

The Kara-kum, or Desert of Turkomania.

By M. PAUL LESSAR.*

THE region bounded by the Ust Urt, Khiva, Bokhara, Afghan Turkistan, Attok, and Akhal bears the general name of Kara-kum, though it is far from sandy throughout, and a considerable part consists of *kyrs*, *takirs*, and *shors*, to be described further on.

Aspects of the Country.—The Kara-kum sands, represented on maps by one conventional sign, are in reality very varied. They are divisible into three principal kinds. In the first kind the soil is clayey, largely mixed with sand; its surface is formed into hillocks, rarely more than seven feet high, and usually thickly overgrown with brushwood. In this kind of desert there is no difficulty in travelling, whether on horseback or in carts, in good or bad weather. To this kind belong all the sands between Merv and Attok, as well as those between Sarakhs and Chacha.

The second kind consists of real sands, not, however of a drifting nature, but everywhere knit together by bushes 10 to 15 feet high. It is only at the summits of the hillocks, which are higher than those of the first kind, that there is a little drift-sand, which is carried from place to place. Now and then, too, it may be met with along the road in ridges 70 to 100 feet wide, rarely more. Generally there are no high elevations in the Kara-kum wilderness, and the levels differ only 140 feet, rarely as much as 200 feet between the extremes, whilst only very few points are sheltered from the wind. Once exposed to the wind two things may happen. (1) In those sandy tracts which are wholly free from bushes, *barkhans*, described below, are formed. (2) With the gradual hardening of the mass of sand the lighter particles do not remain in the hollows; they are either caught by the roots of the bushes or carried to higher ground, where they are sheltered from some winds by the ridge of the hillock. The wind then carries them over the hillock, but is incapable of laying them in the hollow behind. A wind blowing from an opposite direction may in like manner drift the particles to the reverse side of the eminence, but no farther. This explains the small quantity of drift-sand met with on the roads, and its rapid disappearance.

In sands of the second kind carts move with great difficulty, whilst horses and camels, particularly the latter, go freely. This includes all the sands met with along the roads between Khiva, Akhal, Attok, and Merv, between Mikhailof Bay and Mulla Kari, as well as those on the peninsula of Dardja, though these latter are of a looser consistency, and supply a connecting link with the third kind. Between Merv and Sarakhs they also occur, but only for a distance of about three miles,

* Translated from the Russian 'Ivestiya Imp. Russk. Geogr. Obsch.' vol. xx.

where the road crosses them at a place known as Kutche-kum. The sands between Annau and Gawars occupy an intermediate place between the first and second kinds.

In the sands just mentioned no storm is to be dreaded; the quantity of drift-sand being so small cannot become dangerous, though it causes many discomforts to the traveller, covering his things and filling his eyes, &c.

This, however, is not the case with sands of the third kind, the so-called *barkhans*. Here neither tree, nor bush, nor grass-blade is to be seen; the sand is wholly of a drifting nature; the slightest puff of wind effaces the fresh tracks of a caravan; and it is not without reason that the name Adam Krilgan—man's destruction—has been given to a place in the Khanat of Bokhara where whole caravans have been buried.

Between the Oxus and the Caspian such drift-sands occur but very rarely, and usually in distinct ridges or hillocks. They only occur in the south-eastern angle of the desert, and here only near the river; the farther from Chardjui in a northerly direction and the deeper in the steppe, the rarer are these drift-sands. Along the road from Merv to Kavakla the sands are similar in character for a short distance, covered with a little vegetation, though this only consists of a few isolated trees of saksaul, and the form of the hillocks is distinct from those along the road between Merv and Boyun-uzun, which are bare. Wherever there is vegetation the position of the sands depends not only on the wind, but on the bushes as well, and the coincidence of these two causes produces great variety in the shapes of the hillocks. In the barkhans on the road from Merv to Boyun-uzun this is not the case; here, as in all slightly undulating ground, there is no distant prospect, and when the sands cover the bushes growing on them the horizon is bounded on all sides by low, greyish-yellow hillocks, formed by the wind alone, which produces a similar effect on the whole mass of sand, moulding the hillocks according to one pattern; the side exposed to the wind (northern) presents a gradually raised cone, the reverse a sharp curve, whilst a section might be accurately figured by a rib. The axis of the barkhans runs north-east and south-west, and forms an angle of 20° with the meridian.

