonalit, gneiss-granite, gneiss, greenstone, limestone with streaks of pyroxene and epidote, calcareous spar, quartz, clay, sandstone, and slate.

In the way of mammals were to be found wild yaks, wild goats or sheep, deer, antelopes, marmots, hare, skunks, foxes, wolves, lynx, panther, and Tibetan bears. And of birds there were white and brown vultures (*Gyps himalayensis* and *Vultur monachus*), the lammergeyer (*Gypaëtus barbatus*), the golden eagle (*Aquila daphanea*), the hawk (*Tinnunculus alaudarius*, *Hierofalco Hendersoni*), owls, brown owls, and occasionally even kites; also the black raven (*Corvus corax*), the Alpine jackdaw (*Fregilus graculus*, *F. Alpinus*), wild pigeon (*Columba rupestris*), two kinds of hill turkey (*Tetraogallus thibetanus*, *T. Kozłowi*), wild partridge (*Caccabis chukar*), mountain finches, jays (*Rodoces humilis*), blackbirds (*Petrocincla saxatilis*), *Accentor fulvæscens*, *Motacilla*, *Budytes citreola*, *Pratincola maura*, red-tails, peewits, martins, hill swallows, and many others.

The flowers only begin to bloom in the beginning of summer. On entering the Nomokhun nullah we found, on the narrow patches of green meadowland and amidst the thick brush-like grass, just opening out, yellow dandelions (*Leontodon*) and two kinds of silverweed (*Potentilla anserina*). By the banks of the stream were lagotis, and somewhat farther from the water, on the bare, dry, stony soil, termopsis; alongside of this was the tiny Malcolmia, and on the same grassy patches near the rocks, where the full warmth of the sun is felt, grew the beautiful iris.

Some 10 versts higher up the nullah, in small re-entrants, we came across white potentilla, artemisia, androsace, pink draba, and bright yellow, sweet-smelling gadea. Still higher and on damper soil were carex, and growing amongst them the small blue gentiana. In places the ground was yellow with ranunculus and three sorts of iris—two lilac-coloured or blue and one yellow.

During the next day's march, we saw growing in the more tempting side nullahs clumps of very small primula, with pink petals. Here and there amongst these dwarfs towered others, tall and full of sap, with greyish-green leaves and pinky-lilac, sweet-smelling petals. There were various kinds of grasses, more

\* In length not more than 100 versts; i.e. from the stream Nomokhun-khoto on the west to the river Egrai-gol on the east.

ranunculus and polygonum, just in flower. These were along the bottom of the nullah. On the clay hillsides grew three kinds of astragalus, and a tiny euphorbia which literally covered the small mounds of earth thrown up by the burrowing of marmots. We found large quantities of the above flora on the sunny or south-west side, and amongst the rocks was found the first and only specimen of the *Rheum spiciforme* in flower, as well as the *Gnaphalium leontopodium*.

Higher in the hills we came across the *Præwalskia tangutica*, the former handsome iris, pretty yellow pedicularis, ranunculus, two or three saxifraga. The three last, i.e. pedicularis, ranunculus, and saxifraga, grew near water. On clay, broken hillsides was the yellow corydalis just coming into flower, alongside of the ephedra and light lilac-coloured astragalus. On soft grassland amongst resplendent primulas was the *Adonis cærulea*. The great cold coming every now and then had prevented the gentians and violets from flowering earlier. On the southern slope the flowers were poorer and less developed, owing to the colder mountain air; but at the foot of the hills on the southern side, in sheltered places, we found one or two sweet-smelling stocks (*Cheiranthus*).

We reached the northern foot of the Burkhan-Buddha range the first evening, and on the second the Noyon-bulak (spring), where we had arranged to meet the Baron-dsassak. Here we made our final preparations, and got together a flock of some seventy sheep before proceeding further. After passing some nomad Mongols, the expedition reached an excellent camping-ground, where grazing was plentiful; and here we decided to stay for the best part of a week, so as to learn more about these hills and get better acquainted with our animals. This comparatively long halt was all to the good, as it accustomed our breathing-organs to the rarefied air. For our new companions this was especially necessary, as the weakest of them at this high altitude suffered considerable discomfort for the first few days, after which all went well, and we were able to make numerous excursions to the adjacent uninhabited nullahs. The hill flora daily began more and more to awaken, and consequently to enrich our collection. On reaching the hill Laduigin, our indefatigable botanist, seemed to be rejuvenated, and spent whole days in the nullahs, carefully searching them. Kaznakoff, who was also an expert collector, amused himself getting together a quantity of invertebrate specimens, and seemed thoroughly to enjoy filling jars and bottles with the various kinds of molluscs, beetles, and flies, which were unknown to him, not to mention lizards and snakes. Teleshoff was equally in his element shooting birds and animals peculiar to Tibet. In fact, with our arrival in the hills a mantle of energy seemed to have fallen upon the members of the party, and it was to no vain purpose that the south had so loudly called us from the Tsaidam's inhospitable waste.

We were still obliged to keep our huge, fierce mastiff Garza on the chain, for fear of its attacking the Mongols, including even its former owners. Since it had got to know us it would attack all of them, except those of the Buriats who now and again wore their national costume. The strength of the beast was marvellous. Once when barking excitedly at some intruder it dragged about after it the heavy ammunition-box (2½ poods) to which it had been fastened during the day, pulling it from place to place. At night we used to let it loose, and the Mongols had, in consequence, to be careful where they went.

But, alas! a cloud soon darkened our pleasant pastime in the surrounding hills, in the shape of the serious illness of our Chinese interpreter. With each day he grew thinner and paler, so that, much against my will, I was at last compelled to send him first to the Tsaidam, in charge of the Baron-dsassak, and afterwards when convalescent, to his own town—Sining Fu. I discovered later that this invalid (Li, as the Chinese called him) was a great trouble to the dsassak,

compelling the latter to produce whatsoever this licentious Chinaman desired to indulge in.

At dawn on May 27—a clear, frosty morning—we recommenced our march, and by nine o'clock had succeeded in crossing the Burkhan-Buddha. The ascent to the pass was steep and stony, and the top covered with a deep layer of snow. The height of the pass—Nomokhun-dawan by name—was, according to my aneroid, 16,030 feet. The neighbouring peaks, towering one above the other amongst the eternal snows, seemed to be thousands of feet higher. The caravan made good time in reaching the summit, with the exception of one of the camels, which we were obliged to lead back and to leave to its own devices on the first patch of flat grazing-ground we could find, till our Mongols should return to the Tsaidam. From the Tsaidam, which was enveloped in a yellowish-grey haze of dust, a piercing wind was blowing, and the temperature was  $5\frac{1}{2}^{\circ}$ . Fleecy bits of mist, becoming detached from the remainder, wandered amongst the higher peaks, and turning into black, leaden clouds, every now and again burst into sleet. Towards Tibet the weather looked most forbidding. The sky was overcast, and the dark yellow hilltops, buried in the clouds, had the appearance of being wrapped in cotton-wool. Near the summit no animal life was visible, and such vegetation as grew seemed benumbed with cold. It was only when we descended on the southern side of the range that we came upon a stream, free from ice, whose green banks were a relief to look upon. Here we found quantities of wild-yak bones, and from their enormous size it was evident that the animals were unusually large. We were not fortunate enough to come across any of these beasts, though recent traces of a large herd on the soft clay soil clearly pointed to their frequenting the locality. In the course of the day we saw a bear, as well as a small flock of wild goats or sheep.

The following morning we found it fairly cold at our camp at Shara-beilebir, the thermometer showing the minimum temperature at sunset had been  $13.5^{\circ}$  below zero. The stream had dried up, leaving a glistening icy crust behind it, but nevertheless, after an hour or two the rays of the southern sun began to warm us. The onward path lay in a south-westerly direction towards the Alyk-nor lake, which feeds a stream of the same name that flows eastwards till its junction with the Egrai-gol. On climbing the next ridge we saw a large valley, and close to us a wide strip of water shining in the sun. A little later the lake itself came into view, and beyond it, in the grey distance, the Burla-Abgai hills. In the south-east stood out the Amnenkor range of mountains. These, like the Burkhan-Buddha, which we had just crossed, had a covering of snow on the summit. In addition to these principal ranges, there were quantities of smaller hills running away to the south and filling in the whole distance to Tibet, which here had an average height of 13,000 to 15,000 feet.

After a couple of hours we reached the north-east shore of the Alyk-nor, where we selected a soft green patch of ground on which to encamp. Messrs. Karnakoff and Laduigin, taking advantage of the fine weather on the first day (May 28), went out on the lake in our boat to ascertain its depth. The greatest depth was 15 sajens by the steep bank at the southern end, the shallowest part being off the low bank at the northern end. From the northern shore the lake became gradually deeper for some 7 or 8 versts, and only when within a verst of the southern bank did it suddenly become shallower again.

The men went out to shoot antelopes (*Pantholops Hodgsoni* and *Procapra picticauda*), which were to be seen grazing here and there in the wide valley. A herd of wild asses (*Asinus kiang*) were seen across the stream opposite our camp, and on the other bank of the lake was a large herd of wild yaks. The fabulous quantity of wild mammals to be found everywhere in north-east Tibet can be accounted for by the almost complete absence of their worst enemy—man.

Birds, both swimming and wading, soon made their presence on the lake known in the profound silence of the evening. Grey Indian geese, ducks, divers, pintail, redbill, crested mudsuckers (*Sterna hirundo*), handsome widgeon, egrets, plover (*Charagrius Mongolicus*), red-legged water-hens (*Totanus Calidris*), sandpiper (*Tringa Temminckii*), and black-necked cranes (*Grus nigricollis*). Close to the shores of the lake or on the stream we found the long-tailed eagle, fish-hawks, falcons, black-eared kites, ravens, larks, jays, finches (*Pyrgilauda ruficollis* and *Onychospiza Taczanowskii*), swallows, and a few others.

On the second day of our halt by the Alyk-nor, I set out early in the morning to make a rough sketch of the lake, taking with me Badmajapoff and Badukshanoff, as well as one of the Mongols. We all rode, carrying only what was necessary for a shooting trip on our saddles—a teapot, cups, and a few eatables. The weather was glorious—calm and clear. The sky above was marvellously blue, and we could, thanks to the transparency of the air, make out distinctly the most distant objects in the valley. The lowlying shore along which we at first rode was uniform in shape. Sand-banks projected from the water, forming islands, which served as an asylum for the birds. In places we came upon springs, fringed with green, on which wild asses and antelope were feeding. But what interested us most were the bears, whose fresh tracks had been noticeable as soon as we left camp. They had apparently passed the night on the higher ground, moving down at daybreak to the shore along which we were riding. While I was busily employed trying to sketch the banks and put in the shade of colour on the top of the water, as well as to sketch the birds swimming about on it, my companions amused themselves watching the various herds of animals wandering by the shore. The bears were soon sighted, and we could with the naked eye easily distinguish the powerful build of the male compared with smaller dimensions of his mate. Now that they were in our path, the temptation to go after them was irresistible. As we got nearer we saw that they were playing, and that it would consequently be easy to get close enough for a shot at them.

Leaving the ponies, Badmajapoff and I went after them with the cunning of experienced hunters. Not a sound disturbed the deathly stillness of the morning air. Dust, raised by a footfall, fell whence it had risen, and there was no reason to fear that our quarry would scent us. When, however, we reached the patch of level ground on which they were disporting themselves, we were at once perceived. Bruin instantly stopped playing, and, raising himself on his haunches, looked intently in our direction. His mate shuffled up to him, equally alarmed. For the moment they might have been statues, but quickly arranging which animal each was to take, we fired simultaneously. My bruin fell heavily on the sward, while the she-bear appeared to do the same; but quickly getting up, she almost unnoticeably slipped off the green and disappeared. When we came up to the other—the dead bear—she had already gone some distance, but with the glasses we could make out her quick shuffling gait and occasional halts, as the poor frightened beast looked back in our direction. My companion mourned her escape, but I endeavoured to console him by saying that in the future months he would have many a chance of correcting his mistake and proving to us his marksmanship.

Having skinned our victim and fastened his coat to one of our saddles, we were ready to move on, when suddenly I caught sight of another large old bear coming quietly towards us from a neighbouring marsh. While I was wondering what was best to be done, he came closer and closer, as if purposely making for us, until he was within 400 paces. Slipping off my pony, I quickly went to meet him, and when within about 120 paces, dropped him like a log with a couple of bullets from my Berdan rifle. His skin, like that of the first, was in excellent condition, so



we lost no time in removing it. Inside him we found some eggs, probably those of birds whose nests he had pillaged in the marsh. The stomach of the first bruin, which I had killed in the middle of his game of play, had been quite empty.

Having tied the second skin to one of the saddles, we lost no time in pushing on towards the foot of a small hill, Tologinin by name, where by the bank of a clear running stream, flowing from a north-westerly direction into the Alyk-nor, we called a temporary halt. With the dry wood and grass around us, we soon had a nice fire burning, on which we roasted meat and boiled water for tea. Our appetites that morning were indeed to be envied, for we were as hungry as the proverbial hunter. The ponies we let loose, and they revelled in the green pasture land. The weather was perfectly glorious. Not a cloud was to be seen in the pure blue sky, and the rays of the sun, now high in the heavens, were perceptibly warmer. Lying on my back on the soft velvety grass, I gazed upwards into the wonderfully azure sky, and high above me in the blue I could distinguish wandering birds of prey—vultures—from whose sharp eyes the carcasses of our victims had not long escaped. These rovers of the air moved towards the direction of their booty, and then swooped downwards like veritable bombs. Taking up my glasses, I looked at the place where we had left the dead bears, and saw a wild ass come up to one of them, walk round it, and then, stopping with his head erect as if suspecting something, suddenly dash off at full speed. The feathered scavengers were still moving towards one central point—their booty—where a glorious feast awaited them.

After finishing their tea, my companions set to work improving the skins by scraping off the thick fatty tissues,\* which, as we threw them aside, served to entice one of the white vultures. It swooped down quite close to us; but for its daring impudence this winged robber forfeited its life, being bowled over by a bullet from one of our military "three-line" rifles. Its plumage was so beautiful that we kept it for our collection. Later we continued our journey round the lake, keeping for as long as possible close to the shore. The western end was much intersected by small streams falling into the lake and forming between them ponds and pools, which made movement both difficult and slow. Avoiding a bog, we got on to what was evidently an animal track, winding about on gravel soil and gradually, almost imperceptibly rising, bringing us on to the high shore of the lake, whence we could see the valley lying before us in all its beauty. On the glistening surface of the water the huge peaks of the Burkhan Buddha were reflected as if in a looking-glass.

