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A SUMMER IN TURKESTAN.

BY

W. M. DAVIS,

Sturgis-Hooper Professor of Geology in Harvard University.

A rapid journey across Turkestan in the summer of 1903, as a member of Professor Raphael Pumpelly's Carnegie Institution Expedition, gave me a general view of that remote country, and answered many questions that had arisen on the way there; but it left many more unanswered and in a most interrogative attitude. The latter will, I trust, be followed to a solution by my associate, Mr. Ellsworth Huntington, who remained in Asia after my return, and who went eastward in the autumn as far as the desert plains around Kashgar, in Chinese Turkestan, and southward in the winter as far as Seistan, on the eastern border of Persia. Only a brief narrative is offered here; a fuller account of my journey will be published by the Carnegie Institution; but first should come a few general considerations.

Nothing can be more natural than the extension of the Russian empire over the mid-latitude plains east of the Caspian. There was no topographic barrier to hinder the advance—nothing but the difficulty of progress across the desert, and this difficulty did not suffice to call a halt, for progress has not stopped until the mountains were reached on the south and east, where it seems as if the earth's crust itself had risen to set limits to the growth of the Czar's dominion. The range of the Kopet Dagh is a rampart along the southern border of the deserts of Turkestan; beyond this natural wall the basins of Persia are comparatively safe. The ranges of the Tian-Shan and the lofty highlands of the Pamir limit the plains on the east; and beyond these formidable barriers the interior deserts of Chinese Turkestan are fenced off from easy conquest. It is only on the southeast, towards Afghanistan, that the present boundary is unstable; it is there drawn across a corner of the plains, where it may be easily disturbed; and to this part foreigners are not allowed access.

There is much in the history of this progress from which an interesting analogy is to be drawn with the expansion of our own mid-latitude domain in North America; for it is to North America

alone that nearly all of Europe-Asia should be compared, in spite of notable differences of size. Our advance westward across the plains of the Mississippi basin towards a drier and drier interior region corresponds to the advance of Russia eastward into the Trans-Caspian country. It is only a fictitious system of land division and of world-naming that makes the Russians appear to have transgressed the limits of a continent, while our own mainland progress has respected them. But while in our case the further mountain system was found to be of medium breadth and height, and the native population that preceded us southwestward was small and weak, the further mountain systems that impede the southeastward progress of Russia are vast in all their dimensions, enclosing extensive desert basins and plateaux; and beyond them dwell the two teeming populations of the world. It is, therefore, with our position during the first half of the nineteenth century, after the Louisiana purchase, and before the acquisition of California, that the present position of Russia in Central Asia—not Siberia—should be compared. And with our later history Russia is not likely to run a parallel, for we found only a remote offshoot of Spanish power along the coastal slope of the further ocean; while Russia is preceded in India by strongly-entrenched British power, and for China and Japan there is no American homologue. We crossed North America because it is a handy-sized continent, whose most productive zone is not too wide for the stretch of a single nation. Eurasia is, on the other hand, an overgrown continent, and Russia traverses it only in the higher latitudes, where the native population is relatively small, and where the mountain barriers are least troublesome. It is, therefore, with Canada in North America that Russia in northern Asia should be compared to-day.

The half-century difference of American and Russian dates results in different methods of progress. Our extension into the Louisiana purchase began before steamboats and railroads and telegraphs were included in the usual order of things. Russian progress into Turkestan was in a more modern era, and the construction of the Trans-Caspian railroad had not long to wait after the decisive massacre at Geok-Tepee. Our party crossed the sea from Baku to Krasnovodsk last May in a fine steamer—a run of eighteen hours—and the next day we saw the unmitigated desert from our car windows. From first to last our journey was favoured by the Russian authorities; every official, from his Excellency the Governor-General at Tashkent down to the porters on the special cars

that were assigned for our use over the whole length of the railroad, gave us most considerate assistance and service.