The passage of these sands is very difficult; horses sink and are hardly able to extricate their feet. It is necessary to proceed with the utmost caution in order not to lose one's way; there is nothing to serve as sign-posts, nothing to fasten camels' bones to except occasional sticks placed by passing caravans; the wind blows them down, the sand covers them. Each successive caravan replaces them in the most convenient spot. These sticks have to be followed on the march, for when there is the least wind only the most skilful and experienced guides can trace the direction of the road.

The barkhans shift from place to place; plain evidence of their drift-

ing nature is before the eyes of every traveller between Merv and Bokhara. On the road to Kavakla, the roots of trees are exposed to a depth of two to three feet, which should represent the thickness of the sand stratum removed, because the roots of these trees begin almost at the surface. I have never seen more than $3\frac{1}{2}$ feet of roots denuded, and hardly ever prostrate trees. This is explained by the circumstance that the sand removed by one storm is replaced by another, the tree being supported in the interval by its deeper roots. I saw another instance of the transition of barkhans at a *shor* between Adil Well and Boyun-uzun. At the time of my journey the barkhan crossed a well-beaten track which formerly served as the road; to avoid it a second track had already been beaten. This removal of an entire barkhan across a wide *shor* in one mass without undergoing any alteration in shape is a most interesting fact; particularly striking is the slowness of the movement; thus a second track had been beaten before that first occupied had been cleared.

Besides the three kinds of sands described above there are of course many intermediate, but the distinction already drawn is amply sufficient to illustrate the character of the Kara-kum; the more so because, in reviewing the subject of communications, their classification in one or other of these kinds fully determines the degree of facility with which they may be traversed.

As we have stated, there are besides the sands in the Kara-kum *kyrs*, *takirs*, and *shors*.

Firm, clayey (mixed with sand) surfaces, only occasionally covered with sand-hillocks, hardened by vegetation, are known to the natives by the word *kyr*. Far from being flat they usually consist of a row of valleys, alternating with eminences not exceeding 140 to 210 feet in height. The soil is very favourable to locomotion in any weather.

The *takir* is a very hard surface devoid of vegetation, surrounded on all sides by sands almost horizontal, and if sloping at all but very slightly. Externally they present the following distinctions from the *kyrs*. While the latter occupy large expanses of the steppe, particularly north of the Unguz, where they are bounded by a line almost parallel with it, at a distance of 20 versts (13 miles); the *takirs*, on the contrary, extend over limited areas in the midst of sands—never where there are *kyrs*. The soil of the *takirs* is clay, wholly impervious to water, forming during the rains a slippery surface, impeding progress, though they are not usually so sodden with moisture as is supposed, and I have never seen horses' hoof-marks deeper than $2\frac{1}{2}$ –3 inches. The importance of *kyrs* and *takirs*, in relation to the question of water supply, will be mentioned hereafter.

Shors are distinguishable from *takirs* by the quality of the soil: like them they are devoid of vegetation and bare of sand, presenting a similar appearance; their soil, however, is not clay, but ferruginous sand, and

in many places gypsum protruding on the surface. Shors are sometimes dry, sometimes boggy, and in any case not difficult of passage. Lying as they do in the lowest parts of the desert, water is always to be found in them at a depth of $1\frac{1}{2}$ to 2 feet, but invariably brackish.

This description of the Kara-kum would be incomplete were we to omit mention of the so-called dry channels met with in various directions, two of which—the Uzboi and the Unguz—are well known.

