

Tenth Meeting, 24th April, 1871.

MAJOR-GENERAL SIR HENRY C. RAWLINSON, K.C.B., VICE-PRESIDENT, in the Chair.

PRESENTATION.—*E. C. Taintor, Esq.*

ELECTIONS.—*G. E. Bell, Esq.*; *Staff-Commr. Charles Burney, R.N.*; *Walter J. Ellis, Esq.*; *J. C. W. Paul Graham, Esq.*; *Simon Little, Esq.*; *Henry Syme, Esq.*

ACCESSIONS TO THE LIBRARY FROM THE 27TH MARCH TO THE 24TH OF APRIL.—‘*Barometer Manual.*’ Board of Trade. Compiled by R. H. Scott. Donors the Board of Trade. ‘*Gesammelte Naturwissenschaftliche Vorträge.*’ Wien, 1871. Purchased. ‘*Bijou Gazetteer of the World.*’ 1871. Donor the author. ‘*Travels in Central America.*’ By A. Morelet. Translated by Mrs. M. F. Squier. 1871. Purchased. ‘*The Chinese Classics. Vol. III. in four parts.*’ Translated by James Legge. 1865. Donor C. Morrison, Esq. ‘*Observations on Santorin.*’ By K. v. Fritsch, W. Reiss, and A. Stübel. 1867. Purchased.

ACCESSIONS TO THE MAP-ROOM, SINCE THE LAST MEETING OF MARCH 27TH.—Stanford’s large Map of the Seat of War, between France and Germany; sheets No. 12, 13, 14, 15, 16, 17, viz. 6 sheets. Presented by the publisher. A tracing of a Sketch Map of the southern and eastern parts of Thibet, as used by Catholic Missionaries. From the India Office. Admiralty Charts, on 11 sheets, completing the publication up to this day.

The following Letters from Mr. R. B. Shaw to Sir Roderick I. Murchison were read:—

“MY DEAR SIR,

“Camp, Peshawar, Dec. 8th, 1870.

“Though I am not yet able to send you such a report of the results of my late journey to Yarkand, as I hope to do when I have had leisure to compare together my notes, to calculate out my observations, and to complete my map, yet I think you would wish to be informed of my return to India.

“Mr. Forsyth and the rest of our party returned some time ago. But on our journey back I was detached from the expedition for the purpose of examining the country lying between the old and the new routes from Yarkand to Ladák; that is, the country between the high table-lands at the head of the Karakash River and the valley of the Upper Shayok River.

“It is extremely interesting ground to visit; being the westward edge of the series of elevated plateaux which, supported as it were on the summits of the Himalayan chain (using this term in its widest sense), extend eastward beyond our knowledge.

“I found the ground which I had come to examine resembled, on a vast scale, the edge of an embankment which has been much cut up by rain. You are travelling over rolling plains and rounded mountains which, although

attaining 19,000 and 20,000 feet of elevation, are but little higher than those plains. By a scarcely perceptible ascent you reach a low pass, or rather *lip*, and look down on the other side. Your eye is met by a scene of indescribable confusion. High peaks, vertical precipices crowned with glaciers, a labyrinth of dark gorges and narrow chasms sloping steeply away from your feet; these replace the plains behind you. It is like standing on the leads of some immense roof, and looking through an opening down into the maze of pillars and arches of a Gothic cathedral.

"In point of fact, the high plateau which I have mentioned is edged by a huge wall of limestone mountains. This wall, placed like the masonry revêtement of some gigantic embankment, has in a great measure protected the ground behind it from the excavating action of rain and snow which it has itself suffered. The clouds which drift up the course of the Shayok River and its feeders, are arrested by that phalanx of mighty peaks, and expend all their powers on their gradual destruction. It is certain that while deep and precipitous gorges, watered by foaming torrents, abound on one side of the watershed when rain and snow fall; on the other, where vast plains extend, the unguided traveller may wander for days in search of a pool of water to sustain life.

"So much has this limestone range suffered from erosion, that further to the north-west (in which direction it runs) the forces of rain and snow have pierced right through it and beyond it, working into the softer and higher ground behind, which they have bevelled off (as it were); so that we then find a slope which discharges the scanty waters that reach it into the open mouths of the gorges westward, through which they find their way down to the Shayok, swollen as they pass, by many a glacier torrent. These streams, originating on the plateau, traverse, therefore, the entire width of the range, entering at one side and passing through to the other.

