

settling in Usoga rather than in Uganda. I have always found that the Arabs have a very keen insight as to which part of a country is its centre of life, and they have never taken any notice of Usoga but always striven to establish themselves in Uganda. It has been my privilege to see a great deal of the people of Uganda, and I consider them the most intelligent of any people I have found in Africa, and I sincerely hope and trust that the East Africa Company, so soon as it can do so, will make its settlement in Uganda. Mwanga might easily be removed, and the young gentleman of four years of age of whom we have heard be substituted for him. Mwanga is a thoroughly bad king, and has been a pawn between the English and French missions. I have felt from the first that it was a mistake for these two missions to work in the same district, and that as the Church Missionary Society was the senior it should remain. Mr. Ravenstein speaks of the Arabs adopting the northern route; they never go that route so far as I know. They always go via Kilima-njaro, through a country where there are not the natural difficulties of the northern route; it would be a good route for a railway, but as it goes through German territory I suppose it is impossible. I sincerely trust as soon as possible the British East Africa Company will make itself felt as a power in Uganda, and prevent the Arabs returning again. They are but waiting on the border, and if once they enter and get possession it will prevent civilisation for many years to come.

The PRESIDENT :—It is to be regretted, ladies and gentlemen, that neither Mr. Jackson nor Mr. Gedge was here to address us, but Mr. Ravenstein, as usual, put the information which they have supplied into a very clear shape, and has addressed us in a manner which your frequent applause showed was very acceptable to you. We have also, in the short speeches which have followed, received some additional information. I refer more especially to what we were told by Mr. Bowdler Sharpe, from which it is quite evident that in addition to its other functions this expedition has added very seriously to our knowledge of the natural history of that part of Africa and has supplied data which are of general importance in the study of the fauna of Africa. I am convinced that you will wish me to give your thanks to Mr. Jackson and Mr. Gedge for what they have done and for the information they have supplied to us, and I know that you will desire to include the reader of the paper, Mr. Ravenstein, in your acknowledgments. I think we may trust to Sir Thomas Fowell Buxton, who takes an active and important part in the affairs of the Company under which Mr. Jackson and Mr. Gedge are working, to let them know that all they have sent home has been received here with the greatest possible interest.

*Expedition of the Brothers Grijimailo to the Tian Shan Oases
and Lob-nor.*

Translated,* with Notes and Introductory Remarks,
by E. DELMAB MORGAN, F.R.G.S.

Map, p. 248.

M. GRUM-GRIJIMAILO, accompanied by his brother, explored last autumn a very interesting and little known part of the Russo-Chinese borderlands, including the mountainous region to the east and north-east of the Ili basin, forming a continuation of the Boro-horo chain,† in

* From the 'Ivestija,' tom. xxvi. vyp. iv. pp. 272-299.

† On maps generally, Iren-Khabigan.

which I travelled in 1880. He claims to have discovered, as already announced in our 'Proceedings,'* a knot or group of mountains hitherto unvisited and even unseen by any modern traveller. This group, bearing the native name of Doss-megen-ora, i. e. "loftiest of mountains," was not mentioned by Prejevalsky, Regel, Larionof, and other travellers whose routes lay to the southward, neither do I remember to have heard the name from my Kalmuk guides, who gave me those of the peaks visible from the valley of the Kash. Doss-megen-ora is not marked on any Russian map that I have seen, though Bogdo-ola, farther eastward, is a prominent feature in the cartography of the Tian Shan. The fact of its remaining so long unknown is attributed by M. Grijimailo to the high outlying mountains which mask it on the south and west; on the north it is too remote from Peh-lu, or the great northern Peking route, to admit of its being viewed from that direction, while to the east a mountainous tract continuing the main axis of the Tian Shan bars approach from that side; lastly, the inhabitants are shy and reluctant to give information that may lead to the discovery of their lofty and secure retreats. M. Grijimailo could do no more than give a general idea of the topography of this elevated region, for he was anxious to hurry on to the Bogdo-ola. On his way thither he crossed several rivers flowing down the northward slopes of Doss-megen-ora, and describes them as of unusual interest. One in particular, the Khusta, flows in a cañon of great depth and length, with a current so rapid that no soundings were possible. Reading his description of it we are reminded of those marvellous cañons in Colorado where rivers are buried at much greater depths below the surface, though we need not look so far for a parallel. I call to mind the Lepsa, a river that, after watering the town or stanitsa of the same name, cuts its channel almost at right angles through a chain of mountains by a narrow and impassable gorge on its way to join Lake Balkash.

These mountain ranges of Central Asia, running east and west, are in their general features very similar. Great altitude, a rampart-like abruptness of the main axis, and a poor monotonous flora, consisting of spruce fir on the northern slopes of the higher belts, meadow lands descending several thousand feet lower, followed by pebble-strewn plains, and, where there is water and sedentary inhabitants, by a fringe of cultivated oases. Beyond these are the sandy-clayey steppes with their characteristic vegetation.

Bogdo-ola, "the lordly mountain," the next point of interest visited by the Brothers Grijimailo, is more familiar ground—at all events the name is not new, appearing as it does on all maps of Central Asia in lat. 43° 30' approx., and in long. 89° east of Greenwich. The word "Bogdo" signifies in Mongol "lordly," "majestic," and occurs in Bogdo-

* Cf. 'Proceedings,' August 1889, vol. xi. p. 505; October and November 1890, vol. xii. pp. 616 and 668.

Khan, i. e., supreme khan or monarch, Bogdo-lama, the grand lama. It has also the sense of "holy" or "sacred," and reminds us of the Slavonic *Bōgh*, "God." It was the sacred mountain of the Mongols, just as Tengri-tagh was that of the Kirghiz, *Tengri** in their language also meaning "God." A Chinese author quoted by Ritter † says that no Hiong-nu (Hun) or other of the Turkish people dared to cross Bogdo-ola without having dismounted and offered up a prayer. An odour of sanctity still pervades it, for M. Grijimailo found strict orders posted up near the lake at its foot, warning all persons under the severest penalty not to kill the deer and other animals, or allow their cattle to graze on its slopes—orders, it is almost needless to say, disregarded even by the attendants of the numerous temples erected here.

To the south of Bogdo-ola and the ice-capped nameless range continuing to the eastward, lay the ancient kingdom of the Uighurs, mentioned frequently in Chinese annals under the name of Hoi-Hoi, or Turks; and it is interesting to learn from M. Grijimailo that there are many remains of their cities. He speaks of the gold and silver objects dug up in the region round Pichan, Lukohin, and Turfan, of copper vessels and inscriptions (in Uighur characters?) on leaves preserved in wooden boxes. All this is of the highest historic interest, for it brings us nearer to the origin of a race once dominant over a vast portion of the old world. The descendants of those Uighurs, a people known by the name of Chen-tu, allied to the Sarts of Western Turkestan, now occupy that region, where they display extraordinary energy and skill in irrigation works. M. Grijimailo passed more than a month among them, studying their songs and collecting ethnological materials, which will doubtless be published hereafter, together with the detailed notices on the animal and plant life of these regions.

He also visited a volcanic district, or, as he terms it, a burning coal-field in the mountains south of Shi-ho. This calls for a few remarks. It is generally believed by M. Mushkétov and some leading Russian scientists that the theories advanced by Humboldt, ‡ Ritter, and others regarding the volcanicity of this part of the Tian Shan were erroneous. Relying chiefly on the Chinese books and the reports of the few travellers that had made their way into these parts about the beginning of the present century, those great masters of geography fixed upon this central point of Asia as the seat of volcanic activity, associating it with Mount Peh-shan, or the White Mountain, north of Kucha, about 3° east of the Issyk-kul lake, and Mount Ho-shan, near Turfan, 180 leagues further to the east. We now find in the phenomena described by M. Grijimailo some confirmation of these theories. He observed smoke issuing

* Tengri-tagh, "Mountain of Heaven," was the Turko-Tartar name of Bogdo-ola Cf. Humboldt. 'Asie Centrale,' tome ii. p. 36.