The Uzboi has for several years been the subject of special investigation by an expedition appointed for that purpose. Its labours are for the present concluded, and, considering the enormous means at its disposal, it is to be hoped that the results will completely settle the question. In the course of my labours in the Trans-Caspian regions I only came upon the Uzboi in places. Partly from data so obtained, partly from the meagre information which has been derived from other sources, I judge the most probable explanation of its presence to be as follows:—

We know that Aibughir Gulf has been dried up, so to speak, before our very eyes; it is, moreover, highly probable that the Aral Sea reached in comparatively recent times to Charishli and beyond to Bala-ishem by a gulf such as Aibughir (Charishli is 224 feet above the Caspian level, Bala-ishem about 210 feet, or a little below the level of the Aral). Between Sari-kamysh and Bala-ishem there is no kind of channel, but only inequalities in the ground having the appearance of lake-beds; of course, too, after the desiccation of the gulf of the Aral, as the delta of the Amu-daria moved northwards, watercourses were formed between it and Sari-kamysh.

Only from Bala-ishem to Igdi is there a channel bearing unmistakable traces of having been a river-bed along which the superfluous water of the Aral in years of exceptional floods may have had an outlet to the Caspian. Levellings will show how far this stream may have gone; but already near Aidin a level is reached below that of the Caspian, and there can be no doubt that all this part of the Uzboi forms the bed of a gulf of that sea, the drying up of which may probably be explained by the alternations in its level and the influence of atmospheric causes on the shallow gulf.

But whatever scientific results may be obtained from the labours of the expedition,* there is no longer any doubt of the impracticability of

* It is much to be desired that the results may be published *in extenso*, and not in the form of an abstract merely, or of any project for turning the Amu-daria into the Caspian Sea. Persons appointed for the special purpose of elaborating a project to unite the two seas may naturally be carried away by the grandeur of the idea and not weigh impartially favourable and unfavourable circumstances. Considering the importance of this question it should be considered from every point of view; the facts ascertained should, therefore, be accessible to all interested in the work, and not merely to those engaged in it, for however disappointing the results may prove in a practical sense, the surveys would be invaluable in connection with those made in the Kara-kum,

adapting the Uzboi to connect the Aral with the Caspian. It must be understood we are here speaking of effecting such a connection by merely turning the river; in many places there is absolutely no channel for hundreds of versts; in others gigantic works would be requisite for the passage of water; by wasting many tens of millions an artificial river-way might be created, but its adaptability for practical purposes would be out of the question. Supposing that trade were to develop, or that its probable development depended on the construction of elaborate means of communication, even then the choice would lie between a canal and a railroad, and either one or the other would cost immeasurably less than an artificial river.

Of the Unguz, or so-called Charjui channel, I shall speak more fully. Up to the spring of the present year (1883) information concerning it and the larger part of the Kara-kum was almost all from hearsay, though closely affecting the question of communications between Akhal, Khiva, and Bokhara; only part of the desert west of Sheikh had been surveyed and mapped by the topographers of the expedition to examine the old channel of the Amu-daria, and 20 versts of the Unguz had been described by Lieut. Kalitin.* In the month of March, this year (1883), therefore, by order of the commander-in-chief of the trans-Caspian region, I formed an expedition to examine the Unguz and several routes in the Kara-kum. For an escort and for carrying out the manual labour, ten horsemen of the Tekkeh militia with an interpreter were assigned, and ten camels with three drivers to carry baggage and provisions.

The following was the programme of the commander-in-chief:

A. Survey and description (1) of the Unguz from Bala-ishem on the Uzboi to the Amu; (2) of the road from Kizil-arvat via Sansys and Bestem Shah to Kurtysh on the Uzboi; (3) of the road from Khiva to the Tedjend and Askabad. These surveys were executed by me as proposed; they were effected with Stephan's compass mounted on a tripod; men on horseback served for sights; distances were measured with an odometer fixed to the front part of an ammunition waggon taken specially for this purpose; not being heavy it was drawn without difficulty by a laden camel even through drift-sands.