"It was, however, at a point where the real watershed pretty nearly corresponds with the crest of the limestone range (if you can imagine a crest banked up to the brim by the plateau on its northern side) that I first attempted to find a route down to the Shayok. After descending but a short distance from the edge of this plain, I entered the upper mouth of a valley which narrowed into a chasm, and presently became a mere crack no wider than an easy ice-crevasse. The walls, which were at first vertical, presently overhung, forming for miles together a sort of corridor, of which the roof was often so low as to oblige one to stoop, while the floor consisted of opaque white ice, the stream having become solid. A gloomy light was all that penetrated between the overhanging walls, varied by an occasional glimpse of the sky.

"After several miles of this wonderful passage, we reached a place where fallen rocks, jammed between the side-cliffs, had formed an obstacle over which in summer time a cascade probably pours. Now the water was all frozen, and we were able to descend. The baggage had to be let down by ropes to successive stages, where the porters were stationed to receive it. It seemed like descending into a mine, so dark were the caverns through which we finally emerged at the foot of the frozen waterfall.

"This process had to be repeated several times, at fresh cascades; until at last an elevation was reached so low (about 15,700 feet, or the height of Mont Blanc) that the stream ceased to be securely frozen, as it was higher up, and the laden porters began to sink, often breast-high, into the slushy mixture of sharp cakes of ice and half-frozen water (the effect of repeated freezings and thawings). The ice-cakes cut them like razors, dyeing the whole surface of the slush with blood. At last the suffering produced by this and by the intense cold of the half-frozen mass proved too much for them, and with one accord they lifted up their voices and wept, or rather howled, declaring that they were quite content to die where they were, but further they could not go.

After wading on for some few yards, I found a small beach or bed of shingle, produced by the stones which in spring are brought down a kind of 'couloir' in the rock above. This being the only choice of a resting-place between the vertical cliffs and the icy stream, I landed here, but had some difficulty in making the coolies venture again into the ice, from a small rock on to which they had clambered. It was only by holding up a bottle of rum before their eyes that I induced them to perform that icy journey of ten yards; but when they arrived the spirits soon stilled their sobbing for a while. Several times during the night we were awakened by the clash of falling stones, which flew over our heads into the stream. The men were all huddled together for warmth, moaning and sobbing with the pain of their frost-bitten limbs, and in the morning they absolutely refused to proceed. In fact, I found that we were at the bottom of a chasm like that of the Via Mala on the Spugen. As long as the stream had been frozen we could pass along. But where it ran free and of unknown depth through this narrow rent, there was no pathway or foothold for us, for a couple of thousand feet upwards, of cliff, on either side.

"We had therefore to return, losing three days in this exploration. So narrow was the gorge, that I returned dry-footed by straddling across the stream, and resting my feet on the firmer edges of the ice when it was frozen against the vertical rock. We had now been three days without fuel; the men sustained themselves by munching uncooked flour and parched barley, and by eating the raw flesh of some of the sheep which we had brought with us. I was more fortunate, having a spirit lamp, with which also some tea was made for the whole party.

"Having got back upon the high plateau, we now attempted a more westerly route, and at the end of the second day's march through interminable valley-plains, discovered a lovely little blue lake, half frozen and covered with wild-fowl. From near this lake we obtained a view westward along a magnificent avenue of snowy mountains, one range on either hand. Far away in the distance they seemed to come together at last, leaving only a narrow pass between two of the highest peaks, one belonging to either range. I concluded that this apparent pass would be the watershed; as between us and it there was nothing but an undulating plain. What was my astonishment, after walking a few yards, to find some water trickling westwards towards the mountains. I had, therefore, already passed the imperceptible watershed between the great river-systems of the Indus and of Central Asia. Beyond the lake we had just passed, the waters feed the Karakash, the 'Jade River,' which flows through the Kingdom of Khotan into the great central desert of Gobi, while the trickling stream which I had reached pierces the great limestone range, and much augmented on the way, runs through rocky gorges into the Shayok, which is one of the chief sources of the Indus.

"Thus the great water-systems of Southern and of Central Asia are here separated by no gigantic mountain range, but merely by a few yards of level sand; at a prodigious elevation, it is true.

"I need not detail the trouble we experienced in following down the stream which we had just struck, through the narrow gorges which it traverses after entering the mountains we had seen in the distance. Through these mountains we followed it until it reached the great Shayok River. The upper course of this river is of the utmost interest, being the scene of the great *débâcle* of 1841, when a lake, formed by the glaciers near its head, suddenly burst, and swept down the valley into the Indus. It still continued, carrying havoc and destruction in its course, till it reached the plains, and swallowed up a great part of the Sikh army, which happened to be encamped on the banks of the river as far down as Attock, 800 miles from the glacier!