At Krasnovodsk and for a hundred miles inland, as well as at Baku on the western coast, we saw the former shore lines of the expanded Caspian plainly recorded up to altitudes of two or three hundred feet above its present level. I felt, however, that there was much reason to doubt the former great extension of the sea far eastward over all the desert to the Afghan boundary, as has been inferred by some of the Russian explorers. And here arose one of the problems to which further study might so well be given. In spite of all the excellent work that has already been done, that of Konchin being



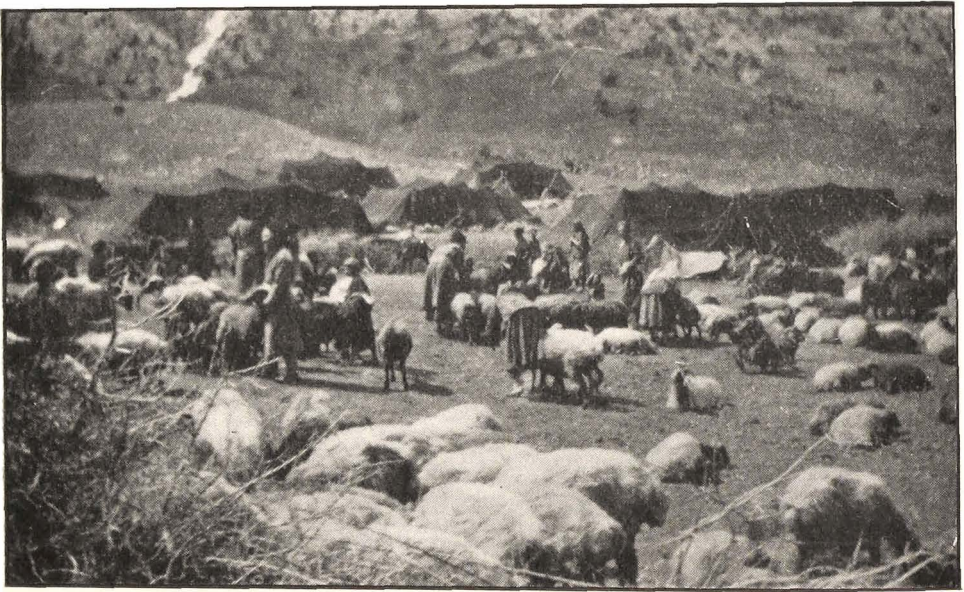
OIL WELLS AT BALACHANY, BAKU.

the most detailed, there is as yet no sufficient understanding of the quaternary Caspian; a monograph on its variations would form a fine Asiatic sequel to the reports by Gilbert and Russell on our quaternary Lakes Bonneville and Lahontan; but whoever undertakes this work must learn to live in the desert.

The railroad follows for over three hundred miles the belt of oases along the northern base of the Kopet Dagh. Here we had fine views of the sharply-dissected bare mountains and of the long, gravelly piedmont slope, spreading in fans from the mouth of each valley. Where the surface streams do not suffice for irrigation, gently-ascending tunnels are driven into the gravel, and thus the ground-water from near the mountain base is led out to irrigate the further forward slope. The irrigable belt is, however, only a

few miles wide; it is succeeded northward by a vast area, where dunes occupy much of the surface, the desert of the black sands—the “Kara Kum.” After one of the heavy rains which the clouds occasionally furnish the mountains, the piedmont slope is washed with local floods, which may advance some distance into the dunes before the water soaks away. We followed the dry pathway of such a flood into the dunes north of Bakharden, but the persistent water supply here was too small and uncertain to tempt more than a few poor Turkomen to subsist on its dwindling stream.