Having killed some shore swallows (*Cotile riparia*) which were flying over the rocky shore, we continued on our way. Shortly afterwards we saw a herd of wild asses coming towards us from the near hills, and they were brave enough to approach within fifty paces of us. I studied them intently through my glasses, but in their large deep eyes could detect no sign of fear—only curiosity. However, we were obliged to push on, and as we moved forward they at once took flight. They raised their heads high, snorted loudly, and then turning round quickly galloped off, kicking at one another as they went. When on the move the wild ass carries his head proudly erect, and waves his short tail from side to side. On our way to camp by the eastern shore of the lake we passed a great number of them, and in addition several antelopes, whose beautiful shape and graceful build, the size and carriage of their horns, as well as their quick and curious gait, called forth remarks of admiration and astonishment from my young companions.

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\* It is only possible to skin animals roughly when out shooting; the actual cleaning and curing of trophies is done in camp.

We were so busily occupied in watching the various animals that we imperceptibly approached our camp, to the east of which (and on the left bank of the stream) Ivanoff and some of the cossacks were waiting to show us the best crossing. A few more minutes and we were in. With splendid appetites we tackled the mutton and drank our tea, describing to the others what we had seen and done.

The Alyk-nor lies in an open valley, bounded to the north by the Burkhan-Buddha range, and to the south by the Under-Kuku hills. Although nearly 40 versts in circumference, this fresh-water basin seems comparatively small, owing to the gigantic scale of its surroundings—the Tibetan mountains. Its height above the sea is 13,370 feet. Its greatest length, which is by the lowlying shore at the north end, is 15 versts. Its other measurements have been already given. The colour on the top of the water was very variable, depending on the condition of the surface and the light. If the water were calm, the surface smooth, and the sky cloudless, the lake seemed steely-blue. Under opposite conditions its colour was monotonously grey, varied only by occasional dark shades.

As regards ichthyological fauna, the lake could boast of but few varieties, though it was literally crammed with fish. The great quantity of them, as well as in all the lakes, rivers, and streams of Tibet, is undoubtedly due to these waters having probably never been fished since the beginning of the world. We kept the following specimens from the Alyk-nor for our collection: *Schizopygopsis thermalis*, *Sch. malacanthus* and *aphus* (*Nemachilus Kungessanus*, *N. Crassus*), of which, according to Prof. A. M. Inkoysky, of the Kharkoff University, the latter is a new species.

The foreshores of the lake were covered with a grassy vegetation. The lowlying ground was dotted with green patches, on which were small reeds, blue and yellow iris, primula, and saussurea; and amongst them the common shrubs (*Myricaria Prostrata*) so typical of Tibet. The flora to be found on the northern shore of the lake were richer and more varied. In a stony nullah close under the hill we came across crimson milk-vetch (*Astragalus scythropus*), while here and there was sweet-smelling stock (*Cheiranthus*), and in the narrower clefts under the cliffs were more of the common shrub (*Myricaria prostrata*). Their leaves appeared paralyzed with the frost, and broke off the moment one touched them. Amongst them the pedicularis was struggling to come into flower. Near the myricaria, as if thrown there, was the green rose (*Saussurea*), of which some of the preceding year's tall bushes were still in flower. On the top of the steep cliffs was the corydalis, and lower down the euphorbia. A somewhat less common plant was the *Przewalskia tangutica* with yellow petals, and growing on the dry clay slopes were wild tea bushes and eurotia.

The stream Alyk-noring-gol, flowing out of the north-east corner of the Alyk-nor, runs in an almost west-to-east direction, corresponding to the trend of the hills and the valley which they enlose. At first narrow and of a yellowish clayey colour, this stream as it moves eastwards widens and becomes clear from the rapid silvery waters of the brooks tumbling into it from the neighbouring Amnen-kor range, which is the western prolongation of the still larger range Amne-machin ("Grey-headed Grandfather"). The length of this stream till its junction with the Egrai-gol (on the left bank) is about 80 versts, and the force of its current was fairly strong.

The Alyk-noring-gol valley, narrowing in places to a width of five versts, and in others opening to nearly double that width, is rich in pasture land, and affords ample grazing for wild animals. The Tsaidam Mongols go there every year to hunt wild asses, antelopes, and wild yaks. The vegetation at the lower end of the valley is little different to that by the lake. The further we proceeded eastwards the greater

quantities of statice, *Przewalskia tangutica*, and eurotia were visible; along the streams rising in the Amnen-kor *Hyppophæ rhamnoides*, *Potentilla fruticosa*, were abundant. Amongst the yellow and lilac-coloured iris mentioned above was the *Iris tigrida*, which eventually took its place. This had large beautiful flowers. By the marshy edges of pools we found *Ladotis*, and a little higher *Thermopsis alpina*. Here and there was the *Myricaria prostrata*, but it was more scarce than formerly, and consequently finer. There was also the greenish-yellow slipper, the small low-growing ephedra and the *Lasiagrostis splendens*; the latter we found along the sides of the valley close to the hills. Amongst the *Hyppophæ rhamnoides* grew clematis (*Clematis Orientalis*) and the tiny sweet-smelling honeysuckle (*Lonicera*), and along the branch streams rhubarb (*Rheum spiciforme*). Under the hill on the southern side of the Burkhan-Buddha range there were quantities of stock (*Cheiranthus*) with yellow and reddish-brown flowers, deeply rooted amongst the stones. By the marshes along the northern foot of the Amnen-kor various kinds of herbs and other grassy plants were growing, among which was the primula and golden-yellow bachelor's button (*Ranunculus*).

At the confluence of the Alyk-noring-gol and the Egrai-gol we met for the first time the nomad Tanguts belonging to the Aimak Rangan. They were living in a small number of "banuiks," called by the Tibetans "banags."

After traversing almost the entire length of the Alyk-noring-gol valley, we left it near the Kuku-bulak (spring), entering one of the northern nullahs of the Amnen-kor, which we were obliged to cross so as to be able to proceed on our journey south. At first this nullah seemed quite attractive, but as we moved up it the view became wilder, the ascent stonier, steeper, and narrower; even the path was sometimes invisible, and before we had been on it long, Jeroy—one of the Mongols who was invaluable as a shepherd in charge of our animals, though worthless as a guide, for which purpose he had been given to us by Baron dsassak—was, to our disgust, obliged to confess his ignorance as to the road. As soon as I heard this I ordered him to proceed in rear, and trusted to my own instincts and the knowledge which I had acquired in my prolonged wanderings to enable me to guide the party.

The first day of our stay in the Amnen-kor hills, June 6, was remarkable for the great cold, coupled with the quantity of snow which fell in great heavy flakes from early morning till noon, covering the ground with a thick layer more than a foot deep. As we slowly ascended, the feathered inhabitants of the higher hills—mountain finches (*Leucosticte hamatopygia*)—flew down the centre of the nullah, and with shrill cries crossed from one side to the other, now and then settling close to the passing caravan. Amidst the noise of their cries I soon heard others—sweet, delicate, soft sounds—quite new to me, and which at once attracted my attention. After a few minutes I was astonished to see on the nearest rocks, as well as on the grass-covered slopes, some very beautiful birds which it was not difficult to recognize as the *Leucosticte Roborowskii*, discovered on the late Prjevalsky's last journey in the Burkhan-Buddha mountains, and which I had for some time hoped to come across in this part of the Tibetan hills. M. Prjevalsky's expedition succeeded in securing only one specimen of this bird, in spite of making a special trip in order to try and get a hen bird (they had already got a cock). And here, sixteen years later, I again saw them, both single birds as well as in coveys, amongst which were both the red males and the smaller grey females. At first I only gazed at them longingly from afar, but within half an hour I was holding two dead birds in my hand, and involuntarily I remembered our celebrated ornithologist V. L. Bianky, who on saying good-bye to me had expressed the hope that I would secure a specimen of this bird, describing the grey colour, which was then more or less a guess. From the specimens in the Zoological Museum of the Imperial

Academy of Science, the above-mentioned zoologist has been able now to recognize a new species, the *Kozlowia* (*Kozlowia Boborowskii*).

Delighted at getting such valuable trophies, I had quite forgotten the unpleasantness of the weather. It was now mid-day. The snow was no longer falling, but the brilliant glare of the glittering snow in the sun hurt our eyes. As the khainiks were tired and our yaks required a rest, we were obliged to halt and ease them for a time of their heavy loads. The neighbouring rocky peaks, towering above the ridge, at times were visible, and again at times were hidden from our view by the moving clouds which wandered picturesquely amongst the mountains. After rather a steep ascent we reached the stony, razor-like ridge. The heavy snow which had fallen, though making movement difficult, enabled us to follow the zigzags, and we at last reached the centre of the pass—height 15,990 feet. The highest peak was some 700 or 1000 feet above it. On neither side of the pass was there any view to be had. To the north it was snowing heavily. To the south was another range of hills. As this route is never used by natives, the path we followed must have been made by animals—wild yaks and asses. The descent down the northern side of this nameless pass was steeper than the ascent, and we were therefore all the sooner at the grassy bottom of the nullah, though obliged to lead each of the bulls so as to prevent them slipping. When darkness came on we decided to bivouac where we were, and we were then able to rest after all the discomforts of the day. We were so worn out that a bear, coming almost into our bivouac like an unexpected guest, was allowed to depart of his own free will. Taking every advantage of his luck, he proceeded along the bottom of the nullah, from bottom to top, and, passing an overhanging rock, leisurely stood up on his hind paws and carefully scratched his back against the rugged projecting boulder.

Next morning, proceeding downwards along the nullah and gradually inclining to the north, we reached a pretty piece of ground surrounded by rocks dotted with shrubs, and close to rich grassland, which enabled us to halt four days with the greatest benefit to our animals. From here two expeditions were made, one by myself to reconnoitre the pass leading over the principal range to the south, the other by Kaznakoff to the north, in order to buy some transport bulls from the nomad Tanguts, and, if possible, to procure a reliable guide. Laduigin and Teleshoff scoured the neighbouring rocks in search of specimens for their collections.

Early on June 9 Kaznakoff and I left camp almost simultaneously. At first I followed the same nullah by which we had arrived, but after a little got into a steeper one leading towards the summit of the southern range. As a rule I preferred riding to walking, and as we went along I carefully scanned the rocks and the grass patches between them for life and flowers. Musk-deer were to be seen grazing, but they scampered off over the rocks as soon as they noticed us. A little further on we saw a herd of wild asses down in the valley, while high above the hills we now and again saw the ubiquitous vultures. The sun rose sluggishly, little by little lighting up the side nullahs, and instead of silvery hoar frost the grass was covered with glittering drops of dew. Hopping about on the boulders were large handsome mountain finches (*Pyrhospiza longirostris*), *Carpodacus rubicilloides*, *Accentor fulvescens*, *A. rubeculoides*, and other small birds, brightening the summer morning with their songs.

As we neared the pass we came across a red bear, which was so occupied with his own affairs that he never perceived me coming up to him till a couple of bullets laid him low. The sound of the shots echoing loudly among the rocks quickly attracted the vultures, who from the near crags had been watching our movements. My companions on this expedition were Jarkoy and Dadai. Having skinned the bear and tied the trophy to one of the ponies, we were about to proceed on our

journey when a vulture swooped down so close to me that I had to slay him, his body falling close to that of the bear. As soon as I fired all his winged companions flew up from the rocks, and, circling over the dead bodies, settled again in their former places. But I was surprised to notice that even when we had proceeded some distance they still refrained from approaching the dead bodies. Meanwhile we had neared the pass. The snake-like path wound about the steep slope and crossed on to more accessible ground, where we saw our pretty friends the finches (*Kozlowia Roborowski*), and halting for a few moments I shot a couple of them. Another half-hour and we had climbed to the top of the pass, whence we eagerly scanned the broad horizon to the south. In front of us was a typical Tibetan hill, down which the descent was considerably steeper than the ascent which we had just made, and almost in the centre of the panorama before us, glistening amongst the greenish-yellow velvety foothills, lay the watery expanse of the Oring-nor. Beyond this fairly large lake, in the bluish distance, rose the wall-like ridge of snow-capped mountains which give birth to the Yellow and Blue rivers. The rarefied air was remarkably transparent, so much so as to mislead us with regard to the distance of the lake, whose shores we could so clearly see. For long I was unable to tear myself away from this wonderful picture, presenting so striking a contrast to the view on the northern side, where the ground fell away in precipitous wild-looking gorges divided by sharp-ridged spurs.

Being sufficiently satisfied with our knowledge of the road, and after fixing the height of the pass as 15,780 feet, we commenced to retrace our steps along the morning's path, zigzagging about across the narrow strips of snow lying on the northern side of the hill. Soon, on a projecting rock, I saw a second red bear, smaller but similar to that which I had killed earlier in the day. They were evidently a pair, and this was now the widowed female searching for her mate, but she was wise in time, and so avoided following him on his unknown distant journey. On the moist edges of green plots we were again lucky in securing specimens of the mountain finches, which were on this occasion together with the *Leucosticte hama-topyygia*. Proceeding on to where the dead bruin lay, we found, to our surprise, that the body had not been touched by the vultures, which had now collected in countless numbers. The reason was, doubtless, the presence of the dead bird lying alongside; so to see what would happen, we amused ourselves by removing its body some hundred paces, when we were rewarded by seeing its companions immediately swoop down one after another on to the dead bear and commence their feast. Fighting over the body, these huge birds attacked each other with beak, talon, and wing, filling the air with their curious discordant cries. To dismount and fire into the brown of them with my "three-line rifle" was the work of a moment, whereupon away they flew, with the exception of six, which had breathed their last. Of the bear little remained. Taking home for our collection a pair of the best specimens of this *Gyps himalayensis*, we finished our sport for the day, and, as the sun had already sunk below the horizon, we made tracks as quickly as possible for camp.

Kaznakoff had already returned with some nomad Tanguts, from whom he had luckily been able to purchase three transport bulls and some butter. We gave them two of the most tired of our khainiks, which we hoped to be able to pick up again at the Tsaidam on our return journey, and we persuaded one of them, who professed intimate knowledge of the neighbourhood, to accompany us as a guide. In the course of conversation with him regarding the route, I learned that the pass which I had discovered was really one of the best over the Amnen-kor range,\*

\* Some 10 versts to the east of the pass which we crossed is another, called the Kara-gol, which is equally accessible.

leading into the valley of the Hwang-Ho, or Ma-chu river, as it is called by the Tibetans. It is also known as the Yellow river.

