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CONTENTS.

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No. 1. *January.*

MAPS.

No. 2. *February.*

MAPS.

No. 3. *March.*

MAPS.

No. 4. *April.*

Maps.

No. 5. *May.*

No. 6. *June.*

am very proud, that now my name and those of my comrades may be included among these names, after having done some work in Arctic exploration. I only want to express my feelings of thankfulness and gratitude.

About the motor car. I do believe, when the surface is very hard, say on the inland ice, and you have a stronger motor car than we had, then it may very well act. The roughness of the ice is nothing, but on the snow the motor generally will be too heavy, and go through; on the inland ice where the surface is hard, I think a big motor car would be very useful.

DR. SVEN HEDIN'S JOURNEY IN CENTRAL ASIA, 1899-1902: SCIENTIFIC RESULTS.*

By Major W. BROADFOOT.

THE larger part of this work, on a great scale, was briefly examined in June, 1906 (*Geographical Journal*, vol. 27, pp. 606-613). It consisted mainly of descriptions of journeys about the Takla Makan and of the country round Lob Nor, a shifting lake in which the drainage of a vast horseshoe of mountains is ultimately received and lost in the expanse of surrounding sand. There now remain for consideration vols. 3 and 4, in which the detail of journeys through North and East Tibet and Central and West Tibet are recorded; it is not proposed to examine these very closely, for they have presumably received sufficient attention in the reviews of the popular edition of 1903.† Still, a few notes on these volumes may be of service to future students.

A commencement is made by describing in minute detail—as, indeed, all Hedin's descriptions in this book are—his first trip in North-Eastern Tibet. Starting from Kárá Koshan, which readers will remember is the present Lob Nor, he set forth to cross the Astin Tágh (the Altyn or Altin Tágh of our maps) and various other ranges, chief of which is the Arka Tagh, back by the west side of Kum Kul to Temerlik. The letterpress, practically a diary, can be followed on his route-maps, which are beautifully drawn and distinct. They begin for this part of the work at Plate 29, and the text is more or less a descriptive commentary on the map. Taken together and fitted into the R.G.S. map of Tibet, a student will acquire almost as much information about the country passed through and its surroundings as is possible without an actual visit. All sorts of information concerning it may be gathered; its configuration, its capabilities in the way of supply of forage and water, and the presence or absence of wild animal life are recorded. Thus in one place we find camels, yaks, antelopes, hares, and partridges; whilst in another, not necessarily very far distant, animal life down to insect

* 'The Scientific Results of a Journey in Central Asia, 1899-1902.' By Dr. Sven Hedin. Stockholm: Lithographic Institute of the General Staff of the Swedish Army; London: Dulau & Co.; Leipzig: F. A. Brockhaus.

† 'Central Asia and Tibet.' By Sven Hedin. Hurst & Blackett.

pests is absent, and there too, it seems, disintegration of rock is most rapid. This again leads to an abominable and treacherous surface soil, which was "as soft and spongy as a morass, and consisted of fine yellow plastic clay and mud. Owing to the *débris* on the top, it wore a deceitful appearance of being able to bear, and yet the animals sank in a foot deep."

Dr. Hedin rightly protests against the introduction of foreign names for the hills and localities in Tibet, and he seems specially to resent the use of the name Colombus, which appears plentifully in America and need not be transplanted to the heart of Asia. We agree with the sentiment; but it must be recollected that the native names about that part of the world seem more than usually casual and transitory. Thus Astin Tagh means merely "the lower range"; Kar-yakkak, "where the snow falls." And many others are scarcely distinctive in a country a network of hills where snow falls heavily over the greater part.

A fact noticed by Dr. Hedin in this Tibetan lake-land was that of two lakes at no great distance apart and connected by a river, in one the water was fresh, the grazing round it good, and the game abundant, whilst in the other the water was salt and its surroundings were desolate. Resulting from this mixture of fresh and salt water are in places a series of ice-sheets amidst tracts which were free from ice. The former might or might not be strong enough to bear traffic; the latter was so soft that animals sank in it to their knees. Where fresh water prevailed the ice was thick, where salt water predominated there was slush or no ice, and intermediate proportions of the waters gave, as might be expected, thicker or thinner ice. So when a stream of fresh water entered a salt lake, it is recorded that "The farther we advanced from the mouth of the stream the thinner grew the ice; thus it was evident that it was only the fresh spring water that had frozen, forming, at any rate in the western part of the lake, a coating of ice upon the top of the salt lake-water. This process is in a high degree facilitated by the extraordinary shallowness of the western part of the lake."

On the way back to Temerlik the gold-mines at Toghri-sai were visited; they seem to be worked by small bodies of men, from thirty to forty, for about a month at a time, and the yield is said to be poor. Further on rock pictures of animals and hunters were seen, and at one of the camps evidence that Mongols had travelled that way was found. The Turgut Mongol pilgrims, on their way to Lhasa, pass through Temerlik and Tsaidam. Temerlik was made a headquarters, whence many expeditions were carried out; these need not be considered in detail. Hedin's great excursion was through the Astin Tagh as far as Anambaruin-Ula, across the deserts of Gobi and Lob, along the Kuruk Tagh, by Kara Koshan and Charklik, and was described for the most part in vol. 2, which has already been reviewed. Of the Tibetan portion (Akato Tagh) of the journey he writes, "Everything was dead and desolate,

not a sign of either animal or plant; even the ravens, which were generally wont to keep company with the caravan, failed to find their way in here. The region was perfectly still and peaceful." The country traversed became more and more difficult, till at last it became impassable and steps had to be retraced. The Russian map of the General Staff is severely criticized; it was found all wrong, adorned with an imaginary range on which the extent of perpetual snow was duly recorded, with as much insistence as if it had been "the Arka Tagh, the very backbone of Asia. On sheet 62 of 'Stieler's Handatlas' this imaginary range has been a good deal toned down, but on the map of Tibet and the Surrounding Regions, issued by the Royal Geographical Society, it figures in all its pseudo-splendour. Thus as one result of the first few days of this present excursion I was able to eliminate from our maps a misleading and vexatious blunder."

Dr. Hedin tells us he has crossed the Arka Tagh in spring, summer, and autumn, on each occasion having been caught in a snowstorm. On this journey he records that it was twilight at noon; the glen, absolutely barren, was covered sides and bottom with snow, constantly deepening as the fall continued, the only relief being the stream whose course was marked as by a dark winding ribbon. He pushed on towards Lhasa, but was turned back by the Tibetans when within one march from Nam-tso, or Tengri Nor. Thence he journeyed west, following the general direction travelled by Bower, Littledale, and others, to Ladak and Kashmir. *En route*, when on the top of a high mountain, seeing the numberless ranges like waves at sea, he moralizes and justly remarks on the insignificance of a single exploring itinerary in a country so large and so hilly, and he recognizes that as regards the geography of Tibet we merely possess a glimmering of its main features, but cannot say that we have even the rudest reconnaissance map of the *whole* of Tibet.

Certain journeys and reports by other travellers are examined and commented on, special importance being assigned to Grombtchevski's in the Pamir, Karakoram, and Western Tibet. Robert Shaw (1867) is mentioned as the first traveller since Marco Polo to give an account of Cherchen, valuable though based only on hearsay. Forsyth's mission to Yakub Beg (1873–4) is referred to, and finally Younghusband's mission to Lhasa, with the action of the British Government thereon, is mentioned.

Volume 4 closes with a description of the orography of Tibet, in which reference is made to a general map which has not been provided; the omission will no doubt be rectified when the account of more recent travel is published. Vol. 6, Part iii., "Racial Types from Western and Central Asia," consists of a number of remarkably clever sketches of the natives of those parts; we may repeat now, what has before been affirmed, that the author's attainments as an artist both in figure and

landscape-drawing are among his greatest accomplishments, if, indeed, they are not supreme.

We have also commented on the system of transliteration followed in the English edition of this work, and of the unnecessary trouble caused by it, and by the use of foreign standards of measurement, to English readers. It is comical and a little puzzling to recognize the well-known Zoji La under the disguise of Sodschi-la, and Takht i-pari, the fairies' throne, as Dschinri (Tokta-pärä); but what is to be made of Nesamorsajuschtscheje, or the "Non-freezing," a name given by "Prschevalskij" to a lake?

The out-turn of the volumes, the reproduction of photographs and sketches, and the fewness of the printer's errors, are in the highest degree creditable to the Lithographic Institute of the General Staff of the Swedish Army.

ON THE IMPORTANCE OF AN INTERNATIONAL EXPLORATION OF THE ATLANTIC OCEAN.*

By Prof. OTTO PETTERSSON and Prof. GERHARD SCHOTT.

I. THE INVESTIGATION OF THE ATLANTIC OCEAN IS ONE OF THE MOST IMPORTANT OCEANOGRAPHICAL PROBLEMS TO BE ATTACKED IN THE NEAR FUTURE.

1. IN regard to Oceanography and Climatology. All deep-sea expeditions of later years have started from Europe to the southward, and have occupied themselves principally with the eastern half of the South Atlantic. But about the interesting and complicated conditions of the western half of the North Atlantic ocean, within the boundaries of the Gulf Stream and the Labrador Current, no systematic deep-sea research has been made with modern instruments and by modern methods since the days of the *Challenger* expedition, excepting some observations of the U.S. s.s. *Albatross*. There can hardly be any doubt that what is going on in the western part of the ocean will furnish a key to what is going on in the eastern part, that is to say, on the European side.

We know nearly nothing about the magnitude and laws of the changing variations of the Atlantic currents in regard to strength or temperature. In this respect a foundation ought to be laid for all later investigations. The non-periodic changes in the temperature of these currents, principally those of the Gulf Stream, are of vast importance for western Europe. Their causes must be looked for in the Gulf Stream itself. Hence the necessity of following it up to its origin further westward. By careful investigations of different scientists it appears very probable that these non-periodical changes in the Atlantic temperature have a deep and far-

* At the ninth International Geographical Congress, which met at Geneva from July 27 to August 6, 1908, Section VI. was devoted to oceanography. In the absence of Sir John Murray, of Edinburgh, senior representative of oceanographic research, Prof. Krümmel, of Kiel, presided. Prof. O. Pettersson, of Stockholm, and Prof. Schott, of Hamburg, each of them, read a paper explaining the necessity of commencing as soon as practicable an exploration of the Atlantic on an international basis in respect to its physical and biological conditions. The substance of the two papers is given in this article.

variations connected with place in the operation of causes whose operation varies according to locality or according to the relation of one locality to another;" and in order to narrow the field, the whole of which he recognizes as geographical, but which is too vast to be profitably cultivated by one specialist, he adds, "especially on human distribution, and hence on the life of man generally." Mr. Chisholm combats the view of Profs. Davis and Penck that biogeography and not anthropogeography ought to be set alongside of physical geography, and he announces that the geography which he proposes to teach is anthropogeography. The relations between geology and anthropogeography are, he points out, threefold: (1) the surface conditions, mainly of soil, which are helpful to man or the reverse; (2) the history of geological process as throwing light on present geographical distributions; and (3) the most intimate relationship that the causes now operating to affect the value to man of local conditions are the same as those which have played the chief part in geological history. Mr. Chisholm concludes, "But these illustrations of the duty of the geographer may perhaps give rise to the objection that after I have handed over one part of geography to the geologist, another to the meteorologist, and others to the botanist and zoologist, and have nevertheless found it necessary to make even the anthropogeographer trench on the ground of all of them, I am now making him trench on the domains of the historian and the economist. My reply is that I frankly admit it; but that in regard to the life of man, so important are the influences attached to local conditions and place-relations that it is of the highest consequence to have a class of investigators whose constant and single aim is to see that the known causes that affect the value for man of place are never overlooked, and to be always searching for unknown causes that have the same effect. And I think I may add, as a proof of the weight due to that consideration, that it is not among economists and historians that such studies are discouraged, but rather among them that geography, specifically anthropogeography, as a separate branch of study, finds some of its most ardent supporters."

Dr. Stein's Expedition in Central Asia—Erratum.—In the *Journal* for December, 1908, page 600, line 2 from bottom, for "1866" read "1865."

OBITUARY.

A. Grigorief.

Our Honorary Corresponding Member, A. Grigorief, whose death we regret to record, was educated at the university of St. Petersburg, and at the beginning of his scientific career was a botanist; but his trips through the northern parts of European Russia, in the White sea, and on the shores of the Murman coast, developed in him the true geographical enthusiast, which he was in the best sense of the word.

The fact that the first circumnavigation of Asia by Nordenskiöld was stopped by ice at Kolyuchin bay, offered M. Grigorief the opportunity for a voyage round the southern part of that continent. When no news from the *Vega* arrived in Europe, the Imperial Russian Geographical Society despatched a rescue expedition, with the aid of M. Sibiriakof and on his ship, the interests of the society and all the scientific work of the expedition being put into the hands of the young naturalist, A. Grigorief. Unfortunately his voyage was unsuccessful: the ship was stranded on the shores of northern Japan, and before its final rescue the *Vega* itself arrived from Bering sea. M. Grigorief, unable to reach the northern

waters, took this opportunity of making some investigations in Japan, where he stayed about six months, and whence he brought home some collections for the society.

After a period of work in connection with the society, he was selected to occupy the post of its general secretary, a very responsible and arduous position, which he occupied during twenty years, with great honour to himself and great profit to the society. During this period a great many large and important expeditions were equipped by the society for investigation in Central Asia, which was in a great part revealed to the world by the work of Russians. The first international Polar expedition also took place during this time, and the two Russian stations at Novaya Zemlya and the mouth of the Lena were organized by the society. All the work of preparation for these expeditions, to which their greater or less success is often due, was made under his supervision.

During the twenty years of his secretaryship, M. Grigorief was continually at his post, and all who wished to do something for the advancement of geographical science in Russia, were sure to get assistance and a warm welcome from the secretary of the society. Many young voyagers and geographers owe their first success to his good advice. He was not a great traveller, not a great theorist, but his wide scientific education and his encyclopædic knowledge, especially about Asia, gave him great authority, which was placed freely at the disposal of his colleagues and much facilitated their work in the advancement of geographical science. In this sense he may be said to have taken part in all the important geographical work done by the members of the society during the last quarter of the nineteenth century. His genial character made him easy of approach for all who had need of his help, and his death is alike a serious loss to all true devotees of science and a great grief to the large circle of his friends.

J. DE SCHOKALSKY.

CORRESPONDENCE.

The Trans-Himalayan Range.

IN several magazine articles published during the autumn Dr. Sven Hedin lays claim to the *discovery* of a *new* mountain range or system to the north of the Brahmaputra. He names it the Trans-Himalaya. This is repeated in a modified form in his communication in the November number of the *Geographical Journal*.* In reference to the Trans-Himalaya he writes, "one-third of the range, or rather system . . . is absolutely new."

Reference to Table XXVII. in Colonel Burrard and Mr. Hayden's 'Sketch of the Geography and Geology of the Himalaya Mountains and Tibet' (Calcutta, 1907) will reveal a group of ten peaks, ranging from 20,000 to over 23,000 feet in height, lying between 84° and 87° E. These peaks were triangulated in 1904 by Captain Wood in the course of Captain Rawling's Gartok expedition. They are included by Colonel Burrard in his "Kailas Range." This is obviously the Trans-Himalayan system under discussion, and Colonel Burrard says of it (p. 95) "trigonometrical observations show that it joins with a range of Tibet, known as the Ninchinthangla, in longitude 88°," a point which Dr. Sven Hedin himself fully confirms. Colonel Burrard's Frontispiece Chart leaves no room for doubt on this point either. The "absolutely new" section of this range cannot, therefore, be taken as more than the distance between W. 135 (N. 29° 55′ 16″, E. 84° 33′ 33″) and the

* Vol. 32, p 527.

easterly extremity of the Kailas group in the vicinity of Mariam La, a distance of about 100 miles.

But the existence and general continuity of this great mountain system has been fully recognized for more than half a century, leaving aside all question of mediæval Italian information. Thus Brian Hodgson * shows it on his map as the "Nyenchhen Thangla Chain," with the added legend "separating southern from northern Tibet." The extent and nomenclature of this range was again discussed in the *Geographical Magazine* † for 1877 by Sir Clements Markham and Mr. Trelawney Saunders, and it is shown on the latter's well-known map as the "Gangsi Mountains." The delineation of the range in the map issued (1882) with vol. 1 of Atkinson's 'Himalayan Districts,' is practically identical with that shown in Dr. Sven Hedin's sketch-maps which have appeared in various magazines and newspapers.

During the discussion on Mr. St. George Littledale's paper ‡ in 1896, Sir Clements Markham, recognizing the general continuity of the range, dwelt on the fact that it had not been crossed between the Khalamba pass and the neighbourhood of the Mariam La. It is this great feat which Dr. Sven Hedin has now accomplished, crossing the range not once only, but on some ten different occasions; but it seems hardly consistent, under the circumstances, to speak of the *discovery* of a new range.

I must not omit to record that some of these points have been already raised in Germany by Herr H. Habenicht of Justus Perthes' Geographische Anstalt.

Discussion of the question as to the discovery of the sources of the Brahmaputra, Satlej, and Indus would unduly lengthen this letter.

T. G. LONGSTAFF.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1908-1909.

Third Meeting, November 30, 1908.—Major LEONARD DARWIN, President, in the Chair.

ELECTIONS:—*Percy Herbert Ashmead; Edward J. M. Chaplin, M.A.; William Henry Foxall; Walter Edney Madkins, B.A.; J. S. H. Matson; Joseph Wilson.*

The paper read was:—

"The Panama Canal in 1908." By Dr. Vaughan Cornish.

Fourth Meeting, December 7, 1908.—Major LEONARD DARWIN, President, in the Chair.

The paper read was:—

"The Danish North-East Greenland Expedition." By Lieut. A. Trolle, R.D.N.

Fifth Meeting, December 14, 1908.—Major LEONARD DARWIN, President, in the Chair.

ELECTIONS:—*William Edmund Calver; Ronald Egerton Critchley-Salmonson (Royal Fusiliers); Dr. John Downie Falconer, M.A.; Laurence Harris; Follett*

* Brian Hodgson, 'Selections from the Records of the Government of Bengal,' p. 88, etc. Calcutta: 1857.

† Vol. 4, pp. 114 and 176 *et seq.*

‡ *Geographical Journal*, 1896, vol. 7, p. 482.

The evidence relates to roads, not to conditions of human habitability, and the conclusion rests upon a belief that the roads then, as now, were selected with a measure of reason. The hard conditions of travel in an inhospitable mountain country make unnecessary circuitousness within short distances a practical absurdity. The llama trails upon the stony beaches, no longer followed because of the incomparably better road below, and the roundabout route on the south side of the basin, long since abandoned for a better one, appear to offer proofs of a convincing order.

Putting the evidences from the three sources in review, one notes, as concluding features, their wide geographical distribution, their interpretative dependence upon absolutely different criteria, the apparently incontrovertible nature of *some* of the evidence in *each* group, and finally the fact that it is just that evidence that in the first two cases is gathered first hand by the recorder himself that is most convincing. So that, with the hearsay evidence entirely omitted, the conclusions we have drawn upon direct evidence of profound climatic change within the human period seem not only tenable but obligatory.*

EXPLORATION IN THE TIAN-SHAN MOUNTAINS.

By Dr. GOTTFRIED MERZBACHER.

My expedition is ended, and, now on my way home, I hasten to forward provisionally a few particulars respecting its course. Only in their broad features and in a cursory manner can I sketch the routes pursued by the expedition. Of the abundance of observations collected, a few passing indications are all that can here be offered. So soon as circumstances permit, it will be my endeavour to fill in the lacunæ by a somewhat more detailed "Provisional Report."

As shown in my communication dated February 15, 1908 (see *Journal*, vol. 31, pp. 395–400), the first year of the expedition was devoted to a more exact exploration of the systems of the chief rivers of the eastern central Tian-Shan, the Agias and Kok-su to an *in*tensive study, so to say. Following up its programme, the expedition's second year was, on the other hand, occupied more with *ex*tensive labours. The disadvantages necessarily involved in this procedure were, however, richly counterbalanced by the fact that a general view was thereby obtained over an immense region and over the homogeneous geological and morphological phenomena constantly recurring therein. Through the comparison thus rendered possible, the genetic connection of the phenomena and their further relation to other facts previously observed elsewhere, such as had hitherto seemed enigmatical or doubtful, was cleared up, and one could gradually arrive at an estimate of the forces

* The climatic change itself, and the physical evidence for it in the form of low-altitude moraines, U-shaped valleys, cirques, glaciated rock surfaces, and abandoned shore-lines in other Andine basins will be described in a later paper.

that in the main determined the present configuration of the Tian-Shan, and in particular of the way in which those forces acted.

To gain the most correct idea possible of the geological structure of the eastern Tian-Shan, the plan was adopted of several times crossing the whole of the chains constituting it, and, as far as possible, in a direction transverse to their strike. This plan was in part successfully carried out, and several nearly complete geological cross-sections could thus be obtained.

As mentioned at the close of my communication above referred to, the final break up from winter quarters at Kulja was fixed for the beginning of March, dependent though it was on the timely arrival of my new geological coadjutor, Dr. P. Groeber. Owing, however, to unforeseen circumstances, his arrival was so long delayed that I was unable to start from Kulja till April 27. To make up for the loss of the guide, Franz Kostner, who had returned home, the expedition secured the services of Franz Wenter from Tiers, near Bozen, in the same capacity. Otherwise its *personnel* was similar to that of the previous year. Besides the three Europeans, it consisted of two Cossacks and another Russian of Central Asia, four Sarts, and two Kirghizes, with a complement of twenty-six to thirty horses.

The first objective was the great longitudinal valley of the Kungess (about 160 miles long), drained by the headwaters of the Ili. The Ili first takes this name after having, as the Kungess, united its waters with those of the Kash, which runs parallel to it, and is hardly inferior to it in size, and debouched into the wide Kulja basin. This valley, leading into the heart of the eastern Tian-Shan, and keeping in its lower course the character of a wide high steppe framed by but moderately high mountain chains, was followed up to near its head. Having reached the upper course of the Kungess, where the landscape has already assumed the character of a high mountainous region, the expedition turned southwards, crossing by the higher passes of Tai-assu and Dagüt, the watershed towards the Yuldus and the intervening longitudinal valley of Zanma. By this course the expedition reached the largest valley system in the eastern Tian-Shan, that of the Chaidik-gol, which flows through the Yuldus valleys, already highly remarkable for their conformation. The study of these valleys and of the causes of their peculiar course formed one of the chief problems of the expedition. In the Yuldus valleys even the Tian-Shan traveller, long habituated to imposing scenery, is astonished at the dimensions of the mountain chains comprehended in one outlook, though extending apparently into the immensity of space, at the grand monotony of the ranges which constitute the landscape, and lastly by the hundreds of *névé* basins which strike his eye, whose waters go to swell the mighty Chaidik-gol.

Pursuing its way eastwards up the so-called "Little Yuldus" valley, some 95 miles wide, up to the region of its headwaters, the expedition

came to the Kotil pass. In the geological structure of its bounding walls, as also in its grand morphological aspects, the valley of this river presents a series of important problems, the full solution of which, however, owing to its inhospitable character, presents insurmountable difficulties. It was impossible to overtake all the work that was then calling to be done, though the material there collected is of the greatest interest. Among other things it may be worth noting that my former assumption respecting the enormous development of the glaciation in the past of the southern slope of the Tian-Shan range was fully confirmed. On May 20 we reached the town of Karashar, which enjoys the great advantage of being situated on the imposing river Chaidik-gol, here fully one-third of a mile broad. Thence we proceeded to the north bank of the great lake, Bagrach-Kul. The expedition next followed its outlet, the Konge-daria, which, in a narrow defile (incorrectly represented in existing maps), breaks through the southern border ranges of the Tian-Shan. And so we arrived at the town of Kurla. Following the foot of the southern declivity of the Tian-Shan for a distance of over 200 miles, we next travelled by way of Bugur to Kucha, one of the most considerable, and in many respects the most charming, of all the towns in the Tarim basin. In consequence of the belated start from Kulja, we arrived at the now overheated southern sides at least four weeks too late, and the members of the expedition suffered much on the march from the enormous heat and the sand-storms.

At Kucha, where I was about 60 miles, on a bee-line, from the extreme eastern point of my route in the last expedition (1903), it devolved on me to make comprehensive preparations for the most difficult and doubtful part of the whole enterprise. Here, where the eastern Tian-Shan attains its greatest breadth, little short of the extreme breadth of the central part of the range, to the average vertical elevation of which it closely approximates, we had to face the task of crossing transversely, in as direct a line as possible, the entire complex, in order to obtain a complete geological profile. For such an undertaking the available bases were inadequate, the intelligence scanty and contradictory, the season unfavourable—four weeks too early or too late. Still I determined to carry my design into execution.

On June 6 the task was begun, its first part being executed with comparative ease. But the farther we pressed northwards the more did difficulties accumulate, threatening at last to become insurmountable, so that we seemed almost driven to the fatal necessity of retracing our steps. And matters might, indeed, have come to such a pass had not the season grown too late, but the circumstances did not allow a retreat. Rivers were so much swollen, that we crossed only under the most difficult circumstances, and we could not comply with the risk to recross them on the eventuality of a retreat. Besides, the northern slopes of the passes already crossed were too steep to be climbed in an

eventual retreat. There was no choice left us but at any cost to push our way northwards. Happily, the results obtained were proportionate to the difficulties and dangers overcome.

In this journey, through country hitherto unexplored, almost each day's march brought with it fresh and unexpected discoveries, and exceedingly valuable observations were secured. We pushed our way into the mountains through the great transverse valley of Kiu-Kenik, which bears also the names of Kiju-Kule, Kuji-Kule, Kuju-Kunnuk, Kiu-Kelik, and is besides quite wrongly represented in our maps. In its peculiar course the valley shows a remarkable variety of features. While trending north it cuts through various younger formations of very diverse age, which, by their geological structure, the peculiar effects wrought on them by climate, and their vivid colouring, form landscapes of a rare type and of a charm all their own. The middle section of the valley being impassable, a diversion had to be made westwards into the neighbouring valleys of Kizil-Ketun and Dshon-Jailak, and several passes crossed. Thence, again bending eastwards, we reached the upper course of the main valley, which is carved out of palæozoic formations and the series of eruptive rocks connected with them.

The further march to the north-east brought the expedition through a morphologically interesting region of lakes (either already desiccated or in process of desiccation) to the foot of the high Kok-tepe chain, which, in consequence of the slight extent to which its ridge has been indented, offers but few crossing-places. We crossed the chain at Kiu-Kenik pass, which, structurally, plays an important *rôle* in this part of the mountain system. A second pass surmounted, we descended northwards, and came into the valley of the northern Kiu-Kenik, known also as Zagan-ussun.* This, one of the most important affluents of the Chaidik-gol, breaks through the chains which hem in the "Great Yuldus" valley on the south. And the place at which it cleaves its way through them is exactly the spot where they present the greatest elevation, the boldest and most manifold mountain forms, and the most important development of glaciers—a development far exceeding my expectations. Even in the Tian-Shan there are not many mountain scenes to surpass in grandeur the panorama here disclosed. The marked thermal contrast between the heights of so considerable elevation and the wide-extended steppes of the floor of the valley, exposed as they are to an intense solar radiation, causes the mountain chains to be in the summer season mostly veiled in clouds, and heavy rains are, as a rule, a daily occurrence.

Having entered the "Great Yuldus" valley we turned westwards, where we were confronted with the task of more closely investigating the eastern continuation of the great conglomerate mountains of the upper Kok-su, mentioned in my former letter, so as to arrive at a more

* In this part of the Tian-Shan also the valleys radiating in different directions from a particular point of a mountain crest often bear the same name.

complete understanding of the mode of their formation. Not only were these investigations crowned with success, but it was further possible to make a series of important observations relative to the tectonics of a large part of the Tian-Shan, the development and present conformation of the valleys of the Kok-su and Yuldus, and finally, to a knowledge of the phases of their former glaciation. In the course of these investigations I crossed the southern one of the Karagaitash passes, and once more entered the Karagaitash valleys, visited the year before, and thence reached, for the second time, the uppermost region of the Kok-su. Dr. Groeber, meanwhile, made his way beyond the headwaters of the Kok-su, over the pass of Ulan-bulak. Our roads offered welcome opportunities of supplementing my previous year's observations.

On its way back to the "Little Yuldus" valley the expedition visited the summer residence of the most important chief of the Torguts, who in the summer months, with the greatest part of his nomadic folk, frequents the wide steppe-regions of the valleys of the Yuldus and its tributaries. The splendid "yurts" (felt tents) of the chief's family, and the many others which served as temples to the numerous lamas here assembled, offered much that was interesting. I was most hospitably entertained, and the Torgut officials were lavish of their assistance on behalf of my further undertakings.

In the "Little Yuldus" valley Dr. Groeber was successfully engaged in investigating the transgressive upper strata of the lower carboniferous there considerably developed. I on my part made ready for a further advance northwards, an advance which brought us to the transverse valley of Dunde-Kelde. There, too, we lighted on palæontological finds, the closer examination of which should be of great import for the determination of the age of the so-called "younger formations" of the Tian-Shan and of their mode of origin. We succeeded in making valuable observations on the tectonics of the region, especially at the termination of the valley at the crossing of the Dunde-Kelde pass, which gives passage northward. Arrived at the northern foot of the pass, the expedition found itself in the valley of the Khustai, the uppermost headstream of the great glacier-fed river Manass, the most considerable of all the rivers draining the northern slope of the eastern Tian-Shan. On crossing the pass the great and widely glaciated chain of Iran-Charbut lay before my eyes for the first time. It forms the backbone of the eastern Tian-Shan. Here, too, as everywhere in the eastern part of the range, the extremely slight indentation of the summit ridge is an important characteristic. There are no easy passes accessible to a large caravan. This unfavourable state of things is aggravated by the circumstance that none of the great river-valleys offers a practicable route throughout its whole course, and that the streams which traverse them, fed as they are by the great accumulations of *névé* stored up in the numerous head and lateral valleys, are heavily swollen

and extremely rapid, and consequently fordable at few spots, and at these only with great difficulty, which is heightened by their very winding courses hemmed in between steep rock-walls. Rich as is the growth of alpine grass in these valleys, they still, therefore, continue uninhabited, even the nomadic Kirghiz and Mongols avoiding them. Only in the winter, when the water-level is low, do the nomads frequent them. In these desolate regions the traveller cannot reckon on finding help or supplies. These circumstances will explain the difficulties I encountered in the execution of my task. The only course open was to endeavour—so soon as its canyon-like contractions rendered one valley impassable—to reach the next parallel valley by crossing a pass in the intervening chain. There we could once more prosecute our northward march till again compelled to have recourse to the like toilsome mode of egress.

In this way I followed first the course of the great mountain river, the Manass, into which numerous large glacier streams, emerging from an extremely ramified valley system, pour their muddy water with bewildering uproar. Repeatedly crossing the main river, the expedition was several times in no slight danger, which at first made me doubtful about trying the venture too often. When, however, in shunning this risk we also failed to force a passage across the Askti pass, it seemed as though the expedition were cut off alike from advance and from retreat. Only after great dangers did we at last succeed in gaining the foot of another pass, the Tsintetoe. After successfully effecting this high and difficult passage, we were able to descend into the valley of Charagaitoe. But as this offered no other outlet, there was no help for us but to cross a farther high gap in the mountains, the Tsoe pass. We next descended into one of the most magnificent alpine valleys of the eastern Tian-Shan, that of Chorgoss. As a background to its principal head and lateral valleys, the grandest mountain forms tower up before the traveller, who sees extended before him the most important glaciers of the eastern Tian-Shan. The glaciers I found in a stage of marked retreat.

Less impracticable was the road over the Tainu pass, which commanded a comprehensive view of the glacier regions of the whole of this region. This passage admitted us to the great alpine valley of Ulang-su. Greatly swollen by the waters derived from numerous *névé* fields in its lateral valleys, and terribly wild, the Ulang-su river opposed great obstacles to the further march of the expedition.

Defiles and rapids at length completely barred further passage in the valley of the river; yet, as the provisions were at an end, some outlet had to be found at whatever cost. The beginning of the venture was hazardous. We had to negotiate a series of eight passes in order to cross the deeply furrowed mountain complex to the west of the Ulang-su and reach the passable Koi-ashu valley, which led us out to the gently sloping northern declivity of the range.

A march of several days was now made through the more recent chain of hills which fringed the northern foot of the old mountain system. These hills are of much interest, especially from a morphological point of view. The expedition thus reached Shikhodse on the northern imperial highway, and thence arrived, on July 22, at the town of Manass. Our arrival here at a date so much later than anticipated filled me with forebodings as to how the further extensive programme was to be executed. I therefore abandoned my previous intention of travelling eastwards along the foot of the range, and availed myself of the imperial highway to journey to the large town of Urumchi, the seat of the central government of the province. There we made a longish halt in order to reorganize the expedition for the exploration of the easternmost of the great glaciated chains, the Bogdo-Ola, and replenish our supplies. On July 31 we resumed our march, which took us at first eastward to the town of Fu-kan. My intention was to combine as careful an exploration as possible of the central and highest part of the chain and its extensive glaciation, which had already impressed us from a distance with a complete traverse from north to south, in order to obtain a geological cross-section. If hitherto the weather had on the whole been pretty favourable to our travels, it now entirely changed. Owing to the considerable vertical elevation of this mountain mass (much over 17,000 feet), between the northern Gobi and the deep depression of the wide Turfan basin on the south, the Bogdo-Ola district is a scene of perpetual storms. Nevertheless it was found possible to carry out the programme. The great transverse valley of Bogdo-Ola leads from Fu-kan to the central portion of the range. It offered the means of advancing directly southwards, transversely to the trend of the chains. In its lower course, the valley is wholly carved out of the coal-bearing formations, supposed to be of comparatively recent age, which are here developed to an extraordinary degree, and of which a thorough examination was to be the task of Dr. Groeber. He succeeded in making some important discoveries of fossils, the determination of which seems likely to shift the age of these deposits back to a considerably more remote era than has been hitherto assumed. Even in these secondary chains, close as they approach to the border of the Gobi, the traces of the diluvial ice-age surprise us by the extent of their development, while they are exposed to view in an unmistakable manner. The Bogdo-Ola valley is watered by the principal effluent of the magnificent alpine lake, Bogdo-Ola, to which it guided us. This lake and its environment may, in point of scenery, be taken as the pearl of the eastern Tian-Shan. It is hard to conceive of anything more charming.

This may be the reason why in their simple faith the Chinese of the plain look on the lake as sacred, and make it the theatre of their religious myths. A number of monasteries are seen towering up, romantically planted on the beautifully wooded mountains which encircle

the lake, and are mirrored in its blue waters, grandly overtopped by the icy peaks of the central Bogdo-Ola group.

Owing to the deep ravines which intersect this region, our further advance to the northern foot of these magnificent mountains encountered many obstacles. From a high camp at the northern foot of the icy chain, and again, after crossing the Miskan Pass which cuts through the heart of the group, from a camp at its southern foot, I occupied myself with the study of the geological structure of the chain and of its widely extended glaciers. The ascent of some high glaciated mountains on the north and on the south border materially furthered these labours.

Meanwhile Dr. Groeber successfully prosecuted his investigations, further eastwards, into the structure and composition of the "younger" part of the range, plotting the results in section. On the way down southwards to Lake Sayopu the expedition reunited, and on August 25 again returned to the northern slope on its way to Urumchi. The season being so advanced, it behoved us to press forward with all possible speed to the more western field of work, which had been included in our plan of travel. I therefore again made use of the Imperial highway—mockery of a highway as it is—in order to return to Manass, and thence to make a further journey to Shikho. From this town it was my intention to go southwards once more, and to cross the mountain chain, by a route as nearly transverse as possible, into the uppermost part of the great longitudinal valley of the Kash, and thence to the headwaters of the Kungess. This would have brought us into the way leading southwards from the valley of the Kungess, which we had struck in the spring. By this course it would have been possible to complete a further geological cross-section, but our design was opposed by the above-mentioned peculiarity in the structure of the chains constituting the Iran-Charbut mountain system, namely, the small indentation coupled with the great elevation of the crests. Only a few of the great rivers flowing northwards take their rise in the main crest of the range, but most of them in the secondary chains in front, and there are therefore no great valleys leading to the main watershed, which accordingly shows no important indentations. In a length of about 125 miles, from the meridian of the Manass rivers westwards to nearly the western end, there is not so much as a single pass admitting passage from north to south of this range.