† Cf. 'Erdkunde,' 2ter Theil, 2tes Buch, Asien, Bd. i. p. 337.

‡ Cf. Humboldt's 'Kosmos,' translated by Sabine, vol. i. p. 232.

from fissures in the ground, the lips of these fissures encrusted with crystals of sulphur; a white substance, probably silex, covering the surface; funnel-shaped cavities emitting jets of steam, suggesting comparison with recently active volcanoes in Iceland; the ground heated so that walking over it became difficult if not dangerous; mud having the appearance of being baked and a general fiery appearance being seen from a distance; naphtha springs and deposits of sal-ammoniac. All this, taking also into consideration the recent alarming and disastrous earthquakes in the Issik-kul district,* call for further investigation. It is true no lava is mentioned, but the great eruptions spoken of by a Chinese author refer back to the 7th century of our era, and the lava might in course of time have been covered by other deposits.

M. Grijmailo's narrative runs as follows:—

We are now at Hami, and it is time we informed you of the chief results of our expedition. Our route may be briefly summarised as follows:—Jarkent, Kuldja, Achal pass, Jin-ho, southwards into the mountains and along the Tian-Shan range, keeping at an altitude of 6000 to 10,000 feet as far as the river Ulan-ho, up this river and back, across the highlands to Khotubii and thence by high road to Urumtsi. From this last-named place we went into the Bogdo-ola mountains; having descended them we again followed the high road to Jimisar and thence northwards. From fort Khobu-zeh a side road led us to Guchen where we struck across the sands into Central Dzungaria. Returning to Guchen we followed the high road to Muli-ho (Morokho) and then crossed the mountains to Jan-bulak. Here we divided our party and penetrated by two passes, Builuk and Ulan-ussu, into the Turfan district, from Lukchin we took the road to Dza, the mountains of Chol-tau and Tinge-tau southward nearly as far as Lob; then via Chiktym by the southern road to Hami. Our itinerary covered 2080 miles altogether. Of these 1700 were mapped and 1417 had not been travelled before; nineteen positions were astronomically fixed; fifty-one heights hypsometrically and one trigonometrically determined.

The features of the country may be described as follows:—If you will look at a map of the Central Tian Shan you will see that exactly at the head waters of the Kash three ranges converge; these are—the Urumtai chain, the range separating Dzungaria from the Ili basin, and a third stretching in a south-westerly direction to Khan Tengri. Here a mountain knot might have been expected, and such we actually discovered, bearing the name of *Doss-megen-ora* meaning “loftiest of mountains.” From the valley of the Kash and the great and lesser Yulduz this upheaval is masked by high spurs, a fact which accounts for this huge mass of snows and glaciers remaining so long unknown. We saw it from the passes on the northern side of the Tian Shan, and fixed its position by triangulation. Our attempt to make our way to the foot of these grand peaks was unsuccessful, owing to the flooded state of the rivers and the absolute impassability of the road. Having in five days only advanced 10 miles up the Ulan-ussu torrent we turned back, not without losing several horses in vain endeavours to find fords and roads round the cataracts. In *Doss-megen-ora* the rivers Khorgos, Ulan-ussu, and the copious Khusta have their sources, besides the subsidiary streams Khumuk-sala and Shincha-ho. The lower Khusta

* For an account of these earthquakes, see ‘Proceedings R.G.S.’ October 1888, vol. x. p. 638.

takes the name of *Manas* and divides into seven channels hardly fordable in summer. Where we crossed this river it is confined in a cañon 10 to 14 feet wide. We crossed it by a narrow little bridge only a yard wide and supported on four *karagatch** poles. Here we lost a horse and its load, as it broke loose and fell into the river a height of 280 feet. We led the horses over, having unloaded them, and carried their packs by hand. The chasm of the *Khusta* is composed of very compact grey limestones worn by the water into the most fantastic shapes. This chasm is 26 miles long. As the river flows out of it and enters the valley it widens and divides, as I have said, into seven channels which serve to irrigate the oasis of *Manas*. Besides the rivers already mentioned flowing to the north, the *Yuldus* and *Kash* also rise in *Doss-megen-ora*, the former flowing to the south-east and the latter to the west.

The *Boro-horo* range, dividing the waters of *Dzungaria* from those of the *Ili* basin, is a lofty continuous wall-like chain with very short abrupt northern slopes and outliers and no valleys. This absence of outlying hills does not allow the snow water to collect and form great rivers. Such streams as there are flow in narrow defiles, becoming mere chasms higher up, where even a pedestrian would find it difficult to make his way; lower down they form cañons, walled in by alluvial conglomerate. The depth of these river beds is very great, in the case of some (for instance the *Kijtyk*) exceeding 1000 feet. There are no terraces, and the rivers are usually hidden from sight till one comes close to them. The largest of these rivers is the *Kijtyk*, and the following may also be mentioned; *Borostai*, *Jin*, *Ebteh*, *Jirgalty*, *Itkhan-Anchkha* with its affluents the *Ulasta* and *Pitchkan-Anchkha*, and the *Altyn-gol*. Where the *Boro-horo* separates from *Doss-megen-ora* its height is very great; large masses of snow lie on its summits and patches of it on the principal spurs. The only pass is that of *Ulan-ussu*, and even this is impracticable in summer—at all events we heard of no other. Unfortunately there was nobody to give us reliable information, for we had no guide. Concealed by mountains in the foreground, we could not obtain a good view of the *Jirgalty-Ulan-ussu* section, so that it was difficult to say if there were a more or less gradual fall towards the west, though this is hardly doubtful, judging from the fact that the *Myngaty*, *Achal*, and *Talki* † passes lie below the snow line. The exceedingly steep axis of the *Boro-horo* is seamed by defiles and is nearly devoid of vegetation.

It is remarkable that there should be no talus in these mountains, though gravel and huge masses of fallen rock frequently occur in the beds of defiles by which the snow water drains away in dribblets. So steep are the sides of these mountains that vegetation finds no foothold; on the other hand, the outlying hills and more gradual slopes, serving to buttress the overhanging cliffs, are fairly well clothed with grass, and the spruce fir, characteristic of these uplands, covers with continuous impenetrable forests the more accessible parts from foot to summit, here and there giving place to meadows. Steppe vegetation is rare, and even Alpine meadows are the exception. These latter are only met with in westerly parts of the range; to the east of *Jirgalty* they are confined to small ledges and a few of the defiles. Wormwood only grows on slopes facing the south. The real steppe feathery grasses are prevalent everywhere below 6000 feet, and only disappear with the last hills, where they give place to gravelly plains with their very characteristic vegetation. This stony steppe encompasses with a wide belt the *Boro-horo* mountains, separating them from the cultivated land which extends along the northern road, the so-called *Peh-lu*. Bushes

* Black elm, a common tree in these parts.—M.