The Amnen-kor range, as has been said above, is the western continuation of the Amne-machin. In length about 100 versts from west to east, and in breadth about 30 versts, this range consists towards the west of two chains of peaks, towering among the eternal snows. We determined the level of the snow-line here as about 16,170 feet above the sea. From the Tibetan side we only were able to see these lofty snow-capped peaks on the western half of the above range. Generally speaking, the Amnen-kor appears much less imposing from the south than from the north. The northern slopes of the Amnen-kor, being usually under snow, feed a number of small streams belonging to the Tsaidam basin. The southern side gives rise to one or two, whose waters fall into the Hwang-Ho, which itself runs into the Pacific ocean. With regard to the indefinite expression "one or two," I should mention that one stream was reconnoitred by us, and is accordingly shown on the map. It rises in the western and higher part of the Amnen-kor, and, *en route* to the Yellow river, receives on its left bank several streams, which flow from the nullahs further east. As the eastern portion of the Amnen-kor is still unknown, one can only guess as to the existence of other streams. The flora and fauna of this range are, generally speaking, much the same as those on the more northern portion of the Burkhan-Buddha.

(*To be continued.*)

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## EXPERIMENTS ON THE TRANSPORTING POWER OF SEA CURRENTS.\*

By Dr. JOHN S. OWENS.

THE great differences of opinion which exist as to the relative importance of wave and current action in moving material upon the foreshore or sea-bed show the necessity for some experimental investigation of the subject. It is one of great importance in connection with the study of coast erosion, and, furthermore, it is one which is beset with many difficulties and pitfalls.

The experiments about to be described, while only touching the fringe of the subject, will, I hope, give rise to some discussion from which valuable information may be obtained; and as the matter is one pre-eminently suited for research, the opinion of the members upon the lines along which this should run will be valuable. These experiments were made last August, on the coast of the Wash, near Holme, Norfolk, where there is a fine stretch of sands exposed at low water; and, owing to the existence of several large pools or swills left by the receding tide, currents of varying velocities could be obtained near the outlets of these pools into the sea. I wished, in the first place, to find out, by actual trial on a natural bed, what sized stones a current of a certain velocity could move.

The method adopted was as follows: Having procured and numbered a series of flint stones ranging in size from half an inch to 6 inches in diameter, I found a suitable current, and placed these stones one by one on the bottom over which the current was flowing, until the size was found which the current was just able to move, the next size above being refused; the number of the stone was then noted. The next step was to measure the velocity of the current. This was done by driving two stakes into the bed a measured distance apart, and timing the travel of a float

\* Research Department, November 15, 1907.

these buildings were constructed with self-supporting walls of masonry, and it is interesting to note that they suffered more damage than those whose masonry rested on the steel frames. So little was the damage to the steel cage "cased" buildings, that nearly all the high structures now in construction are of this class.

Some incidental lessons are also apparent. The old axiom that the triangle is the only figure that cannot be changed in shape without changing the length of its sides is still true. The moral is, that diagonal framing, wherever the structure will permit its use, is yet a virtue; and the same is to be said of the generous use of knee braces and spandrel girders. Interior and exterior facing stones or brick should be most carefully bonded, front to back; and the use of lean mortar is but little less than a crime.

There were practically no buildings that afford a serviceable knowledge of the resisting power of reinforced concrete. Many of the buildings new under way or recently completed are of this kind, and it is the judgment of conservative engineers and builders that confidence in their stability against earthquakes will not be misplaced. In the past, severe shocks have occurred along the San Andreas fault, which traverses San Francisco, at intervals of thirty or forty years. It is reasonable to assume that they will occur also in the future.

In conclusion, a contribution on the mechanics of building and of structural engineering may not be strictly logical in the pages of the *Geographical Journal*, but it is a sort of knowledge that should become as widely diffused as possible. San Francisco has paid more than a quarter of a billion of dollars to obtain the knowledge taught by this object lesson, and she is willing that the rest of the world shall be a kindergarten class to avail itself of the knowledge which she has obtained by experience.

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## THROUGH EASTERN TIBET AND KAM.\*

By Captain P. K. KOZLOFF.

On June 11 the caravan recommenced its march, accompanied by the Tangut guide, proceeding up along the nullah towards the pass, which I had previously reconnoitred, reaching the summit without mishap by 9 a.m. A few moments before our arrival a bear had passed along the top of the ridge, and, evidently scenting us on the breeze, had rapidly hurried off amongst the rocks. On this—our second—visit the pass received us with anything but hospitality. The sky was overcast, while grey dismal clouds, detaching themselves from the higher wool-enveloped peaks, at times sprinkled the hill with thin snow. No voices of birds could be heard in the cold air. The view to the south was equally depressing, for we could scarcely make out even the whereabouts of the lake, which had before seemed so clear as to make us think it was at no great distance.

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\* Continued from p. 415.

Descending into the valley, we pitched camp on the first grassy spot we came to, which, judging by the traces of fires, had been fairly frequently visited by local shikaries. The weather still continued to be bad, and a cold gusty wind brought home to one the full extent of the inclemency. Snow fell all night, so that in the morning we found the ground covered with a white mantle some 6 inches deep. The thermometer fell to 7°, and it seemed like winter, but the sight of a dark snowless tract of country away to the south, near the Oring-Nor, assisted to alleviate our misery. The cause of this tract alone having escaped the snow was explained by our guide as follows: "This phenomenon is common to the winter as well as summer, and, according to old men, has been visible from immemorial times, ever since the arrival there of a wonderful black fox."

When the weather cleared we proceeded down the valley, steering for the nearest bay in the northern shore of the lake. The snow soon melted, especially when the sun peeped out from behind the moving clouds. Nature again came to life, and larks, both large and small (*Otocorys Elwesii* and *Calandrella tibetana*), flying from hillock to hillock, gladdened the air with the sweetness of their song. Having forded a muddy and dirty yellow stream, which in places left its flat flinty bed, we hastened across a piece of dry snowless ground. However, as the lake was still some distance off, and as we had to feed the starving animals and dry our tents, etc., now heavy with moisture, we retraced our footsteps to the stream which we had left, and pitched camp for the night. By ten o'clock the following morning, June 13, the white tents of the expedition were marking the source of the noted Chinese river, or rather its place of exit from the Oring-nor, whose greeny-blue waves were noisily lapping its sandy shores. On the afternoon of our arrival here we met a party of Tibetans of the N'golok tribe, consisting of four men, whom we received with the usual hospitality. They told us that they were only the small advance-guard of a numerous N'golok caravan, encamped on the north-west shore of the neighbouring lake—the Tso-Knor. The number of these pilgrims, who were returning from Lhasa to the Yellow river, or Ma-chu, they placed at 600 men, women, and children, who were divided into eighty fires, or groups, under the command of one of their chiefs (Binchin-sham) with two thousand animals—bulls and horses—and small flocks of sheep, driven in the rear of each of their echelons. To our other questions they either refused to reply or answered cautiously, despite the generous gifts we offered, and which they willingly accepted. The substance of our conversation both at this and at subsequent meetings with N'goloks was briefly as to the nature of the valley of the Yellow river to the east, their mode of life, and their internal administration. When we expressed a desire to proceed along the valley of the Yellow river, and to become personally acquainted with the mode of living of these independent Tibetans, they expressed the greatest displeasure, and endeavoured to change the conversation.

When they came to our camp they pretended not to look at our equipment and arms, endeavouring, evidently, to hide the natural curiosity which these produced. Noticing this, we made a point of showing them our "three-line" rifle with its magazine. "Although your numbers are few," said one of them, "no one insults you; your valuable rifle will always protect you. The N'goloks can only get the better of you by stratagem and cunning. For instance, having got into your camp in the guise of merchants selling eatables, with a party of thirty men or so, and having, at a given signal, suddenly drawn our swords and fallen upon you, we could kill you all in a couple of minutes. You cannot always wear your arms when out in the open valley." Afterwards, when they had been shown the latest things in revolvers, they were still more delighted, and remarked, "The



Russians are too well armed for such a plan to come off. They would pull these little guns out of their pockets and kill us before any of us could do anything." "I remember," continued one of them, "how we tried to fight some men like you in the Amne-machin, but nothing came of it, save that many of us were killed."\* "Hulloa, my friend," thought I, "you and I are old acquaintances." And, interested with what he said, I asked him where the men of whom he was speaking had been going. Without a moment's hesitation, he replied, "To the monastery of Rarchba-gomba, which they probably would have reached if one of their commanders or officials had not lost his head, which was the reason why the Russians were compelled to return to the Toso-nor."† Thus ended the interview with the first N'goloks whom we met.

On the way to the Oring-nor, and also when camped by its shores, we saw the principal N'golok caravan on the march, moving by sections. It was split up into families, the children, both big and little, being carried in open boxes or baskets on either side of the animals, while infants were carried in their mothers' bosoms. Their household effects were carried on yaks. For two whole days the long string passed within sight of our camp, and while watching the march of these wild hordes, I was forcibly reminded of ancient history and its descriptions of the incursions of the Huns, Goths, and other nomadic races into Europe.

Judging that we should spend a considerable portion of the summer in the bend of the upper Hoang-Ho, so as to put in a lot of geographical, ethnographical, and natural history work, I made up my mind invariably to maintain friendly relations with nomads, and in particular with the N'goloks, with whom Russian expeditions had already most unfortunately been compelled to fight in self-defence. We were, accordingly, delighted at meeting the N'goloks on their way home, under the leadership of one of their principal men, and we hoped by friendliness and getting to know each other so to gain their good will as to secure a safe conduct down the unknown upper reaches of the river. As soon as we had pitched our camp by the lake on a nice piece of ground, which lent itself admirably to defence, three of them arrived to visit us. An old man—a Mongol-N'golok ‡—who was assistant to Rinchin-sham, and two other Mongols, not counting some seven men who composed the former's escort, constituted the party. Among the escort were some fourteen-year-old lads, who tried to show off their skill with their weapons as well as their horsemanship. The Mongol-N'goloks had long ago become tibetanized. They had intermarried with the N'goloks, spoke Tibetan fluently, and, to look at, had the same type of features as the Tibetans. After dismounting, these Mongol-N'goloks, though armed to the teeth, calmly walked into our camp, and only parted with their arms at our request. Then, taking the seat usually reserved for guests, after in a few words welcoming us, they asked who we were, and whither we were going? I replied that we were Russians, that we had come from a great distance, had made the acquaintance of many countries and peoples, and that we hoped soon also to be able to visit their land. And I added that we were, therefore, most glad of this opportunity of getting to know the bravest of the Tibetan tribes, for whose chieftain we had brought some handsome gifts. "I hope," I concluded, "that nothing will happen to prevent my maintaining good relations with your chieftain, and that guides for our trip down the river Ma-chu will not be refused

\* He referred, evidently, to the attack made by the N'goloks on Roborovsky's expedition in the Amne-machin mountains.

† Roborovsky had a paralytic seizure just before the N'goloks attacked us.

‡ These Mongol-N'goloks, or Mongols of the Ma-chu, are divided into four camps.

us." To this the greybeard, without a moment's hesitation, and without even referring the matter to Rinchin-sham, energetically replied, "He won't give you a guide. I will let you know whether he will grant an interview to one of your assistants, both for the purpose of receiving your presents as well as for personal conversation."

After an hour's conversation they got up to go, tasting, however, some tea and sweets before departing.

The reply, which we so anxiously awaited, was eventually brought to us by the same hoary-headed old diplomat, who announced his message as follows: "Our prince neither desires your acquaintance nor your friendship, and consequently declines to provide you with a guide. Acquaintance with him and guides provided by him would not in any case give Russians a safe conduct, as an armed conflict might easily ensue between them and others not under his immediate authority. A quarrel is more likely to arise with the inhabitants of camps under the other six princes, for which Rinchin-sham might, if he had assisted you, be held responsible. Only last year, 1899, on receiving information from Sining Fu of the intention of some Russians to enter our country, he began to collect his troops to oppose them." I still tried to convince the ambassador of our harmlessness. I explained to him how in all my four journeys, when I had traversed many lands and met many people, I had been everywhere received in a hospitable and friendly spirit, while here for the first time I was meeting with discourtesy and hostility on the part of the N'goloks.

But in spite of all my arguments, in spite of the fact that after the death in the preceding year of his wife—the sister of the then Gégén of Labran, who exercised a softening influence on her husband's character—Rinchin-sham had sworn before the Dalai-Lama at Lhasa to refrain from killing, and had ordered those under him to return home in a peaceful spirit, in spite of all this, he had no sooner reached his native valleys and hills, so often smeared with blood, than his desire for peace had evaporated. Next morning the prince's secretary did not put in an appearance at our camp, which caused us to indulge in mournful reflections, for in his non-appearance we were compelled to read the ill-will of the N'goloks towards us, and to recognize the possibility of a fight. Thus, sad to relate, we were unable to visit these particular nomads either on our journey south or on our return northwards to the Tsaidam. But the fragments of information which we were able to gather by questioning various individual tribesmen and their neighbours the inhabitants of Ja-chu-Kava will not be found altogether superfluous, as they throw a considerable amount of light upon that most interesting nationality, of which till a few years ago almost nothing was known.\*

For how long the N'golok tribe has been in existence we were unable to ascertain. We were told that at one time Lin-gesur or Gesur-Khan had passed through their country, and that in the distant ages one of the Dalai-Lamas had cursed them. He is also supposed to have cursed another Tibetan tribe at the same time—a tribe living somewhere to the south near the Indian frontier—and for this reason neither of these would acknowledge his authority or accept his faith (Buddhism). To this day the curse is supposed to hang over the N'goloks, though they now are professedly Buddhists. They, however, do not acknowledge the

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\* Ja-chu-kava is the western portion of Dérge, one of the largest districts in eastern Tibet, through which the expedition passed on returning to the Tsaidam from the Lkhado district. All the inhabitants of Ja-chu-kava are nomads, who live in the upper Ja-chu or Yalun-tasyan, a tributary of the Blue river, and are the N'goloks' nearest neighbours on the south-west.

authority of the Dalai-Lama any more than that of China. If they rob any one, or if some one steals their cattle, they assume the most arrogant attitude in the subsequent negotiations, which they preface by saying, "You cannot compare us N'goloks with other people. You"—to whatever Tibetan they may be addressing—"obey the laws of strangers, the laws of the Dalai-Lama, of China, and of any of your petty chiefs. You are afraid of every one; to escape punishment you obey every one. And the result is that you are afraid of everything. And not only you, but your fathers and grandfathers were the same. We N'goloks, on the other hand, have from time immemorial obeyed none but our own laws, none but our own convictions. A N'golok is born with a knowledge of his freedom, and with his mother's milk imbibes some acquaintance with his laws. They have never been altered. Almost in his mother's womb he learns to handle arms. His forbears were warriors—were brave and fearless men, even as we to-day are their worthy descendants. To the advice of a stranger we will not hearken, nor will we obey ought but the voice of that conscience with which each N'golok enters the world. This is why we have ever been free as now, and are the slaves of none—neither of Bogdokhan, nor of the Dalai-Lama. Our tribe is the most respected and mighty in Tibet, and we rightly look down with contempt on both Chinaman and Tibetan."

