

each other; what is observed is, then, the transit of the two images over the same line of a horizontal graticule.

There is no appreciable difference in precision between the two prism arrangements. B has the apparent disadvantage that a closer adjustment of the telescope is required, the line of collimation must be perpendicular to the prism base, and the latter must be truly vertical, whereas with A the horizontality of the telescope and the symmetrical inclination of the prism faces are immaterial. On the other hand, from the practical surveyor's point of view, the use of the easily damaged silvered faces is inexpedient, and the method of internal reflection preferable. The disadvantages attaching to the necessity of more careful adjustment of telescope and prism are, moreover, more apparent than real. It must be remembered that while the actual observation involves no reading of graduated circle or micrometer, a horizontal circle is required for the purpose of directing the line of sight, so that the desired star will cross the field. The telescope and circle must therefore be levelled and adjusted as with a theodolite, and the extra labour involved in the setting of the prism is a very small matter.

As already stated, the preparation of an observing programme involves somewhat lengthy computations. These have now been made, and are available for the use of observers within a wide range of latitude. The "Handbook of the Prismatic Astrolabe" gives a succinct description of the smaller survey form of the instrument, its construction and method of use, and contains tables of all the Nautical Almanac stars down to the fourth magnitude which cross the altitude circle at azimuths suitable for observation for each degree of latitude between 55° S. and 55° N. This list gives sufficient stars for all field work except geodetic survey of the first order, for which more and fainter stars would be wanted. For these, reference must be made to the "Astrolabe Diagram," giving, for the same limits of latitude, a series of graphs from which the azimuth and time of any star crossing the altitude circle can be plotted. A comparison of the relative accuracy of the astrolabe and other survey instru-

ments seems to indicate that it is probably capable of somewhat greater precision than a theodolite of similar telescopic power; and there is no doubt that in it we have a valuable addition to the resources of the surveyor. It cannot, however, take the place of the theodolite, being capable of determining only latitude and time, not azimuths or angles. It has therefore been urged as an objection to its more extended use that as a survey party must in any case carry theodolites the astrolabe could be taken only when the added labour of transport is unimportant. Apart from the fact that the addition of thirty pounds to the baggage of a survey expedition would be found burdensome only in quite exceptional cases, this objection does not appear to have any validity. A theodolite is capable of conversion into an astrolabe by the addition of the prism and mercury trough, and it would be easy to design these so that they could be clamped on to the front of the telescope, and the prism levelled in a minute or two. The extra weight would then not exceed a few ounces.

An attempt has been made, not, however, yet carried very far, to develop the use of this instrument for the astronomical problem of the determination of star places of high-order precision. It is very doubtful if it presents any real advantages for this work. The difficulty of making true plane surfaces is well known, and in an instrument of large aperture and high magnification the inclusion of flat reflectors in the optical system is undesirable. Furthermore, the two star images are not symmetrical, each being formed by only half the object glass, and the results show a magnitude equation, or variation with the brightness of the stars observed. This has not been specially studied in the portable survey patterns, but would probably be found even with them. Trümpler (*loc. cit.*), using an aperture of only 4.7 cm. and a focal length of 50 cm., found it conspicuously. It would increase rapidly with increase of aperture. For the present we must regard the astrolabe as a surveyor's instrument, capable in his hands of useful service, and leave any possible application to observatory work for further investigation. E. H. H.

The Heart of a Continent.¹

By DOUGLAS CARRUTHERS.

"CENTRAL ASIA" used to conjure up in the imagination thoughts of lonely and mysterious frontiers between three great Asiatic Empires, of strange doings in unheard-of valleys on the Pamirs, of long-dead conquerors, and of strange capitals at the back of the world. Even now, in 1920, the heart of Asia is a storm centre, for it forms the meeting-place of the civilisations of the remote past—China; of the present—Great Britain; and of the future?—Bolshevism.

Great happenings have been in middle Asia—

¹ "Through Deserts and Oases of Central Asia." By Miss Ella Sykes and Brig.-Gen. Sir Percy Sykes. Pp. xii+346. (London: Macmillan and Co., Ltd., 1920.) Price 21s. net.