In Askhabad, the capital of Transcaspia, we were courteously received by the Governor, who detailed his aide, Wasili Gregorievitch Yanchevetski, to accompany us on a short trip over the



ENCAMPMENT OF KURDS IN THE KOPET DAGH MOUNTAINS.

mountains into Persia, and thus provided us with a most helpful and genial companion. In this excursion over the Kopet Dagh we met the nomadic Kurds pasturing their flocks in the higher valleys. It was remarkable to note how effective a few thousand feet of elevation was in changing the climate from desert aridity to sufficient humidity, and in replacing the parched lower plains with grassy uplands. The mountains were composed of Mesozoic limestones, compressed into rather disorderly folds, as has been described by Bogdanovitch. Where we crossed the range it has once, at least, been worn down to moderate relief—not to a plain, but to relatively subdued form; its present altitude is due to a subsequent localized longitudinal uplift, in mass, as is shown by the way in

which the present valleys are incised beneath the floors of the former valleys. There are some beautiful physiographic problems here awaiting solution. We had a general view of some of them from the main crest, where we looked down from a height of 9,000 feet to the desert of Turkestan on the north and to the ranges and basins of Persia on the south.

East and northeast of Askhabad, as the railroad traversed the great plain, we saw some of its rivers. First the Tejen, whose recent flood had swept away the rail bridge; a temporary foot-bridge gave us a crossing. In spite of the large volume of water that was passing at the time of our visit, the plain hereabouts has small population; the river is too variable to be trusted for irrigation. Further on the Murg-ab is less variable; it is divided into many canals to water the famous oasis of Merv, a true delta in a desert. Still beyond is the great Amu, the ancient Oxus, crossed by a long bridge at Charjui; a large oasis is here under cultivation. While the Amu still reaches the Aral sea, the Tejen and the Murg-ab wither away in the desert. As they weaken and vanish, their abundant sediment is deposited; and thus a considerable thickness of the plains strata must have been built up. It is doubtful if the world anywhere affords a better example of a fluvial plain than is to be seen here. The plains of northern India, as described by Medlicott and Blanford, and those that stretch eastward from the Rocky mountains, as best described by Johnson, are of the same kind. But these two great examples are to-day largely in process of dissection by their rivers; while in Turkestan the plains are still growing higher and higher by fluvial aggradation. A sight of the plains of Turkestan is, therefore, to be strongly recommended to any one who is so deeply imbued with the importance of the destructive work of rivers that he hesitates to attach much importance to their constructive work. Every grain of sand and silt that the Tejen and the Murg-ab bring from the mountains of their upper courses must be deposited on the plains, where their lower courses wither away. The plains are dead level to the eye; yet the muddy rivers detect a slope and flow rapidly forward to their extinction. The habit that these rivers have of flowing *on* the plains, instead of in valleys eroded somewhat below the plains, is highly suggestive. Such a habit is easily explained as a necessary consequence of the formation of the plains by the rivers; it would be difficult to explain it if the plains had been laid down in a sea or lake basin and then laid bare by uplift. The latter case would involve the chance agreement between two slopes—one,

the slope of the uplifted plains; the other, the slope of the rivers. A chance agreement between such slopes must be rare, and for this reason alone it is probable that the southeastern plains of Turkestan are largely composed of river-laid strata. If the expanded Aralo-Caspian sea stretched so far eastward in quaternary time, its sediments are now well buried.

We saw more in bazaars of modern Merv and in the ruins of ancient Merv than can be written down; but the hospitable reception we met at the hands of the Superintendent of the Czar's Estates at Bairam-Ali, as old Merv is now called, and the comfortable sojourn that we made in his mansion must not go unrecorded. Samarkand fulfilled our imagined picture of an oriental



STREET SCENE IN SAMARKAND.

city—the famous mosques and tombs, dignified even in dilapidation; the little open shops, where one sees the artisans at work; the strange costumes of gaudy colours; the silks of curious patterns. The memory of Tashkent has its foci in two delightful entertainments—an evening with Governor-General Ivanof, who furnished us with letters that opened all the gateways on our further road; a noon with Messrs. Polovzoff and Andraef, whose knowledge of languages, European and Asiatic, excited our lively admiration. It was from Mr. Andraef that we learned the device of carrying coloured cotton handkerchiefs as “small change” with which to pay the Kirghis for supplies and service up in the mountains.