"In the year 1869, on my first return from Yarkand, I had seen the traces

of this temporary lake above Sassar. The marks were visible 200 feet above the level of the stream, and extending for ten or a dozen miles up the widening valley above the narrow bend, where a huge protruding glacier even then seemed threatening to close the exit. Thus the calculations of General Cunningham regarding the size of the lake, founded on the records of the height attained lower down by its escaping waters, are signally verified.

"On the present occasion (1870) I followed the Shayok down into Noobra, over a scene of desolation quite indescribable. Wide terraces of gravel had replaced the pasture-grounds which formerly occupied the sides of the stream. In its tortuous course, it is so frequently washed against opposite sides of the valley, that we had to ford the icy stream, 3 or 4 feet deep, more than forty times in the course of the eight days which were occupied in descending it. A month later, it is hard-frozen, and forms the winter high-road of Yarkand commerce. But I believe no European has followed its whole course before (none having passed a winter there of late); nor visited its source,—a vast sea of blue glacier which, descending from some enormous peaks, spreads out upon a wide plain at their feet, forming a real *mer de glace* of unequalled expanse and beauty. I have also had the satisfaction of fixing the actual position of the cataclysmal lake before referred to, which has been a subject of much conjecture; and of disproving the existence of the glaciers lower down the Shayok, which had been supposed to have caused its formation. The glaciers seen by Thompson above Sassar (or rather the upper one of the two, which I fancy he cannot have visited) were the real cause of the disaster.

"But the most interesting discovery has been that of the fact that the so-called Karakoram *Range* is no range at all in any correct sense of the term, to the eastward of the Pass of that name. (To the west of the Pass it is more correctly called the Mustak Range; no native ever applies the word Karakoram to anything but the Pass itself.) There is no continuous ridge dividing the waters of Southern and of Central Asia. The Karakoram Pass is the *lip* of an elevated plateau; situated, it is true, among enormous mountains, but not coinciding in any way with their axis. Further east and south, on the high table-land of Lingzee Tung which I have been describing, the head-waters of various streams interlock in the most marvellous manner on the open undulating plain, with no high ground to divide them. A stream which begins by flowing east towards China will finish by running west into the Shayok and Indus; while, within a few hundred yards, you will find two parallel brooks running in opposite directions. In this concatenation of waters, a man who should undertake to walk along the watershed would find himself describing the most extraordinary curves, facing alternately each point of the compass, and often retracing his steps almost.

"Farther east again, to the north of Chang-Chenmo and Roodok, a distinct ridge seems to divide the waters. But this ridge is apparently only the continuation of what I have called the Limestone Range. This range, running s.e. and n.w., ceases for a while to be a watershed. It is pierced by the Shayok and its feeders in the neighbourhood of the 35th parallel of n. lat. (the former river piercing it through that narrow gorge which was choked up by the Koomdân Glacier).

"Beyond this (still going north-westwards), it divides the sources of the Shayok from those of the Noobra rivers, and unites with the Mustak Range nearly half a degree west of the Karakoram Pass, probably forming by its junction that very knot of gigantic peaks which give rise to the Shayok *Mer de Glace*.

"This range, which in one place divides the Indus waters from those of the northern plains, which farther on is itself pierced by the Shayok, and which finally separates the two Indus feeders (the Shayok and Noobra) is evidently the true continuation in direction of the Mustak Range. But the fact

that the watershed of the Shayok lies beyond it, and that it is pierced by a large river (a thing which it has in common with most of the Himalayan ranges) has concealed its true unity, and given rise to a supposed Karakoram range, running round the heads of the Shayok feeders in a continuous mountain chain; diverging from the former direction of the Mustak so as to form a huge bay, and then resuming it in a somewhat unnatural manner.

“The idea of a Karakoram Range, dividing the two water-systems, east of the meridian 78° E., should, I think, be abandoned.

“ROBERT B. SHAW.”

“MY DEAR SIR,

“Lahore, Feb. 20th, 1871.

“The accompanying letter was begun more than two months ago, immediately on my return from Yarkand, and when I was at Peshawar, in the camp of the late lamented Sir H. Durand.