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unheard-of movements, unimagined miseries—during the past six years, when all men's thoughts have been concentrated on Europe and the Middle East. The remote highlands and deserts of Asia did not escape the turmoil. The most secluded and most apathetic native races felt the ripples of the storm in Europe. The confines of China, India, Russia, and Afghanistan have returned, by a strange coincidence, to their former place as, what may well be, the centre of a prolonged struggle, not between East and West, but between right and wrong.

Chinese Turkestan, or Kashgaria, is that

part of middle Asia which forms the most westerly province of the Chinese Empire, under the title of Hsin-Chiang, or the New Province, for it is of comparatively recent occupation (since Keen-Lung, 1758). Although an integral part of the Celestial Empire, it is actually Central Asian in physical features, character, and inhabitants. This desert plain is girt on three sides by great mountain walls, yet these barriers seem to be less of a hindrance to man than is the endless desert zone which cuts it off from China proper.

The Chinese rule, but the natives look to Mecca, not to Peking, and trade with Moscow and Peshawar rather than with the cities of China. The oases belong to the group which extends from Khotan, in the east, to Bokhara, in the west.

Chinese Turkestan, then, is a colony where mild and unwarlike farmers, probably the most phlegmatic of all peoples in the world, are ruled by a handful of Chinese officials. On the north and west was a great and virile Russian Empire ever ready to overflow still further eastwards and southwards, while on the south great mountain walls arose behind which ruled the Emperor of India. Kashgar, the capital, was the only place in Central Asia where Great Britain maintained a representative. From the Caucasus to Siberia, and from Siberia to China proper, we had no official residents. It was to this far-off city that the authors went in 1915, Sir Percy Sykes to act for Sir George Macartney, the Consul-General, on leave.

We have a general account of the journey out, by way of Norway, Sweden, and Finland, Petrograd, Moscow, Tashkent, and Osh, followed by chapters on life at the British Consulate, around Kashgar, and trips to the Russian Pamirs and to the great oases of Yarkand and Khotan. These chapters, by Miss Ella Sykes, are ably supplemented by her brother's (Sir Percy Sykes)

section, which deals with the geography, government, and commerce of the district, and also gives us an historical sketch which is admirable in its brevity and conciseness, for it covers in three short chapters a period from somewhere about the third century B.C. up to 1915! It should be realised that Turkestan history was shaped by Hun, Chinese, Turk, Arab, and Mongol, while the romantic names of Kutayba, Jenghiz, Tamerlane, Amursana, and Yakub Beg

figure largely. Sir Percy Sykes traces the story right up to the year of his visit, and by no means the least interesting part is that which deals with the modern period. His final sentence contains much of import: "The future of Chinese Turkestan is not finally settled, but the World War, which has temporarily broken up the Russian Empire, will undoubtedly stimulate China to move along the path of progress. If so, there is hope that the condition of this outlying province of her Empire may benefit, more especially by improved



FIG. 1.—A hunting eagle. From "Through Deserts and Oases of Central Asia."

communications. At the same time, there are many parts of Asia which have reason to envy the peace and plenty enjoyed by the inhabitants of Chinese Turkestan." The chapter on "The Kashgar Farmer" is noteworthy; it shows the difference between this desert land and others. Whereas other arid regions are dependent on scanty and uncertain rainfalls, the great oases of the low, hot plains of Turkestan live by a sure and abundant water supply brought down from

the giant glaciers and snowfields which wall them in on north, south, and west. A certain livelihood, an ample and cheap food supply, and complete safety have produced a contented race, devoid of ambition and easily ruled. The town-folk are much the same. Kashgar and Yarkand are still great trade centres. Since Marco Polo's day, "from this country many merchants go forth about the world on trading journeys." The old

Pamirs, while Sir Aurel Stein crossed the plateau from east to west, and penetrated to the amazingly interesting regions of Roshan and Darwaz.