† The *Talki* is the well-known pass over the *Boro-horo*, north-west of *Kuldja*; it leads directly to *Lake Sairam-nor*, and has a height of 7000 feet above sea-level.—M.

and wide-leaved trees only find shelter in the defiles, where they mingle with the spruce. There are few apple-trees, but an abundance of raspberry (*Rubus idaeus*), never found in the central and western Tian Shan. Generally speaking, the precipitous walls of the main axis of the Boro-horo, its wild, inaccessible defiles, its great outlying hills and abundant humidity, all tend to produce sameness in the flora; one mountain is like another, the gorges are identical in character and vegetation. This sameness in the flora and conditions of existence affects also the insect world. The investigation of the lepidopterous fauna confirmed in a remarkable degree the opinion expressed in my 'Le Pamir et sa faune lépidoptérologique'—that the fauna of this group of animals in the Tian Shan is not an independent one. Since the lepidoptera of any district are closely dependent on its flora, it must follow *à priori* that the two are related to one another, though M. Krasnof denies it. As I am no botanist, however, I will not break a lance with him on the subject. The mammalian and avi-fauna of this region are generally well known. Moreover, our collections of both one and the other were very small—the animals were shedding their fur, the birds were moulting. We obtained, however, about twenty good specimens of *Lagomys*, and an equal number of marmots—*Arctomys baibacinus*, besides one *Cervus maral*. On descending to the gravelly steppes, though we shot *Antelope subgutturosa* and wild ass, their skins were unfit for preserving. And now let me finish my description of the Boro-horo.

The northern slopes of the Doss-megen-ora intumescence, between the rivers Khorgos and Khusta, form an exceedingly wild, almost inaccessible mountainous country, extending far to the north. The Khusta, the largest of the rivers of the northern slope of the eastern Tian Shan, takes its rise in the southern slope of this group and flows, at first, in a wide defile along which lies the track, used even in winter, from the Ulan-ussu pass to that of Keldyn; then turning to the north the river suddenly narrows and bursts into a cañon, formed of compact grey limestone. In this cañon it rushes with amazing rapidity for upwards of 80 miles, then flows in a bed of conglomerate for 20 miles farther, and finally debouches in the valley of Manas, where it divides into seven channels. It would be impossible to say, even approximately, what is the depth of this river in its central course, for the force of its current is so great that a stone weighing 20 lbs. thrown into the river from a height of 50 feet ricocheted several times before it sank below the surface. According to the Torgute natives here, between the Ulan-ussu and Khusta, at the very foot of the many-peaked Doss-megen-ora, there is a plateau or syrt which on the north merges in the above-mentioned mountainous country. This table-land is called Doss-megen, and is held sacred by the Torgutes or Turguts.* There must doubtless be a good road thither, but they refused to show it to us. The fauna and flora of this region offer but few points of dissimilarity from that of the Boro-horo, of which it forms the immediate continuation. The same remark may also probably hold good with reference to the Urumtsi range, though this last was explored least of all by us. If you will turn to the map you will see that our route plotted on it takes a more and more north-easterly direction after leaving the Khusta. This was occasioned by a variety of circumstances of which I will mention the following: want of guides, inaccessibility of the country, and the probable loss of precious time had we set ourselves to find the road. We made haste to reach the Bogdo mountains in order not to let slip the opportunity of securing the remaining lepidoptera which I considered indispensable for my collection. The direction we took brought us by degrees to Peh-lu, and we followed this from Khotubii (not Khotukbai) to Urumtsi. Then we

* A branch of the Eleuth-Mongols inhabiting in greatly reduced numbers the region about Yuldus and the upper valleys of the Ili tributaries.—M.

had to study the Urumtsi ramification of the massive Doss-megen-ora. I will not say that our investigation of it was by any means complete; we could not even decide whether it were a single or a double range; all that we could say for certain was that the height is enormous, and that its outlying hills make up a wild mountainous region, inaccessible even for pack-animals for a considerable distance.

Of the rivers flowing from this range the following may be named:—Santa-ho, Khotu-bii, Lok-ulan, Katun-ho, and Urumtsi. The first of these is bordered throughout its entire course by noble, wide-leaved trees, such as we found nowhere else; the other valleys we crossed within the limits of the cultivated zone, and therefore could say nothing of their floras. Judging, however, from the fact that between this belt of cultivated land and the nearest hills, there is a monotonous expanse of clay steppe, bearing rare bushes of *Rubia* (?) and *Echinosperrum*, and that the hills in the foreground have a reddish-grey tint, it may be inferred that the valleys are more of the nature of pebble-strewn ravines, bearing rare clumps of reeds or *Lasiagrostis*. The whole landscape, however, is not devoid of a beauty of its own, and with our binoculars we could see herds of antelope and wild ass grazing on the plain, though, owing to their shyness, it was a difficult matter to get within range.

Urumtsi, the residence of the Governor-General, Fan-teh, is a town rising from ruins. The district is poor, and besides corn and poppy more recently introduced, produces nothing. Every kind of food is imported, from rice to grapes and other fruit; apples alone ripen here. The people of Urumtsi have not even cattle of their own, notwithstanding the abundance of pasturage; it is all driven hither by the Kirghiz-Kirehs and naturalised Russian merchants from Chuguchak and Altai. This anomaly is attributable to the fact that the Urumtsi district is sparsely populated, and has no nomadising inhabitants. Kalmuks are not allowed to trade, and the Kirghiz-Kirehs are only suffered to pasture their cattle on its way to market. Our Russian subjects are under like disabilities.

I now proceed to the most interesting part of our itinerary, and, in accordance with the order I have sketched out, will begin by generalising, and fill in details afterwards. It is usual in maps to extend the Tian Shan as far as 95° of long. E. of Greenwich; M. Pevtsuf takes it even further. But this is hardly accurate, and for the following reason:—Bogdo-ola is visible from Manas; plainer from Chiteh, Guchen, and Gashun. From every point of view it takes the form of a huge trapezium, with one of its sides protracted as a long range glistening with perpetual snow and ice. Lofty as the Tian Shan is, it appears insignificant as compared with the gigantic Bogdo-ola (Topatar Adlieh), which presents from every side a magnificent sight. This enormous uplifted mass falls with unusual abruptness towards the Urumtsi valley, and only on the east is prolonged as a massive snow-capped nameless range, extending without a break to long. $90^{\circ} 50'$ E. of Greenwich. Here it suddenly subsides, merging in a table land studded with isolated cones, scattered in great confusion. This table land, extending in an easterly direction, has a steep fall on the north and south, where it becomes a succession of wild barren defiles. Having crossed the range at this place, the traveller has on the west a row of sublime peaks with the loftiest wall-like cliffs, crowned by a gigantic hog's back, and on the east an expanse studded here and there with an isolated sugar-loaf mountain; the cart track ascends imperceptibly from the north, while on the south the descent is even more gradual, so that it is impossible to say where the pass is. It would seem therefore that we had before us a sudden termination of the snowy range. But it will be for the geologist to decide from the specimens of rocks collected by us whether this really be the case. Farther east the aspect of the mountain ranges may be described as follows:—The above-mentioned plateau extends for ten miles;

it is then succeeded by undulating land with conical hills continuing for 40 miles farther. There it abuts on a range having a north-westerly direction. A second range less lofty than the first-mentioned unites with it at an acute angle so as to close the undulating plateau on the south. Across it lies the cart track connecting Turfan and Hami. The former range bears the name of the Barkul Mountains, and unites with those of Hami a little to the east of this last town. At their point of junction several snowy peaks are visible, though we were unable to distinguish them, for it was winter, and all the mountains and passes are at this season covered with snow. The Hami range has also a north-westerly direction, and under the name of Mechin-ora closes the Barkul depression on the north; while on the south-east, according to native information, it continues as far as Su-chau. Along these Hami Mountains lies the direct caravan road to the province of Kan-su and China proper, and we shall avail ourselves of it for our journey from Hami to the Nan-Shan.