From Shikho I made my way with the caravan to Sigoshur, the seat of another Torgut chief, who showed me much hospitality, and thence southwards to the great and picturesquely constructed Buddhist monastery of Zagan-ussun, situated immediately at the foot of the high mountains. From this place I made the ascent of a high pinnacle, whence I commanded an instructive view of the structure of the mountains and their glaciation. Unfortunately, I had also to admit the fact that the planned advance southwards through the great transverse valley of Jirgaltoe was

not practicable. A continuous covering of *névé* crest and walls, coupled with an absence of great valley glaciers, again characterizes the glaciation of the north side of the mountains, still so wholly unknown. While searching for a passage further west, the expedition pursued its way to the town of Jinkho with the intention of travelling thence to the valley of Dundoe-Iin, south-south-east of this town. This valley, with the second mountain valley of Dundo-Mutun, was said to give access to a pass—Shari-davan—forming a gap in the main crest, and often used, it was alleged, by the Kalmucks. In this way we hoped at last to reach the Kash valley. Turning in an upward direction, in country interesting for the clearly exposed granite intrusions, we came to the residence of another Torgut prince. Thanks to his friendly assistance, we now reached the range forming the water parting on the side of the Kash valley, not, however, by way of the Shari-davan, which caused me at first some vexation, but further west. This time, however, chance had done us a good turn. The way we took over the Ara-Mutun, Dondo-Khustai, Nilkha, Shargutoe, and Kursai passes, through the valleys of Khar-Mutun, Salikh-toe, Khojurno-Ussun, and Nilkha, and finally, down through that of Borogobossun to the Kash, led through a region which, from a tectonic and morphological point of view, is one of the most interesting in the Tian-Shan, so far as known to me. Instructive phenomena succeed one another in rapid sequence. The phases of past glaciation can likewise be studied as from an open book. Of lower carbonic fossils we were able to gather a rich harvest in excellent preservation. The detailed exploration of the great longitudinal valley of the Kash—140 miles long in a bee-line, and over 200 in actual length—had been planned as the concluding task of the present season. For the history of the formation of the Tian-Shan the valley offers problems of the greatest importance. This is apparent in the heterogeneous form and in the varied character of the landscape of the different sections of the valley. The two great longitudinal valleys, Kungess and Kash, running approximately parallel to each other, once formed a common basin, the formation of which is most closely connected with the deep-seated disturbances to which the Tian-Shan owes its present configuration. The line of elevation which separates the middle and lower courses of both valleys can hardly be dignified by the name of mountains, even when viewed from the Kungess valley, the floor of which lies considerably lower than that of the Kash. For the geological location of the series of quartz-porphyry rocks, so widely distributed and so extensively exposed in the Tian-Shan, indications of great value may be here observed. Among the subjects of investigation were included the relation of the granite, here attaining an unusual development, to the limestones; a study of the younger sediments so well developed in the Kash basin, with their rich coal deposits, and here and there also with their well-preserved

fossils; as well as the present and past glacierization of the heights bounding the valley.

In order to throw light on these questions, it was necessary to ascend the Kash valley to its highest sources. In connection with our present object, we proposed to cross the watershed between the Kash and Kungess several times and at different places, as also to advance into the region of the headwaters of the Kungess and the watershed between it and the Yuldus. Unfortunately, the design could only be carried out in part.

We pushed our way up the river, first on its right and then on its left bank, turning the impassable parts by making use of a series of transverse valleys and the passes connecting them. We then passed over to the right bank, whence we pressed northwards through the Mungati valley to the high watershed. On our further march up the valley, we kept steadily to the right bank, and after long wandering reached the hot springs near the end of the valley.* From a camp which we made there, we visited both the Borochoro valley, one of the largest upper valleys of the Kash, and the uppermost basin of the Kash itself. By ascending several important heights, a commanding view was gained of their glaciated portions. The present development of glaciers in Kash valleys and its lateral valleys fell behind my expectations. There was indeed an extensive display of *névé* both on the crest and walls, and a very large number of *névé*-basins and of glaciers was seen in the upper valleys. Of valley glaciers proper, however, there are but few, and these of no very great extent. Their tongues are almost without exception in a stage of marked retreat. The evidences of diluvial glaciation in this enormous valley system are likewise not nearly so numerous as in the other great valley-basins of the Tian-Shan. Special circumstances, which cannot be entered into here, may possibly have effaced the traces of such action. A tributary river on the left bank, comparable to the headstream itself, particularly attracted my attention in consequence of its great volume of water as compared with the shortness of its course. I conjectured that there must be a considerable extent of glaciation in the area behind its valley, which bears the name Borgora. To clear up the matter, I made an advance into the valley, which I found barred by an impassable zone of vegetation, but from a peak which I climbed for the purpose, I was able to verify the presence of masses of *névé* and glacier falling far short of those of the principal valley.

Hitherto the weather, especially in the fall of the year, had been very favourable to the labours of the expedition. On October 21, however, a sudden and drastic change set in, the winter overtaking us

* Such hot springs are also met with in many places in the transverse valleys, especially in those discharging from the northern chain, and are closely connected with tectonic disturbances.

all at once with great violence. Severe cold and long-continuing snowstorms threatened to cut off our retreat. We had to hasten with all speed to lower altitudes. On approaching the lower middle course of the main valley we were all at once vouchsafed a taste of the terrible fury of the Tian-Shan winter. After a visit to the great Buddhist monastery of Bogdan-Kura, the largest in the whole of the Tian-Shan region, we were surprised by a snowstorm of eighteen hours' duration, which in violence was no whit behind the severest blizzard.

A thick and uniform snowy mantle now overspread the mountains down to the bottom of the valley, imperatively ordering all wanderers, however eager for action, to cease from their labours. Great was my regret at this. Only three weeks more of favourable weather, and the important investigations in the Kash-Kungess basin would be happily completed. At the outlet of the Kash valley, towards the Kulja basin, where the tectonic conditions are unusually complex, we made our final geological observations, which agreed in a satisfactory way with the examination of the same ground at the beginning of the season. With the return to Kulja on November 5 the period of exploration was at an end. Thence Dr. Groeber passed, by way of the Musart pass, into the Kashghar basin, to work there for some months longer, while I was occupied for some time with the arrangement and despatch of the collections.

If, then, it had once more proved impossible to accomplish everything which I had set before me, I may yet, I trust, look back with some satisfaction on these two years of labour and toil. In this last year especially wide regions were traversed, which were in part still very imperfectly known, in part wholly unknown, and a comprehensive knowledge was obtained of the structure of the eastern Tian-Shan.

So soon as the material necessary for the purpose has been housed and sifted, I shall apply myself to the task of drawing up a "Provisional Report" giving a general summary of results. This will, if possible, be provided with a general map, in which some account will be taken of the rich material at my disposal in the form of careful route-surveys, determinations of position as well as of altitude, the last both trigonometrical and barometrical.

The year's harvest is satisfactory also as regards the collections obtained. There is an abundance of material awaiting treatment, especially under the heads of geology and palæontology. The zoological and botanical collections offer much that is interesting, and form a welcome supplement to the material brought home the years before. The result of the photographic labours will be exceedingly rich, and I am in hopes of being able to illustrate my researches by a great number of successful panoramas and tele-panoramas. The results of the meteorological observations, which were regularly carried out, will also supply an important basis for a climatology of the Tian-Shan.

contains much olivine. Masafuera has a rather different aspect from Masatierra. It rises steep out of the sea to a height of about 6000 feet. Towards north and east radiate very deeply cut valleys, veritable cañons. The rock is more coarsely crystallinic than on Masatierra."

3. *Mr. T. Halle's Remarks on the Geology of the Coal-mines between Coronel and Lebu.*

"I spent five weeks working in the coal district in the province Arauco. According to a determination published by Prof. Nathorst, Dr. Dusén collected a glossopteris in Lebu, this genus being the typical fossil of the Gondwana series. As I had studied this formation on the Falklands, I was anxious to visit the locality. I found the same fossil fern, and made some observations of interest, which I, however, cannot deal with yet, from reasons not to be mentioned here.

"The coal-mines of Coronel and Lota have been studied before, and are considered to belong to the Tertiary, or perhaps better the Upper Cretaceous. As one could imagine, that under these layers should appear more ancient strata with Glossopteris, I occupied myself during the first part of my stay with a close survey of the oldest layers reached in the mines, but could only find the same Arauco series. No trace of Glossopteris was seen. Large collections were made of marine and plant fossils, amongst which are ferns, Angiospermæ and Gymnospermæ."

RECENT EARTHQUAKES.

By R. D. OLDHAM.

In the February number of this *Journal* I pointed out the resemblances and analogies between the recent earthquake in Calabria and that of 1783, but in one point the resemblance was incomplete. In 1783 the earthquake was particularly violent and destructive in the interior; in the district round Oppido fissures opened in the ground, numerous changes of level occurred, and 215 lakelets, ponds, and marshes were formed by interruption of the drainage of the country. In the recent earthquake, though we heard much of the destruction of the sea-coast towns, nothing appeared in the daily papers regarding the interior of Aspromonte, and it almost seemed as if this might not have repeated the history of 1783, and might have escaped the ruin which fell on Messina and Reggio. Unfortunately, this was not the case; though the daily newspapers have said nothing, the *Hampshire Chronicle* has published a letter from a correspondent containing some very interesting extracts from the *Resto del Carlino*, which give an account of a medical mission, despatched from Bologna three days after the earthquake. Composed of doctors and medical students, to the number of sixteen in all, it seems to have been

the only relief party which left the sea-coast towns and struck inland to the communes of Oppido, Scido, and Delianova, where, according to the narrative of Dr. F. Cavazzi, they arrived on January 5, eight days after the earthquake, to find that they were the first to bring succour to this district. After attending to the wounded and ministering to their immediate wants, they left, thinking that they were only the first to bring help, not the only ones; yet everything was wanting there. As along the Calabrian coast and at Messina, ruin was widespread, most of the houses had fallen, those still standing were uninhabitable; the people who had escaped with their lives were living in the open or sheltering from the weather as best they might in old wooden sheds, in huts made of branches and grass, or under mats stretched on poles, or carts on end. This account serves at least to show that the earthquake was not confined to the straits of Messina, but was equally severe in the district which formed one of the centres of maximum violence in 1783; it also gives rise to a hope that some of the abundant and, it must be confessed, somewhat indiscriminate charity which has been poured out on the cities of the coast may find its way inland to the towns, whose need is greater though less known.

Apart from accounts of the great shock of December 28 last, the newspapers have frequent reports of earthquakes both in Italy and elsewhere. So far as the reiterated mention of fresh earthquakes in Calabria goes, the explanation is more human than physical; the citizens of San Francisco, who, in public meeting assembled, passed a unanimous resolution that there had never been an earthquake, were not likely to make much of the aftershocks which invariably follow a great disturbance, and discouraged, to the best of their ability, the transmission of news which might check the flow of commerce through their golden gate, but those of Reggio and Messina have no desire to stop the golden stream which is pouring from every quarter of the world upon their shores, and the earthquakes which occur are made much of, their magnitude is not depreciated, and we have heard of several which were nearly, and one which was said to be quite, as violent as the great one. Among the aftershocks there will certainly be one, if not more, of destructive violence, and that on the evening of January 23, which shook down several buildings still standing at Reggio, may, locally, have reached a degree of violence comparable with that of December 28; it was certainly bad enough to have done material damage and probably have led to loss of life had it stood by itself, but whatever its violence at Reggio, the limitation of the area over which it was severe shows that its real magnitude was small in comparison with the principal shock.

Not from Italy alone come the reports of earthquakes, but from every quarter of the globe; yet the great increase of earthquakes in the newspapers does not mean any corresponding increase in their real frequency. The phenomenon lies, in fact, within the province of the psychologist

rather than of the seismologist or geographer, and it is the destruction of Messina which has induced news agencies to report earthquakes, and newspapers to print the reports. Most of these refer to trivial and local earthquakes of no importance or interest in themselves; a few may deserve passing notice. On January 11 an earthquake was felt on the Pacific coast of North America, which did some small damage at Port Townsend, in Washington State, and was said to have been "severe" at Victoria, B.C. The region is one where earthquakes periodically occur, and is on the outskirts of one of the principal centres of earthquake activity of the world. On January 13 the whole of northern Italy and parts of the Tyrol were shaken by an earthquake, which was certainly felt from Triest to Genoa and from Trient to Siena, but did no damage except to a slight extent near Bologna. On January 19 an earthquake in Asia Minor destroyed many houses, and caused some deaths at Phocœa, Cassaba, and Menemen; this again is a region where earthquakes are not infrequent.

The most important, however, is one whose origin lay in the Luristan province of Persia, about two days' journey from Burujird, where some fifty villages are said to have been affected and 5000 lives to have been lost. Though it occurred on January 23, news only reached Europe on February 18, but it had been reported in the daily papers as a distant earthquake of unknown origin, recorded by the seismographs in Europe, India, and at the Cape of Good Hope, which was sensationally reported to be as "great as Messina," and this appears to be about its real greatness. The records reported in the papers showed that the origin must have been somewhere in Western Asia, along a line running about north-north-eastwards, to the east of the Caspian sea, but did not permit of its being more closely located, for the seismograph at the Cape of Good Hope evidently failed to pick up the first preliminary tremors of the disturbance. As time went on and nearly a month elapsed before the place of origin was fixed at the southern extremity of this line, it seemed probable that the centre lay in the deserts east of the Caspian, where there is plenty of room for an earthquake no greater than the Calabrian one to have escaped notice or record; for although this was a great world-shaking earthquake, of what may be called the first order of magnitude, it was among the smallest of that order. We have, unfortunately, no real standard of comparison of the magnitude of different earthquakes; the true measure should be, not the local violence of shock, still less the money value of the damage done or the number of lives lost, but the energy liberated by the disturbance, or the work done, and this energy we have no means of measuring. There is, however, good reason for supposing that it is proportional, even if not directly proportional, to the area over which the shock could be felt, or the seismic area, as defined by Robert Mallet, and as this area can usually be determined with approximate accuracy, we have a

means of ranging earthquakes in order of precedence of magnitude which gives an idea of their relative importance. Judged by this standard, the Calabrian earthquake ranks far below many other historic earthquakes; the seismic area, including in this the area under sea, over which it might presumably have been felt had this been dry land, was not much over 90,000 square miles; the area, similarly calculated, for the Californian earthquake of 1906 was more than four times as great, and in the Indian earthquake of 1897—the greatest which has been subjected to detailed examination—the area was 1,750,000 square miles, or about twenty times as great as that of the recent earthquake in Calabria.

THE GEOGRAPHICAL DISTRIBUTION OF THE MEAN ANNUAL RAINFALL OF WALES AND MONMOUTHSHIRE.*

By GEORGE BRANSBY WILLIAMS, A.M. Inst. C.E.

THE various existing meteorological maps which illustrate the distribution of the annual rainfall over Wales and Monmouthshire, being drawn to comparatively small scales, do not do more than show the broad outlines and approximate positions of the wetter and drier areas. A detailed and accurate rainfall map of the Principality is very much wanted, and the statistics referring to this subject, which have been steadily accumulating for the past forty years, have now reached a point at which they render the compilation of such a map possible; for although the information available at the present time is not sufficient to enable us to fix the isohyets (or lines of equal rainfall) with absolute accuracy in all parts of the country, they can be located with confidence in the greater portion.

At different times I have had cause to make investigations as to the amount of rainfall in various parts of Wales, and I have now included the whole of the country, and brought all the figures up to date. The process has been a somewhat laborious one, but I have endeavoured as far as possible to insure the accuracy of the calculations which form the data from which the map accompanying this paper has been compiled. This map shows the geographical distribution of the rainfall in greater detail than any map hitherto published.

The physical causes for the high rainfall over the greater part of Wales are well known. The moisture-laden winds from the Atlantic blowing up the numerous valleys which intersect the land between the mountain ranges and the sea, and which in the majority of cases on the south and west coasts run in the direction of the prevailing winds, are met at the upper ends by the steep slopes of the mountain sides, causing the air to rise suddenly, sometimes as much as 1500 to 2000 feet. The consequence is a heavy precipitation of moisture on the summits and on the lee sides of the ridges. This heavy rainfall takes place in some instances, as on the mountains of Carnarvonshire and Merionethshire, within a few miles of the sea; but on the Fforest Fawr and Brecon Beacon ranges in South Wales, and on the mountains of Mid Wales, the distance of the high lands (and consequently of the wet areas) from the sea is considerably greater.

Although a large number of gauges have been kept at various times in Wales and Monmouthshire, they have been very unevenly distributed and the records are

* Research Department, January, 1909. Map, p. 352.

church only just in time to have those remains jealously guarded from destruction. The Charterhouse, the Temple, the Inns of Court, the Guildhall are next treated of, and these features of London remaining to us now are interspersed with articles on the City companies, Hanseatic League, and the City arms. Mr. Ditchfield introduces into his sketch of the City companies an illustration of Furnival's Inn in 1804, another example of his curious notion of editing. Mr. Mylne's article on the palaces of London is distinctly useful, though we do not understand why a short disquisition on the "martyrdom" of Charles the First comes in here. Mr. Mylne has, on the other hand, missed the important point of the palaces of the sovereign being outside the City and not within it, and he should have carried his researches a little closer into Bridewell and other places in order to illustrate this important subject. Mr. Ordish's article on Elizabethan London is really good. It is expansive and commanding. It deals with its subject, and does not play around it. It does not waste words on meaningless explanations of small points. To London topographers and students of maps it will be found to be of real service, for it acts as a guide, and we willingly follow the survey thus set before us. Mr. Wheatley on Pepys' London is of course good, and we travel about with him from place to place as the great diarist commands. We think the illustration of a "portion of an exact survey of the streets, lanes, and churches," December, 1666, unaccountably placed opposite to p. 8 in vol. **2**, would have properly illustrated Mr. Wheatley's notice of the Fire on p. 79. Mr. Tavenor-Perry on the bridges gives us a most useful summary, but his modest description of some of them as "frankly utilitarian" does not convey an idea of the hideous monstrosity which takes us from Westminster to Lambeth Palace! The clubs, coffee-houses, and literary shrines are dealt with, but surely Miss Elsie Long should have referred to the historic houses now being marked all over London.

There is much in these volumes which the general reader will gladly possess, and some few things which the specialist will welcome, but it does not appear to fill a gap, it does not illustrate the pageant, which is its special purpose, and we feel that the sporadic collection of articles, however ably done individually, does not compensate for the omission—the fateful omission—of a plan or scheme which will carry the reader forward from one stage to another of the subject-matter.

G. L. G.

ASIA.

An Austrian Explorer in Tibet.

'Eine Reise durch Zentral Asien im Jahre 1906.' By Dr. Erich Zugmayer. Berlin: Dietrich Reimer (Ernst Vohsen). 1908. 12 *marks*.

To those who are familiar with travels in Central Asia, the most interesting part of Dr. Zugmayer's story is that which relates to Tibet. Making Polu his starting point for his attack on the Kun-lun mountains, he followed up the valley of the Kurab Su to its source, and then, striking east from the pass (5850 metres), descended the mountain-side, in spite of its precipitous character, towards the Keria Daria. The journey was so difficult that one part of the route, only 4 kilometres long, entailed ten hours of arduous labour. Then advancing from Baba Hotun, in the Keria valley, towards Lake Markham, the party, after climbing to a height of 5950 metres, found it impossible to proceed further, as their animals could not stand on the slippery ice, which extended to the col (6100 metres). In one night five animals succumbed from cold and exhaustion, and a retreat had to be made the next day towards the valley. Escape from the valley for a time seemed hopeless, and at last, abandoning the attempt to proceed further eastwards, the expedition made its way to Lake Apo-zo (Aport-tso). On the way Dr. Zugmayer found that the headwaters of

the Keria valley consist of two considerable streams, and not of several branches as his maps showed.

In the six weeks occupied in reaching the lake, over two-thirds of his animals had died from exhaustion or accidents, and Dr. Zugmayer found it necessary to abandon a large quantity of his stores and to send messengers to seek for some Tibetan encampment from which other animals could be bought, no matter at what price. Meanwhile he occupied himself in mapping out the lake and investigating the natural history of the region. At last his messengers returned, but with only three yaks, and he had to resign himself to curtail his projected journey and travel eastwards.

On leaving Apo-zo he proceeded to Mangzaka lake, and striking southwards came for the first time into contact with Tibetans, from whom later on he was able to buy yaks and ponies for his train. But word was sent on ahead to Rudok of his approach, and on his arrival at Noh he received a message that he must return from Tibet by the way he had come, and that no provisions were to be supplied him until he started back. After some days he prevailed on the Governor of Rudok to allow him to proceed to Leh, but this was only on condition that he did not visit Rudok on the way, and was attended by an escort. From Noh he followed a route to the north of the mountain chain which skirts Pangong lake; and later on, after the escort had gradually dropped off, a line was struck to the west end of Pangong lake, and thence *viâ* the Kisu-la pass to Leh. After passing the Kisu-la pass the party had their worst experience of thirst. On arriving at last at water, they came into touch with civilization in the person of a hunter attached to an English lady who was shooting wild sheep in the mountains.

The primary object of the expedition was to study the natural history of the country traversed, and the collections formed *en route* will form the subject of special papers. In addition to the work entailed by the collection and preparation of specimens, observations were constantly taken to fix geographical positions along the 700 kilometres traversed in Tibet, and thermometrical and barometrical records were preserved. The story of the adventures in Tibet is extremely interesting, but it is to be regretted that the value of the book is in some degree diminished by the absence of any good map; without this it is impossible to tell where the traveller's route crossed those of Deasy, Rawling, Bower, and others who have opened up to the West this corner of Tibet. Some of the illustrations are very good, and to some extent they incidentally supply the lack of a table of contents to the chapters.

W. R. C.

AFRICA.

The Survey of Africa.

'Colonial Reports—Annual,' No. 565. "The Surveys of British Africa, etc." London: Wyman. 1908.

'Geodetic Survey of South Africa.' Vol. 5. Reports on the Geodetic Survey of the Transvaal and Orange River Colony, executed by Colonel Sir W. G. Morris, and of its connection, by Captain H. W. Gordon, with the Geodetic Survey of Southern Rhodesia. With a preface and introduction by Sir David Gill. London: Harrison & Sons. 1908. *Maps and Illustrations.*

'Ministry of Finance, Egypt. Survey Department. A Report on the Works of the Survey Department in 1907.' By Captain H. G. Lyons. Cairo: 1908.

'Survey Department, British East Africa. Annual Report, Financial Year 1907-08.' *Illustrations.*

The existence of such a large mass of publications on the subject of the survey of British Africa and other parts of the empire is a gratifying evidence of the increasing interest taken in scientific geography and of the progress being made

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JOURNEYS IN TIBET, 1906-1908.*

I. GENERAL NARRATIVE.

By Dr. SVEN HEDIN.

EVERY one acquainted with the map of Tibet will think this map (p. 516) an extraordinary one, as it is not like even the very latest maps published in Europe. We are accustomed to regard Tibet as an enormous plateauland situated between the two highest mountain systems on the earth's surface, Kwen-lun and Himalaya, and from the comparatively level surface of this plateau we are accustomed to think mountains rise as groups or islands, or as small short ranges. Only the Kwen-lun ranges, Arka-tagh, the eastern part of the Koko-shilis, and Tang-la, and some of the ranges situated between the upper courses of the Indo-Chinese rivers were really drawn on the maps as uninterrupted ranges; and the same was of course the case with those parts of West Tibet which have been surveyed by the Survey of India, and where the Karakorum is the most magnificent of all. But for the rest of Tibet, the interior of this the most enormous protuberance or upheaval of the Earth's crust, our maps have hitherto been uncertain, and in vain we have tried to find any kind of orographical order or plausible systematic arrangement of the mountains.

However, if one uses and compares critically all the material that has been brought home by the few explorers who have crossed the interior of this mysterious country, one will easily find that even if the different routes are far apart, they are anyhow sufficient for drawing the most important conclusions. On my journey, 1899-1902, when I crossed Eastern Tibet on three different meridional lines, I had an

* Read at the Royal Geographical Society (Queen's Hall), February 8, 1909. Map, p. 516.

excellent opportunity to examine the situation and east-west direction of a whole series of ranges from the country of Lop in the north to 31½° N. in the south, and I indicated them on a general map. Farthest north we have the Ustun-tagh, the boundary range of the Kwen-lun sloping down to the basin of Eastern Turkestan, and south of it several other ranges belonging to the same system, and spreading out like the fingers of a hand to the east—for instance, Akato-tagh, Yilve-chimen, Piaslik-tagh, Chimen-tagh, etc. Then follows the highest range of the Kwen-lun system—Arka-tagh. South of Arka-tagh is an enormous latitudinal valley, and south of it is the range of Koko-shili, or "the green hills," so called by the Tajinur-mongols of Tsaidam. Then my three routes cross a range which is the western continuation of the Mongolian Dungbure, and south of it I crossed, again three times, the range which, further east, is called Buka-mangna, or "the wild yak's head," by the Mongolian pilgrims going to Lhasa. Only once I crossed in a very high double pass the gigantic range Tang-la, which was made famous some sixty-three years ago by Abbé Huc's journey; and finally, south of Tang-la, I crossed a whole series of smaller ranges stretching east and west, the southernmost of them situated on the southern shore of Selling-tso and Naktsang-tso, or Tso-ngombo.

Now, I have only mentioned the most important ranges. They are separated from each other by very broad latitudinal valleys; but in those valleys, which it takes often three days to cross, there are innumerable small ranges, which it is almost impossible to follow, as they are generally interrupted, and in some cases simply to be regarded as ramifications from the high ranges.

Some one may ask: Well, you know the orographical arrangement and the parallelism of the ranges in *this* part of Tibet, but how do you know that the same laws prevail to the east and west through the whole country? Then I will reply that on my journey of 1896 I went for two months straight east, with Arka-tagh on my left and Koko-shili on my right, without crossing a single pass until I turned north-east, crossing Arka-tagh in the Mongolian pass of Yike-tsohan-daban. Further, we have Wellby's and Malcolm's journey of the same year, 1896, through the whole of Northern Tibet from Ladak to the upper part of the northern branch of Yang-tse-kiang, Napchitaï-ulan-muren, the source of which they discovered. On the whole of this great journey through Northern Tibet they had the Koko-shili range on their left and Dungbure on their right, and had not to cross a single pass worth mentioning until they turned north-east and went over the Koko-shili. Those two routes are a very important control to the fact that the mountain ranges of Changtang stretch uninterruptedly west to east.

Between my routes of 1900 we have the route of Bonvalot and Prince Henry of Orléans of 1889, and they crossed the same ranges as I, but by other passes. To the east the information given by the

Lazarist fathers, Huc and Gabet, 1845, by General Prjevalsky on his several famous journeys from 1870 to 1885, and by Rockhill's fine journey of 1892, is quite sufficient to make it possible to follow the ranges far to the east, the Koko-shili being called Bayankhara-ula, south of the source of Hwang-ho, the Dungbure stretching between Yang-tse-kiang and the northern Mekong branch, the Bukamangna between the two Mekong branches, the Tang-la being a watershed between Mekong and Salwen.

As to the country to the west the material existing seems also to be sufficient for reliable conclusions. Here we have first Littledale on his audacious journey, 1894–5, and west of him Dutreuil de Rhins and Grenard, 1893, their map being one of the best ever made in Tibet. Then follows a great gap, the greatest unexplored patch still left in Tibet, and then my route of 1906, on which I crossed the western continuation of the two ranges I knew before, and which had been crossed, as stated, by Littledale and de Rhins. One step further west we have Bower's journey of 1891, and then the several routes of Deasy, 1898, and Rawling, 1903, both equally important and both giving us the most accurate and excellent maps of Western Tibet, as I have been able to prove more than once. Between their many routes up and down is my last journey of 1908, when I, as far as to Lemchung-tso, had very little to add to their thorough exploration, and when I crossed for the sixth time this enormous range, being the western continuation of Tang-la, and nothing else than the eastern continuation of Karakorum. As to the westernmost part of the Karakorum-Tang-la range, it has of course been crossed by I do not know how many explorers—Adolf Schlagintweit, who was, I believe, the first European to reach Eastern Turkestan from India in 1857, and murdered in Kashgar; Johnson, the first British explorer to Khotan, 1865; Hayward, murdered on his way; Shaw; Dalgleish, murdered on the Karakorum pass; Younghusband several times, more especially on his famous journey over the Mus-tagh pass, and many many others. I crossed the Karakorum pass in 1902, and then, in 1906, a pass situated a little to the east of Chang-lung-yogma, which was taken by the Forsyth Embassy to Yakub Beg of Kashgar in 1873, information which I got from old Guffaru, one of my servants, who had followed Forsyth to Kashgar and seen the great Yakub Beg in all his pomp and state. Lanek-la is also a Karakorum pass, and has been crossed by several explorers, all British.

When going from India to Eastern Turkestan one crosses north of the Karakorum range two very considerable ranges—the Suget range in Suget-davan, a continuation of Koko-shili, and the Sandshu range in Sandshu-davan, the continuation of Arka-tagh. The Dungbure and Buka-mangna die away to the west before they have reached so far. Far West, in countries under British rule, it is easy to study the

parallelism of the mountain ranges by help of the admirable maps of the Survey of India. A country with this strictly parallel arrangement of the ranges is called in German a "Faltenland," and a mountain system with the same orographical architecture a "Faltengebirge," and Tibet is the greatest Faltenland of the earth, although Persia is also a beautiful example of the same structure.

It is, of course, impossible to give a sufficient description of the physical geography of such a great country as Tibet in one or two hours, Tibet being four times as big as France. I will only mention that between the several ranges stretching through the whole of Chang-tang, there are latitudinal valleys, and that every one of them is divided into a great number of self-contained basins, *i.e.* without outlet to the ocean, or even to Eastern Turkestan or Tsaidam. In the bottom of almost every such depression is a salt lake, where the rock salt, carried down by small brooks, has accumulated for thousands of years. As a rule, the ground of the latitudinal valleys is very level; as I said, Wellby had almost no passes to cross on his long journey through Tibet, but going from north to south I had a lot of passes to wander over.

Many different agencies are working constantly to level out the country. The capillary frost forces the hardest rocks to burst and fall into pieces; the finer material, dust and sand, is carried away by the wind and contributes to fill out some depression; greater material is brought down by the brooks and the rain water, and the result is that the ranges are growing lower and lower, the depressions higher and higher, and the relative altitudes diminish in the course of innumerable centuries. If one has seen the Sachu-tsanpo in the rainy season, dark grey with mud and silt brought down to Selling-tso, or a spring storm with the air absolutely full of sand and dust, one will easily realize the enormous work carried out by wind and water in the transportation of solid material. Once Northern Tibet was no doubt as accentuated as the Himalaya—it is the work of the atmospheric influences of geological periods that has given the country its present relief. Solid material has filled up all deep valleys and depressions, and denudation and transportation are still going on, and what we call a plateauland is a perfectly secondary phenomenon. Here the horizontal lines prevail, specially in Central Tibet; one has to go down to peripheral country to find vertical lines in the landscape. My panoramas will show how very level the land is as a whole, in the same way as the ocean seen from a ship's deck, even if the waves are as high as they possibly can be. The whole of Tibet is like a sea, the gigantic waves of which, driven up by northern or southern winds, have been changed into stone at the moment of their worst fury. On the ocean every ninth wave is said to be higher than the rest—in Tibet the case is the same; after a certain interval one comes to a mountain wave much higher than the neighbours. It is the

tangential pressure in the Earth's crust that has forced those ranges to rise, and as the pressure has been stronger in the west, the ranges are here situated much closer to each other than in the east. They diverge from the enormous mountain knot of the Pamirs, and the distance between them becomes greater and greater to the east.

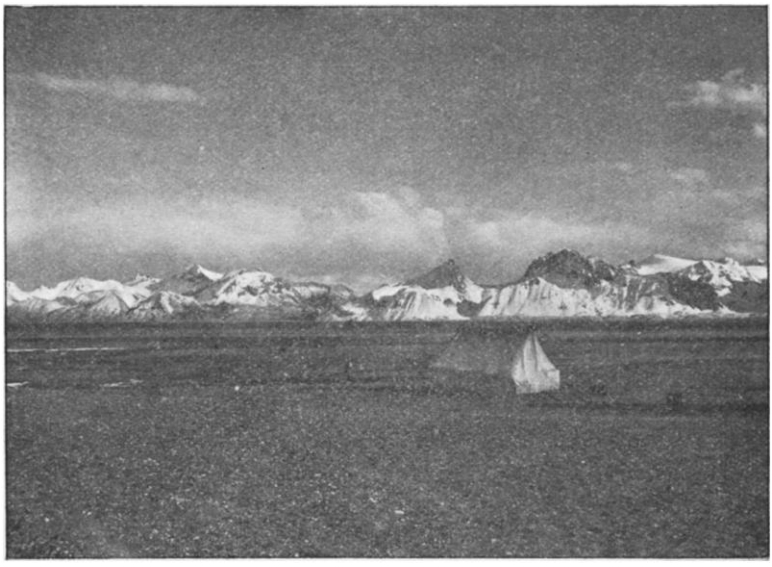
Time does not allow me now to enter upon the interesting question of a probable Ice-Age in Tibet, the curious distribution of the lakes, most of them being situated near the highest mountains, nor can I give now an account of the general meteorological and climatological relations—as I know them—the prevailing west and south-west wind being the most conspicuous and characteristic element. I will only say that, so far as my experience goes, it rains more in the east than in the west, but snows more in the west than in the east—that is to say, that Eastern Tibet gets most of its precipitation in summer, Western Tibet in winter. The fluctuation of the water stored in lakes and rivers depends of course upon the precipitation, and as this is diminishing all lakes are slowly drying up, although this may be only a periodical phenomenon. The abundance of grass depends also upon the rain, and as the prosperity of the flocks depends upon the grass, and the existence of the nomads, nay, the whole country, depends upon the flocks, everybody is looking out for rain, specially in July and August, which is the rainy season.

Of great interest it will be to draw on a map the boundaries of all the self-contained basins we know; they form a very curious mosaic on the plateauland, and their exterior boundary is the chief watershed of Tibet, in which the greatest rivers of Asia, except the Siberian and Aral rivers, rise. As to the heights, the data we possess are now so numerous, that it will not be difficult to make a general hypsometric map with the regions of different height in different shades of brown. The map illustrating this lecture gives only a vague idea of the general orographical structure. From 1200 different places on this journey I have taken specimens of rock with dip and fall, and from these a general geological map and geological profiles may be constructed. Every one of those sciences would give material enough for a separate lecture, and there is enough to do in Tibet for the explorers of the future, even if the period of important geographical discoveries is past.

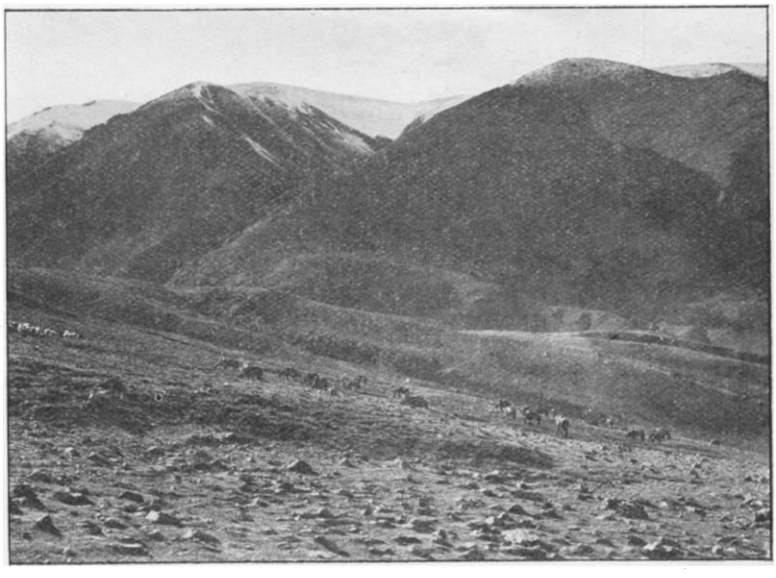
But now to my journey. The red line is my journey of 1906-1908. It looks so nice and comfortable on the map, but in reality it is a very serious and difficult thing to cross the whole of Tibet from north to south. I left Leh on August 12, 1906, with the strongest caravan I have ever had: twenty-five Ladakis, ninety-seven ponies and mules, and thirty ponies hired for the first month. Of the animals only six came through. Dr. Arthur Neve had recommended to me a young Babu, Robert, who proved to be a very excellent help in several scientific observations and a favourite with both Ladakis, Tibetans, and myself. My noble friend

of so many Asiatic years, Sir Francis Younghusband, had been kind enough to provide me with the very best caravan-bashi that could be got, Mohamed Isa, who had been with Younghusband to Mus-tagh and Lhasa, and was Ryder's and Rawling's caravan leader; he was at the side of de Rhins when he was murdered in Eastern Tibet, 1894, and he had an experience of thirty years of Asiatic travel. I shall never forget the great kindness with which H.H. The Maharaja of Kashmir, his private secretary, Daya Kishen Kaul, and, in Leh, Captain Patterson, helped me in every possible way to get together a really first-class caravan.

We went north-east over Marsimik-la, crossed the Karakorum east of Chang-lung-yogma, crossed Ling-shi-tang and Aksai-chin, crossed Deasy's, Rawling's, and Wellby's routes, kept east and east-north-east, and turned south-east between the routes of Bower and de Rhins. On the heights of the Buka-mangna range we lost nine mules in one day, but to the south the country became more and more hospitable, with plenty of grass and water. After eighty-three days' loneliness we found the first nomads, and then we passed black tents almost every day, and could buy yaks to replace our dead animals. We left to the east the lake which de Rhins calls Ammoniac lake, continued straight south to Bog-tsang-tsangpo, which I followed a couple of days to get a connection with my map of 1901, turned again south-east, crossing two considerable ranges; from one of them just a little bit of Dangra-yum-tso could be seen to the south. We reached Ngangtse-tso on December 28, and here appeared my old friend, Hladje Tsering, with a little escort to stop me. The first day he told me I could never proceed in this direction—I had to leave Naktsang territory at once and go north or west; but the next day he gave me permission to continue towards Shigatse. I have never been able to understand why Hladje Tsering changed his mind, but I have heard that this cost him his place and rank. Perhaps it was wrong of me to expose him to such a great risk, but I believed he had got some secret order during his stay in my camp, and he probably believed I had got some private permission to visit Shigatse. Moreover, my geographical morals are quite different to my ordinary morals, and if I can possibly make any geographical discoveries—I go on. And on we went south-east, crossing six passes. I really do not know why I hurried on this time much quicker than usual, without stopping anywhere and making very long marches. It was as if some invisible force had pushed me on, and even when we reached Ye-shung, on the northern bank of the Tsangpo, where several great gunpas were a strong temptation to visit, I did not stop, but hurried on to Shigatse, and entered the city late in the evening of February 9, 1907. On the 11th, in the morning, arrived one lama and one official from Devashung; they told me news had reached Lhasa from Hladje Tsering, and at once they were sent with a little force to Ngangtse-tso to stop me and force



MOUNTAIN RANGE IN NORTH-EAST TIBET.