B. Barometrical levellings along all the routes with corresponding aneroid readings taken simultaneously. For this purpose we advanced in two parties of five men each at a distance of four to five versts apart (one hour's ride) and at stated times wrote down the aneroid readings; to mark the place where an observation had been made by the leading aneroid, a signal flag was left, near which the second observer halted,

and which have yet to be completed. Lastly, let the cost of publication be what it may, the amount would be quite insignificant by the side of the enormous expenditure of surveying.

* Proc. R.G.S., vol. iv., New Monthly Series, No. 4 contains a translation of Lieutenant Kalitin's paper

and when he went away removed it. The first aneroid readings were taken by me, the second by my coadjutor Lieutenant Khabaloff. Levelings were made along the road from Kizil-arvat to Kurtysh and along the Unguz. On returning from Khiva to Askabad the heat and want of water prevented us from travelling all together. M. Khabaloff proceeded from Khiva via Bala-ishem to Akhal, when he described that part of the road from Sansys to Bami for the first time. I returned as intended via Mirza-chileh and Tedjend, so that by this line single barometrical observations only were taken.

We proceeded to the Kara-kum from Kizil-arvat; the route hence via Sansys to Kurtysh and Bala-ishem will be described below with other roads leading from Akhal to Khiva; * I will at once speak of that belt of the Kara-kum through which passes the Unguz, and will quote extracts of my journal relating to this part of the desert.

"On the 12th April I started from Bala-ishem; there were 500 versts (330 miles) to be crossed to the Amu-daria, the whole distance without roads. The most difficult part was on the first day, viz. between Bala-ishem and Islam-kui, the sand-ridges here being for the most part loose, with steep gradients on either side. Having gone 22 versts (15 miles) we extricated ourselves from them and descended to the Unguz, proceeding along the lake-beds, which after the irregular sands traversed produced the impression of a channel covered with drift-sand. This illusion, however, was speedily dispelled, for on looking to the right and left precisely similar hollows met our view. Between Bala-ishem and Laila, said our guide, 'there are five Unguzes,' and in fact there are more, judging from what we saw. The whole surface is broken into hollows; a row of them surveyed and reduced on a small scale map produces the appearance of a channel. The sides of these declivities are 100 feet high, composed of marly clay with layers of sandstone; the bottom is ferruginous sand with frequent outcrops of gypsum both along the sides and bottom. These hollows are separated by high banks and are also encumbered with smaller ridges extending like dams across them and occasionally meeting from opposite sides. After about an hour's progress through them we halted for the night at Islam-kui. Here there are seven wells; formerly there were many more, but the rest are now choked up. Water is obtained 38 feet below the surface and is about 14 inches deep with a brackish taste, becoming nearly sweet, however, after heavy rains. It is eagerly drunk by sheep and camels, and its temperature is 11.5° Réaum. (58° Fahr.). From Islam-kui a road leads to Laila and Kurtysh.

Thirty-five versts (23 miles) to the east of Islam-kui, the surface of the country is again broken by a row of lake-beds; their bottom very rarely forming a takir. Shors on the other hand are frequent, and occasional *kaki* or rain-trenches, conspicuous in the distance by the dense

* This route is omitted in this abridged translation.