I consider that I have now established a *prima facie* right to distinguish the Hami Mountains from the Tian-Shan and include them in the Altai system. In support of this the following facts may be adduced:—The Hami Mountains are by no means the last fold of the Altai system. It was hitherto supposed that the whole Tarim-Hami wilderness was a moderately raised plain, but this is entirely erroneous. It is a mountainous country throughout, the ranges having a general north-west and south-east direction, and by no means so low as those of Dzungaria for instance, where the mountains, having also a north-westerly direction, are apparently disconnected. Some of the Hami ranges on the contrary are of great length, upwards of 200 miles, and from 6000 to 10,000 feet high, besides being inaccessible. If the reports of native hunters may be credited, the area covered by this mountainous region covers more than 10,000 square versts, or nearly half the extent of the Pamir, though certainly only about half its absolute elevation. I shall have another opportunity of speaking more at large of this newly discovered mountainous country, and will now only call attention to one circumstance, viz. that all its ranges have the same general direction as the Great Altai, the Dzungarian Mountains and the Hami range, the last mentioned having a length of not less than 330 to 400 miles. Of the truth of these data I shall, however, soon be able to speak more positively, as we propose travelling along this supposed range to Su-chau.

Though I did not obtain specimens of the rocks composing the Hami range, I did collect some 25 pebbles, and these convince me of the fact that this chain forms a link in the system of folds which furrow Eastern Dzungaria and the Tarim-Hami region. As I am not a trained geologist, I might doubtless be led into error if I were to attempt to determine the age of the strata composing the Altai and Tian-Shan ranges, I will therefore be cautious and confine myself to the following remark: the mountain masses having a north-westerly direction are mostly composed of crystalline rocks (granites, felspars, quartzites) jaspers and marbles; all the other formations may perhaps also be palæozoic and azoic. It is worthy of mention that many of the valleys are strewn with opals, cornelians, crystals of rock crystal and bits of crystal of a bright green colour. In Dzungaria, only the Maile-tau has, besides opals and jaspers, flints, whence it derives its name of the "fat-covered mountains."* In the Tian Shan we find a very different order of things. Here the left part of the range consists of a greenish-grey calcareous sandstone, underlying limestones, sandstones,

* The streams of liquid fat mentioned in the history of the Tang dynasty are referred by Humboldt and Ritter to lava streams, supposed to have flowed from Ho-shan, the fire mountain near Turfan. Cf. 'Asien,' l. c. p. 336; cf. also Humboldt, 'Asie Centrale,' tome ii. p. 32.—M.

coloured clays (clayey schists also occur in the Altai Mountains, but they partake here of a delicate bluish colour, yellow and red conglomerates are likewise not uncommon). Granite I only met with once, and then in the form of river boulders; and I saw no outcrops of it in the Bogdo-ola nameless range. This in itself confirms rather than controverts the above mentioned supposition. We will however leave this question to be settled in St. Petersburg, where doubtless M. Mushkétov will express a categorical opinion.

Next I have to make another small remark. M. Krasnof in his geo-botanical review of the Tian Shan declares there are no larches in that range, though in this instance he overlooked the mention of this tree in Potanin's materials; he is nevertheless entirely right if we distinguish the Hami range from the Tian Shan. I personally convinced myself that the larch does not extend from the Barkul-Hami Mountains to those of the Tian Shan; it is therefore quite admissible that there may be some difference between the floras of these two ranges. Unfortunately I am no botanist, my collections can, therefore, be only incidentally interesting, and I must rest satisfied with the thought that a specialist will soon find his way hither, who will decide this interesting question.

Bogdo-ola may be ascended by a fair road from Urumtsai. This mountain is reckoned to be God's throne; from its heights the Divine Being is supposed to descend occasionally to the lake at its foot. The whole locality has a reputation of sanctity, and from this cause numerous temples have been erected there. A notice has been put up near the lake of the following tenor:—"It is forbidden, under penalty of instant death, to violate the tranquillity of this holy land. There must be not only no shooting and no tree-cutting, but cattle may not even be pastured here, that they may not trample under foot the herbage belonging to God's creatures." The attendants at the temples, however, fell timber without any prickings of conscience, Fan-teh pastures his fifty mules here, and the Kirghiz-Kireh surreptitiously destroy the sacred deer. We were equally profane, and having turned our cattle out to graze by the shore of the magnificent alpine lake, proceeded to explore this marvellous group of mountains. I regret to say that the materials collected are not yet ready for publication, and therefore final results must be deferred for a while. Local circumstances prevented my brother from determining trigonometrically the height of the highest peak—the so-called Topatar-Aulieh, but one of the western summits was measured; we succeeded in making the ascent of the chief spur of the group, and ascertained by boiling-water apparatus the height of the snow-line. We also obtained a satisfactory photograph.

Like the Boro-horo Mountains, Bogdo-ola is clothed from foot to summit with spruce firs and meadows. The alpine meadows only form a narrow belt immediately below the snow-line; there is almost a complete absence of the floras of the steppe and pebble-strewn plains. The bushes do not form coppices, but are scattered here and there in the midst and on the borders of the spruce forest, on the shores of lakes, and by the side of brooks. The apple, the apricot, and the barberry, are conspicuous by their absence; at all events, I did not come across any: on the other hand, juniper and woodbine, and on the lower ground blackthorn (*Crataegus*) are plentiful. Hardly any camel-thorn can be seen, and the large-leaved trees are confined to the river valleys; here, too, there is a greater variety of bushes, and the *karagatch* (black elm) is the commonest of trees, though poplars also occur. Besides these, I for the first time met with the aspen (*Populus tremula*), a tree common enough in the mountains about Issik-kul, but never met with in the Boro-horo and Urumtsai ranges.

Animal life is poorer here than might have been expected. Besides the maral (great deer) distributed throughout the Tian Shan, we only met with wolves and

Cervus capreola; there are but few representatives of the bird world; besides the common kite (*Milvus melanotis*), crows and sparrows, we met with three kinds of crow, two thrushes, a three-toed woodpecker, a species of accentor, a Budytes, a Motacilla, a nuthatch, a green grosbeak, goldfinches, *Megaloperdix tibetana*, and several of the swimming and wading families, altogether twenty-five kinds; however, we did not collect birds very energetically, as they were not in plumage, and their skins were unfit for preserving.

The following rivulets descend Bogdo-ola;—Shim-gu, Khaidajan, Dukhunjan, Yrdo-khoza, Lotai, Sotsa-ho, Dalan-gu, Morokho, and Baian-ho, besides several brooks; these rivulets, however, in summer are deficient in water. If we consider that there are only five or six small streams flowing to the south, it is difficult to explain what becomes of all the water produced by the melting of the enormous snow-fields of Bogdo and Nameless range as far as the meridian 90° 50' (E. of Greenwich) of the Ulan-ussu Pass. Fortunately I am able to answer this question in a completely satisfactory way. The Turfan district between Chiktym and Toksun is comparatively very thickly inhabited, as we learn from a census taken three years ago that there were 11,340 families, or about 65,000 inhabitants. Assuming the whole area of this district at 7500 square versts, and deducting three-fourths of this area occupied by gravel and drift sands, we have 1875 square versts as the habitable portion, with a population of 65,000, who obtain their supply of water for irrigating their fields partly from springs, partly from underground water conduits (karys), in other words they are supplied by subterranean artificial water. The quantity required is enormous, and according to experienced persons, may still be increased by the construction of new channels. The source of this subterranean water can only be the Lukchin hollow and Khandui hollow, in which it accumulates from the Nameless range. It is remarkable that even mountain torrents disappear in the rocks as soon as they leave the hills, and some, let it be observed, are of good size; thus the Kok-yar and Utyu-auza may compare with any of the northern streams.