MOUNTAIN SCENERY, NORTH-WEST TIBET.

me to return. And when they heard I was gone, they hurried on in my steps and reached Shigatse a day and a half after me. If I had travelled just a little slower I should never have reached the town, never seen Tashi-lunpo and the Tashi Lama.

The most important geographical discoveries on this line from Ngangtse-tso to Shigatse were the very high mountain sytems we crossed in Se-la, and south of it the complicated river system of My-chu, which joins Raga-tsangpo one day above its junction with the Tsangpo, and is one of the greatest northern tributaries to the upper Brahmaputra. When I stood on Se-la, and in a biting January gale sketched a panorama of the whole horizon, and later on after having crossed this complicated world of enormous mountains and this labyrinth of deep wild valleys, I understood that this range could not possibly be anything else but the western continuation of the mighty range which is situated on the southern shore of Nam-tso or Tengri-nor, the highest known summit of which is Nien-chen-tang-la. So when I wrote to Major O'Connor I proposed to call the whole range Nien-chen-tang-la.

The eastern part of this range was for several years fairly well known. It was known to be a watershed between the Salwen and Brahmaputra. The famous pundit, A.K., had crossed it in 1881, probably in Nub-kong-la. Abbé Huc and Abbé Gabet had crossed it in 1845 in Shang-shung-la, which again had been taken by A.K., and which for centuries has been crossed by innumerable Mongolian pilgrims with the same feelings of exaltation as the Mohammedan pilgrims pass Mount Arafat on their way to Mecca.

Further one step westward we have the pass Dam-largen-la crossed by the admirable and noble pundit, Nain Singh, in 1874, and just west of Nien-chen-tang-la there is Guring-la, crossed by Littledale on his memorable journey, 1894–95, when he was forced to return the same way. Guring-la and Dam-largen-la are important from a religious point of view. Many pilgrims every year wander round Nam-tso, and some of them include Nien-chen-tang-la in the ring, thereby walking over the two passes. Several gunpas are situated on the shore of this the greatest lake of Tibet. Three journeys round the lake absolve the pilgrim from all his sins and make him sure of a happier existence when he will be next re-born. Then follow Tsebo-la and Shugu-la, of which I have got only verbal information, and finally the last hitherto known pass to the west, Kalamba-la, crossed by Nain Singh in 1872. So far the geographical and orographical situation of this range was known before, when I crossed Se-la and could thus draw the range some 100 miles further to the west. I suspected already that this range continues far, far to the west-north-west, and Major O'Connor told me in a letter from Gyantse that he had long suspected the same thing, partly from the reports of pundits and partly from verbal information he had got in Tibet, and he proved to be perfectly right.

But what did we really *know?* Nothing, or next to nothing! Did the geographical literature of any time or any country contain a word about this range except some meagre hypothesis? No, nothing! Nain Singh had, followed the Brahmaputra valley up in 1865, and so did Ryder and Rawling, Wood and Bailey, on their journey to Gartok, which has given to geographical science the best and most accurate map that ever has been made in Tibet. But from their route in the Tsangpo valley the head range cannot be seen from a single point, as I found afterwards by my own experience. One sees several gangris, or mounts, with eternal snow and ice, but one does not see the head range, or rather watershed, itself, and one has not the slightest idea of the very complicated architecture further north. Verbal information will lead to nothing, as I found. I asked people, especially merchants, who had been up to the north for years every year, and got them to tell where they camped, where they went over passes, where lakes and rivers were situated; but when I tried to get some certain conclusion the result proved to be hopeless confusion. I do not know what Major Ryder believed of the country to the north; probably he believed it was a high plateau-land, the highest ridge or range of which was situated about 31° N. lat., and where Chachu and Charta-tsangpo had their sources. The southern boundary of this plateau-land he probably thought was formed by a border range, several peaks of which he measured, and which he regarded as broken through in transverse valleys by the two considerable rivers mentioned above. I believed, as I have explained in the fourth volume of my last scientific work, that it was a highland with two ranges parallel with the Tsangpo, and I had arrived at this conclusion from Nain Singh's lakes, those which he had heard of but not seen; but it all proved to be perfectly wrong. How little we really knew of the country—"the Dokthol Province," a name absolutely unknown to the natives—is shown also by a letter I got from Captain Rawling, in which he expresses the theory that the great northern tributaries of the Tsangpo come from the Central Lakes, discovered by Nain Singh, and exactly the same theory is found in Sir Thomas Holdich's excellent book, 'Tibet the Mysterious,' which was published after Ryder's and Rawling's expedition. So all of us who had specially paid attention to this problem, knew absolutely nothing of the country, and we lost ourselves in hypotheses of very little value, as they had no real foundation.

But first let us leave Shigatse. I stayed six weeks there, or rather in Tashi-lunpo, where I spent the whole time. The Tashi-lama, or Panchen Rinpoche (Banchin Bogdo, as he is called by the Mongolians), is one of the most remarkable and fascinating men I have met in my life, and I shall never forget the great hospitality and kindness he showed me as long as I was his guest. I arrived just at the Losar, or New Year's festivals, and was invited to every day's play.

ONE OF OUR CAMPS, CENTRAL TIBET.

MOHAMED ISA AND TWO LADAKI CHIEFS.

How very wonderful and picturesque it all was. The Losar hymns of Tashi-lunpo made a deeper impression upon me than even the Church music in Kasansky Sobor in Petersburg, or Uspensky Sobor in Moscow. They are full of faith and longing, of mysticism and harmony, and they lead the listener away to the land of dreams and hope. To begin with, they go in crescendo and then in diminuendo as far, far away as if the singers were already at the gates of Nirvana.

During my stay in Shigatse I made acquaintance with another man whom I shall never forget, Major O'Connor, although I never met him personally; but we were in very lively correspondence, and he gave me any amount of valuable information and advice. The Chinese High Commissioner, Thang Darin, and the Amban of Lhasa, Lien Darin, were extremely polite and kind in their letters to me; they probably wished me to go to Gyantse, as it would be easier to get me down to India from there. But I did not go to Gyantse at all. The Tibetan authorities of Lhasa seemed not to know at all what to do with me. They have hardly made acquaintance with anybody who has been so difficult to get rid of as me—except Younghusband, of course. One day in Shigatse I got three big boxes from Major O'Connor. They contained a whole library of books and all sorts of most delicious tins, cakes, biscuits, wine, liquors, and champagne. Imagine me drinking champagne quite alone in my tent in Tibet. Every day in Shigatse I proposed O'Connor's health at my lonely dinner.

As to the ambassadors from Lhasa, who had to deal with me as to which way to return, I would not tell them openly that my wish was to take some northern road where I could study the great range of Nien-chen-tang-la further to the west. I thought they would be suspicious, and stop me altogether. But I managed to get permission to take the Raga-tsangpo road, and from there the escort took me up over the head range again, which I crossed in the pass Chang-la-Pod-la, and thus I got some 50 miles more of the western continuation of the range.

Now it was my intention to go to Dangra-yum-tso, discovered by Nain Singh, and by help of some rupees the escort agreed to take me down there. As I have said, my geographical morals are a funny sort of thing, but well—they give me their lakes and mountains, and I give them my rupees, and both parties are extremely pleased and satisfied with each other; but for them, of course, it is a risk. Now this time, when we were two short marches from the lake, and it could be seen in the north as a thin blue line, I was stopped by a force from Shansa dsong and made to go down to Raga-tasam. But I had fixed the situation of Targo-gangri, Targo-tsangpo, and Sershik-gumpa, all three heard of but not visited by Nain Singh. And I had discovered Shuru-tso, a rather big lake at the very northern foot of the head range. And now I crossed this range again in Angden-la, continuing it some 60 miles

further west. In Raga-tasam I touched Ryder's and Rawling's route for the first time since Shigatse.

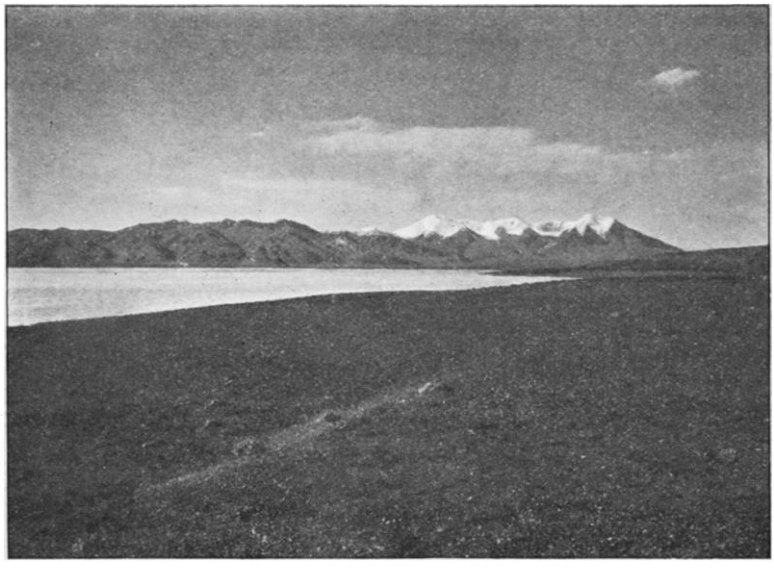
Dangra-yum-tso is much too big on Nain Singh's map, and his Mun-tso, two small lakes, are situated not south but west of southern Dangra-yum-tso. Both Targo-gangri, one of the most magnificent snow mountains with glaciers I have seen in Tibet, and Dangra-yum-tso (or Dangra, as it is usually called) are holy; it is exactly the same combination as Mansarowar and Kailas in the west, and Nam-tso and Nien-chen-tang-la in the east. It takes the pilgrim five days to go round the lake; the water is slightly salt, but they drink it anyhow, as it is holy, and a man or a pony who has drunk of it will for ever be safe from wolves and robbers and sickness. At the eastern foot of Targo-gangri, one day south of the lake, is Sershik-gunpa, a comparatively rich temple-monastery. The lamas belong to the Pembo sect. I do not know exactly the difference between the Pembos and the orthodox, but when the orthodox say, "On mane padme hum," the Pembos say, "On mate moti sale do," and they hate each other heartily. As the Greek Catholics make the sign of the cross from right to left, whereas the Roman Catholics do it from left to right, so the Pembos have the little funny peculiarity of turning their prayer-wheels the wrong way, and both, of course, believe the other will burn in eternal fire, or, at any rate, be re-born in a very poor and miserable form of existence.

From Raga we went to Saka-dsong, leaving the beautiful snow-massive of Chomo-uchong, or "The High Nun," to our left. In Saka Mohammed Isa died, and was buried strictly after the Mohammedan ritual. One year later some Tibetans told me that ghosts were haunting the grave every night, and from the interior of the grave one heard mysterious sounds and sighs, so nobody dared to come near it.

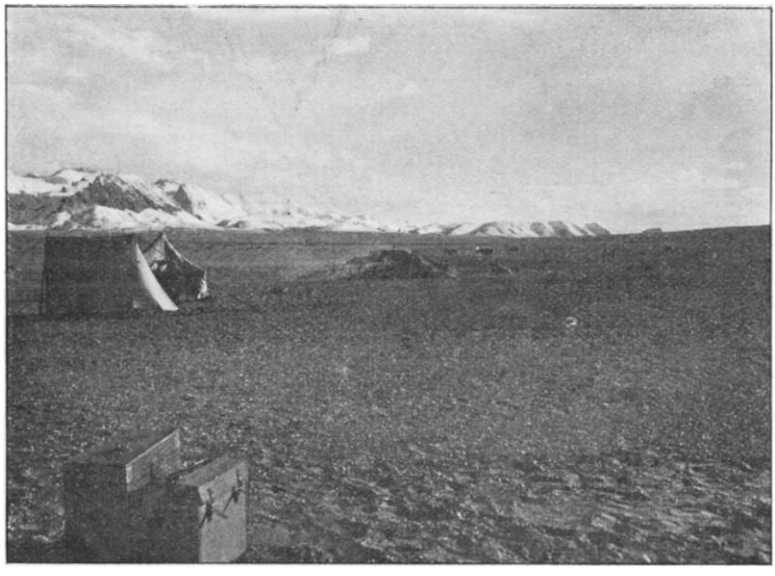
Several times I tried to get permission to go north to see more of the great range and the country north of the Tsangpo, but always in vain; once we tried to slip over, but were stopped by Bongba men. I wrote to Lien Darin and Thang Darin with special mail-runners. Lien replied, certainly I could take a northern road if I liked; but I got his letter three months too late. Thang said he could under no conditions let me go to the north-west, "as both people and country are wild there." I wonder how he knew that. It was really hard to go further and further west, and to leave more and more of the great unknown country to my right, because this patch north of the upper Brahmaputra was the greatest white patch in Asia, with only one exception, a part of the Arabian desert.

The Gova of Tradum, a great scoundrel, but one of my best friends in Tibet, let me go south over the Tibetan frontier and down into Nepal. The Himalayan watershed pass one crosses here * is only about 300 feet

* Kore-la.



A LAKE IN CENTRAL TIBET.



ON THE SHORE OF LAKE LIGHTEN.

above the Tsangpo, and it should be an easy matter for modern engineering to dig a channel and force the upper Brahmaputra to become a tributary to the Ganges, although I really do not know if northern India would become more happy for that; the Tibetans would be awfully angry, that is sure.

The next problem that interested me specially was to find the source of the Brahmaputra, and I have described in a short note how this trip was successfully carried out, so I will not take up time with it now. It was a proud feeling to stand at the three-headed source of the magnificent river that goes out in the ocean near Calcutta, Brahmas son, famous in the ancient history of India. But perhaps it was still more wonderful, some time later on, to camp over a night at the little rock from which the Indus comes out as an abundant spring, growing bigger and bigger on its adventurous way down through the mountains, singing its eternal songs between the rocks, the same melodies as in the Macedonian's time. I had a feeling as if the fate of my own life through this river in some little way got connected with his, although 2200 years lay between us and *sans comparaison*, of course. But all this, as well as the interesting question of the watershed between the Brahmaputra and the Sutlej, and how the Sutlej still, although underground, comes from Mansarovar and Rakas-tal; further, my adventurous navigation days and nights over those two lakes, my pilgrimage round the holy mount of Kailas or Kang Rinpoche, and my journey up to Yumba-matsen and down to Gartok—all this has to be left to my next book.

The two passes Lachen-la and Jukti-la, which I crossed on this trip, are situated in the very considerable range which stretches north-west to south-east, one day north of Mount Kailas, and which I was almost sure was the same range I had crossed in Se-la, Chang-la-Pod-la and Angden-la. Between Jukti-la and Lachen-la are Dopchen-la and Hle-la, and west of Jukti-la several easy passes—for instance, Pema-la. At Chang-la it has been crossed by innumerable explorers and hunters. The Indus follows the south-west foot of the range the whole way to Gilgit, and the range goes through Ladak, Baltistan, and Chitral, and seems to be in very near relationship with the Hindu-Kush, thus going through Afghanistan also. But here was the weak point: it had never been proved that this western range was uninterruptedly one and the same as the eastern one south of Tengri-nor, and when I had come so far, I would give my life to solve this beautiful problem, which might certainly be called the most important and magnificent geographical problem still left to be solved in Asia. But when I reached Gartok I was far from the definite solution. Between Angden-la and Lachen-la I had left a gap some 300 miles long, and of this gap I knew nothing, although I and Nain Singh were the single explorers who had gone round it. Only step by step should I be able to understand and to penetrate

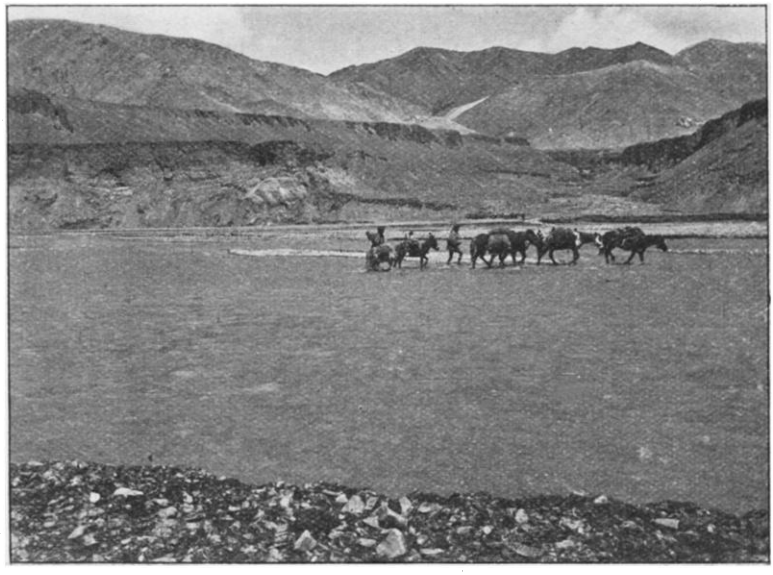
into the very soul of this gigantic world of mountains. It takes time—of course it must take time to digest such an enormous lot of stone as this mountain system. It can be done only successively and with an angel's patience. Every new pass over the head range will make the complicated orography clearer and open new perspectives.

Well, when I arrived in Gartok I was sure I *could* not leave Tibet without having crossed the unknown country at least once. If I succeeded in this, it was my plan to reach India *viâ* Nepal. And so we began to try and demoralize the younger Garpun (the other was sick) in the most horrible way. The great Ladaki merchant, Gulam Razoul, to whom the Garpun is in debt for big sums, tried all possible ways to get permission for me to go eastwards into the unknown. He said that when our animals died we had been obliged to bury some precious boxes somewhere to the east, and had to go and fetch them now, which was, of course, a formidable lie, as we had not lost so much as a box of matches; but the Garpun replied that he did not care a bit for my lost boxes, and that it was more important for him not to lose his own head, which he was sure of if he let me go into the forbidden country. Then Gulam Razoul told him I should give him two thousand rupees if he let me go, but he answered dramatically: "If this house were of solid gold, and he gave it to me, I should not take it; if he tries to slip over to the east without permission, I will send armed men to catch him." So he was too strong for us, and I had to think over a quite different scheme.

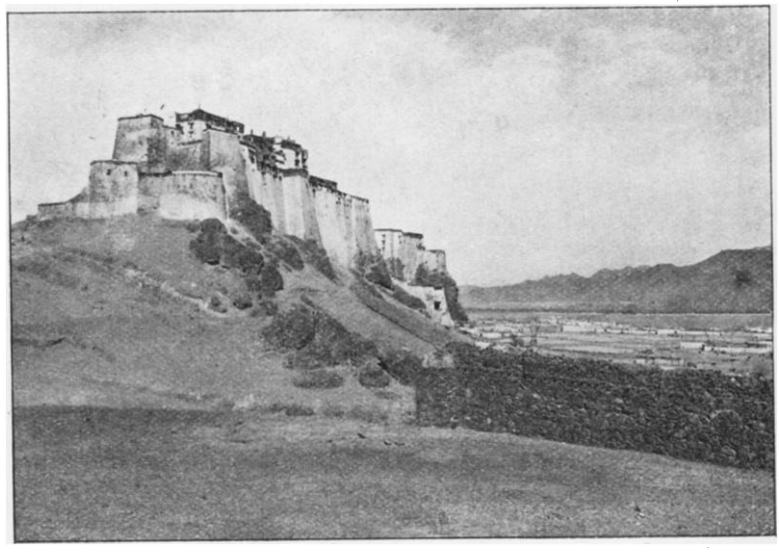
I decided to go round again and to enter the Chang-tang from the north, and cross the whole of Tibet diagonally once more. I knew it was a matter of half a year to reach regions which were only one month from Gartok, and this half year was the winter. But now, of course, the Garpun was suspicious, so much the more as he saw me buy twenty-one Tibetan mules from Gulam Razoul.

From Gartok we sent couriers to Gulam Razoul's father in Leh, old Haji Naser Shah, to arrange a quite new complete caravan for me. He would even provide me with new men; not a single man of the first set should follow me, as they might have been recognized later on. When I reached Durguk, November 30, 1907, the new caravan had arrived the very same day, and everything was ready.

In Gartok I had told everybody that I was going to Khotan and Peking. Even Haji Naser Shah and the new eleven men believed this was the plan. I went so far as to send a telegram to Reuter about Khotan. It was quite necessary that nobody should suspect anything else, because Rudok-dsong has spies in Ladak, specially one in Durguk, and if he should have got the slightest suspicion about the real plan, we should have been stopped somewhere north of Rudok. My new caravan-bashi, Abdul Kerim, was a perfectly honest man, but the greatest ass I have ever met. I ordered him to take corn for the animals for three



CHANG-CHENMO.



SHIGATSE-DSONG.

months, but as he was sure we should go to Khotan he took corn only for twenty-one days. For the men, fortunately, he took five months' provisions as ordered. I had one little tent, the men two bigger. My luggage was reduced to a minimum, three boxes only; amongst their contents there were two complete Ladaki dresses, as it was my intention to travel in disguise as a Ladaki merchant as soon as we came across natives. Only three ponies, two mules and one dog were veterans from the first journey. Perhaps somebody might recognize them. Oh no, they were all dead long ago, when we met the first Tibetans. All the rest, men and forty animals, were new.

We left Durguk on December 4, and it was a hard journey that began now, the hardest I have ever made. We penetrated deeper and deeper into the heart of Asia, but also into the heart of a new winter, and a winter on those enormous altitudes. From Sheyok we took a man, who had to look after our twenty-six sheep; and as he was a new addition to the caravan we became thirteen—but we were not superstitious. We met several caravans from Yarkand. One of them was a perfect wreck, and had lost fifty-two ponies on the road. In one caravan I met my old servant, Mollah Śhah, who was also with Littledale, and now he had not been to his home in Cherchen since he left me in 1902—what a wonderful life of wanderings and struggle they live, those Asiatics. Most of the Yarkandis advised me to wait till spring, as the Karakorum pass was very bad. The whole way is full of dead ponies. At one place, during two hours' ride, I reckoned sixty-three. Some of them looked as if they were taking a rest only, some were half-buried in snow; the dogs barked at them until they got accustomed to see them. At several places we passed heaps of boxes and big packets of silk left by caravans that had lost all their animals—it is like ships having to throw all their cargo overboard when they begin to sink. It is a real Via Dolorosa; those grey granite rocks could tell no end of sufferings they have witnessed; in the night one thinks one can hear the sighs and heavy breathing of an endless carnival of animals, the veterans not able to walk any further.

The Karakorum pass can never be improved—it is the absolute height that kills. But in the Sheyok valley, where the road crosses the half-frozen river twenty-five times, something could be done. It may be strategically wise to leave the bad boundary roads as they are; but trade with Eastern Turkestan suffers from it. In the Durguk valley a couple of dynamite cartridges would improve that horrible road immensely.

We passed a man who had been abandoned with both hands and feet frozen on the Karakorum; the fingers were literally falling off. He said he was creeping down to Sheyok. We gave him bread, flour, matches, and some rupees. In the nights the moonshine was brilliant, the mountains stood like black coffins on both sides of the valley, with

the blinding white snowfields over them. A lonely raven followed us for a month; I hate them; they only wait in case somebody may be left behind. But on December 16 the caravan got an addition—four puppies; two were drowned, one died the very day he opened his eyes to get a glimpse of this cold mysterious world; but the last one came with me to Simla.

At Burtse, where the cold went down to -35° C. (63° of frost Fahr.), I made the first discovery during this journey—only eight days' corn left. To return to get more had been to spoil the whole plan. I was quite prepared that all the animals should die, and we should have to go on foot as far as we could. Now just here a big valley from the east seemed to invite us; if we found a road here we should save several days. A man was sent up and reported that the way was excellent, so we went on and marched the whole long day to a point where the valley was so blocked that hardly a monkey would have been able to continue further. The country was absolutely sterile. In the night the animals were kept tied up; they ate two sacks and most of their ropes. So the next day we hurried down the same way; we had lost three precious days, all were tired, and the situation looked rather hopeless. Mohamed Isa's pony from Shigatse was the first to die; he looked tired and done for where he had fallen in the snow; he seemed to need a long, long rest. The raven at once pecked out his eyes. Now our sheep began to die of cold, height, and fatigue. On the evening of December 23, in the ravine Kisil-unkur, the men, eight of whom were Mohammedans, began to sing a rhythmic and melodious hymn to Allah, praying him to let us cross the Dapsang without a snowstorm. And still nobody knew my real plan. So they were rather astonished when I, the next day, gave orders on the heights of Dapsang to turn straight east. We left the Karakorum pass to the north, went over the range by another pass, and the whole day we ploughed a track through deep snow. The night came down over the enormous snowfields, biting cold; the temperature went down to the freezing point of mercury ($-38^{\circ}{\cdot}6$ C., $69\frac{1}{2}^{\circ}$ of frost Fahr.). I had two candles and a nice fire in my tent, as it was Christmas Eve. The next morning one pony lay dead and hard on his place amongst the rest.

And now our difficulties began. The Mohammedans were constantly singing prayers to Allah, with their eternal "Allahu Ekber" and "Allhamdulillah rabel alahmin errahman errahim." I understood they were afraid and regarding the situation as specially serious. The ordinary profane songs of Ladak had long ago frozen away on their lips. Over comparatively open land we kept east. No grass at all, but where burtse and yapchan plants grew we used to camp. Not a drop of water; the animals had to eat snow. The corn was finished, and rice and flour from the men's provisions given to the animals—we only took care that a supply for fifty days should be kept aside.

In the beginning of January we lost ourselves in a labyrinth of

mountains, passes, and deep valleys, all belonging to the Upper Kara-kash-darya, going down to Eastern Turkestan. On January 11 we camped at the very same point as last year, on the shore of the Aksai-chin lake. It was like a funeral procession; every day took a mule or a pony, sometimes two. All boxes, books that were read, and other unnecessary things were used as firewood. In the night of January 15 the cold was −39°·8 C. (71°·6 of frost Fahr.), the lowest I have ever read. During the periods of intense continental winter cold we had fortunately no wind to talk of. *Ovis Ammon* and Orongo antelopes were numerous now, and once our hunter killed two, and the two last sheep were spared for a time. On January 18 we had lost one-fourth of the caravan; the next day we found the first signs of Tibetan hunters, and on the 20th a hard storm killed two animals, one of which was the last mule I had bought from the Rajah of Poonsh. Now began a storm that went on for weeks without interruption and killed all our weaker animals On January 26 we crossed Arport-tso on the ice, which was covered with snow, green and clear as glass. Two days later we lost three animals, and the last sheep was killed.

On the following days heaps of snow came down; we proceeded hopelessly slowly through 2 feet of snow, sometimes 3. Nothing could be seen; the first ponies and mules in the caravan disappeared as phantoms in the snow-drifts. At the western end of Shemen-tso I thought we should be snowed up for the rest of the winter. It snowed day and night; walls of snow gathered round the tents; it was more like a Polar expedition. The storm continued as before. We followed the northern shore of Shemen-tso. On February 5 sixteen animals out of forty were left. Once more everything that could be spared was burnt. We had no meat left, and almost all rice was given to the last animals; it was necessary to make the loads lighter. The next day one mule and one pony died.

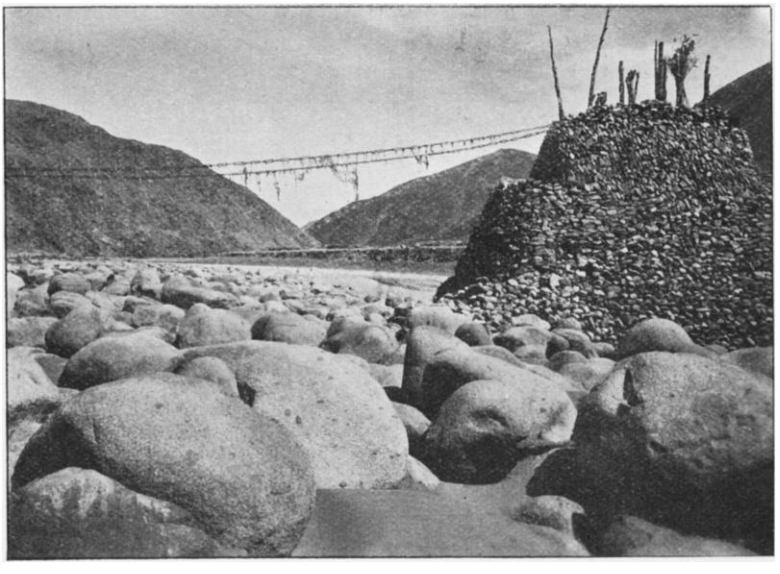
On February 8 we passed a trap with an Orongo antelope in it, and all were happy to get meat. Of course this was a sign that hunters were near, and later in the day we found two tents, and could buy a couple of sheep, milk, and butter. During sixty-seven days we had not seen a man. Now all my European clothes were burnt, and I appeared in disguise quite like the other Ladakis. On February 15 we crossed the Karakorum range again, which killed three of our animals, amongst them my riding pony, which had carried me faithfully through so many adventures for one and a half years, and saved me when once a wild yak was very near to take both him and me on his horns. It was more hard than I can tell to lose him. On the other side we passed some gold-mines. And so we left Deasy's and Rawling's routes behind us, passed Lemchung-tso, always in storm, and entered new country. Again, since a couple of animals had died, several things were burnt or thrown into Lemchung-tso, even some thermometers, clothes, boots,

belts, etc. February 24 we had still three ponies and seven mules, one-fourth of the caravan, left. Two days later great goldfields again. The 29th we reached Lumburringmo-tso, where the Senkor nomads said that never had any Ladaki merchants passed through Chang-tang, least of all in winter, and that we had a European hidden amongst us. We stayed two days with them, got friends, and bought twelve sheep for loads. For several days the storm was so hard that it was impossible to move.

On March 7 we camped on the bank of a river going south-west and frozen all over. One mule died, and the two dogs stayed with her to get a nice meal—they were never heard of afterwards. The storm made it impossible for them to follow our footsteps. As one of them was my special favourite since Srinagar, I felt quite lonely in my tent since she was gone. Now we had only the three-months'-old puppy left. During the five journeys I have made in Asia, the first in 1885-86, I have had hundreds of servants, and I have forgot many of them. But I have not forgotten a single one of the dogs; they stand before my memory as clear and alive as if I had left them yesterday. And it is always more difficult to say good-bye to the dogs than to the men; the men go home to their friends and families and will be quite happy, but the dogs *have* no home and nobody to go to, and nobody will be kind to them afterwards, and when I leave them they look after me with long wondering melancholy eyes, and I cannot possibly take them all home with me; I should have a real exhibition of Asiatic dogs by this if I did. Once I took a dog from Lop the whole way to Peking, through Mongolia and Siberia to Petersburg; but as it was forbidden by that time to take dogs over from Russia into Sweden, I had to give him to a friend in Pulkova. But there he almost killed half a dozen old women and every cat within a radius of three miles. So my friend gave him to a peasant, with whom, I suppose, he continued his wild Asiatic robber life.

And so we reached the district of Nagrong, with two stone houses and a big temple tent belonging to the Gertse Pun. From here the ground was excellent, an open latitudinal valley, but there was still much snow, and the storm went on. March 16 we camped on the shore of Tong-tso, and now we passed tents everywhere and could buy sheep and a couple of yaks. I had to paint my face and hands black every morning, but I could never get so dirty as the Ladakis. So we turned south, leaving the beautiful gangri Shakangsham to the east, crossed two small passes, and heard of Karma Puntso, the Governor of Bongba—it was critical to be so near to him. Once we bought a pony and a big dog, Takkar, wild as a wolf; he soon became our friend and favourite, and was quite mad with fury at every Tibetan he saw. The following days we went through a real labyrinth of mountains stretching east to west, crossed Kangsham-tsangpo, Chaklam-la,

THE BROTHER AND SISTER-IN-LAW OF THE TASHI-LAMA.



THE BRIDGE OVER THE TSANGPO NEAR PUN-TSO-LING.

Sangchen-chu, Sangchen-la and Ladung-la. Our caravan consisted now of two ponies, three mules, two yaks, and twenty-five sheep, all under loads. And so we met the great merchant, Tsongpun Tashi, who stays here over the winter selling tea to the nomads on credit; in the summer, when they have sold their sheep wool, they pay their debts. He came to pay us a visit, and as he seemed very interested in our tents and their contents, Abdul Kerim cried to Kutus, one of my Ladakis, and Haji Baba (that was me) to go and catch a pony that had run away in the mountains. Tsongpun Tashi is a powerful man from Lhasa, and it was nice to come away from him without any further adventures. In three days we passed thirty-two tents, and I had to go on foot and drive the sheep. On April 1 we crossed Satsot-la and came down to Chunit-tso, and followed its western shore for one day; here we met a great salt caravan from Tabie-tsaka, from which most of central and eastern Tibet get their supply of salt. Always keeping straight south we went over Nima-lung-la and reached the district of Kemar with several tent villages.

One of the mighty head ranges north of the upper Brahmaputra is now visible beautifully with great snowfields and glaciers. Turning south-east we had the magnificent Hlunpo-gangri to our right for several days, and for six days we followed the big river Buptsang-tsangpo up to Samje-la, situated in the watershed, and now it struck me that only Trans-Himalaya was the right name. So I had controlled the existence of the system some 110 miles further west from Angden-la. It was an agreeable feeling to go down along rivers reaching the Indian ocean, the Samje river, the Rukyok-tsangpo and Chaktak- (not Charta, which is wrong) tsangpo. We met and passed several salt caravans to and from Tabie-tsaka; one of them told the authorities of Saka-dsong that they had seen Ladaki merchants on a very unusual route.

It was my wish to see as much as possible of Chaktak-tsangpo and the gangris from which it gets its great volume of water, and so I went like a thief behind the mountains which are seen from the "tasam," following Chaktak-tsangpo, leaving it to the left where it comes from a valley in Kanchung-gangri, followed its left tributary Gäbuk-chu to the east, and reached an enormous tent belonging to two brothers, Kamba Tsenam and Panchor. They were kind, sold us provisions, sheep, and a pony, and would show us the road over the two passes, Gebuk-la and Kinchen-la, as they said it was impossible to find the road in that labyrinth of mountains without a guide, especially as it snowed heavily now again. They found it very strange that Ladaki merchants took this road, and said it would be a wonder if we could keep clear of robbers; therefore, of course, the Mohammedans began to sing their hymns to Allah again.

We had passed Kinchen-la and camped in a valley going down to Raga-tasam on April 24, when we saw eight men leading their ponies

and coming down from the pass. One could see by their dresses and arms that they were not ordinary nomads. Some of them went straight into Abdul Kerim's tent; their servants camped just outside the entrance of my tent where I kept hidden. They had a very lively palaver with Abdul Kerim; and when they had gone to their camp, from which they kept their eyes upon my tent, I went the back way into my men's tent; and now Abdul Kerim told me they were sent from Saka-dsong, as the authorities there suspected amongst us was hidden Hedin Sahib from the last year. If they were mistaken they had orders anyhow to look through all our luggage; and then Abdul Kerim had only to write a statement that no European was hidden amongst us, and we could continue our journey.

At once I saw clearly the whole situation and the course to take. To *write* such a statement was a little too strong even for my elastic geographical morals, so I told my Ladakis I should tell the Tibetans the truth, happen what would afterwards. The honest men began to weep as children, believing that I should be killed on the spot at least. But I rose and went down to the Tibetans and sat down between them at their fire. I put my hand on the shoulder of my old friend, Pemba Tsering, from last year, and asked him if he did not recognize me at all. He only opened his eyes as wide as he could and looked round at his comrades without saying a word, but his looks meant as much as—it *is* him. After a few minutes we were all friends, chattering and joking as if our meeting had been the most natural thing in the world. I had a delicious feeling of freedom now since I was caught again by the Tibetans; I was no longer a prisoner in my own tent. I did not need any more to paint myself black as a Morian. I could wash—well, I won't tell what the water looked like after the first bath.

If I had not been discovered here I should have continued eastwards, and I had the little *arrière pensée* to come one day as a Ladaki beggar to Major O'Connor, and after some extraordinary conversation I should ask him for some more champagne and tell him who I was. But now we were caught, and now the principal thing for me was to play my cards well. I had crossed the province of Bongba only once, and now I wondered if I should be able to cross it on one or two other lines. Panchor was in our camp, and he told me such a lot of interesting things of Bongba, that if I had been perfectly free to go wherever I liked in Tibet, I should have gone to Bongba, and my dream was now to finish up definitely with the problem of Trans-Himalaya.