The branch railroad to Andizhan, a good thousand miles from

Krasnovodsk, on the Caspian, led us through the province of Ferghana, a fertile district, because it is an eastward re-entrant of the plains and receives many rivers from the western members of the Tian-Shan system and the Alai range that borders the Pamir. The Alai was seen rising in many snowy peaks of fine Alpine form. Here the Syr, the ancient Yaxartes, is the main river; its branches are largely used for irrigation, and the population suffices for the development of a number of good-sized cities—Khojent, Kokan, Margelan, Andizhan, Namangan. Much silk is raised and woven in this province. We often saw men riding into the cities carrying large bags of cocoons hung on a long pole that lay across the saddle-bow. Much unspun silk is now sent to Lyons. Cotton is also ex-

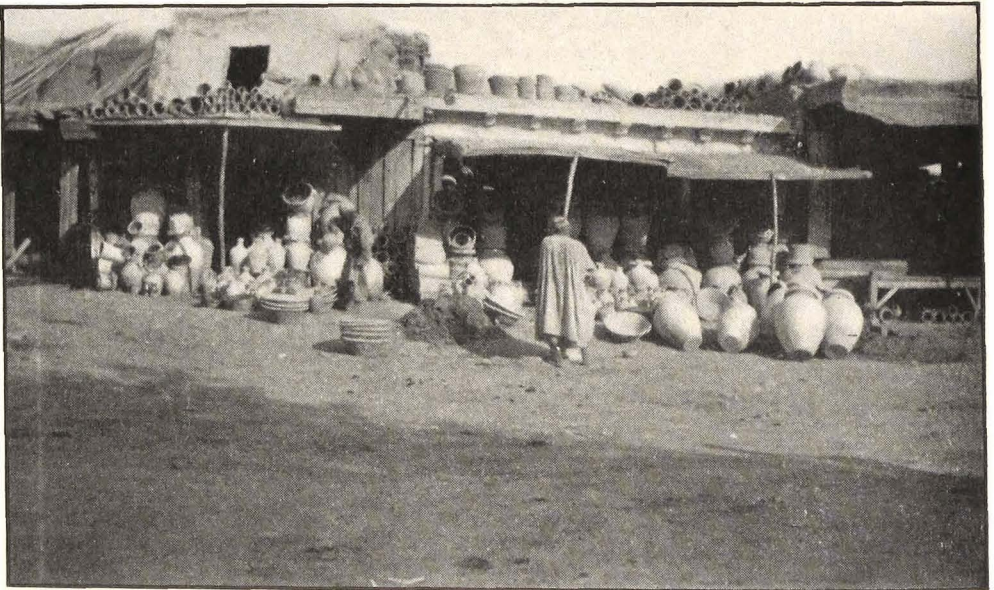


MARKET PLACE IN SAMARKAND.

tensively grown; American cotton seed, introduced only a few years ago, being in high favour. We passed many rice fields, delicately terraced and banked to hold water on the gently-sloping plain. The village houses are small, and are so well hidden by trees that one wonders where the people live. At Margelan we enjoyed the hospitality of the Military Club, where acceptable strangers are admitted to the privileges of temporary membership on the payment of a small fee. The accommodations found there were far superior to anything that the lodging-houses of the place afforded; while the polite attentions of the Secretary of the Club made us feel thoroughly at home.

It was at Andizhan that our party divided: Mr. Pumpelly, with

three others, going southeast, across the Alai and the Trans-Alai ranges to Lake Kara-kul on the Pamir; while Huntington and I went northeast to Lake Issik-kul amid the ranges of the Tian-Shan. Serge de Brovtzine of St. Petersburg, who had thus far been interpreter for the whole party, now was assigned to my division, and made himself indispensable. Andizhan had been greatly injured by an earthquake in March, 1902; the ruins of shattered houses were still seldom cleared up; many of the Russians lived in box freight cars that were standing on temporary tracks in the streets near the station; while the natives often occupied wretched hovels. The local Governor was still encamped in his garden, his new residence not being quite finished. He and his aides were most atten-



POTTER'S PLACE IN SAMARKAND.