What has been said with reference to the Turfan district may also apply to the cultivated land round Bepu. Here springs are more numerous than running streams, but if we take into consideration the boundless steppes, overgrown with reeds so high in places as to conceal a horse, it may be easily understood what an enormous quantity of subsoil moisture is contained in these areas. The oasis of Guchen is fed by springs, the whole tract from Dulan-gu to the Chiteh Valley is devoid of any torrent; the oasis of Khobuzeh to the north of Jimisar is chiefly supplied by spring water, and such springs occur everywhere to the east of Morokho and between Fukan and Irdo-khoza. The belt of springs extends not only along the Peh-lu but for a considerable distance beyond, even to the other side of the Nelsin sands, bounding these latter on the north with a narrow fringe of saline marshes, where it is only necessary to dig to find water in any place. I have myself tried this at three several spots: Gashun, Sy-djir and Chigi-chindza, but it is not at all improbable that the next traveller may find more.

Springs enable the numerous animals inhabiting Dzungaria to exist; of these the most interesting is Prejevalsky's horse (*Equus Przewalskii*). The only known specimen of this animal, in the Zoological Museum of the Imperial Academy, was obtained by Prejevalsky from the chief magistrate of the district of Zaisan, who had received it from the Kirghiz. Prejevalsky himself, though he crossed the desert of Dzungaria in three several directions, never came across any of these wild horses, and if he wrote otherwise he was mistaking kulans he had seen in the distance for wild horses, a mistake the most experienced hunters are liable to make, for at that distance it is almost impossible to distinguish between them. It is only by

their manner of holding themselves that these animals may be recognised. The stallion of the wild horse never leads the herd but is always behind, taking care of the young, which he protects better than do the mares. But however this may be, we were the first Europeans who, for twenty days, made a study of these interesting animals, adding the skins of three handsome stallions and one mare to our collection, an acquisition we may well be proud of, though made at the cost of many hardships and privations. Besides *Equus Przewalskii*, Dzungaria has the tiger, two antelopes (*A. saiga* and *A. gutturosa*), two wild asses (*Equus hemionus* and *E. onager*) and among small animals: hare, *Erinaceus auritus*, and a few rodents not yet determined. The common wolf and steppe-fox are plentiful in all parts. With regard to the wild camel, its existence here is not confirmed, though it may possibly be found near lake Ehbi-nor or Ayar. Dzungaria has a richer avi-fauna than might have been expected; unfortunately we were obliged to give up the birds for the sake of the horses, for any unnecessary shot fired might have occasioned the loss of several days devoted to the pursuit of a herd of these animals, in quest of which we had gone to Dzungaria. We succeeded, however, in obtaining fifteen kinds of birds, among which I will mention the land-rail, two species of shrikes, the redstart (*Motacilla phenicurus*), a kind of sparrow with a shrill note, and the very common sand grouse (*Syrhaptes paradoxus*), several sandpipers, marsh-hens, mallard and teal, and to my surprise the common grey goose, resting in the saline marshes of Gashun near our headquarters. We also found a good number of insects, though it was September, so that we have no reason to complain of the results of this expedition. On the other hand we sacrificed several horses, which fell victims to hard work and brackish water, and had to be abandoned to their fate.

To the east of Ulan-ussu the spruce-fir entirely disappears and the only arborescent vegetation we observed was the cotoneaster, growing here to the size of a small tree; among bushes we found briar-rose, spiræa, caragana, lonicera, juniper, and stunted saxaul; and among half bushes *Eurotis Ceratoides* and *Peganum harmala*. Marsh meadow land occurs in the neighbourhood of springs and rivulets, where an occasional willow appears as a narrow-leaved bush. The prevailing floras are those of the gravelly steppes and saline clayey ground; here the first vegetation to catch the eye consists of saxaul, caragana, climbing ephedra, *Peganum harmala*, and a few of the *Graminæ*; on the salt marshes, reeds and saline plants or feather grass; these two, together with *Festuca*, may sometimes be found on the gravelly plain. The steppe generally overpowers the meadowland, for this latter is only met with high up in the defiles, where we obtained, notwithstanding the lateness of the season, *Primula*, a species of mint and an onion, with some other plants of like kind. The abundance of springs and magnificent pasture land have attracted hither numbers of animals. In the higher mountains herds of ten to fifteen arkari, or wild sheep, may be seen grazing, constantly preyed upon by grey and red wolves (*Canis alpinus*); these last-named animals we saw twice, but did not succeed in killing one. On the lower ground the saiga antelope and kulan or wild ass (*Hemionus* or a new species) are very common. The goat, fox, and bear, which select the wildest crags and the highest ridges for their abode, are more rare. The fox of this country is of a dark red colour, but there are also blackish brown ones, though these are rare. In autumn there are but few birds; among those added to our collection were a species of *Accentor*, a thrush, a linnet, finches, and among the larger birds a bearded vulture, which was shot by the carcass of a wild ass. There were a few insects, although it was September; but it was evident that the time for them had passed and that we might close the boxes set apart for them. It is remarkable that we should not have observed the autumnal migration of birds, only cranes passed over in large numbers and small flights of grey geese, duck, teal, mallard, &c. Winter was approaching

with rapid strides on Peh-lu ; in September snow had begun to fall and storms to blow, and it was time to think about crossing the Tian Shan.

We crossed this range by two passes. I went in light marching order over the lofty Builuk, my brother with the baggage across the often mentioned Ulan-ussu. I met him at Lemchin, having first gone to Turfan, and then, *via* Lukchin to Pichan, whence I returned to Lemchin. It will be seen by the map of my route that our further explorations were concentrated on the southern slopes of the Tian Shan and the mountainous region which must now take the place of the Tarim-Hami desert. While I remained at Lukchin collecting historical data, visiting the ruins of the Uighur and Idihote or Dike-yanus cities, and making notes ethnographical, statistical, and economical, my brother went to the Chol-tau and Tiuge-tau mountains, whence he returned on the twenty-second day with a very interesting survey and two fine specimens of a new species of mountain sheep (*arkar*).

From the date of our arrival at Lukchin our collections of birds, fish, and mammalia made rapid progress, but with regard to reptiles, amphibia, and insects, only an occasional specimen was secured. The most interesting acquisition in the first of these groups must doubtless be considered a very curious frog, found in the warm springs of Chiktym and Lukchin-kyr, where it was in perfect health in spite of frosts ranging down to -7° Fahr. Here it fed on water bugs.

Before speaking of the very rich fauna of the Tarim-Hami region between the Tian Shan and Lob—this latter, let it be observed, being the district as distinguished from the lake Lob-nor—let me say a few words on the orography. The fall of the Tian Shan on both sides, north and south, is about the same, the defiles in either case being equally narrow ; their difference mainly consists in their respective floras, the spruce-fir growing plentifully on the northern side, while the southern slopes are devoid of it. Here one remark must be made. Krasnof, in discussing this phenomenon, accounts for it by the theory that the main axis of the range intercepts the moisture-laden winds from the west-north-west, resolving them into rain and mist, so that the southern slopes, receiving but little moisture, cannot sustain forests, and are therefore only covered with a steppe flora. This explanation, however, is open to the following objection—when the range is divided into several parallel ramifications, the central being lower than those on either side of it, they yet occur forests on the northern slopes of all the chains, the southern having as before only a steppe vegetation ; again, the spurs of the outermost of these parallel chains when facing the south are only covered with artemisia, whereas those with a northern aspect are forested, so that Krasnof's theory cannot possibly apply here, for it must be evident to anyone that the deposit of moisture on either side must be the same. Neither will his explanation account for another well-known fact. On all the mountains of Central Asia where there are glaciers, these are invariably longer on the northern side than on the southern, but since the axis of the chain retains the moisture and the glaciers start from it, there cannot be any great difference between the deposits on either side. All that has been said about the Tian Shan is also true for the Hindu Kush according to my own observations, and for the Kuen Luen according to the observations of Prejevalsky ; and it should be remembered that in the case of the last of these mountain systems the rainfall comes from clouds borne northwards from the Indian ocean. All these facts admit of a more general explanation than that given by Krasnof, and I submit the following : the evaporation of any area is stronger in proportion to the greater warmth it receives ; the southern slopes, always and everywhere more gradual than those facing the north (*M.* Krasnof's opinion notwithstanding), feel the influence of vertical solar rays while the northern slopes are only lit by them slantingwise ; at the same time sunrise is earlier and sunset later on the southern sides of mountains than on the northern, as

every mountaineer so well knows and understands. Hence the flora of any given range depends not on the quantity of aqueous deposits, but on the position of that range; this is why, in the case of ranges situated meridionally, it is not the western slopes facing the north-west winds but the eastern that are forested. I had already remarked this fact in 1885, and had called attention to it in my work 'Le Pamir et sa faune lépidoptérologique.'