The fact that the N'goloks plunder the Gégéns and vanquish the troops of Bogdokhan is evidence that they really do not acknowledge the authority of either the Dalai-Lama or of China. Five reincarnated followers of Daranata, proceeding towards Lhasa with an escort of Manchurians, were held up on the road and robbed by them, while most of the escort were slain. Some of these and the Mongol princes accompanying Daranata were actually obliged to return to the Tsaidam barefooted and hungry. Daranata himself succeeded in escaping earlier. The N'goloks frequently waylay caravans of pilgrims on the road to Lhasa and rob them of, as the saying goes, "their last shirts."

According to the Ja-Chu-Kava-ites, the N'goloks number more than 50,000 families, but we had no chance of testing the truth of what they said. Their statement, also, as to the strength of the N'goloks dwelling in the Archun district, on the banks of the upper Hoang Ho, must also wait upon the future for confirmation. The inhabitants of this Archun district, who call themselves N'golok-Archun Kaksuns, are said to consist of about 28,800 families under seven leading chieftains. Of these, at present the most important is Norbu-dander, who was the highest in rank and possessed the greatest authority after the well-known and powerful N'golok family of Kangren-sen, now extinct. The number of families in Norbu-dander's own camp is 1000. In addition to this, he has under his command more than twenty other camps, and as the strength of each is computed at 100 families, they must contain altogether about 2000 families.

In the deceased Kangren-sen's personal camp, which used to be considered the biggest, there are computed to be 11,000 families; but as his authority also extended over fifteen other camps containing 2000 families, he may be said to have had under him some 13,000 families in all. Amongst the fifteen camps was the most western camp of the N'goloks, called Khorchi. We came across it on the march when near the river Serg-chu (a right-handed tributary of the upper Hoang Ho) on our return journey, and estimated its strength at 800 families.

Third in seniority of the seven chieftains comes Kansuir-sen, who has command of 1300 families contained in thirteen camps, in addition to 1000 families in his own camp. Next is Binchin-sham, with whom we are already acquainted. In addition to his own camp of 700 families, he has control over four other camps with about 1500 families of Mongol-plots from the Koko-nor. Anchin-dopa, the fifth chieftain, has command of 1600 families, of which 1000 are in his own camp and 600 in six

additional camps. Burfa-dander, the sixth, has also a camp of his own with 1000 families and fourteen other camps with 1400 families, *i.e.* a total of 2400. The seventh and last of the principal chieftains is Bamam-bum. He has 1500 families in his own camp, and 800 families in eight additional camps. Total under him 2300 families. From this it will be seen that there are altogether a total of some 26,800 families under the command and jurisdiction of the seven principal N'golok chieftains.

But besides these leading chieftains or princes, whom in importance and significance the N'goloks compare to the Tsin-tsais of Sining-Fu and Lhasa, each camp is commanded by a secondary chief, who is in fact a camp commandant. Their appointments, like those of the principal chieftains, are hereditary; but all chief tains, whether principal or secondary, reserve to themselves the right to select and appoint their own assistants. Matters of importance are decided in council by the seven principal chiefs. The junior chiefs, *i.e.* the commandants, deal only with trivial questions, and report what they are unable to deal with to whichever of the seven they may be under. The four principal chieftains—Norbu-dander, his brother, who now occupies Kangrensen's place, Kansuir-sen, and Rinchin-sham—have exceedingly nice houses close to one another on the frontier of the agricultural and the nomad population of the N'goloks of Archun. We were told that all seven chieftains insist on a very strict etiquette being observed with regard to themselves; none of their subjects being permitted to bother them on any unimportant matter, while no one is allowed to see them without previously asking for an interview, etc. They live either in their fine buildings of stone, clay, and wood, or else in tents, or in Mongol huts called "urgos." Once a year each of the camps sends to its principal chief a valuable offering, but what it generally consists of we were unable to ascertain.

A third of the population of the Archun district are tillers of the soil, and live year in and year out on the banks of the Ma-ohu, or Yellow river, extending as far as Ruirchja-gomba. The remainder are alternately nomad shepherds and highwaymen. A legend is told amongst the N'goloks, and also everywhere in Tibet, as to the origin of their military spirit, and the reason for their success in war or on pillaging expeditions. The story is that when journeying through Archun, Lin-gesur lost his wonderful knife, and searched for it without success, and it is to the presence of this knife in their country that the warlike ardour of the N'goloks is to this day attributed. However, apart from this, their continued success, and the way in which they have been able to guard their riches, are also ascribed to the sacred mountains of Amne-machin, otherwise known as Machin-bumra. The latter is probably the real name of one of the highest peaks in the eastern part of the Ame-machin range, a peak which is washed by the river Ma-chu on three sides. It is exceedingly high, and abounds with massive glaciers, which in the sun or by moonlight are a most beautiful and singular sight. In summer the N'goloks offer sacrifices and hold services on the Machin-bumra, where are many small monasteries. It is held so sacred that no N'golok will eat food either at home or on the march, or will set out on a raid, without previously casting as an offering some portion of food towards the mountain and muttering a prayer.

Every N'golok is a thief and robber; but they only steal from strangers, and never rob each other. If by any chance they do, the severest punishment is inflicted upon them, even though the value of the article stolen be infinitesimal and the crime be committed many thousands of miles away. A thief caught in the act has both his eyes put out, his hands cut off, and the tendons of his heels cut to prevent him walking. If a thief is discovered in camp, the camp commandant takes the criminal before his senior chief. He himself has not the power to punish

him. A N'golok found harbouring or assisting a thief is punished as if he himself were one. If it is known that a N'golok intends leaving his home and joining another tribe, he receives the same awful punishment as a thief. When starting on a pillaging expedition, or to hold up some wretched travellers on the great Lhasa caravan road, they are not obliged to ask permission from their chief. And if the expedition fails, or a number of them are killed, he does not call them to account. If they return laden with the spoils and with cattle, etc., their chieftain, whether one of the seven or only a junior chief, is presented with the best pony, a yak, or the best of the booty, though only a little may have been secured.

But to return to the interrupted story of the expedition.

Soon after the last of the N'goloks had passed our camp the valley of the Oring-nor was deserted. Instead of being alive with nomads, there prevailed that extraordinary stillness noticeable in so many parts of Tibet, and the presence of our tiny solitary camp among the mighty mountains seemed a fairy tale. How well I remember our camping-ground \* on the shores of that beautiful lake so high among the lofty mountains—those dark blue or greenish waters with their edge so prettily scalloped out into bays by the steep high-banked promontories which here and there cut deep into the watery expanse! I can see before me now the beautiful foam-flecked waves ceaselessly beating against the shores with a monotonously recurring murmur, and the mirror-like transparency of its waters reflecting the high banks as well as the errant cloudlets gliding across the azure sky.

We were compelled to double the number of men on duty at night, to issue to every one the full complement of cartridges, *i.e.* a hundred, and to sleep without undressing, with our rifles beside us. In addition to our Mongols, whose sharp eyes were much more useful than glasses for spotting the parties of N'goloks who daily watched us from the eastern heights, two armed cossacks or grenadiers invariably escorted the cattle when put out to graze. Taking ordinary precautions, however, we often made excursions round about, shooting different animals and birds, while those of us who were in camp and not on duty spent their time fishing. There are an enormous quantity of fish in these lakes. Except by white-tailed eagles, fish-hawks, cormorants, and gulls, these waters had apparently never been fished, and our expert anglers were, in consequence, often rewarded with huge bags. The luckiest of all in this respect was Laduigin, who in about half an hour landed ten *Schizopygopsis thermalis*, *Sch. malacanthus*, each weighing from 3 to 5 lbs. I often watched them in the wonderfully clear water. They were most interesting in their native element, and to me it was more enjoyable to watch than to catch them. Most of the fish and cud chewing mammals which we killed were slain purely for the purpose of stocking our larder.

We soon got to know the ground, so I determined to push on with the map-work and to collect information about the two lakes of the upper Hoang Ho, which had been already visited by Prjevalsky when passing along the southern side of this basin. Having cautioned the party as to our relations with the numerous brigand tribe and its proximity to us, I risked leaving the camp for a few days. The *personnel* of my expedition consisted of Kaznakoff, two grenadiers, two cossacks, and two natives—a Mongol and the Tangut. We all rode our ponies, the baggage being

\* On arriving at the lake we pitched camp on the left bank of the Ma'chu, where it runs out of the lake. On the departure of the N'goloks we moved across to the right bank, opposite our former camp. Part of the baggage was taken across in our boat, the remainder being brought across by the animals through a ford lower down, where an island divides the stream into two broad channels. Besides being more isolated, this bank appeared to us more convenient, because of its excellent grazing-land both by the edge of the water as well as on the higher ground along the eastern shore.

carried on camels. I purposely took this number, as it enabled us to split up into two independent parties. The object of the trip was to sketch and examine the western shore of the Oring-nor, as well as the stream flowing from the south-east corner of the upper lake into the south-west corner of the lower. Kaznakoff's work was in prolongation of mine, i.e. to go round the Jaring-nor (or Tsaring-nor) lake, from where this stream runs out of it, up along the eastern and northern shores to where the Soloma or upper Hoang Ho runs into it, soon after its rise on the "Starry steppe" of Odon-tala. We were both successful. I returned to camp on the fourth and Kaznakoff on the seventh day. After our return we were fortunately able to fix astronomically the geographical latitude of the point whence the Yellow river flows out of the Oring-nor.

The lakes of the upper Hoang Ho, the Oring-nor and the Jaring-nor, according to most Mongols, or the Tsare-nor (the lake of clear water) and the Tsake-nor (the lake of transparent shoals), as the Tsaidam Mongols call these waters, are known to the nearest Tibetans as the Tso-khnor and the Tso-khchar, and to us Russians as Lake Russian and Lake Expedition, the names given to them by Prjevalsky. Both these fresh-water basins, which are only separated from each other by a hilly isthmus some 10 versts broad, are 13,900 feet above the sea. The eastern, or Lake Russian, is about 120 versts in circumference according to its bank measurements, while Lake Expedition measures scarcely 100 versts. Both are bounded by high rocky shores, which in places take the form of narrow promontories cutting into the water. The rocks are generally composed of clay sandstone akin to clay-quartz schist, and here and there of limestone, though we found in the north-western corner of the upper lake large pieces and rocks of granite. The bays are separated from the principal or running waters of the basins by flat necks of land or isthmuses which separate little lakes generally of salt water. There are islands in both. Judging from the lowness of the water, and the ease with which shoals can be seen on a clear day, the upper lake is shallow, especially on the western side, where islands jut out of the water as if no part of the promontories of which they really form the ends. Between these promontories and islands, as also across the lake on the southern shore, wild yaks can often be seen wading when wishing to avoid the long circuitous round by land. The lower lake is rather deep. According to measurements taken by Laduigin along its longer axis, it was 15 sajens deep at a distance of 10 versts south of the point where the Yellow river flows out. On the 23rd the temperature at the bottom ( $7^{\circ}8$  to  $8^{\circ}2$ ) was a little lower than on the surface ( $8^{\circ}7$  to  $12^{\circ}1$ ).

The colour of these clear waters was greenish-blue or dark steel, varying according to the light and the clouds. When there was a south wind the waves on the lower lake assumed massive proportions, and made an imposing noise beating against the shores. These, as well as the bottom, were finty, although at the deepest part of Lake Russian there is a quantity of red slime, in which, according to K. C. Merejkovsky, there were numerous different well-known diatoms. The breakers washed up a quantity of seaweed, which formed quite a high wall along the shore of the upper lake. Both lakes are connected by a stream of running water, which flows, as has been remarked before, into the south-west corner of the lower lake. It is about 15 versts in length, and has a width varying from 15 sajens to as much as 50 sajens, in places where it splits up into a network of branches. Where it has only a single channel the breadth does not exceed 30 sajens. During our stay the water was yellowish, and drained off rapidly into the lowlying marshy shores, the muddy colour intermingling with the water in the lake. Red slime was plentiful, and the water was in consequence shallow and full of weeds. Our collection of fish was enriched during our stay here by the following specimens:

*Platypharodon extremus*, *Gymnocypris leptcephalus*, *Nemachilus Stoliczkae*, *N. Kungessanus*, *N. robustus*.

The littoral is generally hilly save for two flat, broad valleys closing in on the northern shore of the upper lake, and disclosing to the north a view of the distant chains of mountains, the Munku-tasato-ula and Khatuin Khara. The lower lake is open on its north and south-western sides. The streams Jaghuin-gol and Razboynik (brigand) add to the running waters, or more properly to the adjacent swamp, by flowing into it from the south. The more northern stream which can be seen on old maps, forcing its way through a hilly neck of land of schist and aplite, in reality does not exist. Vegetation in the sense of pasture is plentiful along the shores, and animal life is visible on every side. During my trip round the shore I shot eight bears, one of them a she-bear with two cubs, while Kaznakoff killed an enormous old one. Of smaller animals we secured two specimens for the collection, a marmot and a *Canis Eckloni*. While camped here the weather was remarkable for the cloudiness of the sky and the quantity of atmospheric deposits which visited us in the shape of hail, snow, or rain. When the sun shone its rays were noticeably warm, especially in the absence of wind; but breezes blew daily, usually in a north-to-south direction. The atmosphere was very transparent.