I cannot tell now all my extraordinary experiences during the following days, our meeting in Semoku with the authorities of Saka-dsong, the distinguished Pun Dortche Tsuen, with attendants and escort, all in pomp and show, my real friendship with him, our picturesque journey back to Kamba Tsenam's tent, the kindness with which he let me take the very road I proposed—certainly not without

risk for himself—no, I say, the eight days we were together would give material to a nice little book about the ways and views of the Tibetans. Well, I love them, I feel the deepest sympathy with them; they were always kind and polite and hospitable to me, and went as far as they possibly could without being disloyal to their own country, and after half a day's acquaintance we were as if we had known each other from childhood. The Lopliks used to call me Padishahim, or Your Majesty, and of course that title was more than enough for my ambition, but the Tibetans of Bongba called me always Rinpoche, or Your Holiness, the same title as is given to the Dalai Lama and Tashi Lama, and that I thought was a little too much for me. But it was well meant, and I accepted the attention as a quite natural thing. In their company we went round the "High Nun," and at Kamba Tsenam's tent everything was arranged. I should have only five of my men with me, the rest under Abdul Kerim would go over Samje-la to Buptsang-tsangpo, where we had to meet. This was an excellent arrangement; it caused no end of confusion. The people of Bongba certainly believed Abdul Kerim's party was the head caravan, because Karma Puntso himself and six Govas caused them a lot of difficulties, and when I passed with only five men, and now in Tibetan dress, as all my European things were burnt long ago, and my Ladaki things worn out, nobody paid any attention to us. It even happened that nomads asked *me* when the "peling" should come, and I used to say he was behind, and if they kept their eyes opened they should see a most extraordinary fellow. So far as to Buptsang-tsangpo I should have an escort of ten soldiers, and they proved to be awfully fond of rupees.

The last evening we were together with the Saka authorities I invited them to a feast in my tent, in front of which a big fire burnt, and round it the Ladakis danced the dances of their country. I believe the Tibetans had never been so amused in their lives; they laughed, cheered, clapped their hands, and began to take part in the songs, and the whole time the snow came down as never before. It was late when the fire died away and my guests went to their own tents.

On May 6 we said good-bye to our new friends, and went straight north to the most important and interesting of all my Trans-Himalayan crossings. In the evening, in Gyegong-lungpa, a fellow came to my tent, telling me he had seen me seven years ago in Nakchu, and when I asked what his profession was, he answered—robber; but that is another story, as Kipling says. By the way, Kamba Tsenam told us that he was "the father of all Tibetan robbers," and a great friend with them. The next day we crossed by Gyegong-la the Kanchung-gangri range, which is not the head range, but broken through by the Chaktak-tsangpo. In Lapchung-tso, situated to the north of this range, all the rivulets meet, which, coming from the head range, form the upper Chaktak-tsangpo. Here we passed a great trade road, being also a pilgrim's road,

to Kang Rinpoche (Kailas). The country of Lapchung is very high and cold, and the winter remains here much longer than elsewhere in the Trans-Himalayan Alps. Several important rivers begin from this upheaval: the Keddo-tsangpo, Raga-tsangpo, and Chaktak-tsangpo to the south, Buptsang-tsangpo and Soma-tsangpo to the north.

On May 12 we went over Sangmo-bertik-la, surrounded by glaciers —the rock, as in all Trans-Himalayan passes I know, consisting of different varieties of granite. Wild yaks are numerous. Almost every day we had storm and snow. So we crossed the Soma-tsangpo, which is, I should say, the biggest of all rivers in the interior of Tibet. It comes from the western side of the Shuru-tso range and empties into Teri-nam-tso. May 19 we crossed Teta-la, from where one has the most brilliant view over the whole Teri-nam-tso, Trans-Himalaya, Targo-gangri, and Shakangsham. In this clear atmosphere one sees some 100 miles distant; everything is light blue, rose and white, and often the boundary between a high mountain range and heaven is only marked by the white dotted line of the eternal snows. Shakangsham is a kingly mountain, raising its shining white head like a lighthouse over the gigantic mountain waves of lonely and desolate Tibet. It dominates a wider area than any other gangri on the plateau-land, it tells you the road as the stars in the night, and at last it disappears under the horizon as a dream of snow and roses. And the lake is marvellous; one is charmed and fascinated by the intensity of its colour, at the side of which the heaven becomes pale and the torquoise loses its attraction. The lake has been almost correctly placed by Nain Singh, although he has never seen it, only heard of it. He writes the name Tede-nam-tso; it ought to be Teri-nam-tso, or the "Throne mountains heaven lake." In its eastern part there is a picturesque rocky island. The water is salt. Nain Singh's Ngangon-tso, nobody had ever heard of here. Two days we followed the southern shore to the west end, and then went up to Mendong-gunpa on the Soma-tsangpo. The monastery has two Kanpo-lamas, one of whom is a rinpoche, sixty monks, and seventy nuns, all dwelling in very comfortable black tents. I suppose they have great fun together in the long winter evenings.

So we went up the Soma-tsangpo, crossed Goa-la, left the little Karong-tso to our left in Bongba-kemar, and followed one of the great "tsalams," or salt-roads, from Raga-tasam to Tabie-tsaka, left to our right Chunit-tso, which we knew before, and reached the Buptsang-tsangpo in Bongba-kebyang, our meeting-point with the caravan which had disappeared altogether. On June 5 we said good-bye to the soldiers, and for three days we followed the Buptsang-tsangpo down to its mouth in Tarok-tso. Only two very poor peasants followed us, and I could have gone wherever I liked.

Tarok-tso has fresh water, but no visible outlet, showing that its water goes underground to Tabie-tsaka. It was my wish to visit this

THE SOURCE OF THE BRAHMAPUTRA.

important salt depression, where so many roads meet from all sides of southern Tibet, but the Gova of the place refused it, telling me to take the mountain road, which of course proved to be much more interesting, as I got the remaining unknown part of Trans-Himalaya very clear, and this would have been absolutely impossible if I had taken the Tabie road. And I could see Tabie-tsaka from a high mountain. The salt is said to be upon clay, and there is very little water. Natives of Bongba may break as much salt as they like; other caravans have to pay some tengas to Devashung for every hundred sheep-loads.

So we passed Lunkar-gunpa, which has twenty lamas, four nuns, and two rinpoches, being a daughter temple of Sera. Some days north, not far from Lakor-tso, there is Marmik-gunpa, with twenty-five monks and six nuns, and also affiliated to Sera. Lunkar-la is situated in the same range, which is called Hlunpo-gangri, north of Saka-dsong, but it is not a first-class watershed, as it divides the water only between Tarok-tso and Poru-tso; to this lake Goang-tsangpo goes down. Poru-tso is salt, and its old beachlines, which I measured, are 108 metres (354 feet) above the present surface of the lake, showing an enormous desiccation. At Lakor-tso I had measured old shorelines 133 metres (436 feet) high. Then we crossed Nyapchu-tsangpo coming from Men-la in Trans-Himalaya and going to Poru-tso; west of this lake we went over the beautiful ice- and snow-covered Surla range—I call it so from Sur-la, a rather high and difficult pass. On the western side is Rigi-changma, or Rundor; and here we followed north the big river of Pedang-tsangpo down to Shovo-tso, which also is salt. Our guides were two boys, one of them ten years old. I really do not know what the Tibetans were thinking of, leaving us quite alone.

From Tajep-parva-la one sees almost the whole Nganglaring-tso—called Ghalaring-tso on our maps. I suppose some pundit has discovered the lake, although I am not sure if he has ever been there, because the map is very wrong. He says, "Monastery on island," and has one little island in the lake; there are five islands, but not a single monastery; and he makes the lake extend from north to south instead of east to west. We followed this big salt lake for two days west; from the south Sumdang-tsangpo comes out. From south-west comes Lavar-tsangpo, which joins with the Aong-tsangpo from west-south-west, a river which begins from the eastern side of the mountains which to the west give rise to the Indus.

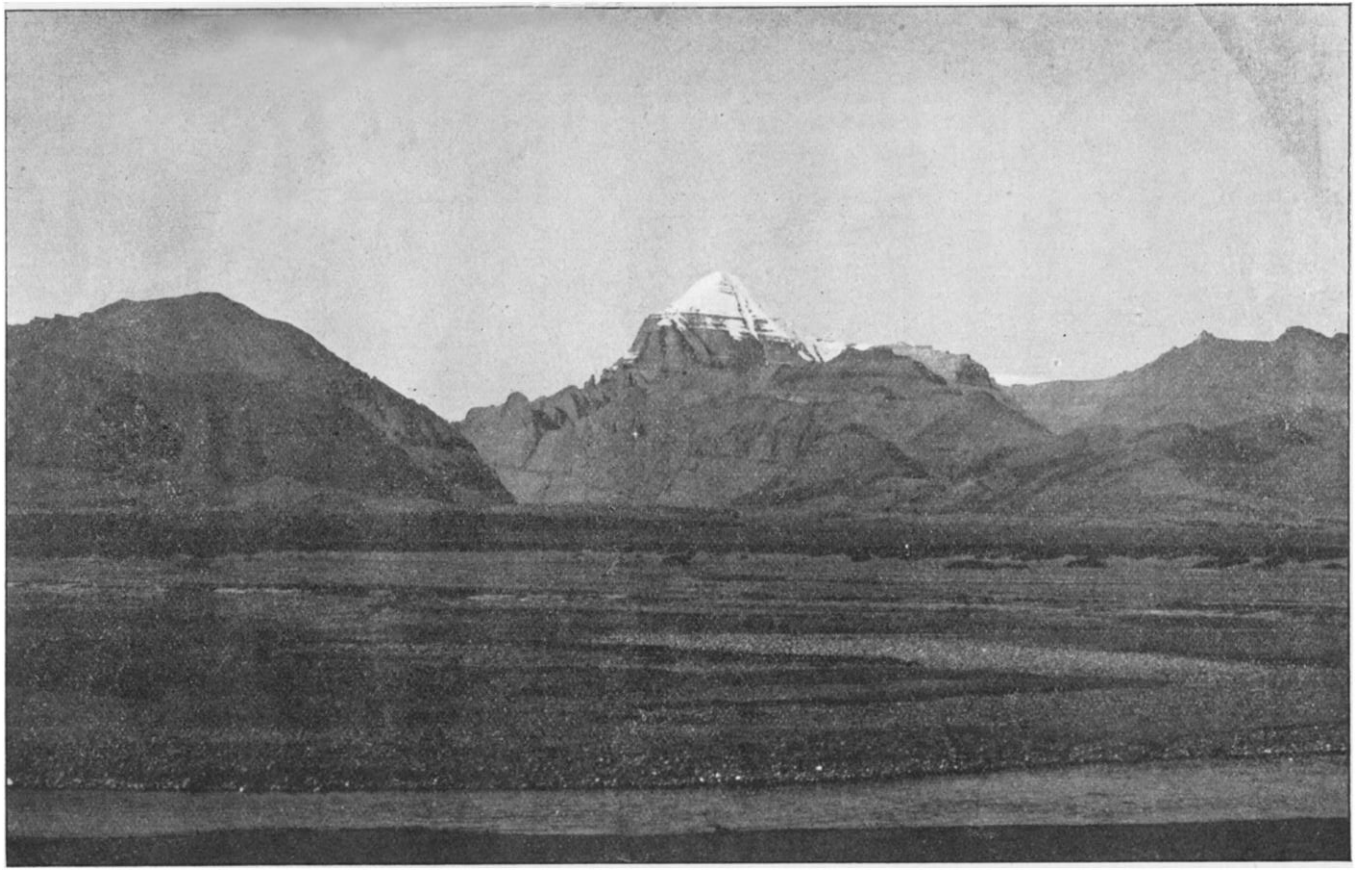
On June 26 I camped at Selipuk, and was received with the greatest hospitality by the lamas of this temple. One of them I had met in Raga-tasam, another in Lelung-gunpa last year, and the Pun, Sonam Ngurbu, of Chokchu, was just here on his prilgrimage to Kang Rinpoche. Him I knew at Shigatse, and he was very polite, as he had seen how well the Tashi Lama had received me. It was interesting to see the Pun's caravan; he had a real village of tents, travelled with all

his household, a hundred persons, had four hundred yaks and four hundred sheep, and a great and picturesque escort of armed men. He has two younger brothers, and all three have two wives together, that means two-thirds of a wife each, which I think is a rather funny invention. I was very short of money, so his presents of tsamba and rice and sugar were very welcome; all our silver was with the head caravan, and when those fellows found us two days later I had exactly one tenga (= six annas) left, and was about to sell ponies, revolvers and watches as a wandering Jew.

From Selipuk we went south-west to Tokchen. As this line is parallel with my journey to Yumba-matsen the previous year, it is of great interest. Here we cross the Trans-Himalaya by the two passes Ding-la and Surnge-la, Ding-la being very high, Surnge-la easy, although it is the head pass, the watershed between Lavar-tsangpo going to Nganglaring-tso and the Sutlej. North of Surnge-la is Argok-tso, from which a tributary goes to Aong tsangpo. Everywhere it would have been very easy to slip away to the north or east or anywhere, as nobody looked after us, but by that time I had got about enough of Tibet after those two long years.

Now only a few words as a *résumé* or conclusion about Trans-Himalaya. The map shows that those two years of wanderings circulate around and across Trans-Himalaya, and that this mountain system has been the chief object of my attention, and I believe I will call my next book, the dedication of which H.E. the Viceroy has kindly accepted, 'Trans-Himalaya.' Because, even if certain parts of it were known before, Trans-Himalaya as a whole geographical unit is a new conquest on our Earth, a new geographical region and signification, that has been more neglected than even the moon, and now it will be introduced for evermore into geographical literature, and the poor schoolboys of future generations will get a new name to remember.

Himalaya has always been regarded as the strongest possible fortress for India against eventual dangers from the north; let us not forget that this fortress-wall, this natural defence of solid granite, is *double*, and it would be rather amusing to see a northern enemy try and jump over those two walls with the Indus-Brahmaputra grave between them. The Capuchin Father Georgi tells us in his admirable book, 'Alphabetum Tibetanum,' how the great Dsungar Khan Tsagan Araptan in 1717 sent an army under Seren Donduk from Khotan through the whole of Tibet to Lhasa, and how this army, although frightfully diminished and several times beaten by the Tibetans, could conquer Lhasa in the time of Ngavang Yishe Jamtso Dalai Lama. And we know from Turner, and lately from Sir Thomas Holdich's fascinating description, how Emperor Kiang Lung in 1792 sent an army of 70,000 men from Mongolia, Sechuan, and Yunnan, to Tibet, and how this



KAILAS FROM THE SOUTH-WEST.

army beat the Gurkhas from Nepal both at Tingri and Kuti since the Gurkhas had plundered Tashi-lunpo twice. But those performances of very irregular troops can hardly be compared with modern warfare. Even light field artillery could only with the greatest difficulty be transported over Tibet, and a strategical railway would be an absurdity. In the great latitudinal valleys there is no hindrance to a railway, but I cannot see how the material could be brought there, and then—those valleys do not lead to India. I have tried with camels, highland ponies, Tibetan mules, yaks and sheep, but as a rule one crossing takes ninety or ninety-three per cent. of the caravan. Often one camps at a spring where the grass is just sufficient for one's animals, but how should it be sufficient for an army. As a rule even a little but strong caravan is spoilt and ruined before it reaches those parts of Central Tibet where grass is abundant, and then it is of no use to try with ponies and mules from the lowlands. My experience has always been that ponies from Eastern Turkestan are the first to die, whereas the Sanskar ponies are the best. I think it is difficult to find another country that has got—from a strategical and defensive point of view—such a favourable geographical situation as India, and all those fears expressed by Vambery or General McGregor are, to use rather a polite word, much exaggerated.

As to the name Trans-Himalaya, I should not have introduced it into geographical literature unless it had had tradition for itself, and the Viceroy of India had given his approval to it, and I am glad to say His Excellency has found it good. As I have said, I was about to call the system, Nien-chen-tang-la, or Hlunpo-gangri, but by that time I had no clear conception of the enormous dimensions of these mountains. Such names are not sufficient. Then I was thinking of "the South Tibetan Mountain system," but that is an ugly and uncomfortable name, whereas *Transhimalaya* tells us at once that this mountain system is situated on the other side of the Himalayas, and is thus a real scientific and characteristic name that cannot possibly give rise to any kind of confusion or misunderstanding. And we have not to go far into Asia to find cases of precedence. Sakaspijskij Oblast, or Transcapsia, is the great province on the other side of the Caspian Sea. Transcaucasia, Transoxiana, and Transbaikalia are all names that do not need any further explanation. The Transilenian Ala-tau is the range situated on the other side of Ili. But the most beautiful case of precedence is found in Fergana, south of which province is the Alai Range. South of Alai is the great broad valley of Kisil-su, being a right tributary to Panj or Amu-darya, and south of this valley is a range called Transalai, because it is situated on the other side of the Alai range. South of Transalai is the plateauland of the Pamirs. Now everybody will see how very like this orographical arrangement is to our present case, the plains of Fergana corresponding to the plains of Northern India, Alai to

Himalaya, Kisil-su to the Indus-Brahmaputra valley, Transalai to Trans-Himalaya, and the plateauland of the Pamirs, the Roof of the World, to the plateauland of Tibet.

Trans-Himalaya is one of the greatest mountain systems on the earth regarding its length, breadth and height, and it can only be compared with the Himalayas, Kwen-lun, Arka-tagh, Karakorum, Tien-Shan, the Cordilleras de los Andes, the Rocky Mountains. From Nub-kong-la to Ladak it is 1100 miles long, but east of Nub-kong-la it continues no doubt some hundred miles south-east and west of Ladak; if it can be proved that it is in connection with the Hindu-kush, its length should be some 2000 miles.

Nowhere is it a single range, it is at least two, but as a rule three or four. In the south its frontier is clearly given by the Indus-Brahmaputra valley; in the north I should say the belt of central lakes, the eastern discovered by Nain Singh, the western by me, is a quite natural and practical boundary, as the ranges situated to the north of those lakes, although some of them may be interwoven with the northern ramifications of the Trans-Himalayan ranges, ought to be called, "The Central Tibetan Alps." They are much lower than the Trans-Himalaya. On both sides of them there is comparatively low land, two latitudinal depressions corresponding to the great latitudinal valleys of Chang-tang. In the northern depression we have the Sachu-tsangpo, Selling-tso, Chargu-tso, Addan-tso, Bogtang-tsangpo, Tong-tso, Lakor-tso, Luma-ring-tso, etc.; in the southern: Kyaring-tso, Tsiku-tso, Ngangtse-tso; Dangra-yum-tso, Teri-nam-tso, Tabie-tsaka and Nganglaring-tso, whereas Nam-tso, Shuru-tso, Karong-tso, Chunit-tso, Tarok-tso, Poru-tso, Shovo-tso, Argok-tso, and Panggong-tso more intimately belong to the Trans-Himalayas. Amchok-tso, Lapchung-tso, and Senit-tso are situated south of the head watershed.

The breadth of the Trans-Himalayan system, where it is broadest, is some 120 miles, whereas the broadest part of the Himalayas is about 200 miles. The average breadth of our system may be said to be 80 to 100 miles; it is broadest in the middle, in Bongba, and becomes narrower to the east and west, at Panggong-tso, for instance, its breadth being only some 30 miles.

I have mentioned the principal eastern passes, and will now add some more to the west. Between my two passes, Angden-la and Sangmo-bertik-la, are Tsalam-nakta-la, Dombe-la, and Nakbo-kongdo-la, the first of which is important, as a great salt road crosses it. Between Sangmo-bertik-la and Samje-la are Saggo-la and Dicha-la, both of which I could see from my road. Then comes the great gap between Samje-la and Surnge-la, where I have not made any crossings, and where the following passes are situated: Dsalung-la, Lungmar-la, Pechen-la, Lungnak-la, Jor-la, Ganglung-la, Men-la, Pedang-la, Gebbji-la, and Tarkyang-la. West of Surnge-la is my Lachen-la. There are said to

be some other passes used only by hunters, shepherds, and robbers, but not for trade, travelling, or pilgrimage. West of Yukti-la, which, I believe, has been crossed by Mr. Calvert some four years ago, there are several passes, most of them easy, but some snowed over and closed in winter.

The orographical and hydrographical rank of the Trans-Himalayas is more distinguished and important than that of the Himalayas. The western Himalayas are a watershed between the Indus and its tributaries, the eastern part between the Brahmaputra and the Ganges; but every drop of water that falls in the Himalayas goes to the ocean. On the other hand, almost the whole central part of the Trans-Himalayas is a watershed between the Indian ocean to the south and the self-contained plateau depressions to the north, from where the water never reaches the ocean. In the far west the Trans-Himalaya is also a watershed between the Indus and some of its higher tributaries, and in the far east it is a watershed between the Brahmaputra and the Salwen. Except the Salwen, there is, within Tibet, only one river that, beginning from the northern side of the Trans-Himalaya, reaches the ocean; but this river is a lion, and the Tibetans call it also Singe-tsangpo, the Indus, which breaks through the range in a transverse valley. Other rivers from the northern side of the Trans-Himalaya are doomed to die, or rather, evaporate in salt lakes without outlet. From east to west the principal of them are: Ngang-chu, Ti-chu, and Bo-chu to Nam-tso, Ota-tsangpo, and Bara-tsangpo falling into Kyaring-tso, which is a fresh-water lake; Tagrak-tsangpo to Ngangtse-tso; Targo-tsangpo to Dangra-yum-tso; Soma-tsangpo to Teri-nam-tso; Buptsang-tsangpo to Tarok-tso, which is fresh; Goang-tsangpo and Nyapchu-tsangpo to Poru-tso; Pedang-tsangpo to Shovo-tso; Sumdang-tsangpo, Lavar-tsangpo, and Aong-tsangpo to Nganglaring-tso. The great geographical homology of this arrangement is very curious and interesting.

The principal Trans-Himalayan ranges are, Nien-chen-tang-la, which further west is called Kanchung-gangri, and dies away to the north-west, north of Samje-la, then the Targo-gangri—Shuru-tso—Lapchung range, finishing at Tarok-tso, and north of it is the Teri-nam-tso range. Further west we have the Hlumpo-gangri-Lunkar range, one of the very highest, and then the Surla range between Poru-tso and Shovo-tso. South of Selipuk is the Ding-la range and the Surnge range, which is the same as the one north of Kaïlas, and which further west is broken through by the Indus.

Transhimalaya is situated in or touches the following provinces: Kham, Nakchu, U, Tsang, Naktsang, Saka, Chokchu, Bongba, Rundor-Selipuk, Singtod-singmet, Ngari-khorsum, and Rudok; that is to say, most of inhabited Tibet.

The province of Bongba, and that of Chokchu, were the only ones in Tibet which hitherto have remained absolutely unknown to

Europeans—I believe even their names were unknown. Bongba is divided into twelve districts, with a Gova as chief of every one of them. It is a well-populated country, with a great many tents, sheep, and yaks; thus the district of Bongba-changma was said to have 300 tents. During such a year as this, when the grass is bad, as there was no rain in 1907, a great part of the nomads go north to the central plateauland where the grass is better.

The province is crossed by innumerable roads. I distinguished seven different sorts of roads — gold roads, salt roads, trade roads, administrative roads, pilgrims' roads, nomads' roads, and robbers' roads. The last category are practically no roads, as they go where nobody else is going. The Serpun-lam, or "the gold-inspectors' road," also called Ser-lam, or "the gold road," is one of the most important roads in all Tibet. It begins from Lhasa, crosses Guring-la, passes Shansa-dsong, goes south of Dangra-yum-tso, north of Teri-nam-tso and Tabie-tsaka, crosses the Surla range in Ka-la, and continues to Selipuk, Yumba-matsen, and Tok-jalung. The salt roads, or "Tsalam," converge from all parts of Tibet to Tabie-tsaka, and many of the Trans-Himalayan passes I have mentioned are taken by the salt caravans. By administrative roads I mean simply local tracks used by representatives of certain districts, who, on a certain day every year, come to a certain place where the Government officials meet to collect the contribution they have to pay for the right of using the grazing-grounds to their flocks.

But now I must finish, and I hope you will excuse the length of this paper. I wrote it between Selipuk and Tokchen, and it is forty-three pages long in manuscript. So, as my diary is a little more than 6200 pages long, I should have to deliver one hundred and forty lectures like this if I should be able to give all the information I have brought home. This lecture is thus a very short account of a very long journey, the results of which it will take two or three years to work out. But, once put into order and published, I hope it will prove to be of some use to India, and then my work in the grand loneliness of Tibet will not have been in vain.

The PRESIDENT (before the lecture): We welcome here to-night the man who, without doubt, has done more than any single individual has ever done to add to the knowledge possessed by the civilized world of Central Asia. It is useless to attempt to condense into a few short sentences all that Dr. Sven Hedin has done for geographical science, and I shall limit myself to reminding you very briefly of the occasions of his two last visits to London. The first of these two visits was in 1898, shortly after he had concluded his great four years' journey in Central Asia, a journey in which, in the opinion of your President, Sir Clements Markham, he encountered "desperate dangers and hardships," and did work which in the circumstances was notable for completeness and thoroughness. Not long after Dr. Sven Hedin had described to us his experiences on that journey, he was awarded

SKETCH MAP OF PART OF TIBET

SHOWING THE

EXPLORATIONS AND JOURNEYS

OF

Dr SVEN HEDIN

1906-1908

Dr Sven Hedin is alone responsible for the New Names on this Map

Natural Scale 1:3,800,000 or 1 inch = 60 Statute Miles

50 0 50 100 Miles

Dr Sven Hedin's routes 1906-1908

Explanation of Tibetan and Mongolian Names.

Bulak . . Spring	Gompa	Monastery	Muren . . .	River	
Tso . . . . . Lake	Dzong	Fort	Nor	Lake	
Chu . . . . River	Kul	Lake	Tagh . Mountains		
Davan . . . Pass	Kurghan	Enclosure	Fort	Ula . .	Mountains
Gol . . . Stream	La	Pass	Ussa	River	
Mazar	Tomb, Shrine	Oghil . . .	Shepherd's Station		

C. Camp L. Lake P. Pass R. River W. Well Railways

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80
82
84
Karakash R.
Islamabad
Tawakal
Tarashlik Langar
Hedin & Stein
Kochkar Oghil
Chigit Korghan
Kenk-kiok
Saghizlik Yailak
Imam Jafar Sadik
Mazar
Mugi
Zanguya
Sanju
Karakash
Piälma
KHOTAN
Yanghi Arik
Karakash R.
Kunat
Dipran
Utroki
Hasha
Tekelik Range
Keriya R.
Bughar
Laiha
Sorgak
Tailkolak Sai
Yulgan-bulak
Owras
Kirtaz
Sumgal
Mudacha Tagh
Karakash R.
Nura
Polu
Central Altyn Tagh
Usu Tagh
Kansai or Kanchep
At Tu
Karatagh Plain
Karatagh P.
Sumnal
Soda Plains
Muztagh
Choipanglik
Yurungkash R. (Khotan)
Shubash
Baba Hatim
Aksu
Karakorum P.
Daulat Beguldi
Kizil Angur
Murghi
Kutaklik
Daknakpo
Shiok R.
Chiamsiam Jilga
Aksai Chin
(White Desert)
Salt Lake
Ling-shi Thang
Ling-shi Thang
Sirigh Jilganang Kul
L. Lighten
Barren Plain
Rolling Plain
Lake Wellby
Markham L.
Antelope Plain
Dongi La
Rawling
Salt
Deasy Group
Stony Plain
Grassy Plain
Goldfield
Gore Tso
Salt L.
Aksai Chin
Shanko Thang
Rivangkaru
Shumal Lungpa
Pukra
LADAKH
LEH
Chang La
Tikse
Sakti
Lanak La
Tokomorpa
Mangtsa Tso
Lungnak
Lungmak La
Rikar
Arport Tso
Fresh
Memar Chaka (Salt)
To Huping Tso (Fresh)
Salt Lake
Drugub
Pamzal
Gogra
Niagzu
Tankse
Dyap Tso (Salt)
Kagbang
Tok
Kenze Chaka
Shemen Tso
Rawling
Aru Tso
Dengor La
Pangong Lake
Lungdo
Salt Lakes
Arid Plain
Bower
R. Indus
Pal
Rudok
Rum Tso
Nyak Tso
Kohche
Shankar
Khamba
Jai Tonghok
Thandak
Tomgo
Nila Ruhlung
Kunchuk Tso
Takdong Chaka
Chabuk
Fugu
Gomang
Jhachan Gangri
Lanchung Tso
Snowy Range
Kangmar
Pangur Tso
Puga
Phongo
Saksum
Punjok Tso
Sirpun Dist.
Buntso
Dantang
Shazia
Shazmut
Snowy Range
Alung Kangri Mt.
Durkang
Nyacten Tso
Kangri
Dundok
Hanle
Chumar
Kalinka La
Demchok
Hagung Tso
Thomchu
Lankar Tso
Charding La
Tashigong
Indus
Daknaru
Pekia
Thok Jalung
Karak
Zoto La
Lang
Chingrong
Gnarba
Littledale
Amzin Tso
Jakar
Pamar Tso
Ngarsa
Gar Gunsa
Giachuraf
Ning Gangri
Saldi
32
Drongmara La
CHUMURTI
Gianchi Tso
Nakduk
Dhubuk Tso
Shipki La
15400
Tibu
Ayi La
Gartok
Jukti La
Charbo Monastery
Niacharphu
Jiachan
Shiokma Khabjior
MAJIN
Many Borax fields
Ngangluring Tso
Lakkor Tso
HUNDES
R. Sutlej
Dunkar
Totling
Chabrang
SINGHTOD
Ruldap Tso
Nakchail La
Shovo Tso
Tabie Tso
Lunkar Gompa
Lunkar La
Poru Tso
Daba Dzong
Dongpo
Jerko La
Dunglu
Kailas P.
Menze or Missar
Ding La
Dingla Range
Peda Range
Surla Range
Lunkar Range
Trabing
Shangluchu La
Niti La
Sami
Shala
Barkha
Lagang Tso or Rakas Tal
Mohang Tso or Manasarowar L.
Tirthapuri
Kangmen
Badrinath
Niti
Kungribingri
Joshinath
Darma La
Milam
NandaDebi
Memo
Gurla
Gunchu Tso
Mayum La
Luhang
Surnge La


82
84
86
88
Kochkar Oghil
Korghan
Kenk-kiok
Saghizlik Yailak
Imam Jafar Sadik Mazar
Chengelik Well
Achik Kul
Andere
Khadirsha Well
Astun Tagh
Muna-bulak
Mandalik
Aialik Su
Aialik T.
Kapa
Molla Mazar
Bogana
Arpa
Dalai-kurgan
Bulak-bashi
Muslik T.
Chong Sarchu T.
Kara Muren
Yeshil Kul
Ak Tagh
Yulgan-bulak
Kara Sai
Owras
Bugha
Kopa
Sorgak
Central Altyn Tagh
Usu Tagh
Kansai or Kanchep
Prjevalski
Ullug Mustagh
24150
S. Kara-muren P.
Arka Tagh
N
Polu
8200
20400
Shubash
Kangush Kul
18500
Antilope L.
Kokoshili Range
Red Rock
Col rouge
Salt Lake
Baba Hatun
Aksu
Barren Plain
Rolling Plain
Salt Lake Wellby
Wellby
L. Markham
Antelope Plain
Dungbure Range
L. Jiggitai (Lac des Hémiones) (Dutreuil de Rhins)
Pass
Yak L.
Deasy Group
Stony Plain
Grassy Plain
Bu Hamangna Range
Crater L.
L. Kashum
Twin Lakes
Goldfield
Salt Lake
Salt Lakes
Arid Plain
Karakorum Range
Snowy Range
Red Salt L.
15600
Volcanoes
Bonvalot Mt.
21470
Geyser L.
KACHI
Partridge L.
Naktsang
HOR PROVINCE
L. Ammoniac
Lankar Tso
Ning Gangri
Pamar Tso
SHANKOR
MAJIN
Borax fields
Ngangtaring Tso
Lakkor Tso
Ring Tso
Tang Jung Tso
Gipu Kara
Ombo
Dangra Yum Tso
Shovo Tso
Tabie Tsaka
Satsot La
Tarok Tso
Mendong Gompa
Chunit Tso
Teri Nam Tso
Teri Nam Ra.
Karong Tso
Targo Gangri
Sershik Gompa
Ngangtse Ra.
Ngangtse Tso
Dara Tso
Lunkar Range
Dingla Range
Surla Range
Pedang Ra.
Lapchung Ra.
Soma Tsangpo
Jiachan
Charbo Monastery
Kailas
Ding La
Dinga La
Sunge La


86
88
90
36
34
32
Astun Tagh
Muna-bulak
Pass
Mandalik R.
Aialik Su.
Aialik T.
Aiag Kum Kul
Hedin
Mt Kremlin
Kalta al Columbus Range
Ikhyn-gazyn-khorgu
Yappkahlik
Shara-gal P.
Mt Ikhyn-gansa-khorgu
Achan 8000
Mushik T.
Chong Sarchu T.
Bulak-basha
Achik Kulning
Achik Kul
Min Bulak
Chan Kum Kul
Sandy Tableland
Mt Jing-ri
Garing
Bulak Bashi
Robroiski
Yeshil Kul
Kara Muren
Prjevalski Mts
Ullug Mustagh 24150
Mt Elisée Réclus
Mt Ferrier
Mt Shapka Menomekh
Arka Tagh
Mt de Niatza 17880
Antilope L.
Red Rock
Col rouge
Kokoshili Range
King Oscar Mt
Salt Lake
Mt de la Borne Annee
Wellby
L. Jiggitai (Lac des Hirondes) Dutreuil de Rhins
Pass
Yak L.
Dungbure Range
L. Bicocular
Hedin
Crater L.
L. Kashun
Twin Lakes
Cone L.
Montalm L.
Bulkamang Duplex Mts
Red Salt L.
Volcanos
Bonvalot Mt 21470
Geyser L.
Karakorum Range
Turken Nor
Rockhill
(Salt) Chih Chung Tso 17008
Keten Col
Tangla Range
Basudun Mts
Gurban-balchi
Armand David Mt
L. Kalasia
KACHI
Partridge L.
Naktsang
Khoklung Chaka
Tsu Tso.
Nagtsi Opo
Yagnoo
Nagsu Tso
Bonvalot
Mt Basudun-lama
AMDO
Tin Kum Song
L. Ammoniac
Polo Tso
Yirna Tso
PHOVINCE
Pahu La 16844
Zoleh
Edjong
Nazuru Tso
Thok Daurakpa (Goldfield)
Chaying Tso
NAMRU
L. Amdo-tsanak
Ring Tso
Sarchuk
Chargut Tso
SELLING TSO
Mt Namching tang-le
Mt Samtyn-kansyr
Gipu Kara
Tang Jung
Tang Jung Tso
Ratka
Addan Tso
Pongok Tso
Toberag
Sitong
Gogalinchin
Bum Tso
Milong Pass
Ombo
Naktsong Tso
Kya Kya Ka
Pam Tso
Long-kiok Tso
Dangra Yum Tso
Nain Sing
Kyaring Tso
Dehak
Mokieu Tso
Shya Gomba
Dalaijur
Teri Nam Tso
Ngangtsu Tso
Dara Tso
Bulf
Ringa De
Teri Nam Ra.
Targo Gangri
Ser-shuk gompa
Ngangtse Ra
Yakpa Thajang Tso
Dombo Thajang Tso
TENGRI NOR (Salt)
Tasha Doche
Dam Niargan La
Nien Chen Tangla Pk 23208


SKETCH MAP OF
PART OF TIBET
SHOWING THE
EXPLORATIONS AND JOURNEYS
OF
Dr SVEN HEDIN
1906-1908
Dr Sven Hedin is alone responsible for the New Names on this Map
Natural Scale 1:3,800,000 or 1 inch = 60 Statute Miles
50 0 50 100 Miles
Dr Sven Hedin's routes 1906-1908
Explanation of Tibetan and Mongolian Names.
Bulak . . Spring
Tso . . . . . Lake
Chu . . . . River
Daran . . . Pass
Gol. . . Stream
Mazar . . . . . Tomb, Shrine
Gompa . . . . Monastery
Dzong . . . . Fort
Kul . . . . Lake
Kurghan Enclosure Fort
La . . . . Pass
Oghil . . . Shepherd's Station
Muren . . . River
Nor . . . . . Lake
Tagh . Mountain
Ula . . Mountain
Ussa . . . . River
C. Camp L. Lake P. Pass R. River W. Well Railways
80
82
84
32
30
28
TIBET
HUNDES
NGARI KHORSUM
NEPAL
Pangong Lake
Rudok
Hanle
Chumar
Demchok
Tashigong
Gar Gunsa
Gartok
Chumurti
Shipki La 15400
Totling
Chabrang
Kailas Pge
Memo or Gurla Mandhata
Kamet 25450
Badrinath
Joshinath
Nanda Devi 25600
Milam
Garbyang 20300
Almora
Pitoragarh
Bareilly
Shahjahanpur
Pilibhit
Kathgodam
Dhaulagiri 26795
Pokhra
Jumla
Simikot
Majin
Singhtod
Lunkar Range
Dingla Range
Surla Range
Ruldap Tso
Ngangtsang Tso

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Geographical Society

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our Founder's Medal for having crossed the Takla desert for the first time, and for having solved various important geographical problems.

In 1903, after the lapse of five more years, three of which our guest of to-night passed in the same inhospitable regions, he was with us again describing his adventures, and again, in the words of your President, proving himself to be "a scientific geographer of the highest rank." During that visit we honoured him with the award of the Victoria Medal, the medal given occasionally for scientific geographical work of exceptional merit; in this case, for investigations concerning the great plateau of Central Asia, the Tarim valley, and the Lob regions.

Again six years passes. Again our indefatigable explorer traverses unknown regions for three years. Again he returns with his hands full of carefully gathered scientific facts. Again we accord to him the most hearty welcome and congratulations. With the record I have so briefly touched upon, we know full well what to expect from Dr. Sven Hedin, and in our expectations we shall not be disappointed. I will, therefore, delay you no longer, but will at once ask Dr. Sven Hedin to kindly deliver his lecture.