The chief interest of this book lies in the fact that it recounts the impressions of a resident in a country which has so far been described only by the passer-by. Even a glimpse of life in the only city of Central Asia where the British Empire retains a representative should commend it to the

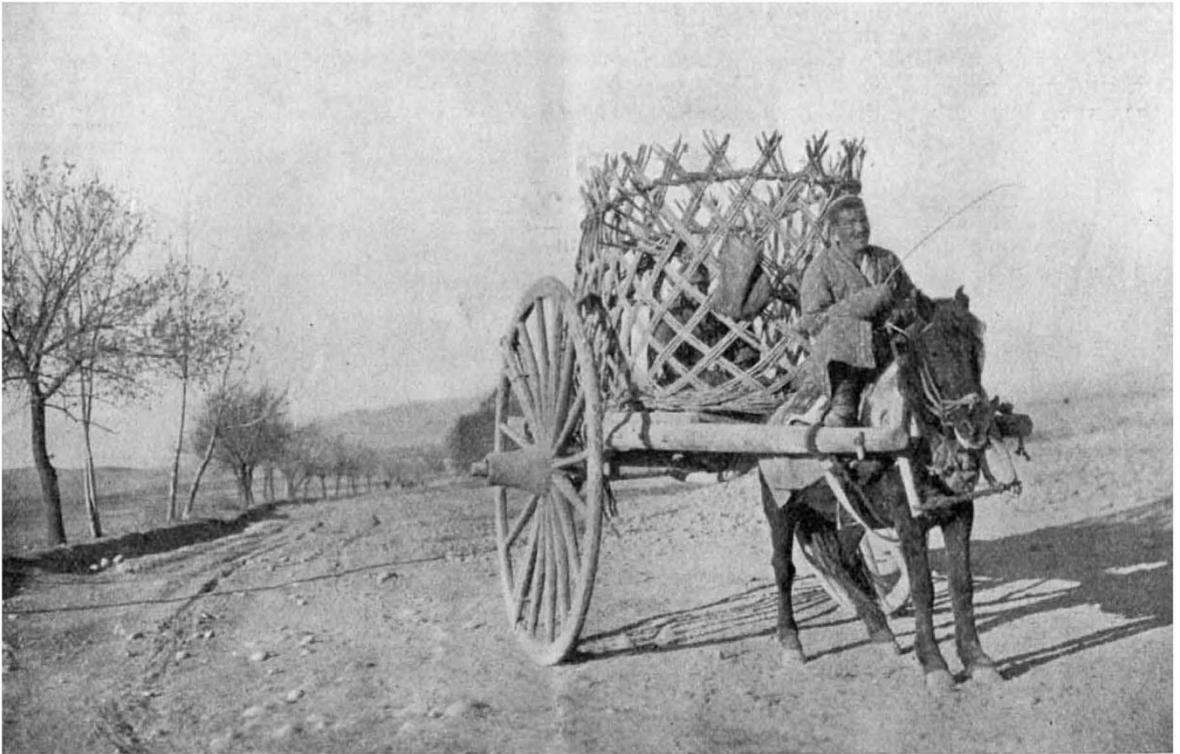


FIG. 2.—Cart used in the Osh district. From "Through Deserts and Oases of Central Asia."

silk route ran the length of the country. All trade between China and Western Asia passed through Kashgar.

The volume ends with an account of a visit to the Russian Pamirs. For a long time the "Roof of the World" has been a forbidden land to the English hunter, but the war proved that Russian designs on India were a bogey. The author was permitted to travel and shoot in the heart of the

reader. For years the post has been held by Sir George Macartney. Far removed from the nearest Englishman, cut off from India, isolated and alone, he has upheld the honour of the Empire, using prestige instead of Cossacks, and relying on his unrivalled knowledge of the East. Sir Percy Sykes had his work cut out to fill the gap satisfactorily, but his life experience in Asia served him well, and he has allowed us to see something of it.

The United States National Research Council.

By PROF. VERNON KELLOGG.

THE National Research Council is a co-operative organisation of men of science in America for the special purpose of promoting fundamental research in the physical and natural sciences, the application of scientific knowledge in the industries, and the training of research workers, all for the sake of the general advancement of science and the increase of the national strength and well-being. It was organised in 1916, under the auspices of the National Academy of

Sciences, especially to help make the scientific resources of the country available to the Government in the solution of pressing war-time problems involving scientific investigation. As now reorganised on a permanent peace-time footing, its membership of about 250 is largely composed of duly appointed representatives of about forty major scientific and technical societies of America, with a group of administrative officers and necessary office staffs, resident in Washing-