“My writing was interrupted by a dangerous seizure of illness (rheumatic fever), consequent on my exposure, &c., up the Shayok. I have only just recovered, having set up my health by a resort to the warmer climate of Calcutta, where Lord Mayo was kind enough to invite me to stay with him.

“I think the accompanying short description of my little exploring trip will not have lost whatever interest it may possess by the delay. I therefore take the liberty of enclosing it, although so late.

“I have just been appointed to the post of British Commissioner in Ladāk, and there hope to have many opportunities of furthering geographical science.

“I should be very grateful if the Geographical Society would permit me to purchase the instruments which were granted to me on loan before my recent journey.

“I fear my full report must be delayed for some time yet, everything having been thrown into arrears by my illness. But I now have the pleasure to send herewith copies of my observations for latitude, longitude, variation of the compass, and altitude by boiling-point, also a map illustrating my letters. I trust this may prove of some interest. The lunars are, of course, the first direct observations for longitude that have yet been made in Eastern Turkistan

“With my best wishes for your speedy and complete restoration to health,

“ROBERT B. SHAW.

“P.S.—I have brought back a complete set of specimens of all the strata and rocks which occur between Turkistan and the Indus, including some containing fossil remains of shells. I have also notes of the order, succession, and dip of these several rocks. If this collection were thought sufficiently interesting, I should be happy to send it home.”

“MY DEAR SIR,

“Lahore, March 18th, 1871.

“I have now the pleasure to send you copies of my observations for latitude, longitude, height, and variation, which I regret were not ready in time to send with my former letter.

“With reference to the subject discussed in that letter, viz. :—the Limestone Range, pierced by the Shayok and its tributaries, I have just come across a singular confirmation of what I advanced, in the travels of Dr. Thomson (‘Western Himalaya and Tibet’), a book which I had not seen for some years. The following passage (chap. xiv.) refers to the view obtained on reaching the high-level plain of Debsang (so marked in my sketch map):—

“By degrees, as I increased my elevation, superb snowy mountains came in sight to the south-west; and, on attaining the top, an open, gravelly, some-

what undulatory plain lay before me, while *behind me a grand snowy range was seen* in perfection, forming apparently a continuous chain, with a direction from south-east to north-west. The snow was to the eye perfectly continuous in both directions, as far as the mountains were visible. . . . As I had passed through this *apparent chain* without rising above 16,000 feet, the continuity of the snowy mass was, of course, a deception.'

"This is the chain which I have ventured to assert to be the real continuation of the Mustâk Range, eastward, although it is, as Dr. Thomson observes, broken through in several places by the Shayok and its tributaries, through narrow gorges. Dr. Thomson also describes this chain, where he passed through it, as being composed of 'greyish massive, but brittle limestone,' exactly the same formation which I found in the eastern prolongation of this range near the Lingzee-tung (or plain), and which I also found to be the composition of the cliffs to the west, where the Shayok escapes through the gorge of the Koomdân Glaciers.

"I should be very much obliged if I could be informed of the result of my observations, when calculated.

"ROBERT B. SHAW."

The following are the results of Mr. Shaw's observations for the Longitude of Yarkand, as computed by Mr. W. Ellis, of Greenwich Observatory.

LONGITUDE OF YARKAND.

(From Observations by R. B. SHAW.)

I.—OBSERVATIONS FOR LOCAL TIME.

September 1, 1870.

Object observed.	Number of Altitudes.	Watch Time.			Error of Watch on Yarkand Mean Solar Time.	
		H.	M.	S.	M.	S.
Sun	2	5	27	55	10	3 slow.
α Aquilæ	2	7	27	35	10	17 "
α Lyræ	5	10	27	22	10	39 "

II.—OBSERVATIONS OF LUNAR DISTANCES.

September 1, 1870.

Yarkand Mean Solar Time.	Distance Measured.	Number of Measures.	Longitude East.	
			In Time.	In Arc.
H. M. S.			H. M. S.	° ' "
5 37 48	Sun to Moon ..	3	5 7 42	76 55 30
7 42 6	α Aquilæ to Moon	5	5 10 16	77 34 0

The Sun was to the *west of the Moon*, and α Aquilæ to the *east of the Moon*.

The mean of the two results gives for—

LONGITUDE OF YARKAND.

In time, 5h. 8m. 59s. east of Greenwich.

In arc, 77° 14' 45" east of Greenwich.

The latitude of Yarkand adopted in the calculation of the above results was 36° 24' 30" north.

WILLIAM ELLIS.

GREENWICH, April 24th, 1871.