After the lecture, Lord MORLEY OF BLACKBURN: I rise to propose a vote of thanks to Dr. Sven Hedin with every assurance that it will be cordially welcomed in every part of this hall. And not only in this hall, but the welcome you have given to-night to the lecturer will, I am confident, be re-echoed all over the country wherever Dr. Sven Hedin may think it worth his while to pay a visit. He has, in the discourse he has favoured us with, not only given us a remarkable account of a remarkable achievement, but he has brought us face to face with the man. He has shown us, as he has shown the world almost ever since he was a schoolboy, not only that he is a born geographer, but that he is a man with a pity in him, with a sense of justice in him, with a good temper in him, qualities which would save all explorers a vast deal of trouble if they would but imitate our lecturer. There has been no bloodshed, so far as I understand, in any of his explorations. He has raised no ill-will anywhere. He has shown us how he is full of pity, and some of us at all events, with ideas of our own, think with him in what he has said about dogs, and were with him when he described the longing, wondering, melancholy eye of the dogs to whom he was bidding farewell. It occurred to me, while I was listening to Dr. Sven Hedin, how different is the career and how different the duties of a great explorer from those of a politician. He told us that he tried to drive a flock of sheep, and that he found he had no gift for driving sheep. If he had been in the profession of politics, he would have found that those gifts were sorely needed. I mention that because it occurs to me that Dr. Sven Hedin may think that the Secretary for India, who, after all, holds the keys of the frontier gates of India, is, unlike himself, a hard-hearted, a cold-blooded, and a timorous man. He will well know the circumstance to which I am now referring, the circumstance, namely, that we thought it inexpedient that he should approach Tibet from the Indian side. I will not be guilty of the intolerable bad taste of attempting for a moment to show that my decision was not over-cautious. I think a good deal of what Dr. Sven Hedin has said to-night rather shows that the decision was a right one as far as it went. But I will not argue it because, after all, be the decision as wrong as you like, Dr. Sven Hedin has to-night had his revenge, for he has drawn me captive—though captive impenitent—at his car, and I am very glad to find myself able to congratulate him on the great exploit he has performed in spite of it. The subject of Tibet not many years ago was a topic of some warm political controversies, not purely party—the controversy was as much within one party as in the other. It may be that the topic may again be revived. It may be that some of the points raised by it may be revived by Dr. Sven Hedin's explorations, and he may have

something to tell us some of these days, not to-night, upon this controversy. And whatever he may tell us, we shall know that we are being told by a man of scrupulous honesty and integrity and of enormous industry in investigating all the phenomena before him, because, so far as I am acquainted with his books, Dr. Sven Hedin is not content with geographical research, but busies himself with historical research as well. But be that as it may, we are every one heartily glad to have heard his lecture to-night. We are also very glad to have seen so brave a man, a man who has performed such a wonderful geographical achievement, face to face. He has got, I think, some two or three years' work still before him in working out all his plans and drawings, and we all hope that he will have the same kind of success in completing this portion of his task as has followed the earlier portion of it. I do not do wrong, I am certain, in expressing on behalf of this very great and rather wonderful gathering, our gratitude to him and our sense of the wonderful qualities which he has shown, and of the great and valuable additions he has made to geographical knowledge. I beg to propose that our thanks be given to Dr. Sven Hedin.

Colonel Sir Henry Trotter: As an old explorer in Central Asia, I have been asked to second the vote of thanks to Dr. Sven Hedin for the admirable lecture he has given us this evening. I am especially pleased to do so as I was intimately associated with the veteran explorer Nain Singh, whose name has so often been mentioned this evening, and described by the lecturer as "the admirable and noble Pundit." On my return from Central Asia in 1874, I started him from Ladakh on the mission to Lhasa which gained him the R.G.S. Gold Medal, and on his return to India I worked up his observations and prepared his map and report, so that I have been deeply interested in noting where his work came in contact with that of our distinguished guest, and was especially struck with the observation that on arrival at the Teri-nam lake, he found that its position had been almost correctly placed by Nain Singh, although he had never seen it—only heard of it. The dotted line which showed its approximate position on our maps for the last thirty years will now be replaced by a correct delineation. Still more important, however, is the confirmation of Nain Singh's observations to peaks of a high snowy range, one of which he estimated to be 25,000 feet high, lying to the south of Dangra Yum lake. I recollect that at the time grave doubts were thrown by unbelievers on the existence of these mountains, but the correctness of his observations has now been verified.

It is difficult perhaps for most of those present this evening to realize fully the hardships and difficulties encountered in such a journey as we have heard described this evening. Dr. Sven Hedin, for instance, says in one short sentence, "On the heights of the Bukamanga range we lost nine mules in one day." I well recollect on the journey of the Forsyth mission to Kashgar in 1873, one mule lost its footing and fell several hundred feet into the torrent below. Its load consisted of twelve months' supply of brandy and whisky for the expedition, and its loss was most serious; what, then, must be the effect of the loss of nine mules in one day? It is difficult to realize. The wonderful energy and perseverance of the lecturer when driven off the ground and compelled to go round to Leh and start a fresh expedition in order to complete the task he had set himself to do—the way in which the almost insuperable difficulties were faced and surmounted is worthy of our highest admiration, and is an example to us all.

Another important factor to be noticed in judging of the difficulties of the work is that the general height above sea-level of the Tibetan plateau from which rise the mountain systems we have heard described to-night varies from 13,000 to 16,000 feet above sea-level.

Dr. Sven Hedin has condensed for our benefit three years' hard work into a single

lecture—a most difficult task, especially as we are informed that he has materials for 140 more, and his "geographical conscience" must revolt at leaving so much good matter undescribed. After the hardships and dangers encountered by Dr. Sven Hedin, not only in this but in former expeditions not less adventurous and noteworthy, it is an extraordinary result, on which we must congratulate ourselves as well as him, that he is left alive and in good health to tell his tale, and I am sure that the audience will join enthusiastically in the vote of thanks which it has been my privilege to second.

The PRESIDENT (after the vote of thanks was proposed and seconded): When travellers return to us after long journeys in distant regions, we have not only to obtain from them all that is new to science in their gleanings, but also to note the difficulties under which they have laboured in making their researches. Dr. Sven Hedin has dealt but lightly with the dangers he has encountered; but, in spite of his reticence, his lucid account of his journeying, and the admirable photographs which have illustrated it, have made it clear how full of difficulties must have been the task of collecting the mass of material he has brought back. To few men, indeed, is granted the physical endurance which he has displayed in his ten and more years' wanderings in the desert. And as to his contributions to geographical science, their extent can only be realized by those who have noted the great white spaces which existed on our maps of Central Asia in 1894, how largely these spaces are now covered with the network of his topography, and how comparatively few great problems now remain to be solved. Speaking in 1898, Dr. Sven Hedin said he was glad to find himself placed by the side of our other Gold Medallists—Carey, Ney, Elias, Holdich, Littledale, Younghusband, and Prjevalsky. Let me assure him that we also rejoice to see his name on our walls in that list of our medallists, since, as I have said before, he has done more than any other one man to open this country to our knowledge. Sweden may well be proud of their great explorer, while we must content ourselves with remembering that he is our twice-honoured Gold Medallist. In conclusion, I know I may declare this motion carried by acclamation, and give to Dr. Sven Hedin your most hearty thanks and congratulations.

Dr. SVEN HEDIN: May I express my very heartiest thanks for the beautiful and sympathetic reception I have had to-night in the R.G.S.? It is twelve years since I first had the honour to address your Society, the richest and most famous in the world, and since then I have been overwhelmed with honours, hospitality, and appreciation by the Presidents, Council, and members of the R.G.S., and when I now am here again, I do not feel any more a guest or a stranger, but a friend amongst friends and as one of your own.

It has been a very great pleasure to me to listen to those very flattering and kind words just addressed to me by the President, and they are the more precious to my heart as I know he has also been talking on behalf of the Council and members of the R.G.S.

And I regard it as a special honour that the Secretary of State for India has been kind enough to propose a vote of thanks, and that he has done it in a way that I appreciate more than I can say and that I never shall forget. Three years ago I did not quite love Lord Morley, although even then I understood very well that whatever he did was done in the interest of that great and powerful empire, in whose service he occupies such a high position, full of responsibilities, and I understood that the personal wishes and ambitions of explorers had to come in the second place. But now, since I have travelled for twenty-five months in the unknown parts of Tibet, I look upon the situation in a quite different light. In connection with this journey, there is no man who has made me a greater service than Lord

Morley. When the noble Viceroy of India so very kindly tried to get a permission for me to enter Tibet on the Simla-Gartok road, the Secretary for India refused it. What would have happened if he had consented? I should have prepared a big and heavy caravan in Simla, crossed the frontier, and—been turned out by the Tibetans already at Shipki! It is easy to understand what a great loss of time and money this would have been, as I could not possibly have brought the same caravan all round with me to the Turkestan side.

But Lord Morley did me a still greater service. During the whole time I was in Tibet he kept the frontier between India and Tibet closed to all travellers, and so I was left quite alone with the great white patch which I had decided to explore as carefully as possible. Everybody will understand what that meant for me—especially in a time when the white patches on the map of the Earth are not very numerous. If the frontier should have been opened by some new agreement, I am afraid the Bongba province would have been overwhelmed by explorers, and I should have been obliged to give up a good deal of the conquest which I desired to save for myself only. And for my life I *would* not capitulate on any single point, as some of the most beautiful and important problems of Asiatic geography were to be solved only on this very white patch. So it is not only a *manière de parler* when I say that nobody has ever done me a greater service than the Secretary of State for India; and if I did not love him three years ago (which was for a very short time only), I hope I may take the liberty now, and for the rest of my life, to reckon Lord Morley amongst my very best friends.

Let me also express my sincere and hearty thanks to Sir Henry Trotter for the excellent and appreciative speech he has been kind enough to address to me, and which is the more valuable for me as it comes from a man who knows so much of Tibetan geography, and who has played such an important part in the history of exploration in that mysterious country. I have always admired the clever and careful way in which Sir Henry worked out the maps, notes, and observations of the great Pundit, Nain Singh, more especially of his journey 1873-74, which is one of the most important that ever have been undertaken in Tibet. I am really proud of the words Sir Henry Trotter has just uttered.

The reception I have had to-night by the President and members of the R.G.S. I regard as a new and very great honour added to those which I have received already years ago. And may I finally express my very hearty thanks to all those distinguished guests present who have spared some hours of their valuable time for coming and listening to the story of my last journey in the fascinating land of the eternal snows, the lamas, and the mysterious formula "On mane padme hum"!

II. DISCOVERIES IN SOUTHERN TIBET.*

By Dr. SVEN HEDIN.

When I left Stockholm on June 24, 1899, for my fourth journey into Central Asia, one of my chief objects was to try and find the source of the Indus, but although I did my best to penetrate to that part of the forbidden country, I had to give it up altogether on account of the opposition of the Tibetans. When I again

* This must be regarded as only a preliminary statement on the points in dispute, necessarily written in some haste.—S.H. Royal Geographical Society, February 23, 1909.

left Stockholm on October 16, 1905, for a new journey in Asia, the source of the Indus still remained one of my greatest ambitions, but the strongest attraction was to fill up the great white patch on our maps of Tibet, situated north of the Tsangpo, between 81° and 89° east of Greenwich. This was a region which had never been crossed by any European explorer, nor by any of the native explorers trained and instructed by Montgomerie, Trotter, and other British officers in India.

Part of this vast area was, to some extent, known to the Chinese; the Shui-tao-ti-kang, or "ground lines of hydrography," contains a description of it, and some other Chinese geographical works deal with it. During my stay in Kyoto, Prof. Ogawa, of the Kyoto University, kindly made translations of those parts in the Chinese books which could be of special interest in connection with my own discoveries in the same country. In 1708 the great Emperor Kang-hi ordered the Jesuit missionaries in Peking to compile a map of the whole empire, which was completed in 1718. In 1717 two Lamas, who had been trained by the Jesuits—in the same way as the Pundits in India later on—were able to deliver to the Fathers a map of Tibet, which contained the only information we possessed of the great white patch—even so late as 1906. From this map D'Anville has entered upon his famous map of 1733 a labyrinth of rivers, lakes, and mountains. On D'Anville's map we find Lanken and Mapama, *i.e.* Langak-tso and Tso-mavang (or Mavam), from which he makes the Ganges take its origin. The rest of D'Anville's hydrographical and orographical confusion, in which it is a hopeless task to try and identify the geographical lines with the reality, I only find two lakes which really exist, namely, "Tarouc-yomdsou" and "Tchapie-dsake-ton-psou," the first being called Tarok-tso, the second Tabie-tsaka. The fact that these two lakes have been comparatively well entered on the map, seems to depend upon their being known all over Tibet, as Tabie-tsaka provides a very great part of the country with its supply of salt, and is visited by innumerable salt caravans, and because several of the most important roads of the interior of Tibet meet at Tabie-tsaka. The rest I cannot recognize, unless Tankin-yamso is meant to be Dangra-yum-tso, although it is connected with Tengri-nor by the river "Tarcou Tsangpou," a connection which does not, of course, exist in reality; but it may be a confusion with Targo-tsangpo, which empties into Dangra-yum-tso, and about which Nain Singh got some information in 1874. Part of the geography of D'Anville's map has been entered by Dutreuil de Rhins upon his map l'Asie Centrale, a map which appeared some years ago in a Chinese edition in Shang-hai.

The material on D'Anville's map for the region north of the Tsangpo seems never to have been accepted by British or German geographers, at least not on the map published by the Royal Geographical Society under the title of "Tibet and the Surrounding Regions," nor on the excellent map of Tibet, which is No. 62 in Stieler's Hand-Atlas—and these two maps are by far the very best general maps of Tibet I have ever seen, and perfectly up to date in all geographical details. On the British map the unknown country has exactly the same aspect on the edition of 1906 that it had at its first publication in the *Geographical Journal*. The single word we find on the edition of 1906 on 'Tibet and the Surrounding Regions,' which is perfectly correct, or which rather *was* so in 1906, is the word *Unexplored*, in big letters, whereas the word Dokthol province has to disappear, as it does not exist in reality; the name proved to be absolutely unknown to the natives wherever I asked for it.

It may be of some interest to point out some of the geographical information of the above-mentioned map. The country between Mount Kailas and Jiachan on the main branch of the Indus is perfectly white on the map, which is correct, as nobody has ever been there, and if anybody ever *had* been there it is difficult to understand why his information should not be used on the map of Tibet issued by the R.G.S.

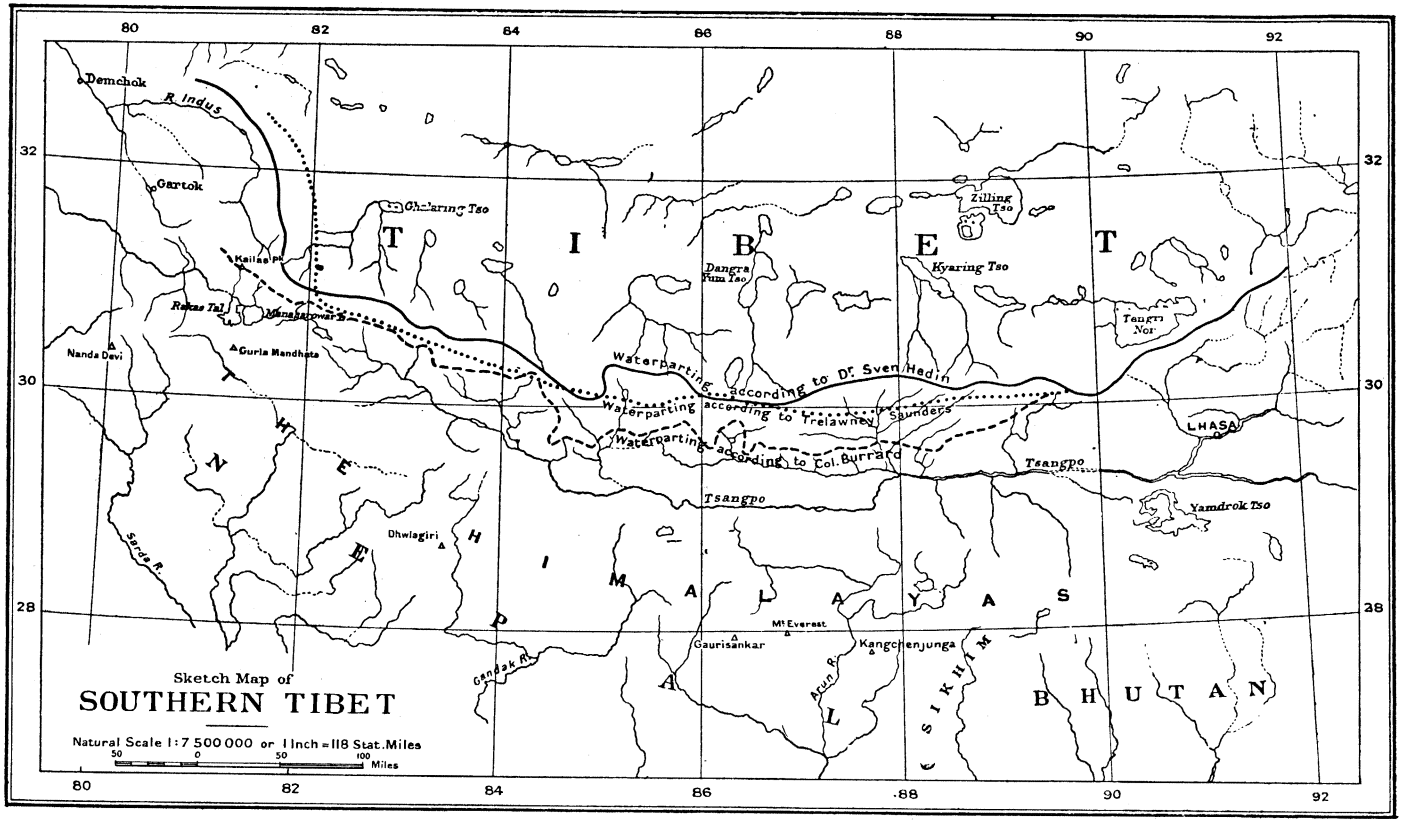
The uppermost part of the Indus, in the province of Singhtod, is a dotted line, the beginning of which is situated about 30 miles from the real source of the Indus. To the east of Singhtod there is some detail on the map. I do not possess the report of the Pundit who has collected this information, but I have the impression that it is partly founded upon verbal communication, because it is so extremely wrong. His river Sumnu-chu is identical with the Lavar-tsangpo and its tributary the Aong-tsangpo, which correctly comes from the south-west. The Sumdan-tsangpo comes from the south, from Trans-Himalaya, and it is on this river, on its left bank, that the great temple of Selipuk is situated. His Ghalaring-tso is identical with Nganglaring-tso, but it is not oblong from north to south, but from east to west; it does not contain one island, but at least five; and there is no monastery on any one of those islands. His peak Khala, south-east of Selipuk, may be a confusion with the very important pass of Kha-la, which is situated in a very high mountain range stretching north-west to south-east, and this pass is situated east-north-east of Nganglaring-tso. Now, of course, one can leave the question open whether it is better to accept such a confusion of geographical information than to leave a perfect blank on the map. Some of the information collected from the natives by the Pundits, and which I have tried to use for geographical conclusions, both in my 'Scientific Results,' vol. iv., and during my last journey, have proved to be so utterly wrong, that I should very much have preferred if the map had been left blank. On the other hand, I am glad to express my greatest admiration for those parts of the map where the Pundits have really been, and for their mapping of parts of Tibet which they have seen with their own eyes, and which are always very correct.

On the north of the white patch we have Nain Singh's, Littledale's, and my own routes, and south of these a perfect *terra incognita*; then to the east we have Nain Singh's dotted lake, Tede-nam-tso, which he did not visit, only heard of. The situation is about correct, the real name is Teri-nam-tso, and the lake is oblong from east to west, not from north to south. Ngangon-tso nobody had ever heard of; Dangra-yum-tso is much too big on Nain Singh's map; it is wandered round in five days by pilgrims on foot. The Mun lakes, which never have been visited by any explorer, seem to be situated west of southern Dangra-yum-tso, not south of the lake, where, instead, the great Shuru-tso is situated.

South of the central lakes, Nain Singh's map is extremely fantastical, which must be excused, as he has never visited that part of Tibet. It would have been far better to leave the map blank here than to enter the "Dumphu or Hota Tsangpo" on it. Even in this region all water runs to the upper Brahmaputra, not to Kyaring-tso. There is an Ota-tsangpo coming from the watershed of Trans-Himalaya straight south of Kyaring-tso, but it is very short, and it runs straighter north. Dobo-doba-tso nobody had ever heard of. Daru-tso I have only been able to see from a pass; both the name and the form are, however, wrong. I do not know why the lake Tsiku-tso is not entered on the map "Tibet and," etc., of 1906, as this lake really does exist.

In the south finally, both Ryder's excellent map, which has never been surpassed by any other traveller in Tibet, the map of 1906, and the map in Rawling's "The Great Plateau," give the watershed of the upper Brahmaputra in a perfectly wrong way. The great peaks which are seen from the north along the river, and which were measured by Ryder and Wood, are by no means situated on the watershed, but south of it. The courses of Chachu-tsangpo and of Charta-tsangpo (Chaktak-tsangpo is the real name) are quite wrong, but they are marked with dotted lines, which was quite right, as nobody had ever been in the interior of the so-called "Dokthol province."

It is a very extraordinary fact that a patch of some 65,000 square miles could remain unexplored anywhere on the Earth's crust—except the poles—so late as in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Demchok
R. Indus
Gartok
Chaaring Tso
Kailas Pk
Rakas Tal
Manasarowar
Nanda Devi
Gurla Mandhata
T I B E T
Dangra Yum Tso
Kyaring Tso
Zilling Tso
Tengri Nor
Waterparting according to Dr. Sven Hedin
Waterparting according to Trelawney Saunders
Waterparting according to Col. Burrard
LHASA
Tsangpo
Yamdrok Tso
Tsangpo
Dhwlagiri
Sands R.
H I M A L A Y A S
Mt Everest
Gaurisankar
Kangchenjunga
Arun R.
Gandak R.
SIKHIM
B H U T A N
Sketch Map of
SOUTHERN TIBET
Natural Scale 1:7 500 000 or 1 Inch = 118 Stat. Miles
50 0 50 100 Miles

1906. The following quotation was written in the summer of 1905, and contains my own views on this great unknown country: "In the south the circumstances are different. The shape of Nain Singh's lakes alone suggests that the mountain ranges are there built up with less regularity. They also lie closer together, are in general smaller, but at the same time much steeper, and abound in hard rock. Of this country we possess but the scantiest information, having no knowledge even of what its broad features are like. Within the very last year or two, the extreme south of Tibet, *i.e.* the valley of the Tsangpo, has been reconnoitred by the members of the English expedition, but the whole of the extensive region between that valley and my route to Ladak is an absolute *terra incognita*, and it is just in this broad gap between the central plateau and the valley of the Tsangpo that the forms intermediate between the two are to be found. The investigator who should, therefore, attempt to set forth the general architectural features of the Tibetan swelling would be certain to lose himself in this very gap in guesses and theories devoid of all foundation. Rather than expose myself to such a risk, I have resolved to study that unknown region with my own eyes on the spot. It is only when this gap has been filled up, and the white patches on our maps have given place to new groups of lakes and new mountain ranges—which, in consequence of their altitude, exercise such a profound influence upon the distribution of the rainfall in Central Tibet—and to new rivers, it is only then that the attempt to convey a faithful picture of the morphology of the Tibetan highlands, and to get to the bottom of the genetic causes of the existing surface forms, can be successfully carried out; for it is only then that the necessary material will be available, and the necessary general view of the whole, without which it is impossible to write a physico-geographical monograph of any value. In these circumstances, therefore, I prefer to postpone giving a general account of the country until after my return from the journey upon which I am now about to start." *

The wish to continue my explorations of unknown Tibet, which I have expressed in these words, has now been realized to a much greater extent, and with richer results, than I had ever dared to hope when I left home. It may be a great temptation to sit down comfortably in one's study and build up theories and hypothoses about the most plausible geographical lines of an unknown country, but it is very dangerous to do it, and all those who have tried to arrange the mountain ranges of the "Dokthol Province" have proved to be utterly wrong. It does not need very much intelligence to presume the existence of mountains within the white patch north of the Tsangpo; it is more difficult really to go there and make a map of the country, and only the explorer who does it and brings back a map of the country with him, only he has discovered the mountains, lakes, rivers, and other geographical characteristics of the same country.

In the following pages I have collected some of the information we possessed of the parts of Tibet I have this time visited. The quotations are by no means to be regarded as complete, as I have not had very much time since I returned on January 17, and this paper is only a preliminary one; the complete scientific discussion must be left to my next scientific work. The greatest difficulty for me is now that I cannot possibly enter upon any detail of my own work, which consists of 6200 pages and more than 900 sheets of map, but everybody will easily understand that it must take years to digest the new material.

H. Strachey says,† "The river which drains the greater part of West Nari to

* The author's 'Scientific Results of a Journey in Central Asia, 1899–1902,' vol. iv. pp. 607, 608.

† *Journal*, vol. **23**, 1853, "Physical Geography of Western Tibet," p. 7.

the north-west, called by the Tibetans Senge-tsangspo, *i.e.* Lion river, is now well established (Vigne, Young) as the chief source of the Indus, a fact which English geographers have had to rediscover for themselves within the last half-century, though I find it distinctly stated in a book written by a Tibetan monk 250 years ago. . . . (p. 9) A few (of the many tributaries) are so great as to form an absolute break through the outermost ranges of the snowy mountains and make the sources of some of the Indian rivers absolutely Tibetan or trans-Himalayan. . . . As none of our modern travellers have visited any part of the great transverse watershed that divides the heads of the river Tachok from those of the Langchen and Senge rivers, or Nari-Mangyul from Nari-Khorsum, for any vague idea of its character, we are left to our own conjectures and native report. . . . (p. 36) The basin of the Langchen is lacustrine in its upper part, containing the Konkya lake in Horba without active effluence, and Tso Mapham and Langnak in Kangri with a partial or intermittent one. . . . (p. 37) The watershed between the Indus and Sutlej has a running length of nearly 500 miles, measured from the supposed position of Maryum La to the north-west extremity of sPiti. . . . (p. 38) Little or nothing is known of the furthest sources in Seng-Tot or elsewhere, and the estimate of 50 miles for the remaining course depends upon native reports and conjecture. . . . (p. 39) Its (Sutlej) sources are somewhat complicated (as imperfectly known to us), lying between the Chukar from the Indian Himalaya on the south, the Ser Chu or other streams from the mountains of Kangri on the north, and the effluence from the lakes Mapham and Langak on the east, the two first being permanent, and the last partial or intermittent. The Chukar is said to be as large as the united rivers of Mensar and Tirthapuri, when swelled by the melting of the Himalayan snow in summer; but we do not know whether it maintains this superiority on the average of the year, nor whether the intermittent contribution of the lakes be equal to the permanent effluence of the Ser Chu or other rivulets direct from the Kangri mountains. . . . (p. 49) Its (Mansarowar) effluent runs through an opening in the hilly isthmus into the western lake; I found it a swift stream 100 feet broad and 3 feet deep in October, and its exit from the lake was seen by Mr. Winterbottom and my brother, Richard Strachey, from a height a few furlongs off; though Moorcroft crossed this very place without finding the stream, even in August, the time of highest flood, whether from its being then dry or from its percolating through a bar of shingle close to the lake, as asserted by some of my native informants, is not apparent. The effluence (from Langak to the Langchen river) is from the north point, which I crossed, however, in October without finding any running stream, or any marked channel for one, though the flatness of the ground, its partial inundation in shallow pools, and obvious descent of the level towards the river, entirely corroborated the native accounts of an intermittent effluence in seasons of flood."

These are the chief characteristics of the geography of this interesting country round the Holy lake, which were known in H. and R. Strachey's time. I will specially point out the following: Strachey knew that the eastern branch was the head branch of the Indus, and his estimate of 50 miles to the source depends upon native reports and conjecture. And so it has remained until I discovered the source in September, 1907. Strachey uses the orographical signification of Trans-Himalaya, which has afterwards been adopted by several other geographers, Cunningham, Godwin Austen, Montgomerie, Richthofen, and others. Strachey is quite right in allotting the lacustrine region to the region of the Sutlej river, and he quite rightly regards the question of the sources of the Sutlej as a complicated one. I cannot now enter upon this problem, as it would carry me too far, and I have no time now to consult my maps and my detailed measurements of the volume of water in every single tributary, both to the lakes and from the southern slopes of the western parts

of the Trans-Himalaya. It is of great interest to note that Moorcroft in 1812 did not find any channel between the two lakes, but Strachey found a rather considerable stream, and then Strachey touches upon the interesting question of a possible subterranean connection between the lakes. My own conviction is that there still remains a subterranean effluence from Tso Mavang to Langak-tso, and that the water then continues underground from the last-mentioned lake to Dölchu-gunpa and reappears in the old bed of the upper Sutlej. It is a physical necessity that such an effluence must exist from both lakes, because if there were none the water of the lakes would be salt, or at least somewhat brackish, and in reality it is as fresh as any river- or spring-water. So I regard the source of the Tagi-tsangpo, situated two days' march east-south-east of Tso-Mavang, as the real source of the Sutlej, or, as I have called it, its genetic source. On Strachey's map this river is fairly correctly entered, although its upper part is marked by a dotted line on Ryder's map, and on "Tibet and the Surrounding Regions." On Strachey's map there is a considerable mountain range entered north-east of Kailas, and the sources of the Indus are marked by dotted lines.

I now come to Nain Singh's remarkable journey of 1865,* described by Montgomerie. Amongst the results he mentions is the "fixing generally the whole course of the great Brahmaputra river from its source near Mansarowar to the point where it is joined by the stream on which Lhasa stands."

He is wrong in regarding (p. 146) the "Mariham-la" (= Maryum-la) as the watershed between the Sutlej and the Brahmaputra. "From the Mariham-la the road descends gradually, following close to the north of the main source of the Brahmaputra, and within sight of the gigantic glaciers which give rise to that great river. At about 50 miles from its source the road is for the first time actually on the river. . . . (p. 211) The river Brahmaputra was ascertained to rise in about north latitude $30\frac{1}{2}°$ and east longitude 82°. . . . The general direction of the river's course during the first 50 miles was, however, quite unmistakable, owing to the gigantic range visible to the south of it, the large glaciers which filled every ravine of that range evidently forming the sources of the river. . . . From Tamjan there was a good view up the river for a considerable distance. The Tibetans all agreed in saying that it was the main branch of the river."

Neither Nain Singh nor Montgomerie gives a quite clear and unmistakable view of the situation of the real source of the Brahmaputra. Even in the title of the paper the source is placed at Maryum-la, which was crossed by Nain Singh, whereas he did not investigate the real head branch, Kubi-tsangpo, at all. But he says that evidently the sources of the river were situated in the gigantic range visible to the south, and fed by its glaciers, which, in reality, is the case. On his map the Kubi-tsangpo is very incorrect. The map of Ryder is here a very great improvement, but not quite correct, as Rawling and Ryder and their party had no opportunity to follow the head river up to its source. So when I came to this neighbourhood I could not possibly regard the problem of the situation of the source of the Brahmaputra as finally solved, as nobody, except the Tibetans themselves, had ever been to the source and fixed its position astronomically, and measured all the branches and mapped the country round. I must point out, in this connection, that modern scientific geography demands more of an explorer than that he simply says that the source of a river is evidently situated here or there, without going and checking the opinion, which, of course, may be a mistake. Before the map and the measurements are brought home, the personal opinion of the explorer is only of

* 'Nepal to Lhasa, and thence through the Upper Valley of the Brahmaputra to its Source,' vol. 38, 1868, pp. 129 *et seq.*

a relative value. And if the question of the situation of the Brahmaputra's source should have been solved by somebody before, in a critical and scientific way, I should, of course, never have cared to try and penetrate to it. So no European, and no native explorer, has ever been to the source of the Brahmaputra, nor mapped the country round it, until I fixed the place in July, 1907.

On Nain Singh's map there is no connection between the two lakes, but a dotted line from Langak-tso marks the bed of the Sutlej. He makes the Tokchen river greater than the river from south-east (= Tagi-tsangpo), which is wrong. South-east of Mansarowar he has a range running south-west to north-east, which does not exist in reality. He has Mount Kailas on the range of Trans-Himalaya, instead of south of it. East of Charta-tsangpo he has a "high snowy range," and north of Raga-tsangpo another range. Those belong to the Trans-Himalayan system, but are not the head range.

Then follows Montgomerie's "Report of the Trans-Himalayan Explorations in 1867."* "The routes have also defined the courses of both the upper branches of the river Indus from near their sources to their junction, and the conjoint stream from that point into Ladak. Neither of these branches had been previously surveyed in any way, except a small portion of the Gartok branch above Gartok, which had been roughly laid down by Moorcroft. The existence of the eastern branch was doubted by many geographers (it was indicated from native information by H. Strachey on his map), as no Europeans had ever seen it. The Pundit's route has now proved that this eastern branch is the main stream known to the natives as Singhi-chu or Singi Khamba (Lion's mouth), the river Indus itself, whilst the other branch, hitherto generally supposed to have been the main stream, is much smaller than the eastern one, and invariably called the Garjung-Chu. (p. 160) The actual source of the eastern branch or main stream of the Indus was not reached, but the people between Giachuruff and Yiachan said it rose at a place called Gangri-Goorgiap, which may perhaps refer to the Gangri or Kailas peak, but the direction of the course of the Indus, as seen from near Yiachan, pointed rather to the east of that mountain. . . . At the highest point visited the Indus was still a considerable stream. At Giachuruff the ford was always a difficult one, and for eight days after the fall of snow the Pundit experienced, the river was not fordable in any way."

From the map it is easy to see that the Pundit of 1867, on his way to Tok-jalung, crossed the Indus some five days' march from the source. Singi-chu and Singi-kamba mean the river Indus. Singi-kabap, or "the mouth (from which) the Lion (river) issues," is the name of the very source of the Singi-chu, or Indus. Since the Pundit, no explorer has ever been in the country of the uppermost part of the Indus; and as Mr. Calvert, on his very interesting journey, never went to the uppermost part of the Singi-chu, the discovery of the source of the Indus was left to be made by me. Just below the source the Pundit would not have found the same difficulties in crossing as he found at Giachuruff—he would almost have been able to jump over the source-branch. There are several small brooks joining the source-branch, just a little below the source, and their sources, being situated on the northern slopes of the Trans-Himalayas, are longer than the source-branch itself. But as they are frozen and dead in winter, whereas the source-branch always carries water the whole year round, the Tibetans are quite right in calling the Singi-kabab the real source of the Indus. Thus, of course, it was a great mistake to presume that the Indus came from the Kailas peak, the neighbourhood of which drains exclusively to the Sutlej. (p. 161) The Pundit heard of the Shellifuk (= Selipuk) district, which "boasted of some streams, but they all run into a large inland

* *Journal* of the R.G.S., vol. **39**, 1869, p. 158.

lake." The streams are, of course, Lavar-tsangpo and Aong-tsangpo, and the lake Nganglaring-tso.

In the *Journal* of the R.G.S., vol. **45**, 1875, it is stated that the "map of southern Tibet has in our region of Ngari Khorsum not undergone any changes at all from the former;" and on p. 301 we get some information about the "range called by Hodgson the Nyenchhen-thangla chain. . . . The Tsangpu or Brahmaputra traverses the whole region from west to east, and receives tributaries from the Nyenchhen-thangla range on the north, and the northern slopes of the Himalayan outer and inner chains on the south." Hodgson had no personal experience of the country, and it may be regarded as a matter of taste whether Nien-chen-tang-la separates southern from northern Tibet or not. At any rate, it is more correct to say that it is a watershed between Tengri-nor and the Brahmaputra, and, further east, a watershed between the Salwen and the Brahmaputra; and one has always to remember central Tibet as situated between the northern and southern parts of the country.

In his "Narrative," etc., in the same volume * Mongomérie says, "During 1871 a party was organized with a view to exploring some portion of the unknown regions north of the Tibetan watershed of the upper Brahmaputra," and in his memorandum, etc., he says,† "Amongst other attempts to explore the various countries beyond the borders of British India, I have always borne in mind the necessity to explore the vast regions which lie to the north of the Himalayan range, from E. long. 83° to E. long. 93°, and I have consequently, from time to time, tried to get more information as to this *terra incognita;* but since the Pundit made his way from Kumaon to Lhásá, I had not till lately succeeded in getting much advance made to the north of his line of explorations, though a good deal was done to the north of the Mansarowar lake. One explorer made his way from Rudok, on the Pangkong lake, to Thok-Jalung, and thence back to the Mansarowar, passing quite to the east of the great Kailas peak. The same explorer subsequently made his way to Shigatse, but he was unable to penetrate to the north of the main course of the upper Brahmaputra. Though disappointed with this, I continued to try and get an explorer to penetrate into those regions, and after many failures I have at last the satisfaction to be able to report that some progress has been made in exploring to the north of Shigatse and Lhásá. (p. 326) To the south the lake (Tengri-nor) is bounded by a splendid range of snowy peaks, flanked with large glaciers, culminating in the magnificent peak, Yang Ninjinthanglá, which is probably more than 25,000 feet above the sea. The range was traced for nearly 150 miles, running in a north-easterly direction. (p. 328) The proof of the existence of a great snowy range to the north of the Brahmaputra is interesting, the Himalayan system, even at that distance, say 160 miles from its base in the plains of India, showing no signs of getting lower . . . . The route followed by the explorer from Dam-Niargan to Lhásá is the route by which Messrs. Huc and Gabet must have approached that city . . . ; one northern tributary of the upper Brahmaputra has been thoroughly explored, thus giving us some idea as to how far back the northern watershed of this great river lies."