vegetation surrounding them, may be seen, while between the hollows are very considerable expanses of kyrs. Farther on, the channel entirely changed in appearance and the lake hollows discontinued. To the north of our road passed a line of steep cliffs, seamed by transverse valleys running nearly from north to south. On the south of us were sands, the intervening space between these and the cliffs becoming greater as we proceeded, the latter receding far to the north, while the sands on the south disappeared from view. We marched over kyrs from which there rose occasional cone-shaped hillocks, consisting, like the cliffs along the whole of the Unguz, of marly clays stratified with limestone. These hillocks are particularly numerous near the wells of Sheikh and have even given a name to the locality—Kyrk-gulbeh, i. e. the forty hillocks. Several of them contain in the limestone formation large quantities of sulphur, such for instance are those occurring 12 miles to the north of Sheikh (on the road to Laila), known throughout the country as the hillocks of Dervaz-kyr, whence all the Turkoman tribes and the Khivans have long since obtained sulphur for the manufacture of gunpowder, and which have been extensively worked. The nearer the wells of Sheikh, the less frequent are the kyrs, which are here replaced by sand, occasionally interrupted by takirs. These wells, framed with saksaul wood, are with the exception of one choked up; water is obtained 21 feet below the surface, with a depth of $4\frac{1}{2}$ feet, abundant in quantity and good in quality. They are situated on an extensive takir, having a north-westerly direction and forming the continuation of a row of lake-beds and generally uneven ground, having nothing in common, however, with a river-channel.

Half-way between Sheikh and Damla we passed through sands and occasional takirs, the sand-hillocks having a height of 56 to 70 feet above the surrounding country.

We here descended again to a row of shors, bounded on the north by cliffs 150 to 200 feet high like those we had passed, and on the south by sands. The shors consisting of iron sand were most diversified in colour—yellow, red, violet, &c. Everywhere gypsum protruded, in some places crystalline, in others amorphous and disintegrated, so that our horses sank three or four inches. The crystalline gypsum forms in many places a very thick layer on the surface, with thin scales resembling the leaves of a half-open book, and appearing in others as large crystals, or scattered over the surface in small sparkling grains.

Some of these shors, covered with sand, stretch continuously for versts; they are mostly swampy, but some are dry, brackish water being obtained at a depth of $1\frac{1}{2}$ to 2 feet. North of the cliffs for a considerable distance are kyrs, for the most part seamed by deep ravines, where we left the Unguz, and took a northerly direction, for instance at Mirzachileh, Dashadj, Edi-kulatch and other places. In general, here and farther on, the Unguz presents the appearance of anything but a river-

channel. It may rather be compared with the foot of some cliff such as the chink or scarp of the Ust Urt, with which it also bears comparison in height, both being about 200 feet above the surrounding country. The cliffs of Unguz are seamed and decomposed by atmospheric causes, and their débris helps to form the sands lying to the south.

But the fact of the loosest sands being found near the Amu-daria leads to the inference that they are partly deposited by the river floods.

The position of shors in the lowest points at the foot of the cliffs probably depends on the cause mentioned above, applicable to all low-lying ground in the midst of sands; when exposed to all winds the sand having nothing to hold to, drifts to the summits; thus in open low-lying tracts along the Unguz there remains a belt of bare surface. Here the moisture caused by rainfall accumulates and forms swampy shors, whilst in many other places sheltered from some winds the sands approach the very cliffs.

These two formations, kyrs and sand, alternate along the whole extent of the escarpment to Chalganak, while the farther east the more decomposed is this Chink, till at length it is broken into a row of detached hillocks some 70 to 100 feet high, hardly connected by a ridge less than 20 feet, with headlands ever becoming narrower and valleys widening. Almost immediately beyond Chalganak the cliffs recede, at first in a due northerly direction and afterwards run parallel with the Amu.

The sands as far as Chalganak are of the second, and occasionally of the first order; it is only between these wells and the river for a tract of eight miles, that barkhans entirely composed of drift-sand are situated. It is very remarkable that all the roads leading from Merv to the Amu-daria cross such barkhans, and it is highly probable that they belong to a continuous belt lying parallel with the Amu-daria, and formed by the deposits of its floods. These are drifted into barkhans and gradually harden as they move towards the west.

After all that has been said, it is hardly worth while speaking of the practical importance of the Unguz, i. e. its adaptability for being utilised as a river-way for the Amu to the Caspian sea. There is hardly one section of it resembling a river-channel or suitable for a watercourse without enormous labour; while the unevenness of the ground and the large tracts of sand offer obstacles to the digging of a canal which must be considered as practically insurmountable.