Ivanoff, accompanied by three\* of the natives, left us on June 25 to return to the Tsaidam. He took with him the boat, as well as our post for Russia and the collection of skins, etc., etc., which we had amassed among the hills. Having seen him safely off upon his return journey, we commenced to make our preparation for the onward march, not eastwards as before, but southwards into Kam. On the night of June 26, the evening before we left, a tremendous thunderstorm came from the south-west. Occasional and deafening claps of thunder shook the air. Streaks of fiery lightning snaked fantastically through the inky darkness of the night, at times brilliantly lighting up the wide expanse of water in the lake. The towering foam-flecked breakers, chasing one another in vain hot haste, dashed noisily against the irresponsive shore. And so it continued all night long, save that a heavy snowstorm joined the frenzied elements, covering the adjacent hills with a white shroud. At sunrise all was still, except the majestic waters fretting, blustering, and vainly raging. Having forded the Hoang Ho below where it issues from Lake Russian, the caravan bore south-west along the isthmus, behind which was hidden the western or upper lake. We revelled daily in the beautiful view on the eastern lake, more especially when we had to climb over high-lying ground abounding in grassy vegetation. What with fish jumping in the water, cormorants swimming about, to say nothing of gulls, white-tailed eagles, etc., etc., we ran no risk of being dull or requiring amusement on the road. Parties of N'goloks were constantly watching us, showing themselves sometimes close and sometimes at a distance. Dadai amused us by telling fortunes—telling our cossacks, for instance, that some N'goloks would soon come into sight, that a khainik would fall sick, or that on the following day the chief of the party would kill a bear. On the fourth day we crossed a tributary of the Jaghin-gol, and after passing the memorable spot where the N'goloks made their first attack on the expedition of my never-to-be-forgotten teacher, we pitched camp.

After leaving the lakes we proceeded up the Jaghin-gol, every now and again crossing from one bank to the other. During its course this stream is in no way inferior to the newly risen Hoang-Ho, which it joins as the latter emerges from the upper lake. Including its bends and curves it is about 150 versts in length. High

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\* Two Tsaidam Mongols and the Tangut guide, who was to leave them in the lower part of the Alyk-noring-gol.

up it follows an easterly direction, but lower down it inclines to the north-east. In places it flows through valleys and breaks up into branches, while in others it is squeezed into a narrow bed by overhanging banks and ridges, which close in on it with their sandstone rocks. Where narrowed by the hills its waters bowl madly onwards, and the stream is quite unfordable, but where it widens out the depth does not exceed 3 or 4 feet. In the rainy season the water is twice as high, and, leaving the river-bed, overflows the banks on to the adjacent lowlying ground. Like the valley of the upper Hoang Ho, that of the Jaghin-gol was covered with feather grass (*Stipa orientalis*), similar to the bristles of a beautiful brush, amongst which could be seen the *Przewalskia tangutica* already flowering. In broader parts there were considerable strips of *Cobresia tibetica*, a characteristic attribute of Tibetan plateaus. Lower down and along the sides was the lychnis, *Adonis cærulea*, euphorbia, astragalus, with beautiful violet flowers, and occasionally the *hedysarium*. But more lovely than anything else were the magnificent pink flowers of the *Incarvillea compacta*. On the hills were dwarf gentians, blue and white, straw-coloured pedicularis, large dandelion, and amongst the rocks the fern-like *Potentilla fruticosa*, and many other plants. The mammals in these parts were the same as in the other hills, the only difference being the quantity of this or that species. We saw more herds of wild yaks than any other animal in this locality, and we killed a number of them for the larder.

Those who are travelling in Tibet for the first time, as well as old hands, find it very difficult not to spend much of their time studying animal life and to be continually shooting. Wild yaks afford the most enjoyable sport. I should mention that the large herds are much harder to approach than single beasts or small groups of them. The largest bulls seldom travel with the big herds, generally keeping to themselves. If one wishes to kill the young ones, one should follow a herd and pick one's shot. The big old bulls are to be found only in the dark nullahs. Shooting yaks, in fact, is little different to shooting any other animals, but, independent of the numbers of animals in the neighbourhood, sport requires both time and knowledge, or what sportsmen call skill, and climbing the hills requires strength and endurance. Owing to the quantity of work which there always was in camp, I personally rarely went out shooting, save when we were making a prolonged halt, as in Gan-su or Kam, and accordingly when an interesting animal in the shape of a bear or a yak came close to our camp, or near us on the morning's march, I never missed an opportunity of shooting it. Before entering the Jaghin-gol valley we had seen a number of wild yaks, but only at such a distance as to make it impossible to go after them, and we were all most anxious to try the destructive power of our new "three-line" rifles on this the biggest of the animals in Tibet. The Jaghin-gol valley, where we were more than ever in need of meat, and where we saw more wild yaks than ever, seemed to give each of us a chance of firing at, if we did not kill, the "bukhu-guresu," as it is called by the Mongols.

One early morning, soon after entering the valley, when the caravan was on the march and skirting some high hills, which fell away in numerous spurs, I suddenly came on a group of wild yaks on the slope of one of these spurs. Having scented us, the beasts became alarmed and quietly began to move off, but one old bull quickly turned in our direction, and, after advancing a few steps, stopped, apparently undecided as to what to do. We could see at once, from the fighting way in which he carried his head, from the glint of his eye, and from the way he raised his shaggy tail, that he was angry and meant war. Slipping off my pony, I went down on my knee and opened fire on the great brute. The fourth shot brought him down, rolling over on the slope. After a minute or so he raised himself up on his fore legs, but his hind quarters dragged behind him, as his spine was broken. Though



helpless, the huge brute was mad with rage. His blood-shot eyes rolled round, his fore legs pawed the ground, and, moving his head, he looked as if he meant charging and crushing us with his massive carcass. But he was mortally wounded, and, to put an end to his suffering, I again fired at him. It took three more bullets before he fell and breathed his last. The destructive effect on animals of the new "three-line" rifle is wonderful. The bullet breaks up bones to small pieces, tears through muscle and membrane, and the more compact they are the greater the penetrating effect. We calculated that, as regards death-dealing capabilities, five or six of its bullets were equal to ten of the Berdan rifle.

In addition to wild yaks, quantities of koulans were seen in the Jaghin valley, as well as a number of antelopes, which appeared generally to fall a prey to the wolf. Tibetan bears were to be found wherever the *Lagomys ladacensis* lived, and our collection was enriched by the skins of many of these animals—skins of all sizes and shades of colour from light to dark, and we seldom found such a variety among other animals.

It rained continuously during the time we were in this valley, stopping only occasionally in the morning, when the caravan had to do its usual long march of perhaps 15 versts. At night or towards morning the temperature used to drop to 3°·8 below zero, and hoar-frost covered the ground.

It is wonderful to what extremes of climate plants are impervious in their struggle for existence. With the rise of temperature by day they open out. At night, and in cold weather generally, they seem to go to sleep. It is difficult to believe that in a valley of north-east Tibet, on the same day in June, and in the same place, travellers can see winter all around, and yet in the middle of the same day, or perhaps a little later, they can look on a summer scene. Snow which falls at night paralyzes vegetable and animal life for some hours. The ground is covered with snow; creeping things hide in their burrows. Jays and finches (*Pyrgilauda rusticollis* and *Onychospiza Taczanowskii*) are not to be seen. One hears neither the voices of larks nor the humming of insects, as if everything had disappeared—had died. But the moment the warm sun begins to peep through the clouds, the snow melts, green patches little by little begin to appear, plants raise their heads and their flowers open; creeping things come out of their holes, finches and jays fly out, beetles, bumble-bees, and other insects crawl forth, and, in a word, nature comes to life again. The medium-sized and large mammals in the Tibetan hills are sufficiently protected from climatic discomforts by thick long wool. This is especially noticeable among the largest animals—the wild yak, for instance, which has on its belly a mass of shaggy hair which with those sort of beasts serves the purpose of bedding or a rug.

During the rainy season, or it would be more correct to say the rainy and snowy season, our tents, felt, and baggage generally got soaked through and through with the damp, the surface of the ground was greasy mud, and our boots soon wore out. The lower ranks of our party, in particular, had a very rough time of it, and the worst duties were those of escorting the animals while grazing, or of cooking, and of the men on duty at night. Cooking the early morning tea was one of the most distasteful and difficult jobs, for the efforts of both reliefs\* were required in order to get the kettle or teapot to boil on the wet yak-dung fuel. The first relief did his best to dry the fuel, while the other busied himself continually with the bellows, trying to keep the fire up. But, as the most important and dangerous hour for a sentry is early dawn, when Tibetans, like all other Central Asian tribes,

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\* By night our sentries were divided into two reliefs. The first relief till midnight, the second till dawn, when we usually struck camp.

attack, there was generally another of us awake to assist in boiling the tea, namely, one of the non-commissioned officers, Teleshoff or Jarkoy. The reader can imagine what difficulties we experienced in this weather with the natural history collection, especially with the plants, which require dry, fine weather. Our arms rusted badly, and required constant cleaning and attention.

One of the tributaries on the right bank of the upper Jaghin-gol brought us out on to a soft grassy pass, called the Chjabu-vrun, which is 15,170 feet above the sea. This ridge is called the watershed of the Yellow and Blue rivers, whence to the north and west the hills of Tibet fall away in huge undulations. To the south the contrast is very great. There one saw successions of deep nullahs, while in the distance the proudly towering peaks of the snowy Hatu-chu formed a perfect picture against the blue background of the heavens. No sooner had we crossed into the basin of the Blue river than Nature seemed literally to fawn upon us. The climatic discomforts which we had so lately endured became a thing of the past. Every day, as we descended along the nullah, the weather became milder, and the general view of the country was a pleasant relief to the eyes. Our herbarium and entomological collection grew apace, for everywhere around us the ground was carpeted with variegated plants, above which butterflies (*Parnassius*) fluttered, and from flower to flower of which flew bees, wasps, bumble-bees, and many other insects, disturbing the silence with their humming. In the noisily tumbling transparent waters of the brooks were fish—*aphua* (*Nemachilus bombifrons*) and *Schizopygopsis thermalis*, while in the hilly glades close to the banks we discovered an interesting new species of *Microtus Kaznakowi*. But the large mammals common to the mountains seemed to have disappeared—squeezed out, in fact, by man, the northern Tibetan, whom we were soon to meet. The first inhabitants of the country whom we encountered along the banks of the Khi-chu stream were northern Tibetans of Namtso's camp, who had previously heard from Sining Fu of our probable entry into their country. As soon, therefore, as the sons of the absent old chieftain learned of our arrival, they ceased reviewing the warlike preparations of their subjects and galloped to our camp to meet us, accompanied by Badmajapoff and Dadai, whom we had sent to them, and by fifty of their fully armed warriors. It did not take us long to make their acquaintance and to establish friendly relations. The eldest son of the "bey-khu," in his father's absence, apologized profusely for not meeting us on the top of the pass, but excused himself by saying that he had not heard of our arrival. Both sons, and especially the elder, seemed extremely partial to alcohol, and willingly drank the brandy and vodka which we offered them. It was late in the evening ere they took their departure to their tents, some 5 versts lower down the nullah, previously promising to meet us early next morning near their camp, to prepare an open piece of ground for our tents, and to allow us the use of their father's grazing-grounds.

They were true to their words. We were met next day near their father's camp by the elder son, looking rather the worse for his strong refreshment of the previous night, and we pitched our camp hard by. The broad nullah was capable of accommodating many people. Everywhere, both up and down stream, the place was black with tents, and on the outskirts were numerous herds of domestic yaks, sheep, and other cattle belonging to the chief. Here and there rode lightly armed horsemen, or there passed a caravan of yaks, laden with the household goods of nomads changing ground. Occasionally mendicant wandering lamas passed and pitched camp, their white tents standing out sharply against the others, showing clearly to whom they belonged, who the owner was, and why he had come. The sound of tambourines, horns, and penicils were often to be heard in these moving chapels, especially in the evenings.

That day, July 16, as we were making a halt, Kasnakoff and I, accompanied by Badmajapoff and Dadai as interpreters, and guided by the chief's elder son, set out to call at the house of their absent father. Entering the large, roomy, and comfortable tent, which was divided into two parts, one reserved for the guests, and one occupied by the women and household accessories, we took our places. Opposite us smoked a huge fireplace, with projecting sides, on which were some eight copper or iron pots of different calibre. The cook and mistress were busily occupied at the fireplace. They were assisted by the latter's young daughter, whilst a servant was making butter in some large tubs. After the well-known ordinary welcome, we were offered tea and "juma," and, afterwards, liberal portions of mutton from a sheep which had been especially killed in our honour. The eldest son of the "bey-khu" waited upon myself and my assistant, while his secretary attended to the wants of our interpreters. Neither the mistress of the establishment nor her daughter stopped looking at us from the moment of our entry till our departure. Having tendered our thanks for their hospitality, we took our leave, but not before the eldest son presented us with a fox and other gifts usually offered to an honoured guest.

*(To be continued.)*

## STEREO-PHOTO SURVEYING.\*

By F. VIVIAN THOMPSON, Lieut. R.E.

### I. THE OBJECT AND USES OF PHOTOGRAPHIC SURVEYING.

THE object of photographic surveying is to map the detail of a triangulated area at a minimum expenditure of time and labour in the field, and at a total cost so far below that involved in plane-tabling as to warrant the sacrifice of that high degree of accuracy attainable in good plane-tabling. From this it might appear that photographic surveying is necessarily less accurate than plane-tabling. This is not the case; but, to attain the same degree of accuracy in detail, so many plates would, in certain classes of country, be required, and the plotting would be so tedious, that the photographic method might be less economical than plane-tabling.

One of the chief reasons why photographic surveying has not proved more popular in the past is that the method has been wrongly applied, and attempts made to compete with the plane-table or the chain in large-scale work. The economical advantages of the photographic method over plane-tabling increase as the scale of the map decreases, and as the ruggedness and general steepness of the country increases. These two conditions, viz. scale and nature of the country, must be carefully considered before a photographic survey is embarked upon. Atmospheric conditions require less consideration, the balance being slightly in favour of photographic surveying in most countries, if a stereoscopic method is employed. Generally speaking, a small-scale contoured map in mountainous country of 2 inches to 1 mile or under, and of sufficient accuracy for all ordinary purposes (military operations included), would be most economically turned out by a photographic method. The time occupied would vary from one-fifth to one-tenth of the time occupied in plane-tabling the same area, and the cost would vary in approximately the same proportion.

Plane-tabling is necessarily slow, but thorough. To compete with the camera the plane-table must hurry, and hurried plane-tabling could not compare with the work plotted from photographs. In very hilly and precipitous country everything

\* Research Department, February 21, 1908. Map, p. 588.

in the Alps is enormous. Pamirski Post represents the climate of the steppe at 3600 metres in the same way as Kasalinsk at 63 metres. The highest mean of absolute yearly extremes is at Pamirski Post, 67°·4; the lowest at Prshevalsk, 45°·1.