It is interesting to find that Montgomerie regards it as a "necessity to explore the vast regions" north of the Tsangpo, and he is right in calling it a *terra incognita;* and so it has remained, except the part between Tengri-nor and Brahmaputra, to which he was able to send out some of his "Trans-Himalayan explorers." Already then, and later on through Krishna, Littledale, Ryder, and de Lesdain, the existence of a magnificent range on the southern shore of Tengri-nor was proved. And thus Montgomerie was able to fix the situation of the great watershed. But he

* *Journal* of the R.G.S., vol. **39**, 1869, p. 35. † *Ibid.*, p. 325.

had never the satisfaction to see the vast country between 83° and 89° E. long. penetrated by any one of the Pundits, and so it has remained until I was able to cross the country and the great watershed on several different lines in 1907 and 1908.

Now I come to Trotter's report on Nain Singh's journey from Leh to Lhasa.* On p. 105 he speaks of Targot Lha, from which extends eastward a snowy range, numerous peaks in which were fixed by the Pundit, along a length of 180 miles, up to where the range terminates in a mass of peaks called Gya'kharma, which also lie to the south of and very near the Pundit's road. . . . This range is probably not the watershed between the basin of the Brahmaputra and the lake country of Hor, for the Pundit was informed that to the south of the range, running parallel to it, is a large river, the Dumphu, or Hotá Sangpo, which ultimately changes its course and flows northwards into the Kyaring lake. . . . (p. 110) The largest river crossed by the Pundit in this section of his travels was the Dumphu, or Hotá Sangpo, which receives the drainage of the southern slopes of the Targot-Gya'kharma range of mountains, and flows into the Kyáring Cho, forming one of the numerous sources of the Nák-chu-khá."

The Targot Lha is identical with Targo-gangri, a magnificent snow massif standing south-east of Dangra-yum-tso, and with its northern extremity reaching to the very shore of the lake. There may, of course, be a Targo-la also somewhere in these mountains, but the complex is perfectly isolated from the range to the east, upon which Nain Singh found the peaks of Gya'kharma. He is quite right in saying that this range, culminating in Gya'kharma is not the watershed between the Brahmaputra and the lake region, which I have called the "Central Lakes of Tibet." I have already mentioned above that the information the Pundit got about Dumphu or Hota-Sangpo is quite wrong, which I was able to control very closely when I crossed the unknown region from Ngangtse-tso to Ye-shung on the Brahmaputra. From the head range of Trans-Himalaya the water goes north to the lakes, Targo-tsangpo, Tagrak-tsangpo, Bara-tsangpo, Ota-tsangpo, etc.,† and those rivers break through the range, which he calls the Targot-Gya'kharma range, in transverse valleys; to the south all the water goes to My-chu-tsangpo, which is a tributary to Raga-tsangpo, and one of the greatest of the tributaries which reach Brahmaputra from the north. The range, which is a continuation of Targo-gangri, goes to the south-west, west, and north-west, and forms here the main watershed, and I crossed it at Sangmo-bertik-la in May, 1908. South of Kyaring-tso the main watershed is situated considerably south of the Targot-Gya'kharma range; the pass Khálámba-la of the G.T.S. explorer of 1872 gives an idea of the situation of the great watershed in this part of Tibet, and as a matter of fact Khálámba is situated in the range which is the immediate south-west continuation of Nien-chen-tang-la. About this range Markham says,‡ "Great Tibet . . . (is bounded) on the north by another lofty range, called by Hodgson the Nyenchhen-thánglá chain, which separates the country of villages and cultivation from the nomadic hordes on the still loftier plateau of lacustrine drainage between that chain and the Kuen-lun."

Godwin Austen says in his article, "The Mountain Systems of the Himalaya," etc., p. 86 §, "I leave it to future travellers and those who know the country, to work out this subject still further and with greater exactness, and after a closer examination of the country than I was ever able to give it; and I leave it especially to those who may have the good fortune to visit the middle and eastern portions of the Himalayas, and that great *terra incognita* beyond." On p. 87 he mentions

* *Journal* of the R.G.S., vol. **47** (1877), pp. 86 *et seq.*

† For the last two mentioned Nain Singh has Pára and Hota.

‡ 'Travels in Great Tibet,' etc., *Proceedings*, vol. **19**, 1874, p. 327.

§ *Proceedings*, vol. **6**, 1884, pp. 83 *et seq.*

Mr. Trelawnay Saunders' Aling Ganghri, or his own Trans-Indus extension, and he continues, "It is then carried south to unite with the high range north of the Manarasowar lake, and is there continued east as a range north of, and parallel with, the Sangpo. It is unnecessary to define it further, for the topography does not exist from which we can lay down such lines."

Thus Godwin Austen, in 1884, calls the country north of the upper Brahmaputra a *terra incognita*, and says that the topography does not exist from which we could be able to lay down the watershed. And so it remained, until I succeeded in crossing the watershed in this very region by seven different passes, to which are to be added three more further west, one of which had been crossed by Calvert only, the two others by many travellers. So for the Trans-Himalaya, the lines laid down upon Godwin Austen's map, illustrating his article, are hypothetical, and of no real scientific value. Here, in Trans-Himalaya, he includes the northernmost water-dividing range of the Himalayas, and all the ranges between the upper Brahmaputra and Nain Singh's route, and joins together ranges of three different mountain systems under one general name. But it may be that he puts into Trans-Himalaya the same meaning as Montgomerie obviously does—namely, all the mountains and regions which are situated on the other side of the Himalayas, and only under such conditions the name of Trans-Himalaya could be used at a time when nothing was known of the topography and orography, and when the country was a real *terra incognita*. On his map, Godwin Austen has also marked with a dotted line the "Gangri of Mr. T. Saunders," which is meant to be the chief watershed. It is, of course, simply hypothetical, and only for the part south of Tengri-nor, Nien-chen-tang-la, correct; all the rest is wrong.

During his remarkable journey of 1879–82, the famous Pundit Krishna* must have crossed the eastern part of Trans-Himalaya at least twice, but I cannot make out now whether his passes Koli-la and Nub-Kong-la are situated in the water-dividing range or in ramifications.

It is remarkable how very meagre the Society's publications are in matters Tibetan. Only occasionally one comes across an article about a journey or about some special item of this interesting country. One of the most interesting articles is written by Tanner, under the title of "Our Present Knowledge of the Himalayas."† Here we find the following truth: "I here remark that the moot question as to whether the Sutlej actually issues from the Manrasowar lake or not, does not appear to have been definitely settled, though controversies have been raised on the point, and notwithstanding that more than one Englishman has actually been along the supposed bed as far as the lake." To this I will only remark that, during my long stay at Tso-mavang and Langak-tso, I was able to solve this problem definitely, and to add a good deal of direct observation material to the excellent work of Ryder and Rawling's expedition.

After the interesting paper of Captain (now Colonel) Bower, "A Journey across Tibet,"‡ we find the following remarks by Delmar Morgan: "The paper we have listened to is one not only of great geographical interest, but of great importance, because it shows what may be done by a European in the Trans-Himalayan country. It has been stated, and frequently reiterated, that access to these regions is impracticable, owing to the obstinate exclusiveness of the natives or their rulers, and that if it is to be explored at all in the interest of science it must only be by trained native surveyors. I have always been of opinion, and have before remarked here,

* Walker, "Four Years' Journeyings through Great Tibet," etc. *Proceedings*, vol. 7, 1885.

† *Proceedings*, vol. 13, 1891, pp. 403 *et seq.* ‡ *Geogr. Journ.*, vol. 1, 1893, p. 406.

that these natives, however valuable some of their work may be, and however carefully trained in the use of instruments, cannot bring us that accurate information as to these countries which we require. They seem to lack that spirit of critical inquiry, and that fertility of resource, that distinguish the European traveller. . . ."

I quite agree with Morgan: the work of native explorers is not sufficient from a scientific and critical point of view, but as pioneers they have almost always proved to be admirable, and in some cases we have had to be indebted to them during some forty years for all our knowledge of certain parts of Tibet. In his "Note on the Royal Geographical Society's map of Tibet," * General Walker says, "On the south the information has been wholly taken from the Trans-Himalayan operations of the native explorers attached to the Indian Survey . . .;" and to this Major Ryder adds,† "Our knowledge of the country lying between our frontier and Lhasa depended chiefly on the surveys executed by different explorers trained by and working under the supervision of officers of my department—the Survey of India. They worked under extraordinary difficulties, and in great danger of their lives; that, when at last we have been able to carry through a regular and systematic survey of the country, we have not been able to find that the rough maps prepared from these explorers' surveys were in any important points other than very fairly accurate, reflects the very highest credit on these men, notably the late Pundit Nain Singh and the explorer A.K." I have already stated my opinion of the Pundits, and I should like to point it out in the following way: Their topographical work is excellent in giving us a rough idea of the country; the information they have gathered from the natives is almost worthless, and the result of their different journeys can hardly be used for scientific purposes.

In the above quotations it is interesting to note that Morgan talks of the "Trans-Himalayan country," and Walker of the "Trans-Himalayan operations." The word Trans-Himalayan is thus very vague and diffuse; everything beyond Himalaya seems to be Trans-Himalayan country—operations and explorers.

From the last ten or twelve years I have picked out of the *Geographical Journal* some more quotations on the parts of Tibet which I have explored. In the description of his journey, Littledale says,‡ "On the south it (Nam-tso) was fringed by the magnificent range of the Ninchen-Tangla—a succession of snow-clad peaks and glaciers, partially hidden in clouds and vapour, which added to their size and grandeur; while above all towered, with cliffs of appalling steepness, the great peak of Charemaru, 27,153 feet." Littledale crossed this part of Trans-Himalaya by the pass Guring-la.

Speaking of Tso-mavang and Langak-tso, Holdich says,§ "We are indebted chiefly to the brothers Henry and Richard Strachey for our mapping of the two lakes, and those gentlemen are the authorities for that connection between the lakes which is shown in some maps, and should be shown in all." And Richard Strachey himself says,‖ "From the height to which we climbed we looked down on the stream that connects Manasarowar and Rakas-tal." In the summer of 1907 and in the summer of 1908 there was not the slightest visible connection between the two lakes. I will try later on to point out the cause of the very different information of different travellers on this subject.

Again a quotation from Holdich:¶ "Meanwhile, there is no more promising field still open to the *bonâ fide* explorer than that of Tibet and the farthest ranges of the Himalayas. Few people are aware how vast an extent of the Himalayan

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* *Geogr. Journ.*, July, 1894.
† *Ibid.*, October, 1905, p. 369.
‡ *Ibid.*, 1896.
§ *Ibid.*, 1898, p. 588.
‖ *Ibid.*, **15**, 1900, p. 395.
¶ *Ibid.*, **20**, 1902, p. 415.

area still remains untrodden by any European." In connection with this I must quote what Sir Clements Markham said after Littledale's paper: * "I am sorry to say that on the map we have to-night that chain of mountains does not appear, which only shows how important it is that further exploration should be conducted in Tibet. I have called that range the northern range of the Himalayan system. I remember Mr. T. Saunders was anxious to name it, and he has done so on a map he drew for me, the Gangri range, after the knot of peaks which connects it with the Karakorum; but B. Hodgson has called it the Nyendim-tang-la, as does also Mr. Littledale himself. These mountains are of the greatest possible importance and interest; they have only been crossed by native explorers and by Mr. Littledale opposite the Tengri-nor, and in the whole length from Tengri-nor to the Mariam-la pass no one has crossed them, so far as we know. One of the last suggestions by General Walker was that a rough survey should be undertaken of these northern parts of the Himalayan system, and I believe that nothing in Asia is of greater geographical importance than the exploration of this range of mountains, which I trust geographers will agree to give some name to. . . ."

Another President of the Royal Geographical Society has been aware of the great necessity to explore the unknown parts of Tibet, namely, Sir G. Goldie, who says in his "Address to the R.G.S., 1906," † "To us, as British geographers, it is somewhat tantalizing that the British Government has declined to grant permission to experienced British officers to enter Tibet or to explore the unknown reaches of its great rivers; but this is not the place for either approval or condemnation of the policy on which this decision is based."

I now come to Ryder's most interesting paper on the "Exploration and Survey with the Tibet Frontier Commission, and from Gyangtse to Simla *viâ* Gartok." ‡ On p. 387 he says, "We now followed the river (Brahmaputra) valley for a week or so, always in the same large plains, until we could see the watershed range ahead of us, from the valleys of which innumerable streams issue to form the Tsangpo, the largest coming from a snowy range to the south-west." From this one gets the impression that this largest stream was regarded as the source branch of the Brahmaputra, but a few lines lower down, on crossing Mayum La, Ryder says, "We had now finished with the Tsangpo, having surveyed it from Shigatse to its source," whereby Maryum-chu, coming from that pass, seems to be regarded as the source branch. And this view is also emphasized on p. 390, where Ryder gives the following *résumé* of his and his comrades' work: "We surveyed the Tsangpo from Shigatse to its source, surveyed the Mansarowar lake region, and settled the doubtful points connected with it, which have been the subject of much discussion; we completed the survey of the Sutlej river from its source to where it enters British territory, and surveyed the source of the Gartok branch of the Indus." So from this it is not quite clear which branch Ryder regards as the real source of the Brahmaputra. And this fact gave me the idea of visiting the real source, as I had Ryder's paper with me. In an article § on my last journey, Ryder says, "Sven Hedin also visited and surveyed the true source of the Brahmaputra. This, however, had been approximately located—I think by Nain Singh—and fairly well surveyed by Rawling and myself, though Sven Hedin, having actually visited the real source, his map will be more accurate."

It is of no very great importance, really, if you call my journey to the true source of the Brahmaputra a discovery or not, but the fact will always remain that even the few Europeans who have ever been in this part of Tibet before me

* *Geogr. Journ.*, vol. 7, p. 482.

‡ *Ibid.*, vol. 26, 1905, pp. 369 *et seq.*

† *Ibid.*, vol. 28.

§ *Ibid.*, vol. 32, December, 1908, p. 590.

sometimes call one branch, sometimes another, "the source of the Brahmaputra"; and that nobody knew whether the river originated from one or several glaciers, or from a glacier lake, or whatever it was like. I gave myself the trouble to measure with boat and instruments the volume of water in all the upper branches, and, finding the Kubi-tsangpo 4½ times as big as the Mariyum-chu, I followed the Kubi-tsangpo up to a point where it is formed by two rivers, the biggest of which is still called Kubi-tsangpo. Then I followed this river further up to the very front of three great glaciers, all of them having different names, and the westernmost being the real source of the Brahmaputra. All this was new to geography, as neither Nain Singh nor any of the members of the Gartok mission had ever been up the Kubi-tsangpo; approximate discoveries, which are not made on the very spot, are not sufficient, at least not from a scientific point of view.

As to the Mansarowar problem, and the problem of the real or genetic source of the Sutlej, I do not quite agree with Ryder—or rather, I believe I have added some more points of view to his very excellent and careful observations. I regard the source of the comparatively big south-east river, Tagi-tsangpo, as the source of the Sutlej, at any rate as one of its sources, if the three rivers from Trans-Himalaya, which join the Sutlej a little above Tirtapuri-gunpa, also are to be regarded as source branches—and this must be a question of the volume of water as an average of the whole year. But as these three rivers are more temporary, depending upon the season of the year and upon the rains, whereas the effluent from Rakas-tal is constant, although underground, I regard the Tagi-tsangpo, the greatest river falling into the Mansarowar, as the real genetic source.

At this conclusion we can arrive only by measuring all the rivers falling into the two lakes, and I have measured every one of them; and at the source of the Tagi-tsangpo no European or native explorer had ever been before, and on Ryder's map this river is, in its upper part, marked with a dotted line, although this line goes a little too far to the east. Ryder gives a very complete and correct history of the hydrography of the lakes as given by different travellers, and he himself found that Strachey was quite correct. "No water was flowing at this time of year, but the local Tibetans all agreed that for some months in each year there was a flow during the rainy season and the melting of the snows, *i.e.* about from June to September. As a rise of about 2 feet in the level of the lake would cause water to flow down the channel, this appears quite worthy of belief." Now this is different in different years. In 1907 not a drop of superficial water went from Mansarowar to Rakas-tal, which may have depended upon the fact that that year almost no rain at all fell in this part of Tibet. In 1908 a good deal of rain fell, but on account of the preceding year being so dry, it had no force to swell the Mansarowar sufficiently to cause some superficial effluent. But the underground effluent continues even in dry years. In the summer of 1904, however, that is to say a few months before Ryder's visit, there was really a superficial effluent from Mansarowar, as the lamas of Tiju-gunpa told me, and this temple is situated on the northern bank of the channel, just above the bridge which still crosses the bed, and is in a very good state of repair. Many Tibetans told me they remembered very well the days when it was impossible to cross this effluent on horseback, and the existence of the bridge proves that they are right.

As an addition to Ryder's history of visits and views about Mansarowar, I may add the following from Pearse's article on "Moorcroft and Hearsey's visit to Lake Mansarowar." * "Mr. Moorcroft . . . found reason to believe that the lake has no outlet. His stay, however, was too short to allow of his making a complete circuit of it; and adverting to the difficulty of conceiving the evaporation of the lake's

* *Geogr. Journ.*, vol. 26, p. 182.

surface in so cold a climate to be equal to the influx of water in the season of thaw from the surrounding mountains, it may be conjectured that, although no river ran from it, nor any outlet appeared at the level at which it was seen by Mr. Moorcroft, it may have some drain of its superfluous waters when more swollen and at its greatest elevation, and may then, perhaps, communicate with Rowan lake, in which the Sutlej takes its source (!), conformable with the oral information received by our travellers."

Hermann von Schlagintweit takes the following perfectly correct view:* "Die ganze breite Stelle zeigt sich am unteren Ende als eine flache Senkung gegen Westen, versumpft, mit zahlreichen Wasserpfuhlen, deren Anordnung allerdings ganz gut damit sich verbinden lässt, dass, nach Angabe der Eingebornen, zur Zeit des Hochwassers periodisch ein normales Abfliessen hier stattfindet, also eine Ausdehnung des Sutlejbettes bis zu diesen Seen." To this I would only remark that the connection of the lakes with the basin of the Sutlej is not periodical, but permanent.

To the problem of the hydrography of the Mansarowar, Mr. Savage Landor gives this extraordinary contribution:† "It was my good fortune to make quite sure from many points that . . . the ridge between the Rakas and Mansarowar lakes is continuous, and no communication between the two lakes exists. With the exception of a small depression about halfway across, the ridge has an average height of 1000 feet all along, a fact which ought, in itself, to dispose of the theory that the two lakes are one. I also further ascertained from the natives that there is no communication whatever between them, though the depression in the ridge makes it probable that at a very remote period some connection existed. The lowest point in this depression is over 300 feet above the level of the lake." This is very curious, considering the fact that Ryder gives 2 feet only as the lowest point in the depression, which is about the same as I found.

Mr. Sherring says,‡ "It is a fact that at this present moment (1905) no water is actually flowing between the two lakes, the reason being that storms blowing from the east have thrown up sand at the mouth of the passage to a height of about 4 feet, but the best native information on the spot gives it as a fact that after heavy rains the water traverses the channel. The last occasion was eleven years ago, when exceptional rain fell, and there were floods, accompanied by great loss of life to cattle." And later on he has this very interesting communication:§ "The actual source of this river (Sutlej) is at the monastery of Dalju (Dölchu-gunpa), where there is a large spring, though a dry channel is continued up to the Rakas Tal, and in places in this channel water is found. The local statements all agree in asserting that there is an underground flow of water throughout the entire length of this dry channel, which occasionally comes to the surface, only to disappear later on. There can be no doubt that during a season of very heavy rain and floods this dry channel would connect the source at Dalju with the Rakas Tal."

The lamas of Dolchu told me that the spring was about the same the whole year round, but it is interesting to find, through Mr. Sherring, that even some of the natives seem to have found out the right explanation.

The following is what Captain Rawling says in his very excellent book about his different journeys in Tibet:‖ "Many have supposed that the Sutlej runs from this lake (Rakas Tal), and as Rakas Tal and Manasarowar are connected, it

* 'Reisen in Indien und Hochasien,' vol. 3, p. 58.
† 'In the Forbidden Land,' vol. 1, p. 257.
‡ 'Western Tibet and the British Borderland,' p. 272.
§ *Ibid.*, p. 284. ‖ 'The Great Plateau,' p. 259.

stands to reason that the Sutlej would actually originate in one of the streams that run into Manasarowar lake. To settle the question as to whether such was the case or not, Ryder and I set out at dawn the following morning with two local guides. We travelled first in a southerly direction in search of the channel, and this was eventually found some 2 miles further away than anticipated. The passage was broad and dry, and the level of the lake many feet below the bed of the channel. It was evident that no water had flowed from Rakas Tal down the passage for a considerable time, but there was nothing here to prove that such might not be the case during the melting of the snows in an exceptionally wet season. The guides and the shepherd whom we met stated that no water at the present time ever flows out of Rakas Tal, but added that during the Nepal war, about fifty years previously, the overflow took place annually. To make quite sure, we entered the channel and moved along it in a westerly direction. At places the bed widened considerably, and the dry ground was covered with a thick encrustation of salt; such would not have been the case had water flowed over it during the last few years. When 5 miles distant from the shore, we obtained from the sand-marks in the bed of the stream conclusive proof that the Sutlej rises a few miles to the west of the lake, for their arrangement indicated that at one place the rain-water, draining from the adjacent hills, runs eastwards towarde Rakas Tal, whilst a little further on other streams entering the channel flow in a westerly direction, and form the source of a river. Rakas Tal, like most Tibetan lakes, is said to be steadily diminishing in volume, and it is therefore more than probable that this sheet of water will never again overflow into the channel of the Sutlej."

My own observations during visits to the dry bed in 1907 and 1908 agree in every single detail with Rawling's, although I explain the hydrographical arrangement in a different way from him. He says that the object of his and Ryder's visit to the bed was to settle whether one of the streams that run into Mansarowar could be regarded as the source of the Sutlej or not, but that the result was that the Sutlej rises a few miles to the west of the lake. I have already shown above that I regard the Tagi-tsangpo running into the Mansarowar as the real source of the Sutlej. Rawling quite correctly observes that Rakas Tal is steadily diminishing in volume, which is also perfectly correct and obvious. But if the lake has no outlet at all, and if the evaporation alone was stronger than the influx of fresh water, and if the lake in this way was constantly diminishing in volume, it would necessarily become more and more salt year by year. I have already pointed out that the fact that the water is absolutely fresh all over the lake is proof sufficient that it must absolutely have an underground effluent, which does, however, not need to be very considerable. Above Dolchu-gunpa's big spring there are several perfectly fresh springs in the bed, which all must come from the lake alone. But as soon as the level of the lake in future shall have reached some layer of impermeable clay, this effluent will die out and the lake will become salt, and, like Panggong, cut off from the system of the Sutlej. I cannot possibly enter now upon all the details and all my different observations and measurements in connection with this most interesting and beautiful problem of physical geography, but in the near future I hope to get an opportunity to lay them all before the geographical world.

Finally, a quotation from Holdich's excellent book:* "The Indus rises on the slopes of Kailas, the sacred mountain, the Elysium or Siva's Paradise of ancient Sanskrit literature. Its long and comparatively straight course from its source at 16,000 feet above the sea, through channels running north-west through gigantic mountains, is often comparatively placid. . . . The Sutlej rises on the southern

* 'Tibet, the Mysterious,' p. 12.

slopes of Kailas. It flows no longer from one of the sacred lakes of Manasarowar, famous in Hindu mythology. Abandoning its ancient cradle in Rakas-tal, it now issues from the foothills of Kailas." Several of the above quotations show that this has been generally adopted amongst British geographers. But, as a matter of fact, the Indus rises by no means from the slopes of the Kailas, and only one of the tributaries of the Sutlej rises from the southern slopes of the Kailas. Even from the northern slope of the Kailas, from Diripu-gunpa, one has to ride one day's march to the north-north-east, to the source of another tributary of the Sutlej. Mount Kailas is thus altogether situated within the domains of the Sutlej, and the Indus has absolutely nothing to do with Mount Kailas. This proves how very little was known about the situation of the source of the Indus. And even so late as in 1905 Rawling writes about the same question,* "Formerly the main river (of the Indus) was supposed to originate from these small streams, but the Pundit Nain Singh proved, about fifty years ago, that they form but a large tributary which joins the main branch a few miles below Gartok. The Pundit was only able to follow up the latter for a few miles, *so the actual whereabouts of the source of the Indus is still unknown*, though the natives assert that it rises from the northern slopes of Kailas Parbat."

So the confusion about the situation of the source of the Indus was still greater than that about the source of the Brahmaputra. Holdich says,† "As has already been pointed out, the Brahmaputra and the Indus start from nearly the same point, the intervening watershed between their sources being called the Mariám La, in about east longitude 82°, not very far east of the Manasarowar lake." But, as a matter of fact, the Maryum-la is simply a watershed between one tributary to the Brahmaputra, namely, the Maryum-chu, and the Gunchu-tso, which is a self-contained salt lake. Holdich has obviously adopted Ryder's view of making the Maryum (= Mayum)-la, or rather the Maryum-chu, the source of Brahmaputra. On p. 265 he says, "Rawling and Ryder have lately completed a valuable geographical survey of all this country, from Gartok on the Indus to the sources of the Brahmaputra, and from those sources to the city of Lhasa." And again, on p. 296, he has a similar expression.

In his article about my fifth journey, Ryder says,‡ "The geographical results of his journey may be summed up as follows:—

"(1) The discovery and careful exploration of the Trans-Himalaya range, and the filling in of the large white space on our maps north of the Brahmaputra from Gartok to Shigatse, and the discovery of the provinces of Bongba and Chokchu, which he has been the first to discover, that of Dokthol, on the map, not being in existence.

"(2) The discovery and exploration of the source of the main branch of the Indus.

"These, I believe, are two absolutely new and most valuable discoveries."

It is too much to speak of my discovery of Trans-Himalaya. I myself have put it in the following way in the telegram which was sent to the *Times* by Mr. Hensman in Simla:§ "Dr. Sven Hedin sums up the results of his explorations as follows: My great discoveries are—first, the true sources of the Brahmaputra and Indus, and the genetic source of the Sutlej east of Mansarowar lake. Secondly, the exploration of Bongba, which I traversed twice by different routes. But the greatest of all is the discovery of that continuous mountain chain which, taken as a whole, is the most massive range on the crust of the Earth, its average height above

* 'The Great Plateau,' p. 269.
† 'Tibet,' etc., p. 233.
‡ *Geogr. Journ.*, December, 1908, p. 590.
§ *Times*, September 18, 1908.

the sea-level being greater than that of the Himalayas. Its peaks are 4000 to 5000 feet lower than Mount Everest, but its passes average 3000 feet higher than the Himalayan passes. *The eastern and western parts were known before, but the central and highest part is in Bongba, which was previously unexplored.*" And in the lecture which I gave at Viceregal Lodge on September 24, I gave the history of all the exploration in the western and eastern parts of the Trans-Himalayas, and summed up in the following conclusion: "Even if certain parts of it were known before, Trans-Himalaya as a whole geographical unity is a new conquest on our Earth, a new geographical region and signification, that has been more neglected than even the moon, and now it will be introduced for ever and evermore into the geographical literature." As to the name, I compared it with such significations as Transcaspia, Transcaucasia, Transoxiana, Transbaycalia, Transilenian Ala-tau, Transalai, and others. I have referred above to the name of Trans-Himalaya. Cunningham subdivided North-Western Himalaya into three main ranges—Trans-Himalaya, between Sutlej and Indus, Bara-lâtsha range, and Pir-Panjal range. The word was used by Montgomerie, Godwin Austen, and others for everything situated to the north of Himalaya, and so it is also used by Holdich, who says,* "One of the earliest (Pundit explorations) was also one of the best, for it opened up to us a new era in Trans-Himalayan knowledge." And on p. 232, he talks of "the Trans-Himalayan explorer." It again appears in David Fraser's 'The Marches of Hindustan, the Record of a Journey in Thibet, Trans-Himalayan India, Chinese Turkestan, Russian Turkestan, and Persia.' I will also mention in this connection that in a letter to me, Prof. Supan has preferred the name Anti-Himalaya, a name which also appears in *Petermanns Mitteilungen*. But as the name Trans-Himalaya has tradition for it in the history of Indian exploration, I think it may be regarded as preferable, especially as the Viceroy of India has approved of it.

Even long before my exploration of the unknown country north of the upper Brahmaputra, any one could easily understand that there must exist *somewhere* a northern watershed of the great Indian rivers. The journey of Nain Singh in 1874 drew this problem a great step forwards, as he passed several self-contained salt-lakes, and somewhere between them and the northern tributaries of the upper Brahmaputra, there must, of course, exist a chief watershed. On several rather old maps attempts have been made to put in this watershed, as, for instance, in Markham's 'Narratives of the Mission of George Bogle to Tibet,' and of 'The Journey of Thomas Manning to Lhasa,' where we find a map drawn by Mr. T. Saunders, and on this map we find a tremendous range called Gangri mountains, as forming the watershed. If this range, which was entered also upon Godwin Austen's above-mentioned map, had had any foundation in real exploration work, we should never have needed to visit the country north of the upper Brahmaputra any more, but unfortunately it is perfectly fantastical and utterly wrong, and belongs to that category of geographical discoveries which are accomplished at the writing-table at home. It has the same value as the tremendous range on the same map which runs north-east from Tengri-nor, and does not exist in reality, or as the information "Turki tribes" in the very heart of Tibet. The Gangri mountains of Saunders are drawn as *one* continuous range or chain. In reality the Trans-Himalayan system consists, in its central part, of at least ten different ranges, to which I have given different names, and several small ranges. Through this orography the curious arrangement results that the watershed of Northern India runs over from one range to another, and very often is situated in a latitudinal valley between two ranges. Nobody had ever suspected, and for my own self I

* 'Tibet,' etc., p. 228.

had never believed, that the orography of this part of Tibet would be so extremely complicated as it has proved to be. The Gangri mountains of Saunders are broken through by the Charta-tsangpo in a transverse valley, a mistake which we find still on the R.G.S.'s map of Tibet, published in 1906. The Charta-tsangpo begins on the southern slopes of Trans-Himalaya in several small branches which all run into the lake of Lapchung-tso, from which the main branch of Charta (or rather Chaktak) tsangpo issues.

On map 8 of vol. 1 in his great work, 'China,' Baron Richthofen has three ranges north-east of the upper Indus and upper Brahmaputra, and here we find the names Aling-gangri, Karakorum, and Kailas. On the map No. 69 (p. 690) in vol. iv. of my 'Scientific Results,' I have marked out two hypothetical ranges in the unknown country north of Tsangpo. I supposed that between them was a chain of self-contained lakes, to which "Ghalaring-tso" and the Mun lakes belonged. The northern range I regarded as a watershed to the central lakes, discovered by Nain Singh, the southern as the watershed of the Tsangpo. During my last journey I have been able to prove that this hypothesis was utterly wrong.

I must mention also a few points from that most valuable and excellent work of Colonel Burrard and Dr. Hayden, entitled 'A Sketch of the Geography and Geology of the Himalaya Mountains and Tibet.' On the frontispiece map to vol. 1 we find the Kailas range running between the two branches of the Indus, and north of the upper Brahmaputra, and joining the Nien-chen-tang-la. I have no time now to enter upon a discussion of Burrard's views, which I find extremely hypothetical for that part of the hitherto unknown country which I have crossed. Mr. Longstaff* says, "This ('Kailas range') is obviously the Trans-Himalayan system under discussion," and Colonel Burrard says of it (p. 95), "Trigonometrical observations show that it joins with a range of Tibet, known as the Ninchin-thangla, in long. 88°, a point which Dr. Sven Hedin himself fully confirms." But Colonel Burrard also says, on the very same p. 95, "East of Manasarowar the Kailas range forms generally the northern rim of the Brahmaputra's trough; it cannot, however, be called the water-parting, as it is cut through in places by rivers from the north." Now, the Trans-Himalaya is nothing else than the very water-parting of the Brahmaputra trough, and thus it cannot possibly be the same as Burrard's Kailas range, as Mr. Longstaff professes to have discovered. And when he then says, "The absolutely new section of this range cannot, therefore, be taken as more than the distance between 135° W. (29° 55′ 16″ N., 84° 33′ 33″ E.) and the easterly extremity of the Kailas group in the vicinity of Mariam La, a distance of about 100 miles," I will remind him of Markham's words after Littledale's paper, "In the whole length from Tengri-nor to the Mariam-la pass no one has crossed them, so far as we know, . . . and I believe nothing in Asia is of greater geographical importance than the exploration of this range of mountains." In fact, the hitherto *absolutely unknown* part of the Trans-Himalaya which I have explored is exactly 500 miles long. But the most amusing of all is when Mr. Longstaff tells the readers of the *Geographical Journal* that Atkinson's and my own maps of Trans-Himalaya are "practically identical," regarding the fact that Atkinson has never been in Trans-Himalaya, and I have never published my maps. It is not sufficient to quote sources which have no foundation in reality. So Colonel Burrard says:† "The question may be asked whether the snowy range seen by Nain Singh to the south may not have been the Kailas range. The answer is that the snow peaks fixed by Nain Singh stand 120 miles north of the Brahmaputra,

* *Geogr. Journ.*, January, 1909, p. 97.

† *Ibid.*, p. 112.

and many miles north of any known peaks of the Kailas range. Thus the Aling Kangri peaks east of long. 81° are 100 miles north of the sacred peaks of Kailas. In long. 85° the two ranges are 100 miles apart, and in 36° N. 80 miles. The interval, in fact, between Nain Singh's range of peaks and the Kailas range is greater than between the Kailas and Ladak ranges, and if we have regard to the spans of the known ranges of the Himalaya and Karakoram, we find it more reasonable to assume that an intermediate trough separates Nain Singh's range from the Kailas than that the two apparent chains of mountains are the respective flanks of one broad range." In reality there *is* only one water-parting range, or rather system, although, as I have said before, there is a labyrinth of different ranges. But this uncertainty proves how little we really knew of the country. On Chart XVII. in his work, Colonel Burrard has left a tremendous gap between the Ninchin-thang-la range and the ranges in the far west of Tibet. This is right, as nothing was known of the geography here. On his Chart XXX. the northern water-shed of the Tsangpo ought to be removed some 50 miles further north, between long. 84° to 89°.

How little we really knew of the country north of the upper Brahmaputra I have shown in several of the above quotations. One of the greatest authorities upon the geography of southern Tibet, Captain Rawling, wrote to me, when I was in Shigatse, and expressed the theory that the northern tributaries of the Tsangpo came from the central lakes, discovered by Nain Singh. And exactly the same hypothesis is advanced by Holdich in his book, which was published *after* Rawling's and Ryder's journey: * "Judging from the great size of these northern tributaries, and the number of them, there certainly seems good reason for supposing that part of the central lake district lies within the Brahmaputra basin. There is no other way of accounting for their volume." Speaking about Littledale's route, Holdich says † that it was "probably near the northern rim of the Brahmaputra basin; . . . the fact that no large rivers are crossed seems certainly to indicate that it is here, or near here, a little to the south, that the northern watershed of India is to be found. *From some of the innumerable lakes it is probable that those big affluents of the Brahmaputra noted by Nain Singh must take their rise;* but intermediate to this long line of route through the central Chang and that of the Brahmaputra river, no traveller has yet contributed the necessary topography to enable us to decide with certainty." And, finally, Holdich says ‡ about Ryder, "It seems unlikely that he has established the position of that dividing line between the central lake region and the Brahmaputra basin, one of the most important geographical features in Asia." So even those men who had specially studied the geography of southern Tibet believed that the central lakes drained to the Brahmaputra. In reality, those lakes are self-contained, and, with two exceptions, salt. And instead of rivers streaming from them to the Tsangpo, we find between them and the upper Brahmaputra the most massive and gigantic mountain system in the world, the volume of solid stone of which must be more considerable than that of Himalaya.

On Colonel Burrard's Chart XXII., published in 1907, we find a very clear and up-to-date map of "Routes of Explorers in Tibet, 1865 to 1905." Between long. 81° and long. 89° and on both sides of lat. 33°, we find a perfectly white patch, about two degrees broad. All explorers who have been in Tibet, including "The Trans-Himalayan explorers," have carefully gone round it, as if they would purposely avoid it. And the very same white patch we find on "Tibet and the Surrounding Regions" of 1906. I have been happy enough during my last expedition to fill it up with the main northern watershed of India, with mountain ranges, rivers, lakes, temples, tribes, and roads, and to follow and map all the chief geographical lines of

* *Geogr. Journ.*, January, 1909, p. 234. † *Ibid.*, p. 284. ‡ *Ibid.*, p. 296.

this white patch, on which only one single word had been perfectly correct, namely, the word *Unexplored.*

The following communications from Sir Clements Markham and Sir Thomas Holdich were read :—

Sir CLEMENTS MARKHAM: No one can read Dr. Sven Hedin's paper on "Discoveries in Southern Tibet" without being struck by the exhaustive character of his researches. In combining this essential part of an explorer's equipment with his qualifications as a surveyor and observer, I look upon Sven Hedin as the *beau ideal* of a Victoria Medallist, most fully complying with all the conditions laid down in the Council Minute by which it was instituted.

The so-called Nien-chen-tang-la mountains were unknown from the Tengri-nor to the Maryum-la pass, and I always looked upon their discovery, on those meridians, as the most important *desideratum* in Asiatic geography for many reasons. I now hail Sven Hedin as the discoverer, and I think that his name of Trans-Himalaya is the best and most convenient that could be adopted.

