

alterations having been made in the fittings, it was carried safely in one of our leathern mule trunks for more than 3,000 miles over I suppose some of the most difficult roads in Asia, without receiving the slightest injury, or having at any time been unserviceable. For its size it is a most perfect instrument.

I had, however, also to consider what I should use in case of secrecy being necessary, and for this of course there was nothing like a sextant, so I provided myself with a 6-inch sextant by Troughton and Simms, as well as a small pocket sextant by the same maker, taking with them the ordinary mercurial artificial horizons.

I may allude to the fact that Captains Biddulph and Chapman both spent a short time at the head-quarters of the Great Trigonometrical Survey for the purpose of practising astronomical observations in anticipation of the probability of our party separating in different directions in Eastern Turkestan. It was arranged that the former should take with him a sextant and the latter a theodolite, a sister instrument to my own. There were, therefore, in camp duplicates in case of any accident happening to my own instruments.

I also provided myself with a very small light theodolite for use on high peaks (where it would be unsafe to attempt to carry the large instrument) and for traversing along roads if opportunity should occur. Besides the instruments already named I had a supply of prismatic and pocket compasses (I may mention that owing to breakage and accidents I at one time ran short of pocket compasses, and I was much indebted to Colonel Gordon during the Pámír trip for the loan of a very good little instrument), and a small light plane-table, which I had specially made to fit on to my theodolite stand. A good hand telescope was fitted to the same stand which also served, when necessary, with a slight adaptation, for a Hodgkinson's Actinometer belonging to the Royal Society and lent to me by Mr. Hennessey of the Great Trigonometrical Survey for the service of the expedition. Colonel Roberts, the Acting Quarter Master General, kindly gave me an old astronomical telescope which had been in use for many years in the Quarter Master General's Department. This telescope was presented to the Dádkhwáh of Yárkand on our return to India.

It was proposed that I should take a complete set of instruments for observation of the magnetic elements—intensity, dip, and declination; but considering the great bulk and delicacy of these instruments, as well as the time that would have been occupied in making the necessary observations—time which I could not expect to be able to snatch from more important duties—I determined to take the dip circle only, a small instrument and one not occupying very much time to observe with. Observations for declination (variation) I was able to manage with my theodolite, with sufficient accuracy for practical purposes.

With regard to chronometers and watches for astronomical purposes, it was decided that I should only take pocket chronometers, and as the Survey Department could only provide me with one good one, I had to order two from England, a gold one by *Dent*, and a silver watch by *Brock*, a maker strongly recommended by the Royal Geographical Society. These watches, I found while crossing the Himalayas, could not be depended on for very accurate results, as the sudden and enormous changes of temperature combined with other causes to make the rates very irregular (although all were professedly compensated for temperature), and for that portion of our journey I consider it better to rely upon the Pundit's pacing, checked by latitude observations, rather than on differential longitudinal observations depending on these watches. During trips in Turkestan, however, where there was considerably less variation in temperature, the results are much more satisfactory, and in my excursion towards Ush Turfán the resulting positions in longitude depend entirely upon chronometric differences of time, as also in great measure do those between Káshghar and Panjah in Wakhán.

For meteorological observations and for determinations of height I decided to run the risk of taking with me mercurial mountain barometers, feeling that the greater confidence that would be placed in results deduced therefrom would more than compensate for the risk of loss by breakage; I procured two from Bombay and one from Calcutta, and on the whole I am glad that I did so, as I succeeded in safely transporting all three over the Himalayan ranges, having been able to get them carried by men on foot. On the other side of the mountains I was not so