One of the most striking phenomena is the ratio of decrease of temperature with increase of height, which is almost unique. Khorog and Samarkand, though vertically separated by 1400 metres, are nearly equally warm in summer, which condition is expressed by a gradient of only 0°·35. Comparing Khorog to the very hot Kerki (245 metres) the mean gradient is still only 0°·44. The low steppe at Petro-Alexandrovska (85 metres) and the high steppe of Pamirski Post (3640 metres) are again brought into close relationship. The differences between their monthly gradients are very small, and the yearly rise and fall—so marked between any other two stations—is almost entirely effaced. It is to its character as a steppe, not to its height, that the High Pamir owes its climate.

The chapters on moisture and rain will be closely scrutinized by all who are asking questions about the past and future state of Turkestan. An absolute monthly minimum is attained at Kerki in August and September (no precipitation at all); but the driest years are at Pamirski Post (62·3 mm.), Petro-Alexandrovska (97·1 mm.), and Kasalinsk (122 mm.). The wettest month is March at Djisak (84·4); the wettest year at Prshevalsk (452·8). At Pamirski Post the maximum of water falls in June (15·4) and the minimum in March (1·6), while October, November, and December show an even supply of 2·5, 2·1, 2·1. April, the wettest month at Kasalinsk (16), runs the Pamir June pretty close, but June is the driest at Kasalinsk.

There is practically no snow in the Pamirs during winter, but the traveller descending through the valleys of the border mountains finds himself overwhelmed by huge quantities of snow.

The longest periods of drought observed at different places were at follows: at Kasalinsk, three months; Kerki, six months; Tashkent, four months; Samarkand, five months; Pamirski Post, three months, etc.

The able *résumé* on the climate of the Duab of Turkestan would have to be quoted in *extenso* up to the bitter end, which speaks of the hopeless future of a dying land.

The author is to be congratulated upon so happy a choice of subject, no less than on his masterly treatment of it, which has given us a standard work of reference that no student of Central Asia can afford to neglect.

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## THROUGH EASTERN TIBET AND KAM.\*

By Captain P. K. KOZLOFF.

On returning to our camp, we found it literally besieged with natives—men, women, and children from all parts. The Tibetans were enormously interested in all our European things, especially the electric battery, which they regarded as miraculous. Later in the day we were honoured by a visit from the camp chieftain's corpulent old wife, who came under an umbrella, bringing with her a nice-looking daughter. The latter was dressed in a red woollen dressing-gown, and had

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\* Continued from p. 534. The map on p. 651 should be substituted for that given in the first instalment of the paper; the former was only provisional, the latter is based on the materials which have been definitely worked out.

not neglected to add artificial colour to her unpolished sun-burned cheeks. Several other Tibetan girls were also there, all dressed in their best, and all of them behaving in the boldest manner. The chieftain's wife and these giddy wenches smiled continually, she encouraging them openly to approach us. The women and girls were quite fearless in looking into our tents. They literally besieged us, and Kaznakoff had, in consequence, no difficulty in taking some good photographs of them. We were told that the morals of the people in these parts are very slack, and that women are extremely free, especially with regard to the Chinese officials when passing through from Sining Fu, to whom even the parents themselves bring their daughters. When my young grenadiers and cossacks sang Russian airs to the concertina, the Tibetans were wildly delighted, and tried to imitate the "little Russians." Then, at a hint from the chieftain's corpulent spouse, the local beauties began to sing. Their songs and style of singing were no different to those ordinarily in vogue in Central Asia, but their songs were full of flattery and gratitude for our generosity.

In the evening the chieftain Namtso-Purzek-Namchje\* returned from his travels. He was a tall old man of some seventy-seven summers, grey-haired, and bent. I should mention that Purzek, as the Tibetans call him, is not officially the "bey-khu," though he has had complete control of the camp for many years, as, when scarcely out of his boyhood, he gained the love and respect of his clan by his exploits when fighting N'goloks and other Tibetans. We were surprised that letters and papers, given to us in Sining Fu, were addressed to him by name as the official "bey-khu," as if the real or hereditary chieftain was in no wise recognized. He talked fluently, but was reserved before the large assembly, and we were favourably impressed with him. As gifts he brought me the fox and usual offerings, apologizing, as his son had done, for not meeting us at the boundary of his camp. "It is my fault," said the old man. "When my son was in Sining Fu, the "tsin-tsai" personally told him that you were to be shown every possible kindness if you came to our country. I will do my best to help you on your onward path." He remained with us for two or three hours, replying willingly to my inquiries as to the best place for crossing the Blue river, telling me about the country and the people living further to the south, etc. He expressed a wish to be shown our new rifles, and to see the escort fire a volley with them. We gratified both his desires, and he and his subordinates were greatly impressed. Before he departed I gave him a revolver, which delighted him enormously.

On the day after Purzek's visit, I and my companions went to return his call, hoping to have another chance of questioning him on various points. The entertainment was again repeated, after which I asked him to allow us to take a photograph of himself and family, and to show us his troops on parade. He refused my first request, but without a moment's hesitation consented to the second, remarking at the same time that the short notice would unfortunately prevent him from being able to collect many of his men. When talking of military matters, the old man seemed to come to life again and to grow young: his dark piercing eyes flashed with fire, his figure straightened, and his energy was remarkable when recalling to his mind forays of olden days.

The evening before we left to continue our onward march, the promised review was held. A number of horsemen assembled at the appointed hour on the level ground close to our camp, whence we were most interested in watching them

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\* Rockhill, in his 'Land of the Lamas,' pp. 182-185, calls him "Namtso Purdung." Purzek, when talking to me, explained that he remembered Rockhill in 1889, although he did not mention his name.

T S A I D A M

**PART OF EASTERN TIBET**  
Showing routes of Capt. P.K. Kouloff's expedition

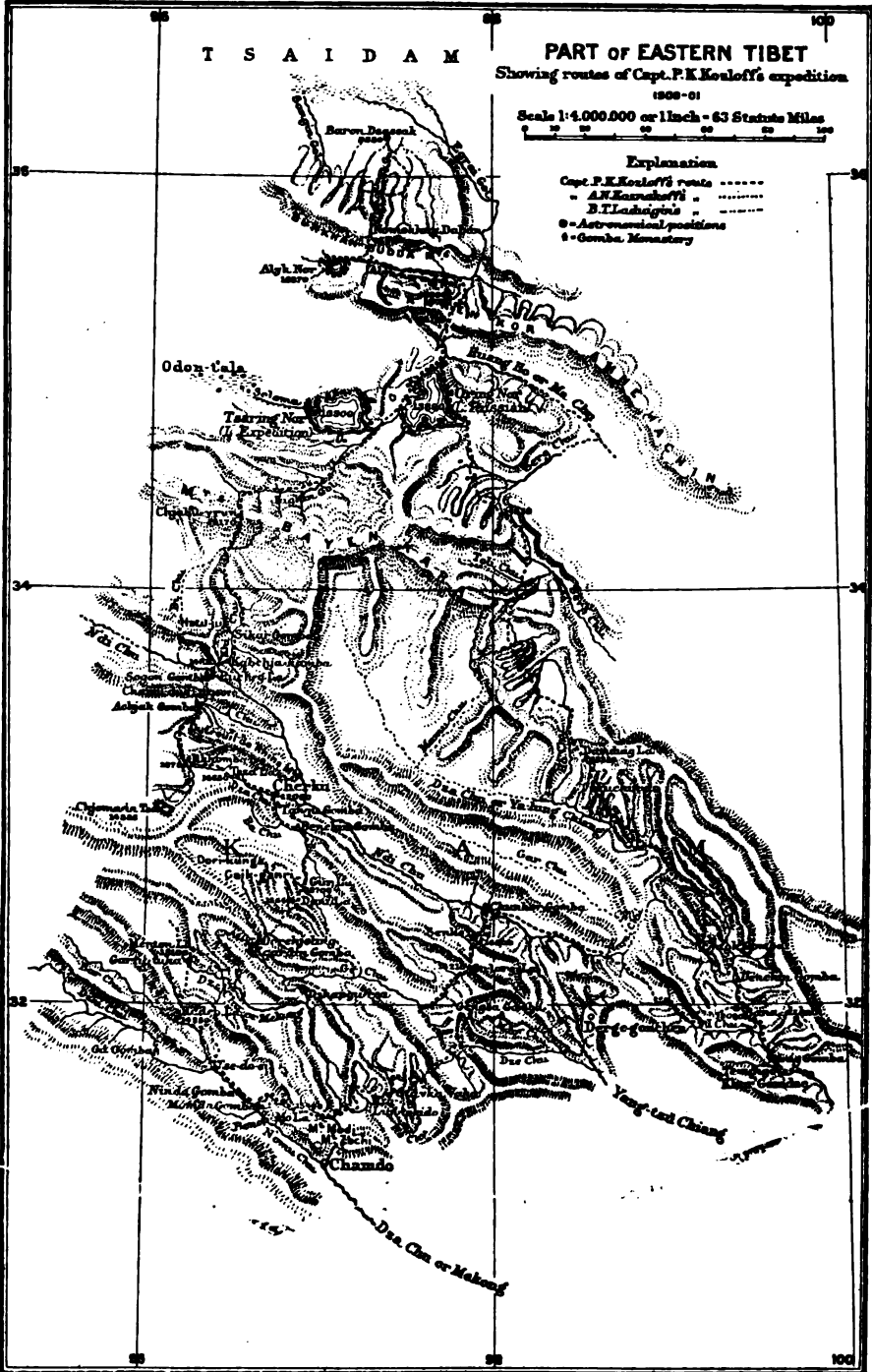
1900-01

Scale 1:4,000,000 or 1 inch = 63 Statute Miles



**Explanation**

- Capt. P.K. Kouloff's route -----
- A.N. Krasukoff's " " - - - - -
- B.I. Luchigin's " " - - - - -
- - Astronomical positions
- ⊙ - Gamba, Monastery



practising their feats of arms and trick-riding on the way to the parade-ground. At first they cantered along, every now and then taking a jump. Then they increased the pace, and finally, with loud yells, they broke into a gallop and went at full speed. Purzek's eldest son, his assistant, and two twelve-year-old lads, all in their best clothes and on their best ponies, passed the camp bearing themselves right well. The old chieftain, who all this time was in our camp, at length invited us to accompany him to the parade-ground, where were collected twenty-five mounted Tibetans, who from time to time let off a shot as if to show their impatience. In ten minutes we had reached the ground. The faces of the riders showed excitement, and their ponies were equally restless, snorting, rearing, pawing the ground, and anxiously looking around. We were first shown a duel between two men. One of the horsemen having ridden out some 30 or 40 paces in front of the remainder to represent an enemy, on the signal "to commence," galloped off as hard as he could. He was at once pursued by one of the others, who unlung his clumsy flint gun very smartly while at full gallop and fired at him. When they had gone some 300 or 400 paces, both riders turned back in our direction and rehearsed in the same manner. This time, however, they reversed places, the attacker being pursued and doing all he could to avoid the enemy's bullet by leaning down on whichever side of his pony seemed to offer the greatest safety. Several of the Tibetan warriors were exceedingly good horsemen, and performed excellent feats, especially the heir-apparent, who was the first to perform, and who constantly brushed the ground with his cap while going at a gallop. He performed more often than the others. Sometimes he took two rifles, firing them both off as before; and he always did various manual exercises with them previously. During each performance the remaining Tibetans shouted, the old chieftain always taking the lead, especially when his own son was in the arena. Afterwards eight of the men galloped out, four of them going on ahead again to represent the enemy. This was considerably more interesting, both parties firing going out as well as coming in. The full dress, the long hair hanging over their shoulders, and their ugly features were very effective. In a way, this Tibetan review vividly recalled to my mind the onslaughts of the brigand N'goloks on the two occasions when they attacked the late M. Prjevalsky's expedition.

Afterwards we saw some independent and volley firing; but the shooting was bad, in spite of the employment of a huge heavy gun, which took three or four times the ordinary charge of powder. This gun, weighing about a pood, was made locally out of an enormous gun-barrel, which was accidentally found on a hill close by. For long Purzek and his subordinates had endeavoured in vain to ascertain whence this weapon had come and who had been the owner. Needless to say, this rarity belongs to the "bey-khu," and is only used at home for defensive purposes. Having returned to camp with Purzek and his sons, we began to prepare for our onward journey. Our guests remained with us a considerable time, and the old man, dropping his reserve, drank a fair quantity of alcohol, with the result that he became both comical and entertaining. But in spite of it, our memories of him and his camp are of the kindest. He was the first in Tibet to give us a hearty welcome, and he was of the greatest assistance to us on our further journey, providing excellent guides as well as letters to friendly chiefs. By playing upon his reputation of being a sagacious and sensible man—a reputation which reached far beyond the boundaries of his camp—he prevailed upon others, through whose country we were to pass, to assist us.

On July 19, having parted with him, we moved off down the river Khi-chu at the usual early hour. The nullah soon narrowed, bending towards the east, and here at the foot of the cliff we came upon a hot spring, the waters of which are

drunk by the local people for many ailments, but particularly for rheumatism. The temperature of the spring, surrounded by stone walls, goes up to 42°. A little lower down the river, opposite to the spot where the waters fall rapidly over the boulders and are narrowed by the rocky banks, towers the sacred mountain of Hatu-ju,\* covered with the eternal snow which glistens in the sunlight. On the banks of the river just under the mountain is the monastery of Sikar-gomba, whose priests, like those of many another which we came across in eastern Tibet, jealously refused to receive a call from us. There are some three hundred lamas in this monastery, and the Gégéna, Chjiku, and Tséma, of whom the former and elder has been reincarnated. According to Purzek, this monastery is very old and wealthy, and is chiefly composed of monks from his own camp. Having temporarily left the stream, we climbed a spur, which we crossed by the Sadi-lakha pass, about 1000 feet above the river, gaining from here a glorious view in all directions. The whole expanse, as far as the eye could reach, was mountainous, and we could see the peaks of the southern prolongation of the Hatu-ju, intermingling as they met the rocky chain adjacent to the Blue river. Descending by a very steep path from the pass, we again reached the Khi-chu, where lower still, as it broadened out, we saw the greyish-yellow clay buildings of the agricultural population. This was to the south. It was worth looking back again to see the Hatu-ju, with its cones, domes, and tongue-shaped ridges standing out in relief, and the white patches of eternal snow. All around us grew handsome grasses, at first among shrubs, then lower down among trees (*Juniperus pseudo-sabina*). On the way to the village of Kabchja-Kamba we passed a second narrow gorge through the cliffs, where in a schisty cave on the left bank of the stream was supposed to dwell an earthly spirit, who lived in perpetual fear of a water-spirit inhabiting a similar cave on the opposite bank of the stream. Passing these haunts of spirits, we soon came to the dwellings of the Tibetans themselves, close to which we pitched our camp. The sun was warm, and the mild summer breeze prettily rocked the golden barley, above which martins darted to and fro and swallows flighted. The nullahs adjacent to the lower reaches of this turbulent stream enriched our herbarium with more than a hundred specimens. In the upper part of the hills we found, besides those plants which have already been mentioned as growing in the upper Hoang Ho, the following: a very sweet-smelling stellaria, pink androsace, anemone, violet (*viola*) with seeds, euphorbia, chrysanthemum, pedicularis, gentiana, and others. Lower down shrubs were plentiful—willow, caragana, honeysuckle, and spiræa. And of herbaceous plants were quantities of iris, *Isopyrum grandiflorum*, hippocrepis, large parnassia, onion (*Allium*), tall, handsome pedicularis with purple-coloured flowers, and two sorts of aspidium.