He also is undoubtedly the discoverer of the true source of the Brahmaputra, and his journey with this object strikes me as a most painstaking and accurate piece of geographical work. His discussion of the question of connection between Mansarowar and Rakas-tal is very interesting and instructive, but I am unable at this distance from means of reference to offer any remarks upon it, or upon the question of the source of the Sutlej. His paper is sure to give rise to an important discussion.

Sir THOMAS HOLDICH: I do not like the term "Trans-Himalayas" for several reasons. In the first place, it is not a name at all. Of course, Sven Hedin's mountains *are* Trans-Himalayas—that goes without saying; but why print such an obvious fact on the map? In the next place, the expression is not new—it is very old indeed, and has been applied for years to the mountain region (Trans-Himalayan) in the extreme north of Kashmir, including the Mustagh range from which the Hindu Kush takes off, the Karakoram, etc. So that, as Sven Hedin admits, the term Trans-Himalayas (why not put it in English—"beyond the Himalayas"?) would extend from the Hindu Kush to the Salwen, and would not be in the least distinctive of his *Trans Tsangpo* section of the system or "cordillera." The Indian Survey Department would no more think of printing "Trans-Himalayas" or "Beyond the Himalayas" across such an extent of Asia, than they would put "Beyond the Indus mountains" from near Karachi to Buner. Besides, it is only "beyond" from the Indian point of view. I cannot say that I remember the expression "Trans-Caspian" or "Trans-Indus" or "Trans-Himalayan" in our maps, though, of course, they are all convenient geographical definitions when writing. Trans-Alai, I believe, has got crystallized, but I always regarded it as a foolish definition due to the fact that no one had taken the trouble to find a name locally. Are those mountains "Trans-Alai" for India, by the way? I am not sure that they are not *Cis*-Alai. In naming the various sections of the one great, long-extended system or "cordillera," which begins with the Hindu Kush and ends in the west of Persia (or beyond), we always adopted such local names as we could find. If the mountains had no name, we took the name of the district. In the case of the Trans-Tsangpo, part of this Trans-Himalayan system, I think, Sven Hedin has the right to suggest a name, and he has already given a name to a large district in that white space of our Tibetan maps which we look to him to fill up. That name is Bongba. Why not apply it to that section of the Tibeto-Trans-Himalayas which forms the northern divide of the Brahmaputra? It is easy to remember, and we should know what we mean when we talked of the Bongba mountains,

which we certainly shall not know if we talk of Trans-Himalayas. Has the India Survey Department (which publishes the map of this part of Asia) been asked what they think about it?

Colonel GODWIN-AUSTEN: It is now forty-six years since I was in the Pangkong district of Ladak,* and took a last longing look from a high point near Radok to the eastward, over the flat-looking broad belt of elevated country stretching to the eastward, dotted with small lakes, and bounded by a snowy range on the south, the Aling Kangri of the Royal Geographical Society map. Dr. Sven Hedin often refers to the white patches on that map of 1906, but to me, looking back to their size in 1863, it is wonderful what an enormous amount of topographical information has been accumulated in the interval; a very large amount of this work has been executed by Dr. Sven Hedin. I congratulate him sincerely on having done it, and it has been a great pleasure to me to make the acquaintance of so admirable and zealous an explorer. Knowing something of the country, it is a marvel he is here after his journey in the depth of winter from the neighbourhood of the Karakoram pass, that death-bed of thousands of men and baggage animals; a place the name of which I never see without thinking of Dr. Stoliczka, a member of Forsyth's mission, and a friend of my own, who succumbed to the cold and height of the pass on the return journey from Yarkand.

In connection with Mansarowar lake and its outlet, on which so much has been said and written, I would refer to the pioneer work done long ago by two brothers, Henry and Richard Strachey, who were among the first to make surveys in this part of the Himalaya; Henry beginning in 1846 to 1848.† I would point out how very accurate their work has proved to be, for it must not be forgotten that they had no peaks in Ladak fixed by triangulation to guide them. I am glad to tell you that this talented officer, Colonel Henry Strachey, is still living; he is ninety-three this month. Unfortunately, his sight is quite gone, but his memory is wonderful, and he still enjoys talking of his explorations in Tibet, and that of other workers in the same field.

Dr. Sven Hedin has referred to what I have written on the 'Mountain Systems of the Himalaya,'‡ more particularly with reference to the "Trans-Himalayan Range," a term first used, I think, by Colonel Cunningham (1854), but he included in it the Zaskar axis. Several writers since have used the term in a very general way, more or less hypothetically, according to the period they wrote, and their knowledge of the country, few having personal knowledge of it. Assuming that the basis of any system of orography should be geological structure, when compiling and setting out the sections of the western Himalaya from south to north across the strike of the rocks, I drew largely on the writings and work of Medlicott, Blanford, Stoliczka, and Lydekker, and what I had noted and mapped myself, over a large extent of the northern frontier of India. As a whole, the mountain mass consists of many more or less parallel lines of gneissic rocks and gneissic intrusions, with intervening synclinal basins of stratified rocks, more or less altered. There is great continuity and similarity of structure on certain zones, occupying the same relative positions on sections across the mass; the same physical feature presents itself over and over again, showing that the forces playing a part in the elevation and crushing have been on a wide and gigantic scale. The north-west-south-east Ladak axis represented by the central gneiss of Stoliczka, is a characteristic feature in Ladak for 300 miles, the Indus flowing on its south side, the synclinal trough of

* "Notes on," Journal of the Royal Geographical Society, 1866.

† 'Physical Geography of Western Tibet.' With Map. *Proc R.G.S.*, November, 1853.

‡ *Proc. R.G.S.*, February, 1884.

Nummulitic age holding that position, and resting on it. I took this as a starting line, and the most southern of my Trans-Himalaya lines of elevation, including in it the Mustagh with its subsidiary ranges, the Shayok on the south, and the Karakoram on the north. South-east of Leh for 100 miles, the same gneissic ridge, the Ladak, bounds the Indus on the south, that river having cut through it, and it holds that position for quite 150 miles. The Mustagh axis, I consider, has its easterly extension to the Marse-mik La and the high mass of gneiss north of the Pangkong lake, crossing that to the high range south of the Rudokh plain, where I say, in 1883, "we enter unsurveyed ground"; whether it is continuous to the Aling Kangri (Gangri), of the Royal Geographical Society map of Tibet, is to be seen. Here, these lines laid down by me as Trans-Himalaya are hypothetical; all deductions, made without personal observation of the country, partake of that nature. In the map and sections of 1884, the Ladak range, and all I grouped with it at that time as Trans-Himalaya, I took great care to lay down in dotted lines eastward of lat. 32° and lat. 80°.

Where there is so much of intense interest, it is most difficult in a few minutes to know what to refer to; but among the many discoveries of Dr. Sven Hedin, the history and extent of the lake basins he has visited is one, and I look forward to reading his more detailed account of the country and what he has to say about them. There is an enormous field of observation in Tibet, and his suggestion of mapping the self-contained lake basins is one, showing their extent and former outlets. I only know those of the Pangkong lake and Tsomorhiri, with the extinct lake basins in Rupshu. In the case of Tsomorhiri, local alteration of level has been assigned for the damming of the exit, but ordinary silting up by wind action may have done this. The Pangkong lake, when at the period of the greatest level of its waters, and when fresh, must have extended very far to the eastward—how far would be a very interesting point to solve. No levelling has ever been carried out in either case to determine the height of the old lake deposits. I cannot follow Mr. Huntington that this lake was scooped out by a glacier; my own observations tended to show the dam was formed by talus accumulations from the mountains on the south side. This view is confirmed by Frederick Drew in his description of the lake,* yet I note that Mr. Huntington's glacial lake theory is considered applicable with respect to Pangkong.† The Pangkong has all the appearance of a river valley of ordinary depth eroded in the usual way, once filled up with water to the height of its dam, but which, since that step was reached, has been broken up into a series of lakes by the sedimentary deposits of its largest tributaries as at Ote. All the broad gravelly valleys so typical of this Pangkong country are silted up, having had, I imagine (when the climate was milder and moister), a section of the usual **V** form.

Sir Henry Trotter: So many references have been made by Dr. Sven Hedin to the exploration work of the Pundit Nain Singh, that I feel bound to say a few words on the subject—in which I take special interest, as I started him from Ladak on his great journey *viâ* Tengri Nor to Lhasa in 1874, in which he discovered and roughly mapped the great lake system of Central Tibet, and on his return to India I took his report and prepared his map.

It is extremely gratifying to find that both Dr. Sven Hedin and Major Ryder have expressed their admiration for the general accuracy and excellence of his work along his actual lines of route—*i.e.* north, east, and south of the great *terra incognita*—the topography of which has been so lucidly described to us this afternoon.

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* 'Tummoo and Kashmir Territories,' p. 323.

† 'Geog. and Geol. of Himalayan Mountains and Tibet' (Colonel Burrard and H. H. Heyden), pt. iii. p. 263.

Dr. Sven Hedin has stated in his paper that the information gathered by the Pundits from native reports is almost worthless. From my own experience I know that for scientific geography hearsay information, whether collected by Pundits or any one else, is of little value. At the same time I was much struck by one statement made by the lecturer, referring to the lake of Teri-nam-tso, marked in dotted lines on Nain Singh's map, that he found its position "almost correct, although the Pundit had never seen it, but had only heard of it."

I must, however, take exception to the lecturer's statement that the result of the Pundit's different journeys can hardly be used for scientific purposes.

Their astronomical determination of latitude are admittedly excellent, and may be accepted as within one minute of the truth; and as regards the much more difficult question of longitude, I will cite two cases. As the result of the protraction and adjustment of Pundit KS's work, in 1874, in the preparation of the map of Eastern Turkestan, I shifted to the eastward by 23 miles the hitherto accepted longitude of Khotan (*i.e.* from 79° 26′ to 79° 59′), and I find that in the latest map of Khotan prepared by Dr. Stein, it is placed in longitude 80° 1½′, *i.e.* differing by 2½ miles only from my original determination.

Again, in preparing Nain Singh's map in 1875, I fixed the position of Lhasa, from his work, at 91° 5′ 30″ E. long., considerably to the east of former estimates. This also held its ground until the recent trigonometrically determined value of Major Ryder's Lhasa, 91° 10′ 46″, showing a difference of about 5 miles, by no means a large discrepancy. I therefore maintain that the Pundit's work has been distinctly of value for scientific geography, although it must, of course, give way to connection by triangulation with our Indian system.*

Nain Singh was a Gold Medallist of this Society, and has been dead for many years, but I consider myself bound to vindicate his reputation for accurate and valuable work. It is due not only to his memory, but also to that of my former chief, the late Colonel Montgomerie, who instructed the first pundits and superintended their work.

To revert to Dr. Hedin's explorations. Nain Singh, in his passage through the lake district, fixed the position of numerous snowy peaks to the south of his route for a distance of several hundred miles; many of these correspond well with Sven Hedin's work. The most important of these peaks, Targot-Yap, the pundit estimated to be 25,000 feet in height, and it is undoubtedly identical with the Targ Gangri of Sven Hedin. Major Ryder, on the other hand, in his recent journey up the Brahmaputra, fixed the position of several snowy peaks to the north of his route, varying in height from 20,000 up to 23,150 feet; but between these two mountain ranges on the north and south, Dr. Hedin has found several other ranges whose existence was unknown. He has crossed seven times this *terra incognita* extending 500 miles in length, and of great and varying breadth, and his work will remain a splendid record of his zeal and energy, and will probably not be improved upon until our grandchildren or great-grandchildren, in future ages, shall explore and map the eight minor blanks which will have been left by Dr. Hedin between his seven lines of route.

To this newly discovered mountain system, Dr. Hedin has most appropriately given the name Trans-Himalaya, to which only one objection can be raised. The mapping of Central Asia has been chiefly done by Russians from the north, English from the south, and by the renowned Swedish explorer from many directions.

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* It is interesting to note that in d'Anville's map of date 1733, the longitude of Lhasa is within a mile of Major Ryder's determination, while its latitude is in error by no less than 22½ miles.

Indian map-makers would naturally call the newly discovered system Trans-Himalaya, but to the Russians it would be Cis-Himalaya. As, however, in a precisely similar case, the Russians have called the range south of the Alai, the Trans-Alai, and we have accepted that name, so we may hope that the Russian geographers will accept the term "Trans-Himalaya," although if *they* had discovered this mountain system, it would naturally have been called Cis-Himalaya.

A few words as to the source of the Brahmaputra. It must always be recollected that a river has several sources, and although both Nain Singh and Major Ryder ascended the great river for several hundreds of miles, up to *one* of its sources, in the Maryum La, yet neither one nor the other has laid claim to have visited its principal source; both of them indicated a much larger stream coming from the north-west; and about 30 miles short of the Maryum La, Nain Singh speaks of the gigantic range visible to the south, the large glaciers of which filled every ravine of that range, and evidently formed the source of the river. It is this glacier region that Sven Hedin has now visited and mapped—a great triumph on which we must heartily congratulate him, as no one can doubt that the area in question contains the principal sources of the mighty river.

The still more complicated and difficult problem as to the sources of the Indus and the Sutlej I must leave to persons having greater knowledge of the subject than myself.

Sir MARTIN CONWAY: The fact that behind the main range of the Himalayas there exists another great range, has long been understood by mountaineers, but between the recognition of such a fact and any kind of precise knowledge of the nature of the range in question there is a great gap, and it is this gap which Dr. Hedin's discoveries have done so much to fill. It is hardly necessary to say that no study-drawn outline of imagined mountains ever approximates to the actual facts of mountain-contour which an explorer reveals. This is true even in the case of small details—the ridges and abutments of a single peak, even when the form of its summit has been known, as in the case of K_2. To discuss, therefore, the relative inaccuracies in this or the other sketched-in approximation to what different geographers have believed might more or less vaguely represent the actual form of an unexplored range is to waste time. The man who actually traversed previously untraversed ground, is the first to replace deductions and hypotheses by actual knowledge, and thenceforward his information becomes the starting-point for all future developments in knowledge.

Dr. Hedin has briefly indicated in his papers the central fact, which is to be revealed by the cumulation of all the explorations of Tibet, and the ultimate revelation of the detailed form of that great elevated region. It is the answer to the question, How was that region sculptured out into its present complicated form? Assuming the whole Tibetan area and the adjacent highland to east and west to have been elevated together, with the Himalayas for the southern, and the Kuenluns for the northern scarps, it seems likely that originally the general aspect of the whole region was such as is now characteristic of the central portion, north of the Trans-Himalaya. We may think of it as high undulating ground with ridges running roughly east and west, ridges which in time have weathered to their present condition. The strike of these ridges would naturally tend to shed off the water that fell on the region to east and west along the furrows. As the rain mainly came from the hot south, the southern streams would have been most active, and of the tributaries those draining southward facing slopes would have been the more vigorous. It is for this reason that so many of the principal east-and-west ridges are cut through by what were at first merely short torrents tearing down the slopes. It is, therefore, not at all surprising that Dr. Hedin should have revealed such a

complication in the northern feeders of the upper Brahmaputra, or that he should have found them penetrating through what were originally parallel and continuous ridges. Just as the Indus, the Sutlej, and the Brahmaputra itself cut through the main Himalaya range, having been captured by the more vigorous southward-flowing torrents of the plateau's original edge, so their upper reaches in their turn have cut back into the ranges behind, and doubtless are still cutting back and tending ultimately to gouge out and abolish the last fragments of the great plateaus, with their relatively few remaining salt lakes and wide expanses. Not until the whole detailed topography of interior Tibet is revealed shall we be able to form any complete account of the history of the growth of the great rivers and the various transformations their course has undergone. It is Dr. Hedin's great service to geographical science to have contributed materially to the reduction to relatively small compass of the unknown area which not long ago was so large.

Mr. Douglas Freshfield: Dr. Sven Hedin will, I am sure, understand, if, under the pressure of time, I omit all compliments and congratulations on his wonderfully successful explorations of unknown Tibet.

There are two points, one in what he has said to-day, one in his first lecture, to which I should like shortly to return. I have never myself crossed the frontier of Tibet proper, but from a height of over 20,000 feet in the Debatable land I have looked over many hundred square miles of that country. It is not, I must confess, a region the natural features of which attract a mountaineer; for a proper mountain ought to have a bottom as well as a top. The Tibetan ranges, springing from a platform, as Dr. Sven Hedin has told us, of 12,000 feet, have no bottoms. Let the believers in the spadework done by glaciers explain it as best they can. The Tibetan glaciers have not succeeded in digging valleys. That feat has been reserved for the torrents of the southern slope. In upper Sikhim as you approach the watershed you can recognize the exact spot where the protection of the ice has ceased. This, however, is only an incidental remark; the subject is rather one for my friend and companion, Prof. Garwood, than for myself.

The point in Dr. Sven Hedin's recent lecture on which I wish to express some doubt, is his allusion to military geography. If I have not been into Tibet, I have at least made a study on the spot of some of the routes frem Tibet into India.* Dr. Sven Hedin speaks of the eastern Himalaya as a granite wall impregnable to modern armies and sufficient to protect India from any fear of invasion. He thinks that any apprehensions on this score may fairly be called "exaggerated." At the present time this is in no sense a question of current politics, and I can refer to it without any fear of trespassing on forbidden ground. As a general proposition, I dissent from Dr. Sven Hedin's view; I do not think it is borne out by history. Mountain chains have never served—except in poetry—as efficient ramparts. In this particular case the evidence is at hand. The Chinese have never found any difficulty in sending troops to Lhasa. Of course they send them by the regular road, and not over the remote highlands Dr. Sven Hedin has been the first to reveal to the Western world. They have done more. As Dr. Sven Hedin has reminded us, at the close of the eighteenth century they sent an army of 70,000 men into Nepal and won a battle within a few miles of Katmandu. It is true that a modern army carries more impedimenta than a primitive force, but on the other hand the facilities for light transport and provisionment have increased. The Chinese may at any day imitate the Japanese in adopting and improving on European methods. In 1888 a Tibetan force crossed the Himalaya, threatened Sikhim, and alarmed Darjiling. We have

* See *Geogr. Journ.*, January, 1904; and *Journal of the Society of Arts*, February, 1905.

recently sent an army with light artillery over the outer Himalaya to Lhasa. No doubt in the Himalayas, as in the Alps, it is not so much the actual passes as the gorges on the south side of the chain that form the most formidable obstacles to the invader. But most gorges have a way round them, and there are too many to guard them all.

I do not anticipate that India will be invaded from the north-east in the lifetime of any of those here present. But I believe that if China were allied with a Western power and a Chinese force were collected in the Brahmaputra valley, it would necessitate the detention of a corresponding force to protect Bengal, and thus interfere with the adequate protection of the North-West frontier. I cannot but regret, therefore, that Tibet has been handed over to China, body and soul, in place of being constituted in some sense a buffer state. Dr. Sven Hedin suggests that the situation produced by an attempt to invade India on this side would be "amusing." It might be so to the disinterested observer at a distance, but I doubt if this would be the point of view of the officials at Calcutta responsible for the defence of the British possessions in India. Dr. Sven Hedin is so great an authority on all things Tibetan that I fear that his words—even in an *obiter dictum* —may be taken in a sense and given a weight which he possibly does not intend by some civilian and economical statesman. I have, therefore, ventured very briefly to suggest a view which is, I know, held by others far better qualified than myself to enforce it.

Captain RAWLING: I understand that the discussion of Dr. Sven Hedin's last journey which is taking place to-day will be confined to Southern Tibet, and will mainly fall under four heads—the mountainous region lying to the north of the Brahmaputra, the sources of the Brahmaputra, and the sources of the Sutlej and the Indus, and to that part of Tibet alone will I confine my remarks. I do not intend to argue on the pros and cons of the discoveries of former travellers, but simply to lay before you the more valuable geographical features as seen during our journey in 1904–5, in order that they may be compared with the latest information obtained by Dr. Sven Hedin.

It must be remembered that my expedition then was a political mission and not a geographical one. We were compelled to travel at express speed and to cover 1100 miles, the distance from Gyangtse to Gartok and Simla, in three months. Nevertheless, much fresh geographical information was obtained and 40,000 square miles of country surveyed. This work would have been impossible had there not been attached to my expedition a survey party under, and I say this without the slightest intention of flattery, two of the finest experts in survey work to be found in any country, Major Ryder and his assistant, Captain Wood.

The remarks I intend to make are based on the unanimous opinion of all of us, formed when we were on the ground, and from the closest observation that the limited time at our disposal would permit of. Of the perfect accuracy of Ryder's work, Dr. Sven Hedin bears generous witness. It does not profess to be a complete map of the entire basin of the upper Brahmaputra, but simply the country which could, with extreme labour and only by skilled hands, be accurately surveyed during a hard and rapid journey. A glance at Ryder's map will show that the Chata Tsangpo, opposite Saka Dzong, and some other tributaries, are entered in dotted lines, showing where the courses of the rivers appeared to lie, judged by the trend of the mountains as seen from a great distance.

Having mentioned Saka Dzong, let me break off for one moment, to pay a token of respect to the memory of that faithful servant of Sven Hedin who died here. Mahomed Isa was one of the finest characters it has been my fortune to be thrown with. Trustworthy and indomitable in his work, his knowledge of Asia was unequalled by any native, for he had accompanied Younghusband in his famous

journey from China, he was with Cary, with Dalgleish who was afterwards murdered, and with Dutreuil de Rhins, where he was a helpless witness of his master's violent death at the hands of the Tibetans. He acted as my caravan bashi in the Gartok expedition, accompanied Sven Hedin during his recent journey, and died, after thirty years of faithful service, at this desolate spot.

The early reports which reached England respecting Dr. Sven Hedin's discoveries gave the impression that a great range, rivalling the great Himalayan chain, had been found far to the north of anything seen by us. As Dr. Sven Hedin has since informed us, the report was incorrect, no such range being in existence, and he has also proved that the range surveyed by Ryder, which runs parallel to, and distant 50 miles from, the north bank of the Brahmaputra, is not surpassed in altitude by any range of mountains right up to the Kwen Luen. But of equal importance to this negative proof are his discoveries of numerous self-contained basins formed by, not one, but many ranges, some of which constitute and define exactly the entire watershed of the upper Brahmaputra basin, and extend its limits far beyond what was formerly believed to be its area.

You will notice the similarity of the drainage system of the northern slopes of the Himalayas and what I will call at the present moment Ryder's mountains. The rivers on the northern slopes of both at first flow northwards, then, when stopped by another and lesser range, turn to the south, and, cutting their ways by devious gorges through their original ranges, join the waters of the southern slopes, and form a part of the great rivers which finally pour into the Indian ocean. Now, it is an established fact that the rise of the great Himalayan range has taken place during recent geological periods, and, as Colonel Burrard says: "The whole length of the great Himalayan range belongs to one geological age, and in the same geological age as the mountains of Afghanistan and Beluchistan, in fact the ranges of Central Asia appear to belong to one great system, and to have no separate existence from that system." But it has remained for Dr. Sven Hedin to prove that all these ranges are alike, and that the earth movements taking place in one are duplicated in the other. Alike in their formation, the final results are opposite: the basin of the Ganges cannot increase in area, but the basin of the Brahmaputra can and will, for as the tributaries, in the course of centuries, cut back into the plateau by head erosion, so will the self-contained basins to the north be absorbed and finally form part of the great Brahmaputra basin, provided there is no material decrease in the rainfall.

And now as to the name of the mountainous system. Personally, I do not like the term Trans-Himalaya, for by rights this belongs to the range lying immediately to the north of the Himalayas, and between that range and the Brahmaputra. Foreign names and duplication of names are, if possible, to be avoided. May I suggest such a one as *Peu Kangri*, or the Snow mountains of Tibet, or *Peu Lho Kangri*, a free translation of the Snow mountains of Southern Tibet. Kailas range, the name suggested by Colonel Burrard, is good for that particular range in which Kailas is situated, but, as Dr. Sven Hedin has demonstrated, this is only one of similar ranges, and therefore it hardly seems quite appropriate for the whole system.

I will now leave this district and move to the source of the river. Dr. Sven Hedin takes a too literal reading of certain remarks of Ryder and myself with regard to the Maryum La being the source of the Brahmaputra. Where the matter is dealt with in a more detailed and scientific manner it is evident that we clearly recognized the main source of the river: for, as Ryder says, when facing the Maryum La: "We could see the watershed range ahead of us, from the valleys of which innumerable streams issue to form the Tsangpo, the largest coming from the snowy

range to the south-west." Again, Ryder, in his map—and this after all is the best proof—distinctly shows the source in the glaciers far to the south-west of the Maryum La. It seems to me that the whole question can be summed up in the sentence: that the principal sources of the Brahmaputra were known to lie in the Indo-Tibet borderline glaciers to the south of Gunchu Tso, but it has remained for Dr. Sven Hedin to survey and locate more definitely than has ever been done before, the headwaters of the river.

Next comes the question as to the sources of the Sutlej. First of all, what is a source? I maintain, though it is possible I am in error, that it is the longest visible branch of a river system, and, if there are two branches of equal length, then that which carries the most water at its greatest flood. On this hypothesis I base the following problem and its solution. To start at the beginning, it will be granted that small rivers run into Manasarowar and that that lake and Rakas Tal are connected, for by photographs and the testimony of every traveller, except, of course, Mr. Savage Landor, such is proved to be the case. All that remains now is to determine whether the Sutlej is connected with Rakas Tal. At present there is no surface outflow, and none has been reported for many years. From my definition of a source, therefore, I am forced to draw the conclusion that the connection does not exist. Dr. Sven Hedin takes a contrary opinion, basing his view on the probable supposition (also held by Henry Strachey in 1846) that some of the water of Rakas Tal filters through the soil, afterwards rising as springs in one of the tributaries of the Sutlej. In 1905 Mr. Sherring reported that the natives likewise believe in this underground escape. But it is an extremely difficult thing to prove. Even the fact that Rakas Tal is fresh at the present time means nothing, for we know that the lake did regularly overflow forty or fifty years ago, and it would take centuries for a lake the size of Rakas Tal to become salt. Ryder, I consider, is correct in placing the present source in a branch flowing from the southern hills. I may be quite wrong in my reasoning, but the whole question appears to turn on the definition of the word "source."

I am to-night making observations based purely on personal experience, and as I have never visited the northern and main branch of the Indus, will not venture an opinion as to its source.

In spite of the interest centring around the sources of the Brahmaputra, Sutlej, and Indus, yet, as a matter of geographical value, they sink into comparative insignificance when compared with the definite elucidation of the northern watershed of the upper Brahmaputra basin, and the intricate system of ranges found in and beyond that region. And for this knowledge we are entirely indebted to Dr. Sven Hedin.

Dr. T. G. Longstaff: I beg to congratulate Dr. Sven Hedin on the successful conclusion of his latest journey, a journey during which he had again displayed those qualities of endurance and determination with which we have always associated his name. May I particularly congratulate him on being the first traveller to force his way right across the centre of that great range of mountains which lies to the north of the Indus-Brahmaputra trough.

I have a few comments to make on this paper, but I feel that they are privileged for this is a scientific society, and the academic discussion of papers must always be one of its chief functions. I wish to draw attention to that range of snow mountains discovered by Nain Singh in 1874, and along the northern side of which he travelled for more than 800 miles ('Walker's General Report,' G.T.S., 1874–75, p. 20). I am uncertain whether Dr. Sven Hedin includes this in his own Trans-Himalaya. The lecturer identifies Nain Singh's Targot Lha with his own Targo-gangri, and I think that when he has worked out his observations we shall find that his own Shakangsham

is none other than Nain Singh's Shyalchikang Jang. I was sorry to hear that remark deprecating the value for scientific purposes of the work of such very remarkable men as the late Nain Singh, C.I.E., and Kishen Singh, R.B. Many of us must recall the very different opinion of them which was expressed before us by such authorities as Sir Frank Younghusband and Major Ryder less than four years ago. I may be excused for recalling this testimony, since I am personally indebted to Kishen Singh. The methods of any traveller may be considered antiquated by those who follow in thirty or forty years' time. It is almost a truism to say that no explorer can expect to produce an original map in which corrections will not be made by those who come after him.

It is rather surprising that the lecturer is so unappreciative of Trelawney Saunders. His delineation of Dr. Sven Hedin's 'Trans-Himalaya' in the 'Atlas of India' (Stanford, 1889; 12 Maps and Memoir) is based on the work of the Pandits, including Kishen Singh's later journeys, and I still venture to recommend it to the notice of any one interested in this discussion. Saunders calls it the Gangri range, because it is *par excellence the* snowy range of Tibet; although, as was pointed out in 1877, and again in 1896, Brian Hodgson had already adopted the name "Nyenchenthangla." ('Selections from the Records of the Government of Bengal,' Calcutta, 1857, p. 88, etc.) In the Memoir, Saunders begins his description as follows: "The northern side of the great Tibetan trough culminates in a range that, for extent, importance, and altitude, may well stand alongside of the parallel ranges of the Himalaya."

This range is included in that great mountain-system described by Burrard and Hayden in their 'Sketch of Geography, etc., of the Himalaya and Tibet,' as the Kailas range. It is definitely known to extend for more than 1400 miles. Their frontispiece shows its middle section of about 600 miles extending eastward as a continuous range from the 80th meridian until it is joined by the Ninchinthangla at about the 88th meridian. In this middle section they give a list of a dozen peaks ranging from 20,000 to upwards of 23,000 feet. These, with numerous lesser points, were fixed (mostly by Captain Wood) by trigonometrical methods of the first degree of accuracy, in the course of the expedition to Gartok under Captain Rawling's leadership. The series may be considered an extension of the G.T.S. of India. Certainly its parentage is irreproachable.

I am quite sure that the lecturer did not realize what he was showing us in that Chart XVII. of Colonel Burrard's, and upon the blanks in which he laid so much stress. That diagram is entitled 'Chart to illustrate how the great Himalaya range terminates firstly at the Indus, secondly at the Brahmaputra.' To render that chart clearer, such insignificant details as the Sutlej river, together with *all* the mountain ranges both north and south of the great Himalaya, except those at its two extreme ends, are purposely omitted; therefore, naturally, the Kailas range is omitted with the others. But in any case, as I understand him, Dr. Sven Hedin excludes this great range from his own Trans-Himalaya, because Wood's peaks are not situated on the actual water-parting. Yet how could we describe, and by what name should we call, the loftiest peaks in the world if we applied a similar line of argument to the Himalaya itself?

As to nomenclature, we already have Ninchinthangla, Gangri, and Kailas. The latter name was first applied to the whole range by Cunningham in 1847. You will find the name Kentaisse (a misprint for Kenlaise, the old form of Kailas) on Rennell's map of 1782, but he gave it to that well-known peak only. Now "Trans-Himalaya" is suggested to us. As the lecturer has himself admitted, Cunningham has already bestowed the name Trans-Himalaya on that range which in Ladak and Western Tibet separates the valley of the Sutlej from that of the Indus ('Ladak,' p. 43 and

plate 1). Morphologically, this range is continued eastward north of the true Himalaya, though it is broken through by the Sutlej. It culminates south of Mansarowar in Gurla Mandhata (25,350 feet), the highest mountain situated entirely within Tibet. It extends eastward again right up to the bend of the Brahmaputra, carrying twenty-five measured peaks of over 20,000 feet. It is quite a distinct range from the Great Himalaya. Standing on Gurla Mandhata, the Himalaya of Nepal seem almost as far to the south as the Kailas range seems to the north, so that the beholder realizes that he is already standing on a truly trans-Himalayan range, and if any range is to be called Trans-Himalaya, it should be this, as Cunningham perceived. But Himalayan nomenclature is already too complicated. We have Upper, Lower, Outer, Inner, Mid, Sub, Lesser, Great, Central, and Trans-Himalaya. It was to obviate any further extension of the name that Burrard and Hayden labelled the whole of this range (I mean the first range north of the Great Himalaya) the Ladak range, and applied the name Kailas range to that system still further to the north and across the Indus-Brahmaputra trough. The analogies of Trans-Caucasia and Trans-Caspia do not, I think, hold good. Such terms are very convenient to apply to a region whose exact limits you do not wish to define, but they are not sufficiently distinctive to apply to a mountain system. For many years we have read of the "trans-Himalayan regions" and of the "trans-Himalayan sources" of Indian rivers. Let us also speak generally of trans-Himalayan ranges; but we must give up this useful adjective if the name is to be affixed to one particular mountain system.

Discussion as to the exact location of the source of any great river system is complicated by the absence of any universally accepted definition as to what actually constitutes the ultimate source of a river. Since it has already been mentioned this evening, I will begin with the Brahmaputra.

In 1864 Mr. T. W. Webber, Colonel Edmund Smyth, Henry Hodgson, and the Hon. Robert Drummond (who in 1855 launched his collapsable boat on Mansarowar lake) were at Taklakar, in Purang. Thence they crossed the lofty Dak Eo pass to the south of Gurla Mandhata, a route seldom traversed even by natives. This led them over into the very head of the Brahmaputra valley. That river is described as taking origin in the glaciers or a great peak called Limi. Of course this is a Bhotia and not a Tibetan name. They followed down the main stream to within sight of Truksum, 80 to 90 miles from the source, and only 50 miles above Tradom. This expedition is described by Mr. Webber in his 'Forests of Upper India' (chap. xi.), and I think he and his companions must be given the credit of being the first travellers to reach the source of the Brahmaputra. At the same time it is obvious that Dr. Sven Hedin is the first to give us a detailed survey made on the spot, although he substantially confirms Nain Singh's general accuracy.

The whole question of the hydrography of the Mansarowar basin is, I know, a very complicated one, for, as the lecturer evidently perceives, we are watching a change in the "Pulse of Asia," but I would venture to urge that the chief credit for its solution must always remain with Henry Strachey. Burrard and Hayden, after reviewing and summing up all the evidence, definitely include it within the Sutlej drainage area, a conclusion with which Dr. Sven Hedin seems in entire agreement. The hypothesis of an underground communication between the two lakes was advanced by Colebrooke in 1816 ('Asiatic Researches,' vol. **12**, p. 376), in consequence of Moorcroft's failure to find a visible efflux. I think any one who examines Sherring's panoramic photograph ('Western Tibet,' p. 271), which shows the whole channel between the two lakes, will see where that underground communication is situated. The reason Moorcroft did not find this channel is quite simple. In his anxiety to miss nothing, and he rarely did miss anything, he

walked along the actual lake side of Mansarowar, and the shingle bank over the effluent channel, beside which he was walking, effectually concealed that channel from his view.

The source of the Sutlej was formerly that stream which enters the Gunchu Tso on the west side of the Maryum-la. It is interesting to recall that Alexander Gerard placed it there ninety years ago ('Account of Koonawur,' etc., p. 139). This lake formerly discharged into the Tokchen river, and so reached Mansarowar. Now the first link in the chain is broken. The Gunchu Tso, shrunken and salt, is no longer able to find an exit towards the west. So we regarded the Tokchen river, with a course of about 30 miles, as the prime source. Now Dr. Sven Hedin finds that the Tagi-tsangpo carries a greater volume of water down to Mansarowar, and so makes this stream the genetic source of the Sutlej. But, as he himself perceives, another link in the chain is giving way between Rakas Tal and Tirthapuri, and when this process is complete, and the Mansarowar basin is quite cut off from the Sutlej, another source will have to be found. Perhaps this may come sooner than we expect. In August, 1905, I forded the Sutlej a mile above Tirthapuri, and about 6 miles above the point where the Chukar joins the main river. During the same month I crossed the Darma Yangti and the Guni Yangti at a point distant about 23 miles from the Sutlej. These two streams unite with the Chu Naku and the waters from the Gyanema lagoons to form the Chu Kar, which discharges into the Sutlej. Now I found as much water in both the Darma and the Guni Yangti as I found in the Sutlej at the point named, though they are not so wide as the latter river. The united volume of the Chu Kar itself must therefore be very considerable. Indeed, if we accept Dr. Sven Hedin's own definition, we cannot even now locate with certainty the genetic source of the Sutlej. Let us suppose some future traveller proves that the Chu Kar itself carries more water than the head-stream of the Sutlej after it has been joined by the Missar river. He may then seek the source of the Dharma Yangti amongst the Nui peaks to the south. Should he return and tell this or some other Society that he has discovered the true source of the Sutlej, some one would, I trust, make the comment that, in 1846, Henry Strachey said, "It is a question that can be decided only by actual measurement perhaps, whether the main source of the Sutlej be not in the Darma Yankti" (*Journal Asiatic Society of Bengal*, 1848, p. 157).

In reference to the Indus, the lecturer has told us how Nain Singh crossed it at Giachuruff, some five marches below its source. But we must not forget that at Giachuruff, in spite of the imminent danger of his position, this intrepid surveyor voluntarily separated himself from his companion, despatching the latter up stream in search of the river's source (*Proc. R.G.S.*, vol. **39**, p. 151, etc.). This second pandit made his way up the river for nearly 50 miles, and was only stopped at Jiachan by the unwelcome attentions of a party of robbers. These may have been the fathers of some of those friends of Dr. Sven Hedin's about whom he told us the other night. At any rate, these robbers did him a good turn, for they prevented the pandit from reaching the Lion's Mouth itself, and in consequence, Dr. Sven Hedin has gained the distinction of being the first traveller to reach the ultimate source of the Indus.

May I add in conclusion, though it must be obvious to all of us, that Dr. Sven Hedin has only been able to place before us to-night a very small portion of his vast store of observations, and that until these come to be published in full it is almost impossible to realize the great importance and the very solid scientific results achieved in the course of his latest expedition.