Thus the southern slope of the Tian Shan is deprived of arborescent vegetation, but not entirely; in deep defiles clumps of poplar and narrow-leaved willow and a variety of bushes find shelter; and it is worthy of remark that the farther east the greater the variety in the undergrowth. In places, though not everywhere, along the southern slopes, there are tracts of clayey sandy hillocks interstratified with loose conglomerate—the most barren parts of the range, only to be equalled by the gravelly steppe at its base. In defiles of these arenaceous formations the only plant to meet the eye is *Eurotina ceratoides*, the gravelly tracts presenting an occasional Ephedra and a kind of bush whose berries found their way into my herbarium.

The Turfan district is divided into two unequal parts by the small range of Tuz-tau, running parallel with the Tian Shan and composed of variegated clays, red clays interstratified with pebbles, and lastly with clayey sandstones overlying the pebbles, with veins of gypsum and outcrops of coal. Both parts are nearly equally barren. In the north the pebbly beds predominate, in the south salt marsh and drift sands year by year gain ground. Man is the cause of this change, for with marvellous energy he is ever burrowing beneath the surface to find water and lead it to his fields. South of Turfan our maps show an area probably designed to represent marsh land. If extended a little way to the north-east, this would approximately correspond with the floor of a depression continued between the Tuz-tau and Chol-tau ranges. Even within historical times this tract, as the words of a song testify, "*Anattyke djanliada*" (the great reeds of Anat* shake) was covered with famous reeds tenanted by wild boar, wolves, foxes, and other animals. At the present day nothing is left of these reedy tracts but mounds held together by the stumps, the reeds having been remorselessly cut down for fuel. There is even a special name for these reed stumps—*Chatkal*, and several settlements have adopted it. As the chatkal disappears, the sand held in place by it moves with threatening dunes towards the cultivated land and overwhelms it.

Here then we were witnesses of a marvellous struggle between nature and man. The native of Turfan, whose energy is astonishing, exploits his land so thoroughly as not to leave a drop of moisture in it—he takes it all; nature deprived of her portion dies, but in dying avenges herself on those who have robbed her, by laying waste their settlements and destroying their fields and gardens for the sake of which they robbed her so mercilessly. In this way the native of Turfan digs his own grave; there are but few spots left where the reeds can grow, and wild boar and other animals find shelter; doubtless, in course of time these too will disappear with the increase of population and the digging of more water-channels; then, restless mortal, beware, for thou shalt in vain contend against the sand-drift which has already half buried the suburbs of the city of Turfan!

The northern part of the Turfan lands is more happily situated; here water is more plentiful, and the soil presents the appearance of a pebbly steppe, affording but little material for the formation of sand-drift. As I have already stated, several rivulets descend the southern slopes of Nameless range, some of them scooping out deep channels in the pebbly soil; such are the Kok-yar and Utyu-azua; unfortunately they run to waste without benefiting the inhabitants. The natural water

* There is still a settlement of this name.

supply of the district is far short of requirements, though innumerable springs are scattered along the southern foot of the Tian Shan and Hami ranges. In the Tiuge-tau and Chol-tau mountains they are of rarer occurrence, and their water has generally a bitter-saline taste. But this mountainous country is of extraordinary interest to the zoologist, for there can be no doubt that it forms a remnant of an ancient continent once uniting the Kuen Luen and Altai by means of the Hami and Dzungarian mountains. From this point of view the road from Sha-chau to Lob-nor is very interesting.

But I have no intention of diverging from sober fact into the region of conjecture. My purpose is to interest you in this newly-discovered country explored for about 160 miles to the south of the Tian Shan, our farthest point being a valley confined between two ranges. Beyond this, for about 50 miles, according to the guide, the road to the south crosses at right angles range after range of mountains. That distance having been passed, the district round Lob begins, with its abundance of springs and pasture lands, continuing uninterruptedly to the Lob-nor marshes. There are no sands along this route, and a caravan of asses or camels may pass along it without difficulty. The road, too, from Lob-nor to Sha-chau is also easy; there are no waterless marshes here, and if disused, that is because there is no traffic to pass that way; all Chinese officials, however, going to Khotan from their own country, travel by it; and not long ago two Sarts, subjects of Russia, escaped this way from the Sha-chau prison, where they had passed seven years in confinement.

The northern limit of this mountainous country is the Chol-tau range, its name signifying naked or barren. Indeed the traveller might look in vain for springs and vegetation of any kind here; all is barren, and the monotony of the landscape is only relieved by whole patches of blood-red cornelians and bright jaspers of every hue and variety of pattern; but farther on he will meet with springs everywhere, luxuriant vegetation, and herds of antelope—in a word, food for himself and fodder for his cattle. The tamarisk, the briar-rose with thorns half-an-inch long, and the variegated poplar growing to a fabulous size, are objects that will arrest his attention. *Populus diversifolia* is particularly remarkable, with a stem as straight as a palm tree, and a girth of nine to twelve feet. There are reeds here tall enough to hide a camel, and vast areas covered with Alhagi and Ephedra, the haunt of many a boar. Wolves and foxes are so bold that they will carry off almost from under your very nose, and in broad daylight, the spoils of the chase; and lastly, wild cats (*F. manul*), wild camels, and wild sheep. All this will give you some idea of the vegetation and animal life of this region. One more fact has to be mentioned, viz. that from the meridian of Guchen to the westward for 40 miles, lies the district of Syngim, inhabited by agriculturists and the residence of a bek. The distance from Syngim to the Tarim is reckoned to be 53 miles, or two days' journey.

On existing maps the Nan-lu or southern road is quite erroneously rendered; in fact, for all that relates to the country beyond the Boro-horo range cartography is at fault. I am therefore well satisfied that, by a fortunate selection of routes, we have been able to fill in blanks for the countries bordering on the Tian Shan. One reservation, however, has to be made; we are specially indebted to the well-known cartographer A. A. Bolshef, and the not less accomplished traveller A. J. Skassi, for their advice and instructions before we left St. Petersburg, instructions the full value of which we only understood when we arrived here. Let the cartographical results of our journey show that we have toiled and laboured not altogether in vain. . . . As my brother was able, in spite of the severity of the cold, to fix two positions instrumentally along this road, it is to be hoped our survey will be free from error.