tive in helping us to buy our horses, to hire our men, and to collect the necessary supplies. He summoned a neighbouring chief, the Min-bashi of Kugart, to meet us in the city and to escort us through his department, and under these favourable conditions our journey to Issik-kul began. Mr. Huntington has written so full a narrative of this part of our experiences that I shall not dwell upon them, more than to remark that our month on the way was like a long picnic, with science and entertainment delightfully blended. Our men were faithful servants to the last. The Min-bashi, with whom we started, showed us polite and gentle consideration. The nomadic Kirghis, whom we met repeatedly in their summer encampments among the almost treeless mountains,

treated us in so friendly a way that we had no reason to speak of them unkindly, as the Russians usually did. We were made much of in their villages; a good yurt, or felt-covered tent, was placed at our disposal, and carried to a fresh patch of grass before the clean felts, rugs, and quilts were spread in it for our use. We saw repeated instances of extinct local glaciation in the higher valleys, and found some excellent illustrations of newly uplifted mountains, which I shall describe elsewhere; and so we reached Issik-kul.

Issik-kul, or Issik-lake, a hundred miles long, from thirty to forty miles wide, and about a mile above sea-level, stands in a peculiar relation to the River Chu, that flows past its western end. The Russian maps showed the lake and the river to be joined by a



HEAD-MAN OF KIRGHIS VILLAGE AND HIS SON.

short stream, the Kutemaldy, which we not unnaturally took to be the lake outlet—a most respectable error, inasmuch as we were preceded in it by Humboldt and Ritter! But the stream, when it flows at all, runs from the river into the lake, and the lake is slightly brackish. The content of salt is not, however, so great as would be expected, if the lake had never overflowed since its basin was first depressed between the adjoining ranges; and the flat gravel plain between the river and the lake makes it very probable that the Chu was once both an inlet and an outlet for Issik-kul, the upper river flowing northeastward into the lake, and thus causing it to overflow northwestward into the lower river. The change from these conditions to the present was probably brought about spon-

taneously by the river itself; the inlet seems to have built a fan delta, on which a chance diversion of its course led it directly to the outlet. The Kutemaldy is of similar natural origin, being a distributary of the Chu at the elbow where its upper and lower courses to-day join.

But the changes in Issik-kul are not only those that have been determined by its variable relation to the Chu. Several abandoned shore-lines may be traced around it, up to about twenty-five feet above its present level; hence it has been higher than it is now. These shore-lines are continued across the floors of shallow valleys, which themselves are slightly invaded or drowned by the lake waters; hence the lake was lower than it is now before it was higher. The drowning of the valleys is hardly perceptible at the west end of the lake, but it is strongly pronounced at its east end; hence the lake basin has been relatively depressed to the eastward. The drowned valleys of the east are eroded in a plain of horizontally-bedded sediments, apparently of lacustrine origin; hence the lake was once decidedly higher at its east end than it is to-day. These changes are of interest in their physiographic relations alone, but they have a human interest also; for it is credibly reported that the ruins of houses are to be seen beneath the waters near the eastern end of the lake; and we were shown a square brick that was said to have been dredged from the lake bottom near the drowned houses. Here is work enough for an entire summer, and we had only a week for it!

Moreover, the origin of the lake basin deserves attentive study. It seems to be in genetical contrast to the uplift of the mountain blocks on the north and south. The uplifts were long enough ago for the formation of stony piedmont waste slopes, which greatly decrease the beauty of the lake, as they are several miles wide on each side; the material of the slopes having been eroded from the valleys in the mountain blocks. One slope faces southward to the noonday sun; the other descends northward from it; hence the surrounding ranges are called by the Kirghis the Kungei (midday) Ala-tau, and the Terskei (midnight) Ala-tau. Small glaciers occur to-day near the summits of these ranges; larger glaciers once occupied the high valleys and laid moraines in them. It is probable that close study would discover a point where the glacial record and the lacustrine record could be compared. Here is a fine problem for some less hurried traveller.