As regards the lower part, it might be divided roughly into two parts—upper and lower boundaries of cultivated land. As we descended into the cultivated area we were struck by the size of the grasses and their shape. About the ploughed fields were umbellar, two sorts of saussurea, blue-bell (*Campanula*), very handsome yellow pedicularis growing thickly on the small damp patches of grass on the banks of the stream, cusinia, cumin (*Carum*), green pea (*Vicia*), *Brassica rheum*, gallium, *Malva borealis*, polygonum, and euphorbia. Near the same ploughed land, by the more or less steep slopes, were quantities of barberry, currant, and gooseberry bushes with large berries, and amongst them were withered-up old junipers. Among these berry bushes flowered geranium with lilac and white petals, a wonderful blue forget-me-not (*Myosotis*), and a very sharp stinging Himalayan

\* This is the name by which it is known to the local inhabitants; in far distant localities it is called the Amne-tsokchin-donra.



nettle (*Urtica hyperborea*). The thick stalks of bright green cucumbers and atropa covered the open spaces, rubbish-heaps, old dwellings, and foundations of houses, so thickly that it was difficult to walk. Stone walls separating the path from the ploughed fields were overgrown with the above-mentioned currant and gooseberry bushes, whose roots went down through narrow chinks between the stones some 2 or 3 feet into the soil. Quantities of weeds could be seen growing among the barley, and in lesser quantities were thlaspi, erysimum, carum, pedicularis, blue and green acconitum, myosotis; geranium, aster, lactuca, brassica, boraginea, and two kinds of gentiana. Between the fields we found sedum, valeriana, gymnadenia, gnaphalium, saussurea, euphorbia, and about six different herbs.

The hamlet of Kabchja-Kamba consists of small houses of stone and clay, built in the form of a square. Above these hovels rises a large new house belonging to Purzek, which is built of rounded pebbles, and is as good as one could require. In case of emergency, the besieged inhabitants of the village could make a stand in it, and, taking cover behind the small walls which surround it on all sides, could easily defend themselves from an enemy. We were received in the village by Purzek's sons, who had preceded us on purpose to make the necessary arrangements for our passing through, and a large number of supplies were provided for us. Two brothers of the guides, who had been recommended by Purzek to accompany us to Chjerku, also put in an appearance. Tibetan guides seldom consent to go alone, except in the district of their own camp. In districts belonging to neighbouring or distant communities they will never move with a party of less than two. This is so even with men who know how to protect themselves.

Bidding farewell to the sons of "bey-khu," we left the pleasant Khi-chu nullah, as the road to the ferry across the Blue river inclined south-west, cutting across a high precipitous range of hills. From the steep Pucheg-la pass, 14,810 feet above the sea, we could only see a portion of the narrow blue valley. The river itself at the foot of the cliff was not visible, though the noise of the rocking waters could be distinctly heard with a favourable breeze. The mountain peaks bounding the river on the south block out the horizon. By mid-day we were on the left bank of the Yan-tsui-tayan river, called by the Tibetan of these parts, the N'dui-chu. The current was extremely strong, as the river flowed in its stony, capricious, winding bed. Shortly afterwards we crossed it, being ferried over in a couple of boats which were fastened together at their stern. This ferry is in frequent use. The charge for a man or an animal, a sheep or calf, etc., is about fifteen kopecks in Russian coinage. A third of this is given by the ferrymen to the camp chieftain, while the remainder, two-thirds, they keep for themselves. As we gradually got the baggage and sheep across—the bulls and ponies having to swim—we pitched our camp on a raised terrace on the right bank close to a small, poor-looking monastery (Sogon-gomba). The latter, though not well known, is fairly old. In it are only thirty lamas men and women, and one reincarnation, Durku-rimbuchi, Sogon-gomba has a very good reputation as regards the purity of its morals, although the monastery contains both sexes. The nuns cut their hair short like the men. The Gégén declined to make our acquaintance, although his companions frequently came into our camp. To the south of the monastery on a high hill was a clean, trim-looking chapel, beside which the yellow-hatted lamas can be seen sitting or wandering about. At a short distance from the monastery, and on the other side of a mountain stream, is a village, out of which rises a tower which was once inhabited, but is now empty.

Close to the ferry the N'dui-chu river flows from north-west to south-east, corresponding to the trend of the hilly chain, which encloses it between its rocky feet. The breadth varies from 50 to 60 sajens, with a depth of from

3 to 4 sajen. The water is highest in June. At this time, i.e. July—a month later—it was a sajen and a half lower. In late autumn the blue colour of its waters fully justify the name given to it by the French. In summer the water is a dirty yellow. The temperature was 13°. According to the local inhabitants, the river freezes over in October and is open again in March. The height by the ferry was 12,610 feet, and we were able astronomically to fix its latitude. All along the upper part of the Blue river the Tibetans exploit gold, though not quite in accord with the superstitious belief taught them by the lamae. The shores of the Blue river in the N'ruchu district or near the ferry were no less attractive than the lowlying reaches of the Khi-chu. The pretty valley and the adjacent deep nullahs running into it on either side were thickly covered with shrubs. Besides barberry, gooseberry, and currant bushes, hawthorn, spirææ, and honeysuckle, we found bog-myrtle, whose bushes grew to a height of almost 14 feet, with a diameter of 7 inches at the root of the stem. There was also a forest of juniper\* covering the slope of the right bank. Fields of barley, grown in terraces along the valley, thrived, and there were quantities of meadow grass. We added the following plants to the herbarium from the sacred Khi-chu: Handsome *Astralagus tanacetum*, bluebell, tall graceful rhubarb, lilac gentiana, orchis, avena, and various grasses; on the sandy shore of the river, salt-wort, blue onion, scorzonera, small-petalled erigeron, and saussurea with sweet-smelling lilac flowers; and on the higher ground amidst the clematis, orobanche, euphorbia, polygonum, convolvulus, plantago, astragalus, and a small-petalled geranium. In the wood of juniper bushes it was not difficult to distinguish lactuca, blue veronica, two sorts of onion, and several others.

As regards animals in the part of the valley through which we passed, there were few of either mammals or birds. Among the latter, besides large and small birds of prey, were the following: Jackdaw (*Coleus dauricus*), hoopoe (*Upupa epops*), jay (*Podoces humilis*), blackbird (*Merula kessleri*), cuckoo (*Cuculus canorus*), red-tail (*Ruticilla rufiventris*), Pratincola maura, Accentor fulvescens, finches, *Carpodacus rubicilloides*, *Montifringilla alpicola*, *Pyrgilauda ruficollis*, hawfinch (*Mycerobas carneipes*), swallows (*Chelidon urbica*), *Hirundo alpestris*, *Cotile riparia*, martin (*Cypselus apus*), linnet (*Linota brevirostris*), wild sparrow (*Petronia petronia*), *Abroornis affinis*, white and yellow *Motacilla*, *Budytes citreola*, wild pigeon (*Columba rupestris*), and some others. Very few butterflies or beetles were to be seen, but we hoped to come across some interesting mollusk specimens later on.

From here we climbed a yet steeper and higher range of hills to the south ere again descending into cultivation in the valley of the I-chu, a tributary of the Blue river on the right bank. To assist our transport animals, Purzek had made arrangements for fifteen bull-yaks to be given us, and we in consequence crossed the Chamu-dug-la pass fairly easily: it is 16,070 feet high. Nevertheless, during the ascent up the slope of the narrow and rugged nullah, composed of granite and gneiss, we lost one of our loads, which fell off, and rolling down was broken into many pieces. Fortunately, it was not part of our collection. From the pass, which is somewhat lower than the rocky, slaty peaks of the range, we could see towards the south a deep precipice, at the bottom of which winds the narrow, glittering, snake-like river I-chu. And beyond, the view of the distant horizon is obstructed by the rugged lofty mountains of the Nierchi and another range of hills further away, and nameless, composed of some red rock. In the nullahs through which we

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\* The trees of which grow to as much as 70 feet in height, with a width at the root of 20 inches.

passed grew a straw-coloured primula, labiate with light lilac petals, three kinds of gentian, a handsome blue aconitum, corydalis, pyrola, and on the pass itself a curious saussurea, another primula, and a large petalled delphinium.

Having descended a short distance on the southern slope of the hill, it repaid one to look to the left, or the east, in order to see two monasteries prettily and snugly situated on the tops of two hills, which fall away sharply on either side. The nearer monastery, called Bagu-gomba, contains about 200 lamas of the Gélupa sect (that is, yellow lamas), with a Gégén called Guchi as its principal. The other and the smaller—Lanchin-gomba—has only twenty red monks of the Nyimapa sect, at the head of which is the reincarnated Tartee-jaola. After entering the valley of the I-chu and proceeding some versts up it, we reached Achjak-gomba, the third monastery on this river, with twenty white lamas of the Karmara sect.\* While we were camped here these brethren were away collecting alms for the monastery, so we were, unfortunately, unable to see any of them. At the foot of the little hill which gave a refuge to this monastery stretched a grove of tall willow trees, which grew at regular intervals some distance apart. Between them, and none the less pleasant to look upon, was a green carpet of grassy vegetation, which pointed to being an ideal spot for us to camp. Lower down along the banks of the river were fields of barley bounded by canals and stone walls and by a hedgerow of gooseberry, currant, and barberry bushes, alternating with honeysuckle, intertwined with clematis and *Lasiagrostis splendens*.

On the next day's march the expedition reached the Nierchi mountains, which is the western extremity of a separate mountain group. I named it after that far-famed geographical traveller in Central Asia, Dutreuil de Rhins, who met his death through the savageness of the Tibetans in one of the eastern hills. The characteristic rocks of the Dutreuil-de-Rhins mountains—Nierchi—are composed of light grey quartz sandstone, and of grey and very small-grained limestone. Further eastwards along the foot of the hills on the southern side, we found pieces of hornblended granite, dark grey fine schistous filite, a few sorts of limestone, light grey slate, gneiss, hard brown-pink marl, brown-red conglomerate of small pieces of crystal schist, and clayey sandstone. The small I-chu stream is about 120 versts long. High up and in the centre its course lay right along our road, but lower down it flowed to the left. The Dutreuil-de-Rhins mountains compel the stream to flow in a curious semicircle, at first in a south-westerly and afterwards in a south-easterly direction. The R'khombo-tso lake, whence it rises, lies in an upland plateau which has the appearance of a lovely meadowy steppe, inhabited by nomads.

The I-chu valley enabled us to add the following specimens to our collection: Large-petalled tanacetum, several astragalus, handsome gentiana, two kinds of bracken, a new species of orobanche, Dame's violet (*Hesperis*), two or three saussurea, and a number of grasses, including feather grass. By the lake itself, which is situated at a height of 13,730 feet, we quite unexpectedly came across the common utricularia and reed-grass. By the rocks at the foot of the hills, which are washed by the silvery clear waters of the I-chu, we came across woodcock (*Ibidorhyncha Struthersii*), *Cinclus Kashmeriensis*; mountain finches, *Pyrgilanda ruficollis*, *Pyrrhospiza longirostris*, *Carpodacus rubicilloides*, the former martins and swallows, to which were added a new hill species, *Biblis rupestris*. There was also their handsome relative the redstart (*Chamarrhornis leucocephala*), the first of which are found either by the water or high up amongst the overhanging rocks, and these added a touch of life to our pretty camping-ground. At times from our tents we

\* According to Rockhill ('Land of the Lamas,' p. 217, note), the Chinese call the lamas of the Karmara sect "white" lamas.

heard the monotonous cooing of wild pigeons, and against the blue background of the heavens floated the unalterable snow-vulture, the lammergeyer, and the golden eagle. As regards mammals, we secured specimens of the Alpine polecat (*Mustella*), a small colony of which were at the foot of the rocks.

During the daytime none of the local inhabitants attempted to pass our camp, which was pitched in a gorge of the Dutreuil-de-Rhins mountains, but at night we were aroused by the noisy tramping of ponies ridden by Namtso brigands, who were hastening to pass through unnoticed. Our guides contrived to exchange a few words with them, and in the morning they told us that this was a party of young bloods who had made a successful raid upon the possessions of the Nanchina, and who were now making their way home as fast as possible, doing by night as much as 70 to 80 versts, and by day resting and concealing themselves in unostentatious places. We were not a little astonished at the pluck evinced by these brigand Tibetans, considering the awful darkness, especially in the deep and stony nullahs. Our march through the valley of the river I-chu was not difficult, and it was made easier by the chieftain of the Aiun encampment, who supplied us with transport, and for some days accompanied our caravan in person. This chieftain, or "bey-khu," who made his appearance in our camp at Aohjak-gomba, looked, in spite of his sixty-three years, a healthy, well-set-up man, while his great height and athletic figure, together with his abrupt manners, spoke still more in his favour. At our first meeting this original old man asked for some Russian vodka, at the same time remarking, "I don't want anything else, but I shall be delighted to drink some vodka, as yesterday at some friends' we had a feast, and I have a bad head to-day." He, however, drank the vodka very cautiously, having previously given it to his attendants to taste. When we became better acquainted with him, we found that he really wished to assist us as much as he could, and to follow the example of his respected friend Purzek. "On us," said the "bey-khu," turning to his followers, "on our twenty-five camps, lies the dark stain of a man's murder; \* we must, as much as it is in our power, blot out the shame."