Between Chiktym and Lodun, a distance of 117 miles, we did not cross a single

rivulet; but there are several springs and wells, such as Kyrk-Ortun, Yanchi, Kuram-tash, Otun-koza, Chigi-chinza, Choglu-chai, and Wan-chandza. There is enough pasturage in spring and summer round the stations for the caravan animals at Yanchi, Otun-koza, and Chigi-chinza. Going in spring from Hami, with a small caravan and horses, one day's supply of fodder should be taken, though this is not indispensable, for at Choglu-chai there are always reeds on sale. We travelled this road in winter, and consequently suffered great inconveniences. We did two stages, or about 27 miles a day; the shortness of the winter day obliged us to rise at 1 a.m., drink tea and load our endless quantity of baggage in the dark in 20 to 25 degrees of frost; then we encountered severe north-easterly winds, whose icy blast froze feet, hands, and face. . . . It was some consolation to know that wherever we might have been at this season, our sufferings would have been the same. Particularly inhospitable were the defiles between Yanchi and Otun-koza. Heavens, what a storm that was! Owing to the extraordinary frost (nearly 2° Fahr. at mid-day in the sun), sitting on horseback was out of the question; but to make head against the wind accoutred in felt boots and fur cloaks was a difficult matter—yet we had to trudge, in spite of the wind which swept from the road not only the pedestrian but the laden horses.

From Chiktym to Lodun, the whole country is under the district governor of Barkul; at Lodun the Hami district begins, with its population consisting of Sarts, Dungans and Chinese. Here too, there are but few streams; springs however are plentiful, pasturage is good and brushwood is abundant, so that this country deserves its good reputation. The mountains, even their southern slopes, are forested with larch and poplars, though these trees are only found in the sheltered defiles and along the crest of the Hami range; lower down only one tree—*Populus diversifolia*—is met with, if we except the plantations round every hamlet. The poplar, however, is being ruthlessly destroyed. A great forest of it, once covering the Chigi-chinza valley, has been felled to a tree, only a few stunted specimens remaining, and there are no young shoots to take its place, only stumps 1½ to 2 feet in diameter. Rushes are common enough, and I counted six varieties of real bushes, and ten bush-like plants, most of them new to me, though as they were all without leaf or fruit, it was difficult to say. A specimen or two found their way into my herbarium, and in particular, one interesting plant from the neighbourhood of Yanchi, flowering in December in 25° of frost. The commonest plants here are reeds, two kinds of Alhagi, Caragana, tamarisk, a species of rose with broad, flat thorns, an Iris and a tulip with very large seed panicles, confirming the reports we had heard of the large size of its yellow blossom and long root-like leaves; besides these here and there grow couch grass and a small sedge.

Animal life in the Tarim-Hami region, including the neighbouring mountains, is varied and abundant. Eighteen kinds of wild animals may be counted, and seven of the smaller mammalia. The more common among them are *Felis manul*, *Canis vulpes* and *C. lupus*, *Sus scropha aper*, *Lepus* sp., two kinds of *Ovis* (*O. nov. sp.* and *O. Poli*), antelope, *A. subgutturosa*, *Cervus maral*, and a species of wild ass; of the smaller animals, a species of bat, *Erinaceus auritus*, three species of mouse, and a rodent to which we were unable to assign a genus or species. What we obtained will be stated below. I will now remark upon the interesting fact that in the above mentioned mountains there is neither badger, marmot, nor Alpine hare; we found no marmots even in the Bogdo-ola, or anywhere east of the meridian of Urumtsi.* I call the attention of naturalists to this

* Along the northern foot of the Boro-horo mountains marmots are so plentiful that the ground is often honeycombed by their burrows. Riding here at any pace is

circumstance with reference to animal distribution. Of wintering birds, I counted 57 kinds, but this number is only approximate, for new forms were daily met with, and the Hami Mountains were unexplored by us—they doubtless contain much that is interesting; probably too we might have found there nuthatches, red beaked crows, and large vultures, to say nothing of small birds.

The following is the classification of the birds to their orders:—Birds of prey, 15; Songsters, 21; Sparrows, 8; Doves, 2; Gallinaceous, 5 (6?); Aquatic, 4; and Waders, 2.

An interesting discovery was *Megaloperdix altaica*, in the Hami Mountains, another proof of these being distinct from the Tian Shan system where the Tibetan species of this partridge is only known to exist. It is true I mentioned the last named species among the birds obtained by us in the Bogdo-ola Mountains. Another interesting point is that Hami is the wintering place of several exotic forms, doubtless new to the palæarctic and ornithological faunas.

Our arrival at Hami nearly closed the first period of our journey; I say "nearly" because, before resuming our journey to the east, we hope to survey the region between Hami and Shaar-nor, and then, perhaps, that further to the southwest; we are only waiting for our horses to recover their strength, as they were so exhausted that they could hardly reach Hami, and we are without the means of buying fresh ones. This want of means deprived us of the possibility of undertaking an excursion from Lukchin to Syngym, an oasis on the Tuge-tau mountains, important for us from several standpoints; firstly, an expedition thither would have thrown light on the Tarim-Hami mountainous country; secondly, we should have passed on our way thither localities abounding with wild camel and bears (according to the description, a new species); and lastly, we should have been in the centre of former settlements of the Kalmuk-Uighurs. According to reliable information there are very many Uighur ruins at Syngym; parties of treasure-seekers proceed thither annually from Lukchin and are not badly repaid for their trouble, for there are many gold and silver things there, besides copper vessels, censers, &c. These are at once melted down and sold to the smiths and brass-workers of Lukchin. In spite of all my efforts, I was unable to obtain any of these Uighur antiquities; not even Uighur writings, which, as I learned, are frequently found with grains of wheat in a particular kind of earthenware vessels; leaflets with inscriptions round them enclosed in horn and wooden boxes are also found, but these are so brittle that on being handled they frequently fall to pieces. This is all I was able to learn concerning Syngym, the existence of which nobody knew or heard of hitherto. Let me also remark that the Uighurs have left a memory behind them in the names of towns and places; such are Anat, Assa, Syngym, Astyn, and a number of others.

Having completed the sketch of the geographical and topographical results, I pass on to the other materials collected by our expedition, and first of all must mention the meteorological data.

The temperature of the air was taken as far as Urumtsi twice or thrice a day, and observations recorded of the state, of the sky with general remarks on the weather. These observations were continued for fifty days. . . . From Urumtsi, however, when our movements were less rapid and we were frequently stationary at one place for ten days together or more, it became possible to observe

a dangerous pastime, as your horse is liable at any moment to put his foot in one of these holes, and give you a nasty fall. In camp we amused ourselves by practising with the revolver at these little animals as they sat at the entrance of their houses.—M.

for temperature at shorter intervals of time, so that during five consecutive months, from the 1st August to the 1st January, 1890, observations were taken from five to nineteen times daily, and sometimes synchronously at different altitudes. . . .

In collecting specimens of the rocks, I adhered to the instructions of J. V. Mushkétov. Coal-fields were examined at Jirgalty, Fyho, in the neighbourhood of Urumtsai, near Lukchin, and at Turachi, in the steppe south of Nan-lu, within the Khanat of Hami; these last were the richest of the coal-fields we visited, and were employing a number of hands under the direction of an official of the Khan. It is almost unnecessary to say that we took specimens of the rocks both above and below the coal-seams, as well as of the coal itself. We also visited a burning coal-field in the mountains south of Shi-ho (Jirgalty). After a difficult and somewhat dangerous descent we safely reached the openings from which smoke was issuing by vents having the appearance of cracks, encrusted near their edges with crystals of sulphur, the surface being coated with a white substance. Some of these cracks, which were very numerous, emitted smoke, while others had apparently ceased to do so; here and there funnel-shaped cavities had been formed, whence issued thin but strong jets of steam; here, too, we observed the white deposit, but no crystals of sulphur. The whole of the soil was so hot that we felt it through the soles of our boots, the clay having the appearance of being baked; this and the numerous cracks made walking here a somewhat risky matter. This fire is visible from the River Ebtah and from Shi-ho, whence it has a striking appearance. We were unable to visit the naphtha springs near Urumtsai and the sal-ammoniac* beds in Central Dzungaria, but we obtained samples of both.