The mountains themselves near Issik-kul interested me greatly, because they appeared to be tilted and carved fault-blocks, such as

Gilbert and Russell have described for the Great Basin of Utah and Nevada. This origin seems to be particularly appropriate for the Alexander range, that stretches westward from the lake, as far as our sight of its eastern end could determine. It is composed, where we saw it, of crystalline rocks; the northward slope is precipitous and deeply dissected; the southward slope is remarkably even when seen in profile from a distance, and but moderately dissected when seen from the southern base; next, south of the range is an open basin, occupied by subrecent deposits. All of this is consistent with the supposition that the mountain mass is an uplifted part of a peneplain of erosion, that fracture and uplift on the north were accompanied by tilting and relative depression on the south, and that these movements are ancient enough to allow a significant amount of consequent erosion, especially on the northern or faulted face of the block, and to allow the heavy burial of the southern or depressed part of the block. If it had not been for the deposition in this basin of the waste brought by the upper Chu from its mountain gorges, the western end of the Issik-kul basin would probably be much more filled up than it is.

Huntington set out from Issik-kul on his journey southward over the Tian-Shan mountains to Kashgar; while Brovtzine and I posted northward in a springless tarentass past Vyerniy to Semipalatinsk—nearly a thousand miles in a week, not counting a two days' stop at Vyerniy. We followed down the Boam gorge of the Chu for some thirty miles, along which the river is rushing at torrential speed; the steep gorge walls and the rapid descent of the channel testify to the subrecent date of the regional uplift that the Tian-Shan must have hereabouts suffered. North of Vyerniy we crossed subdued mountain ranges, and on nearing Semipalatinsk, on the Irtysh, in Siberia, we traversed a great steppe of small relief, a worn-down surface of crystalline and greatly-deformed stratified rocks; by far the best undissected peneplain I have ever seen. I am tempted to generalize here: the uplifted peneplain that is seen on the back slopes of the mountain blocks around Issik-kul, and that occurs much more extensively further south in the Tian-Shan, as reported by Huntington, was probably once continuous with the peneplain that still lies low about Semipalatinsk; and the difference between the strong relief of the Tian-Shan and the monotony of the steppes in the bordering part of Siberia is chiefly due to the invasion of the former area by the telluric forces of deformation and uplift, while the latter area still lies quiescent.

From Semipalatinsk we descended the Irtysh in a commodious

steamboat, and at Omsk took a west-bound express on the Siberian railway; and so entered Europe early in August. It may be noted in closing that Mr. Pumpelly is now—March, 1904—again in Turkestan, where he is continuing his studies under the most favourable conditions.

THE ANNUAL REPORT OF THE COAST AND GEODETIC SURVEY FOR 1903.

Aside from its scientific interest as a record of progress in geodetic and terrestrial magnetic measurements, the present Report contains a large volume of results of the highest economic value. The precise levelling operations that have been carried on by this Survey and their interlocking connections with the similar measurements that have been executed by the Geological Survey, the survey of the Northern and Northwestern Lakes, the Mississippi River Commission, the army engineers, the great railroad corporations, and by the State of New York in connection with the contemplated improvement for water-borne traffic between New York Harbour and the Great Lakes are scientifically discussed and summarized in an extensive and valuable report, which has an intimate bearing upon the industrial development of the country.

A large amount of progress was made at an unusually rapid rate in the extension, from Kansas to the Rio Grande, of the primary triangulation for the measurement of the arc of the 98th meridian in its extent throughout the United States. Beyond the interest attached to the extension of this system of precise triangulation as a contribution to the more perfect discussion of the size and shape of the earth is its immediate usefulness in providing reliable points of reference for the more detailed geographical surveys that are continually being carried forward by private and Government organizations.

The Coast and Geodetic Survey has been for some years carrying forward a magnetic survey of the United States under very able administration, and much practical good has already been done in the establishment of meridian lines for the use of surveyors in every part of the country, and in forestalling litigation and in paving the way for the orderly conduct of isolated compass surveys. Fixed magnetic observatories have been established in different