On bidding farewell we gave him a present, which pleased him enormously, and amply compensated him for his kind assistance. Nevertheless, after the departure of our guests from camp, we discovered that an enamelled iron cup, which he had taken a great fancy to, had disappeared from one of our tents. It should be mentioned that, having learned by bitter experience the shameless way in which Tibetans invariably and continually begged, and of their uncontrollable tendency to theft, we always, when expecting a visit, made a point of concealing our private property, so as not to lead these savages into temptation more than could be helped. Our friend the old man personally guided us for two days, camping with us at night at the foot of the sacred mountain Chumuik-rapkha, which was covered with a dense forest of tall junipers. On my asking him to come and shoot in this wood, he replied in the affirmative, but it was not difficult to read from his face that he did not want to accompany me. Seeing this, and as there did not appear to be any unusually rare birds, I decided not to shoot.

In the I-chu valley, close to where the Dunchjon stream joins the river on the left bank, there is a small curiously shaped hill, called by the Tibetans Vak-khelkhari. According to tradition, this hill, which is now overgrown with grass, was once the favourite camping-ground of the great Gesur-Khan, in the days of his campaigns. His camp used to be pitched round it, and on the summit his enormous helmet was always placed. When we passed this historical hill, we found close to

\* He apparently referred to Dutreuil de Rhins. In the majority of cases Tibetans have no conception as to the division of European races by nationalities

it a travelling monastery, from which proceeded the sound of a prayer-tambourine. The night before arriving at the R'kombo-tso lake we camped at a place which, according to legend, was equally interesting, namely, where two separate little hills, personifying a fish and an eagle, stand close together. The latter hill vigilantly watches the former, to prevent its moving into the lake, which, according to tradition, would portend a second flood. Every summer, in the wide valley close to these hills, the Tibetans hold a military display, which is followed by a general debauch.

On the last day of July the expedition reached the northern shore of the lake, where a piece of ground close to the dwelling of the local headman was assigned to us. This headman—head of the R'khombo-doma encampment—appeared to be frightened, like his nomad neighbours, and was exceedingly dirty. On shaking hands, he proffered to me the customary gifts, welcoming me with a trembling voice. The reason for the fear displayed by the lake nomads transpired to be that they believed we had come to avenge the death of our comrade, Dutreuil de Rhins, who had been killed by Tibetans of the Det-ta encampment. The lake, which not long ago had contained a quantity of water, was now merely a marsh, overgrown with reeds. During our stay by its shores there glistened in places, midst the bright green reeds, large and small patches of fairly clear running water. The circumference of this marshy lake was about 20 versts, conforming in shape to the lie of the valley. The depth was not more than 2 or 3 feet in places where we were able to measure it. The bottom was composed of mud and alime. According to my aneroid, the height above the sea was 13,730 feet.

We saw the following birds on the lake : black-necked crane (*Grus nigricollis*), the Indian goose, the *Totanus calidris*. Further out on the open patches of water were duck, and, every now and then the *Sterna hirundo* flew across from side to side. Amidst the grass were long-tailed and white-tailed eagles (*Halastur albicilla* and *H. Macei*), and large larks (*Melano-corypha maxima*), which on clear bright mornings broke the surrounding stillness with their song. Occasionally martins darted through the air, as well as hill and land swallows. In the near hills black-headed larks and wild doves made their homes. Animals were conspicuous by their absence, with the exception of the antelopes, which came out each morning to feed on the grassy slope of the opposite shore. The reason for their scarcity was not far to seek, namely, the nomads, whose tents blackened the surrounding country, and whose large herds of yaks and flocks of sheep were everywhere to be seen. Occasionally we came across droves of ponies, the Tibetan's best weapon against the mischievous intentions of his neighbour.

During the few days of August which we spent by the R'khombo-tso the weather was showery. The blue sky was seldom visible, for clouds were continually coming from east or west, bursting into rain-drops over the thirsty lake. Thunderstorms were of frequent occurrence, accompanied usually by snow and hail, and in the evenings, to the south-east, we often saw summer lightning. The minimum temperature here was zero, and when at zero hoar-frost covered the ground. The local people, curiously enough, attributed the continued bad weather to our shooting, and used to tell us that if we would desist, the weather would at once clear.\*

While here, Kaznakoff made an expedition to sketch the neighbouring lake Chjoma-in-tso, which lay 35 versts to the south-west, resting its salty waters in a deep valley. Round the open clear water of this lake, which was 30 versts in

\* Throughout the whole period of our travels shots were always to be heard near the camp, or wherever we might be. Our men were always out shooting.

circumference, grew quantities of reed grass, winding among which were little streams flowing into the lake. The bottom of it was flinty, judging by the shores, and there appeared to be seaweed. On the surface geese and cormorants were swimming about, and the presence of the latter indicated that there must be fish. In our spare moments we did what we could to add to our supplies, buying sheep and butter from the Tibetans, who were willing dealers, being anxious to obtain silver with which to pay their taxes. Our stay by the shores of the R'khombotso, which was longer than we had originally intended, was marked by the sudden illness of the head guide, with whom we were most reluctant to part. But he rapidly grew worse, and so, after leaving him in hospital\* in the charge of the local headman, we set forth without him. Our path lay east-south-east, where the valley was hemmed in by red-brown hills of marl and conglomerate.

Keeping on in a south-easterly direction, and after descending again into a cultivated region, we reached on our fourth march Chjerku, a village 12,090 feet above the sea. Now that we were again near the Blue river, we particularly noticed the warm and comparatively dry air. The rainy weather and somewhat raw air had been left behind when we crossed the Tza-la pass (14,650 feet), whence the small stream Dza-chu, which joins the Ba-chu † at Chjerku, brought us to our camping-ground. At Chjerku nomads put in a temporary appearance, merely visiting the place so as to exchange their raw materials for articles of daily need.

Thinking to spend some time here so as to come to an understanding with the local authorities with regard to our onward journey, and as we were expecting to meet the Chinese, whose advanced party had already arrived, we arranged our camp close to the village, on the bank of the stream, and sent our animals up the Dza-chu to the fertile and hospitable ground by Darin-do.‡ This was famed for its waterfall, Gochinda, beside which we spent the last night before arriving at the monastery. At Darin-do, at daybreak one morning, a band of some thirty Tibetan thieves made an attack upon the camp where six of our grenadiers and cossacks were living in charge of the animals. Fortunately the ruffians were seen in good time, and were easily repulsed by rifle-fire. To which encampment they belonged we were never able to discover.

Chjerku ¶ is a fairly large village consisting of about a hundred mud houses, and is conveniently situated on the southern slope of the eastern extremity of the Dutreuil-de-Rhins mountains. On the valley side it is fringed with fields of barley

\* The sick man definitely declined to touch any of the remedies of the quack lama doctors, being suspicious of treachery — of being poisoned — especially after our departure.

† The two streams, joining together, form a large one, called the Tzan-da, which is a right-handed tributary of the N'dui-chu.

‡ Five versts to the west of Chjerku.

§ Here, as well as in the Dza-chu valley, we found new specimens for our herbarium. They were principally grasses; and high up were herbs, gentian, wide-leaved rhubarb (*rheum*), delphinium. Lower, besides the shrubs already mentioned, grew three kinds of gentians, orchis, a pink epilobium, saussurea, and two or three plants unknown to us. Near the waterfall there were salix, umbelliferae, and gramineae; and in Chjerku, triticum, gentiana, linum, labiateae, compositae, and cuscute.

¶ Rockhill, in his 'Land of the Lamas,' calls this village a town, and gives it the name as "Jyekundo," pointing out (*vide* note 9, p. 206) that it is sometimes called "Jyek'or." Pundit A.-K. calls Chjerku "Kegedo" (*vide* 'Report on the Explorations in Great Tibet and Mongolia,' made by A.-K. in 1879-82, prepared by J. B. N. Hennessey (Dehra Dun, 1891, p. 59). I noticed, however, that the natives call the village Chjerku, and the local monastery Kegedo.

which, when we were there, from August 9 to 20, were quite ripe, and were being cut. To the east of the village the rich monastery of Kegedo, with its 500 lamas (disciples of the old school), looks particularly handsome and imposing, perched as it is on the summit of a steep hill. It is supported by nine encampments, and is directly subordinate to the chieftain, a man called Rada, who is head of the local encampment. He is assisted by two men, one of whom is in charge of the nomadic population, and the other of the agricultural families. Of an evening both of them, without their people knowing it, used to come to our camp, but they were always very reserved in their conversation. Our attempts to explain to them the difference between the English owning the country to the south and Russians living far to the north were not of the slightest use. Like all other inhabitants in eastern Tibet, they took us for Englishmen, just in the same way that many Mongol tribes call the English Russians, when they happen to travel in the confines of Mongolia, eastern Turkestan, the Koko-nor, and the Tsaidam. It was interesting to note how the Tibetans could never look at those of us who had fair hair and eyes without feeling certain that we were English. The head "gégén" or "bey-khu" also evinced great interest in us, and he gave Kaznakoff an interview in the village one evening. He was affable, but very reserved, like his deputies. From the simple inhabitants of Chjerku we heard that the Lhasa government was anything but pleased with the Tibetans of Sining Kam, because, apparently, during the last five years they had paid nothing to the Dalai-Lama.

Thanks to its position on the great Ssü-ch'uan-Lhasa road, Chjerku is enlivened by the constant passing of merchant caravans, who keep large depôts of goods here, chiefly comprising tea. Every year trade to the value of more than 100,000 lams passes through, while from Ssü-ch'uan to Lhasa is imported, besides tea, which constitutes 70 per cent. of the export trade of China into Tibet, cotton cloth, silk, crimson cloth, sugar, Russian leather, and chinaware. The exports from Tibet consist of wool, fur, musk, horns of stags, pastille, statuettes, gold, and a few other products. Almost every day the tents of new-comers can be seen in the valley, resembling drops of ink spilled on green paper, attracting the attention of the local population. The village and monastery seem to be equally favoured. In fact, fresh arrivals move about freely to distribute news, playing, like all caravans in Central Asia, the part usually falling to the press. Our little camp came in for its share, being besieged by curious-looking and invariably cunning Tibetans, amongst whom we once saw a musician who performed on a one-stringed instrument. To my proposal that he should sell it, he at once declined, pleading that, as he had no other source of income, he would lose his livelihood.

From our tents we had a glorious view of the southern mountain chain in the distance, which, south-west of Chjerku, was often crossed by long strings of bull caravans moving towards Lhasa, or from Lhasa to Ssü-ch'uan. Close to us stretched a fairly broad valley, whose pleasant green surface was intersected by silver brooks uniting with the larger streams. It was the pasture-ground of donkeys, calves, and goats, with which the village children frolicked all day long, in groups of boys and girls. The former tried to race with the donkeys, but rarely succeeded in getting anything out of the stupid brutes, and generally fell back upon the goats, driving them into the water. The girls, as a rule, were merely modest spectators of the boys' exploits, and preferred to remain near their mothers, who were busy washing clothes. The shouts of their merriment and light-hearted laughter resounded along the banks of the stream. In the clear waters of this rapid-running stream we were most successful in netting fish, which belonged to the *Schisopygopsis thermalis* family mentioned previously. Our collection was supplemented by a specimen of the *Nemachilus stenurus*.

On the day of our arrival at Chjerku a Chinaman brought us news from Ivanoff, who had safely reached the depôt at the Tsaidam. He reported that, while on his way back, the men in charge of our camels, horses, and sheep at the depôt had been attacked by a band of Tangut robbers, belonging, it was thought, to Rangan's encampment. Luckily my two young travelling companions, Teleshoff and Afutin, kept their presence of mind, and succeeded in repulsing them, despite their numbers and the fact that the attack was renewed at intervals throughout the night. In the morning the brigands decamped, and two or three hours later my men drove the animals from the hills into the plains, to the depôt. Here their senior, Muravieff, in Ivanoff's absence in Tibet, was able to assist them by deeds as well as words. This repulse taught the Tanguts to leave us Russians henceforth in peace. We were told afterwards by the Tsaidam Mongols that the Tanguts abandoned their attempts to steal our animals, as they had suffered a loss of some three or four men in the affair. They, however, sought to avenge themselves for this by making many attacks upon Mongol encampments in distant parts of the Tsaidam.

On the third day of our sojourn in Chjerku we received a visit from Chinese officials—the tax collectors. Notwithstanding the wet weather, their entry into the village was made by the *gégén* or "bey-khu" an occasion of ceremony. Lining the road or standing on the roofs of the houses, the lamas blew their horns, played their flutes, and waved flags, while the poorer folk gaped at the incomers, exchanging greetings with such of the scribes, soldiers, or interpreters as they were acquainted with. When the Chinese officials called upon us, they arrived so early that we were still in bed, and were in consequence compelled to keep them waiting for some little time outside the camp. The next day we returned their visit. Both of the Manchurian officials endeavoured to assist us as far as they were able, but they confessed that they had little power here with regard to anything which was beyond the scope of their mission. Indeed, the only way in which they were able to be of assistance was enabling us to exchange their silver for Indian rupees, and by getting the question settled of securing provisions and reliable guides for our further movements into the territory of the Khan Nanchin-chjalbo.

During the twelve days of our sojourn in Chjerku we were often invited to the Chinese camp, and they in turn were entertained by us. They always complained of the dulness of the place, and of the weary waiting till they could return to Sining Fu. The Chinese are a very domesticated people, and fond of family life, so here, as in other places, they took to themselves temporary wives from among the local ladies. These sometimes accompanied their husbands back to Donger or Sining Fu, where, though seduced and betrayed, they were abandoned by the Chinese, and compelled of necessity to carry on a life of pleasure. This accounts for the inhabitants of some nomad Tibetan camps we met, on mistaking us for Chinese, asking us "if so-and-so and so-and-so, their wives or daughters, who had been taken away by Chinamen on a previous occasion, were with us? and if they were not of our company, could we tell them how they fared abroad?" Some of their eyes were even filled with tears.

Neither we nor the Chinese received news from our own country, so that we were utterly ignorant of the Chinese-European war being waged in the Far East, otherwise our modest dinners with the usual toast to our respective nations would have been somewhat out of place. I gave the Chinese a packet of letters to be despatched on their return, in one of which I briefly informed the Geographical Society of the progress we had made since entering Kam. The fate of this letter is, alas! still unknown.