I only began a systematic collection of minerals at Bogdo-ola, continuing it thenceforward as a separate branch of our investigations. When the strata were much distorted or lay at different angles, I had recourse to photography or the pen. 320 specimens were altogether collected.

The poorest part of our collections was the botanical. We had no hands to spare for the herbarium; therefore, while keeping a general diary and entering in it observations on the flora, I only preserved a few characteristic plants of each locality, and chiefly such as were unknown to me. In this way I collected 100 plants. Moreover, the flora of the spruce forests of the Tian Shan is so monotonous, and has been so thoroughly studied, that it would have been presumptuous in me to suppose that I should find anything new in this belt, the more so as my botanical knowledge is very limited. . . . On the Bogdo-ola, however, I happened upon a remarkable plant growing in the rock detritus at an enormous altitude. Knowing as I do, from my former explorations, the appearance if not the names of the species of the upper zones, I consider this plant as exceptionally rare and peculiar. Imagine a large cabbage, the head of which is replaced by a flower six inches in diameter, and you will have some idea of its appearance. Unluckily, in descending the Bogdo-ola we were overtaken by very heavy rain, the slopes became alippery, and all we could do was to take special care of our hypsometer and photographic apparatus. The plant was left behind, but, fortunately, fearing that it might lose its appearance in drying, we photographed it before starting. One of the negatives turned out to be excellent, and I think a fair description might be written from it. All parts of the flower, the position of the leaves, stalk and root may be seen from it.

The largest of our collections are the zoological, these numbering 14,000 speci-

* Sal-ammoniac obtained in the caves and fissures of Ak-tagb, the fire mountain of Biahbalik, as the region between Urumtsai and Ili was called, was collected by the natives who paid their tribute to the Emperor of China in this product in the eighteenth century. Ritter's 'Asien,' l.c.—M.

mens. The vertebrates comprise 110 mammalia, viz. 29 large, 39 of medium size, and 42 small. The most interesting specimens, in our opinion, are four of *Equus Przewalskii*, and two mountain sheep from the Tiuge-tau Mountains. Among the medium-sized animals, *Felis manul* and *Canis corsac* from the Hami range are of special interest, and a *Lagomys* from the Tian Shan, of which we have 15 specimens.

We have 380 birds, a comparatively small number, owing to the circumstance already mentioned of their not being in plumage in summer, so that of ten killed perhaps two might be fit for preserving. Even in September the birds had hardly done moulting, and the collections were poor; later on they began migrating. We observed no great flights, with the exception of cranes and small flocks of mallard and pintail, teal and gray goose. We were, however, somewhat tied by the instructions I received from the Academy of Sciences, to turn our attention chiefly to hawks and small birds of prey, and on no account to collect any of the waders and swimmers, as Prejevalsky had brought so many of these. It will be readily perceived that this would reduce the number of kinds available for our collection by two-thirds. Of course we did our utmost to fulfil our instructions in the best possible way, and the results obtained fortunately surpassed our expectations. In order to estimate our collections at the proper value, it will suffice to bear in mind that of the 380 specimens there are 97 crows, one large hawk, 12 horned owls, 8 screech owls, 3 other raptorial birds, and altogether 121 of this last order (or 30 per cent. of the whole number). . . .

With regard to fish, reptiles and amphibia, our collections are far from being as completed as we could have wished them to be. We have in round numbers 50 specimens of fish, and about the same number of amphibia and reptiles. The only lake we came to was the Alpines one of Bogdo-ola, absolutely devoid of fish; in the larger rivers we also did not find any fish, either in the Boro-horo or to the east of Urumtsi, so that we had only springs and marshes to fall back upon, and in these we secured about ten kinds. The collections of amphibia and reptiles might have been increased in number, but I guarded myself from doing this, as I judged it quite unnecessary to take dozens of *Ablepharus deserti* and such kinds common all over Central Asia. To our regret even Dzungaria proved to be unusually deficient in reptiles; there were or one two kinds of lizards, no more, in the sands between Guchen and Gashun. I met with no representatives of the genus *Stellio*; the commonest forms of lizards, as usual in Central Asia, were *Phrynocephalus* and *Eremias*, and in the cultivated tracts *Ablepharus deserti*. Of the snakes two kinds of *Trigonocephalus* are interesting, both found at considerable heights, and the common viper never before, it appears, met with in the Tian Shan. Among the amphibia were *Bufo variabilis*, everywhere common, and therefore not added to the collection, and a very interesting frog, possibly a new order and species. This was found in the warm springs of Chiktym, where it existed comfortably though the thermometer marked 25° frost.

All the rest of the collection, numbering about 13,000 specimens, were insects belonging almost exclusively to the two orders Coleoptera and Lepidoptera. Of these I shall say nothing here.

To finish with our zoological materials, I will remark that all our mammalia have perfect skulls, and we also took the skulls of a few specimens which for some reason had been rejected for the collection, among others that of an old arkar or mountain sheep (*nov. sp.*) We also exerted ourselves to obtain a complete skeleton of *Equus Przewalskii* of medium size. All this together increased the weight of our baggage so materially that we were obliged to buy extra horses and disburse all our spare cash on forage, but the temptation was so great we could not resist it.

In concluding my report, which notwithstanding my wishes to the contrary, occupies far more space than I had intended, I must mention that in my spare moments, and they were few, I did not sit with hands folded, but occupied myself diligently in collecting statistical and ethnographical materials, in this way a vocabulary of the Chan-tu * or Chentu dialect was formed, the customs and songs of this people written down; even their trade, economy, industry, &c., were not forgotten. Of course in a short time it is impossible to acquaint oneself with the inner life of a people, but this becomes possible when you are stationary in one place a month or more, and the people among whom you are living had been, however slightly, known to you before. This was my case with the Chan-tu, a people allied with our Sarts. I acknowledge, however, that with my inferior knowledge of the language and the necessity of conversing with them through the medium of an interpreter, I found it a tedious and thankless task. All that I could do some days was to write down and translate one of their songs. It was easier to make notes on their domestic economy, and on this head I can command interesting and I think complete materials.

In completion of the above itinerary I borrow a few particulars from a letter of M. Ed. Blanc, dated from Tashkend, December 22nd, 1890, published in the 'Compte Rendu' of the Société de Géographie (No. 5, 1891.) M. Blanc passed three days in the company of the Brothers Grijmaillo, when the travellers passed through Tashkend on their way home. He says that after leaving Hami they crossed the Gobi to Su-chau by Morgol, Yan-dun, and An-si-chau, then by way of Gao-tai, Han-chau, and Yun-chan. At this last point they branched off to Sining, and thence to the Hoang-ho, crossing this river at Gui-wei. Hence they advanced southwards to the foot of the mountains bordering Sze-chuen, where Prejevalsky was stopped on his third expedition. It was doubtless here that they were turned back by the Chinese authorities, as announced in the newspapers. Retracing their steps to Gui-wei, they afterwards skirted the west shore of Koko-nor, having previously passed to the east of it and regained Su-chau by a new route, arriving at the last-named town in September 1890. They then returned to Kuldja, and proceeded by the usual post road via Verny to Tashkend.

The map we give is a reproduction of the one published in the 'Izvestija' to illustrate their journey as far as Hami. Special prominence is given in it to M. Grijmaillo's theory of a division of the mountain ranges into two separate systems, Tian-shan and Altai. This and the mountainous country south of Turfan is new to cartography. It is to be regretted that no heights are supplied, but these will probably appear later when the scientific observations made by the expedition are worked out. The original map is without projection, which we have not attempted to supply, as it was found that by doing so several places would be thrown out of position.

* Cf. Col. Mark Bell's interesting paper, published in our 'Proceedings,' February, 1890, p. 85.—M.