Major LENOX-CONYNGHAM : First, looking at the name as a whole, there are two grounds of objection :

In the first place, the name, as Dr. Sven Hedin has mentioned, has been used before. It was applied in 1847 by Sir Alexander Cunningham, to a range which lies to the south of Ladak. It is no longer in use, but to resuscitate an old name and apply it to a new locality is to sow a seed of future confusion.

In the second place, a great many names of the same sort as Trans-Himalaya have been used in the past, there have been Upper-Himalaya, Lesser-Himalaya, Outer-Himalaya, Lower-Himalaya, Sub-Himalaya, Inner-Himalaya, Great-Himalaya, Central-Himalaya. To add yet another to this confusing series is a course which is much to be deprecated.

Next, considering the use of the prefix "trans."

Unless used with the sense of motion, as in Trans-Atlantic steamer, this prefix should always be in contradistinction to "cis," and even though the word with the prefix "cis" may not be in general use, there should be something which could be called by that name. There should be a distinct line of demarcation separating the cis-side from the trans-side. Thus, in the case of Trans-Caspia, the Caspian sea is the dividing-line, and we have a Cis-Caspian region corresponding to Trans-Caspia. So with the Caucasus, there is a Cis-Caucasian region balancing Trans-Caucasia. But in the case of the proposed Trans-Himalaya there is no Cis-Himalaya, but the plains of India, which could not appropriately be called by that name, and which forms no adequate "pendant" to the highlands of Tibet.

Again, in the case under discussion, the Himalayas do not form the line of demarcation, the Indus-Brahmaputra valley is the dividing-line between the Himalayas and Dr. Sven Hedin's Trans-Himalayan system, so that Trans-Tsangpo, or some such name, would be more suitable if the prefix "trans" is to be used at all. It is true that the case of the Alai and Trans-Alai ranges affords a precedent, but it is an unfortunate piece of nomenclature, and is rather an error to be avoided than an example to be followed. It was quite correct to speak, as Montgomerie and others did, of Trans-Himalayan exploration, for then the Himalayas formed the dividing-line, and everything on the other side of them was included in the term.

But the most serious objection to the name Trans-Himalaya does not lie in the prefix "trans," but in the word Himalaya. The important, the primary, geographical feature of this part of Asia is the great Tibetan table-land. This is the dominant fact. The Himalayas are merely the southern rampart of this mighty mass—an incident of its configuration. To take the name Himalaya and apply it to the parent mass is to call the greater after the less, the cause after the effect. This is a course which should at all costs be avoided. Moreover, the term Himalayan already covers a very wide area, and from a practical point of view it is undesirable to extend its use. When Colonel Burrard was writing his 'Sketch of Himalayan Geography,' he decided, in agreement with Sir T. H. Holland and others, that the name Himalaya should be strictly confined to the southern rampart of the Tibetan mass, and that the number of compounds, such as sub-Himalayan, should be cut down as much as possible. These authorities view with dismay the suggestion to bring yet another of such compounds into use, and to carry the name Himalaya further into Tibet.

In a recent letter, Colonel Burrard says—

"I trust that Dr. Sven Hedin will not think that the objections raised to the name trans-Himalaya are frivolous or obstructive. I can assure him that they are considered weighty by men who have devoted their lives to the study of geography and geology, and who wish to avoid all risks of future inconvenience and controversy."

The PRESIDENT (after the discussion): If nobody else wishes to speak, I should like to make one or two general remarks in bringing this interesting discussion to a close. My remarks will be quite general, because I am not an expert in matters of Tibetan geography. I have always been taught to concentrate my mind as far as possible on things and facts, and to consider that words and names are far less important. The misuse of words, of course, may do harm, but words and names in themselves are of comparative little importance. Now, facts may, broadly speaking, be divided into two classes—facts which are known, and facts which are not known. To-night we may add a third class—facts which are known to Dr. Sven Hedin and which are not known to us. I make this remark, because it does seem to me extremely hard that an explorer, after coming back from a great expedition like that which our distinguished guest has undertaken, should be expected immediately to give his results to the world in a full and complete form. It is absolutely impossible for any man, work he ever so hard, to give the full results of his labours until after many, many months' labour. If time had permitted, it would have been interesting if Dr. Sven Hedin could have given us a few more specimens out of his huge storehouse of information; for there are so many important subjects he has yet hardly touched on. There is, as a single example, that great question of the desiccation of Tibet—whether this country is getting drier quickly or slowly, temporarily or permanently. With regard to the known facts concerning the white patch on the map, which Dr. Hedin has covered with his exploration, we all know what was done by Nain Singh on the west and north, by Littledale on the east, by Ryder and Rawling on the south, and concerning the peaks which have been observed by Wood at a distance. These facts are all known, and on record. Those discoverers have had due credit given them; and I am quite certain that Dr. Sven Hedin would be the very last person to wish in any way to detract from what they have done. Then, with regard to the question of what I may call "hypothetical map-making"—the filling up of white unexplored places on slender information—I fully agree with Dr. Sven Hedin that the best thing is that some one should go to these places and ascertain the facts as he has done. This is not always possible, and in these circumstances we must be permitted to fill up these blank spaces as well as we can, a work which is useful if clearly indicated as hypothetical.

I have always been struck with the profound wisdom of the words of Bacon, who said "that the truth comes sooner out of error than out of ignorance." The filling up of a blank space in a map may be erroneous, but it may also be a step in the right direction. I think, if Dr. Hedin will look back, he may possibly recognize that where maps have been filled up even erroneously they have stimulated his imagination and helped him forward in the path of exploration in which he has done such wonders. But the making of these hypothetical maps, this filling in of blank spaces on slender information, is a totally different thing from filling up the map from actual knowledge. The two operations are quite different, and need not be discussed together. One is a hypothesis for the purpose of facilitating discovery, whilst the other is actual work done, for which the same credit is due whether preceded by a correct hypothesis or not. Lastly, with regard to the facts which are indisputable concerning Dr. Sven Hedin's work. If we take two points in Tibet, and if we draw a curved line between them some 300 or 400 miles long, we shall find there is all along that line a complicated system of mountains which Dr. Sven Hedin has called the Trans-Himalaya range. Now, it is a fact that no civilized man ever put his foot on any part of that line of mountains before Dr. Sven Hedin did, and that is a fact that will remain for ever recorded to his honour. With regard to the name of this range, I intend to say but little. He has told us that his

proposal has been approved by the Viceroy. Possibly he will think I am prejudiced when I tell him that my belief is that this question will be settled in a way I have been taught to believe an immense number of questions have been always settled, and that is on the principle of the survival of the fittest. Several objections have been urged against this name, some of which, I think, are of little value. The only objection that strikes me at the moment as of weight is that to which Dr. Sven Hedin has himself alluded, namely, that if you look at this range from the north the name Trans-Himalaya is inappropriate. He also mentioned the name Anti-Himalaya, and I allude to it for two purposes. In the first place, because the title Anti-Himalaya seems to be perfectly correct, and not open to this objection to which I have alluded. I also want to place it on record that if Dr. Sven Hedin should see that name Anti-Himalaya on any map—whether he will do so or not I do not know—I ask him to remember that he with them still occupies the honourable position of godfather to this enormous range of mountains. But I am not here to sit in judgment on a technical matter of this sort, and I do not intend to do so, because I am not an expert, and because I do not think that the question of a name is one of prime importance. In short, in my opinion, on an occasion of this sort, what we ought to do is to concentrate our minds on the deeds of a great explorer, and not on the words by which those deeds are described. Dr. Hedin, without doubt, has done magnificent work, and the deeds he has done in filling up the white spaces in Tibet will stand on record for all time in the book of geographical discovery, greatly to the honour of our distinguished guest.

Dr. Sven Hedin.

I wish to express my very hearty thanks to those gentlemen who have been so kind as to take part in this discussion, and for the very kind things most of them have said of me. Specially was I glad to hear what Sir Clements Markham had to say, as he had taken such a great interest in the development of our knowledge of Tibet. I have already mentioned my own opinion about Sir Thomas Holdich's suggestion to call the range the Bongba system, and so I do not need to enter upon that. We have heard several propositions for the name: the Bongba range, the Trans-Tsangpo, etc., and I think the real name that is to survive, as the President said in such a beautiful way, will have to go through some kind of a struggle for its existence; but I think it will clear itself out of the struggle. Then as to Colonel Godwin Austen's communication, I found it extremely interesting, especially what he said about lakes Panggong and Tsomahiri, because the problem of these two lakes is exactly the same problem as the hydrographical problem of Rakas-tal and Mansarowar, although the problem of Panggong is advanced much further, and I think it is extremely easy to find the valley through which the effluent of Panggong flowed out and became a tributary to the Sheyok river. I measured the beach lines of the Panggong lake at some places, and found the highest of them to be 175 feet over the present level of the lake, so I suppose the height of the threshold in the valley must be something like 175 feet; but I quite agree with Colonel Godwin Austen that the problem cannot be definitely solved, unless a precise level has been carried out in the valley. This is extremely easy to do; any Commissioner of Ladak could do it on a holiday.

Now as to Mansarowar and Rakas-tal, they have not yet advanced so far as Panggong. Panggong is, as we know, salt because it is absolutely cut off from the Indus system. There is no underground connection with the Indus, but in Rakas-tal there is an underground connection, and I cannot agree with Captain Rawling when he says it would require centuries for the lake to become salt. I do not

think it would take centuries. I believe it would take only a few years, as I have seen the lakes situated on the right side of the lower Tarim filled artificially by the natives by opening small channels on the river, and as the ground is lower than the river itself, the depressions become filled when the channels are opened. Sometimes the natives close the connection between the river and the lake, then in three years the water becomes salt, as I have proved myself. They do it because they profess that the taste of the fish becomes much better when the water is salt; and that is only a question of three or four years. Of course, it would take a longer time for Rakas-tal, as it is much deeper; but anyhow it would not take centuries, I am quite sure.

Now as to Sir Henry Trotter. I emphasize what I said about the native explorers and the Pundits. I have said several times how I admire their work, and I admire specially Nain Singh, and nobody has admired him more than I, because nobody has travelled so much in the same country as he as I have both up the Tsangpo and on his journey of 1873–74. I have said that the Pundits' topographical work, especially in any country they have seen with their own eyes, is always correct and always admirable. Their reports, however, are useless for scientific purposes. When I talk about scientific purposes, I do not mean astronomical points, as I know how well those determinations agree with other observations; I mean a description of the physical geography. A pundit can easily pass a very great lake, and never tell you whether it is salt or fresh. He can cross a river, and not tell you whether it is a big or small river. He can cross a mountain without telling you whether it is solid rock or loose material. I mean it is impossible for a geographer to draw any valuable physico-geographical conclusions from a report of a pundit, and what we get from them is the topographical idea of the country. I have also said that their information on any parts of a country which they have not seen with their own eyes, but about which they have collected information from the natives, has proved to be absolutely impossible, and I will show that presently on the map. Sir Henry Trotter will remember, as he worked out the map of Nain Singh of his journey from Leh to Lhasa, that Nain Singh filled up the map south of Dangra-yum-tso, and placed a river he calls Dumphu or Hota-tsangpo, which goes round in the most extraordinary way I have ever seen for a river; it goes round like a semicircle, and that in the part of Tibet which is situated south of the watershed, and in a country where most of the water goes to the Brahmaputra and the Indian ocean. That is what I mean. I admire the Pundits. At one time we had nothing else to do but train the natives, but I agree with Delmar Morgan, who says that they are not trained as we are, and their education is not sufficient for the solving of the problems of modern scientific geography. For instance, it is very difficult to use the information Nain Singh gives us of Tashi-bup-tso in the middle of Tibet, which I passed twice. It would have been extremely important to know from the Pundit the exact length of Tashi-bup-tso. I passed it, but to my eyes it had absolutely disappeared. It was a salt lake, and at the place where Nain Singh puts his big lake of Tashi-bup-tso I did not find anything except shining white salt, and not a drop of water; but, on the other hand, Tong-tso still exists. I mean that it would have been interesting to get some detailed information from the Pundit about Tashi-bup-tso, and as I saw it in 1908, that is to say, some thirty-four years after him, I should have been able to get a really correct figure of the rate at which one of the salt lakes of Tibet has dried up. That is what I mean by scientific physical geography. But, of course, I like the Pundits; and I like Nain Singh just as much as Sir Henry Trotter, if not more.

It was very interesting to hear what Sir Martin Conway had to say; and as to Mr. Freshfield, I think it was a very important remark he had to make. Of course

the Trans-Himalayas begin from a height of 12,000 feet; I do not intend to enter upon that. On the strategical question I really did not mean the Chinese when I was speaking about a "northern enemy," who could put the safety of India into any danger. I did not mean the Chinese at all—I meant somebody else. So when the Emperor Kyang-lung in 1792 sent his 70,000 Mongolians and Chinese through China to Tibet and down on the ordinary way to the neighbourhood of Katmandu, he did not go the way I meant at all, because I meant the roads I knew myself. I meant to say the whole of Tibet is impossible for an army to cross. Mr. Freshfield refers, in a very interesting letter I got from him the other day, to the fact that the expedition to Lhasa proved that field artillery can easily be brought up to Tibet. But I would say that it would be impossible to carry field artillery through Tibet from the north; and it is almost impossible to cross Tibet with an army, even if you have only field artillery. I have crossed Tibet several times, and I have found that 90 per cent. of the caravan is lost *en route*, and if that is the case with a little caravan, it must be still more the case with an army; very often you come to a spring, or some lakes, which prove to be sufficient for your own little caravan, but which would never be sufficient for an army.

Captain Rawling's communication is important, and I know from his book and his publications that we agree very well on most of the points—I believe even as to the Sutlej problem. As to the geological details he mentions, everybody will understand easily, that there is no possibility for me to enter upon such details now. But I do not agree with Captain Rawling when he calls the northernmost range of the Himalayas the Trans-Himalaya; I regard it as belonging to Himalaya, so much the more as it is the water-parting range. Then he proposed that the name Peu Kangri, or the snow mountains of Tibet, or Peu Lho Kangri, the snow mountains of Southern Tibet, should be given to this range. That is all right, but it is quite unnecessary to introduce any Tibetan names into Tibet.

As to Dr. Longstaff, he has brought forward a great many details; I could, if wished, come with many more details about this country, but there is no time now. Those ranges seen to the south by Nain Singh on his journey are by no means the head range of the Trans-Himalaya. That is a mistake. I do not see what Shakangsham has to do within the limits of this discussion at all. Of course everything north of the upper Brahmaputra belongs to the Trans-Himalayan system, but I say from the valley one cannot see anything except those mountains situated close to the route. As a rule those mountains coming down to the upper Brahmaputra valley hide everything that is behind. It is very comfortable and easy to sit down in your study at home and write down a lot of hypotheses; go out and try to observe the facts; it was open to everybody as well as to me. Sir Martin Conway has just pointed out the difference between deductions and hypotheses and actual knowledge. It is very surprising, but anyhow a fact, that one member of the Council of the R.G.S. has maintained that only 100 miles of the Central Trans-Himalaya belong to me, whereas all the rest was known before, and that I had no right to call it a discovery. Those who are not familiar with the exploration of Tibet will very likely be taken in by all the names, dates, longitudes, latitudes, and figures in Dr. Longstaff's remarks, but the experts present in this hall will not agree with him. The whole of his argumentation is built on a foundation of extremely fragile and valueless hypotheses and theories brought forward at different epochs, more specially by Hodgson, Saunders, and Atkinson, and it is not surprising that the whole construction must fall to pieces when brought face to face with the real mapping of the country. I need only remind you of the fact that all three have *one* mighty range in the middle of the Bongba country, and that there are in reality ten absolutely different and sharply defined ranges with broad open

valleys between them. Nevertheless, Dr. Longstaff says that Atkinson's map and my sketch-map are "practically identical." I think it is a great pity that any member of the R.G.S. should ever have published anything of that sort, and it is a bad excuse when Dr. Longstaff now explains that he meant the map that I had published in the *Times* of November 10, as that map was a photograph of the sketch-map on which I have demonstrated my last journey to-night. Major Ryder and Colonel Burrard believe that the peaks seen and measured by Wood and Ryder from the route along the river belonged to *one* range, which was also supposed to be the watershed of the Upper Brahmaputra. That this is Burrard's opinion can directly be seen on one of the maps in his and Hayden's splendid monograph of the Himalayan and Trans-Himalayan mountains, a map representing the drainage area of the upper Brahmaputra. Now those peaks are situated on different ranges, so from whatever point you regard the orography of this part of Tibet, you can never talk of *a range* joining those peaks. There is one reason more why "The Kailas range" has to disappear—it does not exist in reality. But if you are going to speak of the Kailas system, you can do so if you like; I will anyhow take the liberty to call the ranges on both sides of the watershed the Trans-Himalayas. And the signification which is the strongest will be accepted by geographers, and will survive long after the golden inscription on your graves and mine has disappeared.

Well, the situation is this: Dr. Longstaff has never touched the country of which I am speaking now, that is why he has been obliged to quote half a dozen travellers and geographers who have never been in the country either. They have probably collected their information from native explorers who have never been in the country either, and who have thus got their wisdom from natives. Is it surprising, I ask you, that the result of this uncritical criticism is a hopeless confusion? I won't enter upon the question of Mansarowar any more. As Dr. Longstaff mentioned, it is not so much the question whether it is the chief source or not, that is why I called it the genetic source and nothing more. I mean to say that in my theory those two lakes belong to the system of the Sutlej. That is the important thing, not whether any other of those rivers coming from the north have more water or not.

Mr. Thomas Webber never pretended to have discovered the source of the Brahmaputra; he simply says (p. 129), "Here were the sources of the great Brahmaputra originating from the glaciers of Gurla," and he tells us that the Indus, Sutlej, and Brahmaputra take their rise from the glaciers of Gurla Mandhata. But Mr. Webber, if alive, would now be agreeably surprised to learn that Dr. Longstaff has suddenly discovered that Webber discovered the source of the Brahmaputra forty-five years ago. I beg everybody, who takes any interest in this discussion, to look up the sketch-map in Webber's book. Here the uppermost Brahmaputra is so like Nain Singh's map that one must almost believe the two maps stand in some relationship to each other. They are both absurd, but Nain Singh's is much better than Webber's, so far as the Brahmaputra is concerned. On Webber's map we find the words, "Snowy ranges unexplored," just in the very part where the real source is situated, and Webber's route is a good long way from there. South of Rakas Tal and Manasarowar we find the words, "Sources of the Indus," but I don't know whether Dr. Longstaff regards Webber as having discovered the source of the Indus. Only when my maps are worked out and published will I be able to show the value of Dr. Longstaff's communication that Webber was the first traveller to reach the source of the Brahmaputra. Webber has never been to the source of the river, nor has Nain Singh or the Gartok Mission. I am the first who has been up the Kubi-tsangpo, a river that is four and a half times as big as the Maryum-chu.

I should like to say one word about a matter which has not been under discussion to-night, with reference to a letter which has appeared in the *Standard*. It was about the maps, very well known by historical geographers, which have been painted on the walls of the Ducal Palace in Venice. I need only say Prof. Mittag-Leffler, of Stockholm, asked Prof. Volterra in Rome to make an investigation into the matter, and that he sent a rather detailed description, together with photos of those maps, and that the chief librarian of the Royal Library at Stockholm, Dr. E. W. Dahlgren, gave me some other very interesting communications about them. Those four maps were painted in the middle of 1500 by Gastaldi in place of some maps which were destroyed in 1483, and those four maps represent Asia, from the mouth of the Indus to China, the Pacific, and a part of America. The second is Western Asia, the third Africa, and the fourth Italy. I do not need to say that nothing on the map of Asia is like the reality. The Asiatic maps were renovated in the middle of 1700 by Grisellini, and the mountains and rivers form a very hopeless confusion. It is impossible, for instance, on the map of Tibet to tell which mountain range is meant to be the Himalayas, and which river is meant by the Ganges or Brahmaputra, so everybody will understand that those maps, as far as Tibet is concerned, have no value at all. Moreover, as we know they were painted just to immortalize the memory of Marco Polo, and the memory of some other Venetians, and as neither Marco Polo nor any other Venetian of that time ever were in Tibet, it is very easy to understand that these maps could not possibly contain anything that has been found by me during my last journey.

Finally, I give my heartiest thanks to the President for the most flattering and amiable words he has addressed to me. He touched upon one extremely interesting problem of the physical geography of Tibet, namely, the desiccation of the lakes. I think the fact that the erosion of the sea-going rivers enters more and more into the heart of the continent is one of the causes why the salt lakes dry up. But we must remember that it is not only the salt lakes of Tibet, but the salt lakes of the whole of Asia that are drying up; so it is not a local problem, but the root and cause of this phenomenon must be sought for somewhere outside our planet. I am very glad to hear that the President agrees with me to the name of Trans-Himalaya, and I hope the Royal Geographical Society will accept it.

I take the liberty to mention one other matter which does not belong to this discussion, but anyhow to the subject of it. The *Pioneer* of February 6 contains an article—"The Sven Hedin Mountains," signed "Astrabadi." This article does not contain a single important or original point of view, so I need not waste time on it.

Before I finish, I should like to ask one question—What is the result of this discussion? I will leave it to everybody present to reply to it in silence for himself. I have my own opinion. But I agree with the President, the material has to be published before any one is in a position to judge it. It is surprising that certain people seem to believe that I should have begun this expedition without knowing exactly what was left to be done. I started on my fifth expedition rather well prepared, and I had decided to do my utmost to find the source of the Indus and the Brahmaputra, and to fill up as much as I could the great white patch of absolutely unknown country north of the Tsangpo. I have done it now, and I have solved many other problems of physical geography which have not even been mentioned during this discussion.

III. SCIENTIFIC RESULTS OF DR. SVEN HEDIN'S EXPEDITION.

By Lord CURZON of KEDLESTON, G.C.S.I., G.C.I.E.

I HAVE been asked to say something about the scientific results of Dr. Sven Hedin's latest and greatest journey. I have great pleasure in doing so. I only regret that I did not enjoy the opportunity of giving to Dr. Hedin greater official advantages and encouragement than he received in the earlier stages of his journey —as I had promised to do had I remained longer in India. There is one feat of Tibetan exploration still unachieved, of which I should like him to have carried off the laurels. On the other hand, the disheartening circumstances in which he started were in reality the cause of some of his greatest achievements in his latest journey, and thus "it is an ill wind that blows nobody any good."

I venture to place Dr. Hedin's discoveries, which are, I think, the most remarkable in his long and unequalled career of exploration, in three categories of merit. The highest ambition of a geographer is to add to the sum total of human knowledge by filling a blank space on the map, or erasing some speculative error that may hitherto have disfigured it. First, accordingly, I should be disposed to place his filling up of that great "white patch" of 65,000 square miles, between the Tsang-po and the Central Tibetan plateau, stretching from Gartok on the west to Shigatse on the east, and containing the hitherto unknown Tibetan provinces of Bongba and Chokchu.

Alongside of this great discovery I would place the tracing for hundreds of miles and the assurance of a definite orographical existence to the mighty mountain palisade or series of palisades to which he has, in my opinion very appropriately, given the title of the Trans-Himalaya. This range has been surmised to exist in its entire length for many years; it has been crossed at its extremities by Littledale and by native surveyors. But it was reserved for Dr. Hedin to trace it on the spot and to place it upon the map in its long, unbroken, and massive significance—its peaks a little less high than the Himalayas, but its passes much higher, its normal width nearly 100 miles, its total length at least 1000 miles, nor improbably, if its extremities could be followed, nearly twice as much. It is no mean addition to human knowledge that we should realize the assured existence of one of the greatest mountain masses in the world. As regards the name which Dr. Hedin has given to it, I will only say that the desiderata for the title of a new and momentous geographical discovery appear to be these: (1) that the name should if possible be given by the principal (Dr. Hedin would not say himself that he was the sole, or even the first) discoverer; (2) that it should not be unpronounceable, unwriteable, over-recondite, or obscure; (3) that it should if possible possess some descriptive value; and (4) that it should not violate any acknowledged canons of geographical nomenclature. The name Trans-Himalaya combines all these advantages, and it has a direct Central Asian analogy in the Trans-Alai which is a range of mountains, standing in the same relation to the Alai, that Trans-Himalaya will do to Himalaya. I am not in the least impressed by the fact that the name was once given to another range, where its unsuitability secured its early extinction. Any attempts to substitute another title on the present occasion will, in my opinion, be foredoomed to failure.

Second in order of importance, I would place the discovery of the true source of the Indus. There can be no doubt that Dr. Hedin is the first European traveller who has traced the main branch of this mighty river to its glacial origin. Native wisdom is by no means to be despised in such matters, and the Tibetan title of Singi-ka-bap shows that local information, based on the experience of centuries, is in accord with Dr. Hedin's thrilling discovery.

Third, I should be inclined to place what I would call the determination, rather, perhaps, than the discovery, of the true sources of the Brahmaputra and the Sutlej. When a traveller visits or ascertains or sees something which no one has visited, ascertained, or seen, or perhaps even suspected before, he discovers. When he pursues earlier investigations a few stages further, on lines already followed and accepted but not carried to their logical or geographical conclusion, he determines. Thus Livingstone determined the central course of the Zambesi, but he discovered the Victoria falls.

The range of Dr. Hedin's achievements in this wonderful journey is a fitting crown (unless he has yet further ambitions) to the triumphs that have won for him the first place among living Asiatic explorers. I would only add that when disputes are raised, either as to the facts of discoveries so important, or as to the inferences to be drawn from them, I think that it argues some presumption to reject the judgment of the man who narrates what he has seen with his own eyes and done with his own hands—more particularly if he possesses the unequalled record and the unique intellectual and scientific equipment of Dr. Hedin.

IV. WHAT WE HAVE LEARNT FROM DR. SVEN HEDIN.

By Colonel Sir T. H. HOLDICH, K.C.M.G., K.C.I.E.

THE great traveller, Dr. Sven Hedin, has spoken from the London stage and passed on to repeat to wondering audiences the story of his marvellous adventures elsewhere. His amazing energy and determination (before which the hedge set up between India and Tibet by the Indian Government was but an obstacle of straw), his indefatigable patience and keen powers of observation, his fluency of speech, and the charm of his personality win him applause and admiration wherever he goes, and the congratulations of his friends surround him like incense. It is too soon to expect that we should learn even a tithe of the mass of interesting facts that must result from such wide extended research and such intimate association with the natives of Tibet. There is hardly a branch of science to which Sven Hedin is not capable of adding new and valuable information, but it must be years before he can collate and sift his facts and observations so as to place before the public even an epitome of the scientific results of his self-imposed mission. It is not, however, with the general character of his observations in the many branches of science to which he has devoted his attention that I wish to deal at present. I am but taking count of what has fallen from his lips in explanation of his position of a geographer, and in matters geographical we have, at any rate, a certain slight foundation on which to base an elementary criticism—if not of his results, at least of his methods of attaining those results. There was much point in the concluding remarks of his address at Queen's Hall, when he thanked Lord Morley for the legislation which prevented any interference with his work whilst filling up what he called the white space in the map of Tibet. But for that determined attitude of the Government of India on the subject of crossing the Tibetan border, it might well have happened (as Dr. Sven Hedin suggested) that we should by this time have secured a scientifically constructed geographical map of all that "white" space, and the question naturally arises, What shall we get from Sven Hedin?

In these later days, when the white spaces of Asia are so restricted and there is little or nothing left to "discover," it cannot be too strongly insisted on that satisfactory geographical map-making must necessarily be based on two scientific functions, *i.e.* triangulation, which means the accurate fixing by observation and

mathematical deduction of certain points and features on the Earth's surface; and topography, which means the accurate delineation *on the spot* of the features of the county relating to these triangulated points. Nothing short of this is the requirement of scientific map-making in these days, especially in the military field, and the conditions which render these processes impossible relegate all other map-making to the position of a temporary makeshift awaiting better opportunities. Neither triangulation nor topography (in the strict sense) formed any part of Sven Hedin's methods, although the conditions of travelling in that country are not such as to exclude either. Bower, Deasy, Rawling, Ryder, and Stein (especially Stein) have all effected excellent mapping with the theodolite and plane-table in Tibet, and so far we cannot but regret that no such results are forthcoming from Sven Hedin. For not the least advantage of the modern system of topography by use of the plane-table is that the map grows under the hand of the explorer as he travels, and he emerges from his labour with completed results dependent on no further efforts of memory and liable to no errors introduced by the difficult and uncertain processes of subsequent compilation. Sven Hedin's geographical survey methods may be compared to those of the old Indian native explorers who first traversed Tibet, and still hold the record for patient persistency in a certain class of exploration. That grand old pundit Nain Singh (to whom Sven Hedin occasionally refers), when he first crossed Tibet, had in front of him a white space indeed—for it was the whole of Tibet! Lhassa was his objective, and Lhassa he attained. As he moved eastwards from Ladak on that surprising venture, he could only be compared to Speke making for the source of the Nile. He had nothing to guide him, no previous intimation of what he would find *en route*, and a very full assurance of hostility to be encountered every yard of the way. To the south of him he saw the glittering pinnacles of that Tibetan mountain system which forms the northern water-parting of India, and he fixed the position of some of them. The inference that these were part of that great water-parting and not isolated peaks was overlooked, and geographers came to regard the Tibetan plateau as a huge uplifted series of steppes, of which the Himalayas formed the southern revetment, reaching down step by step to the plains of India. Nain Singh could not turn aside from his more important objective to examine the nature of this central divide; that was left for Sven Hedin, and we now know that the northern rim of the Indian basin is a mountain system as fully developed as the Himalayas, and in all points, except that of altitude, more extended.

The value of the work of these old explorers for purposes of compiling a map of Tibet depended on the accuracy with which they could preserve their position. This again depended on their distance measurements, and, incredible as it may seem, these measurements were maintained by the monotonous, unending, process of counting their paces through every yard of the thousands of miles of their wanderings. From day to day, from year to year even, the same perpetual counting, counting; dropping a rosary bead at every hundred paces, starting again as the weary round completed the tale of the necklace; unresting, unhasting, till the effort became mechanical (a function of the body rather than of the mind), did this extraordinary record continue, until finally the traverse came to an end in some point fixed by the Survey of India. No European could have done it; but the native did, and the result was extraordinary. Even allowing for the tendency for errors in pacing to compensate themselves, there was always a most satisfactory agreement when the long (sometimes years long) traverses were worked out. Consequently, in the processes of map compilation these records still stand as authoritative, only displaced where scientific geographical surveys have been run, and quite undisturbed by the usual sketchy forms of European exploratory traversing. So

far as we know at present, no such direct method of measurement was adopted by Sven Hedin any more than triangulation or the determination of altitudes with the theodolite, or the delineation of natural features by local topography.

It is, perhaps, too soon to speculate on the actual geographical results which he has attained by other methods, but he makes great mention of "panoramas," some 2000 of which he has sketched (presumably by eye) from such positions as passes or other elevated points in his route—and we may well ask what use he proposes to make of these. How far will they assist his mapping? Photographic panoramas have indeed often been made very useful. Combined with special instruments, and taken from positions well fixed by triangulation, they can be utilized for subsequent topography, and under certain conditions, dependent chiefly on the necessity for extreme rapidity of action (in cloudland, for instance), they are invaluable, although it is doubtful whether photo-topography will ever rival the ordinary method of mapping direct from nature itself. Photographic panoramas were found exceedingly useful, again, in illustrating the nature of that much-discussed divide which parts the Atlantic from the Pacific in South America, where they told a tale which could have been told in no other way, but they did not assist map-making. Another more remarkable series of panoramas which I can call to mind were those taken by Mr. Griesbach, the geologist of the Russo-Afghan Boundary Commission in 1883–85. Griesbach was an artist (as is Sven Hedin), but he trusted nothing to eye sketching. He worked with the camera lucida, and the skill with which he seized on all those small outward and visible signs which betokened certain geological conformation, and finally retained in a plain black-and-white drawing a distinct impression of perspective and distance, was most admirable. But although he was a sound topographer, he never made use of such panoramas for map-making. Indeed, he was a consistent opponent of what he called 'reminiscent' topography—*i.e.* topography put together after the country it illustrated had passed from view. It is, therefore, still a little difficult for us to forecast the geographical results (expressed in mapping) of Sven Hedin's great exploration. Undoubtedly he will fill up a white space in the map of Tibet, and we shall, in time, be in a better position to criticize those results.

The splendid reputation which Dr. Hedin has built up for himself is not affected by comparatively minor details of method in the prosecution of any one branch of scientific research, and he is able—no one better—to maintain his position as a scientific geographer in his own way. But there is a danger that the very glamour of his achievements should lead younger generations of explorers (not possessing his remarkable topographical memory and artistic skill) to adopt methods which, at any rate, are not those which the Geographical School has set itself earnestly and resolutely to teach, and which may very possibly have been forced on Dr. Sven Hedin by circumstance rather than by choice. It may be suggested that possibly the Geographical School want too much, but recent experiences hardly justify such a view. It happens that another great explorer (a scientist of equal rank with that of Dr. Sven Hedin) has but recently returned from Central Asia with a truly magnificent geographical record. Dr. Stein is a skilful observer himself, and an excellent triangulator. Assisted by a trained native topographer under his constant supervision, he has placed no less than 130 sheets of the standard "degree" size of completed mapping on the scale of 4 miles to 1 inch in the Survey Office at Dehra Dun, to be reproduced as fast as Colonel Burrard can publish them. This magnificent geographical "bag" is the result of two years' work, and, knowing Dr. Stein's previous records, I can confidently say that his is the sort of geography that we want.

V. REPLY BY DR. SVEN HEDIN.

Sir Thomas Holdich calls his article "What we have learnt from Dr. Sven Hedin. As I have followed now the same methods as during my former expeditions in Asia, the author probably means *all* my journeys. It is interesting to compare this article with the opinion he expresses about my journeys in his own book, 'Tibet, the Mysterious.'

So far I have only had time to read a paper about the last half of my journey (in Queen's Hall), and later in a more technical paper—more especially about the results of other travellers in Tibet. But it will take me three years to work out all the scientific results, and until this is done it is curious that anybody should take the trouble to write criticisms about those results.

As I am lecturing all over Europe, I have no time to enter in any detail upon Sir Thomas Holdich's article, but there are some points on which I must say a few words in reply. Sir Thomas Holdich says that the conditions of travelling in the country did not exclude the possibilities of triangulation. If the conditions were such, it is wonderful that the British in India have never sent out any expeditions to the unknown country north of the Tsangpo. In reality the conditions were such, that I had to travel a great deal in disguise, and I cannot see how a triangulation of the country should be possible under such conditions. In another critical article the same author asks why I did not take Russian topographers with me when the Indians I had asked for, and whom Lord Curzon so kindly had promised me, were refused. This question is probably only meant as a joke, so I don't reply to it at all.

Sir Thomas Holdich regrets that I did not carry out the same trigonometrical mapping as Bower, Deasy, Rawling, Ryder, and Stein. They had all native surveyors with them, and all the moral and substantial support from India which had been refused to me. I had not even a single man as an escort. Then the circumstances of travelling in those parts where the explorers mentioned have been are extremely different from those in the province of Bongba.

Sir Thomas Holdich compares my methods with those of the Indian native explorers. He has never seen my methods, so he has no right whatever to judge them; but regarding all the praise he gives to Nain Singh's work, one may get the impression that my work is at least as good as Nain Singh's. He seems to believe that only Nain Singh had a lot of difficulties to overcome, but that I had none at all. The "glittering pinnacles" Nain Singh saw to the south are by no means situated upon the Indian water-parting. They are situated on another range north of the water-parting. It is difficult to understand how Sir Thomas Holdich, who has not the slightest idea of the geography of Bongba, can express an opinion about the situation of the water-parting; but it may be interesting in this connection to note that the same author twice in his above-mentioned book believes that the great lakes of Nain Singh drain to the upper Brahmaputra. This proves, however, what vague ideas Sir Thomas Holdich has of the situation of the water-parting.

How does Sir Thomas Holdich know that I did not determinate the altitudes with the theodolite, nor delineated the natural features by local topography? It would have been wiser of him to keep to himself such reflections, but as he has given publicity to them without having got a word of information from me, I am very sorry to be obliged to address him publicly in this way. As to the value of my maps, I should advise those interested in this question to look up the two folio volumes of maps I brought home from my last journey, and to compare them with the maps of the pundits. Then they ought to compare what Dr. B. Hassenstein says of my maps from my journey 1893–97 (in *Pet. Mit.*, Erg. Band xxviii.), and

what Dr. Stein said of the same maps in his lecture, March 8, before the R.G.S. —with Sir Thomas Holdich's criticisms. Dr. Hassenstein worked out those maps, and Dr. Stein found the ruins near Lop-nor and the end of Keria-darya by help of them, so they have, anyhow, had more occasion to be familiar with them than Sir Thomas Holdich. And since then my methods of topographical survey and astronomical determination have improved considerably.

I hope nobody will be so extremely childish as to suppose that I do not understand the difference in exactitude between the first mapping of a pioneer in an absolutely unknown country and the careful detailed work of a general staff or a Survey of India. But I cannot understand how two such things can ever be compared by any serious man. And I cannot understand how anybody can be so absurd as to blame me, or "regret," as it is called, that I did not introduce trigonometrical mapping in the blanks of the map of the Bongba country. With the same right somebody may blame me for not having started some gold-mining companies, and built some cathedrals on my way through Bongba.

To Sir Thomas Holdich triangulation seems to be all. There are some other sciences a traveller in an unknown country has to serve. As I could not possibly do everything myself, being alone, I had to do as much as I could and as the length of the days allowed. It was my wish to take three native assistants with me, and I should have paid them myself, but the British Government refused me them. So if Sir Thomas Holdich has to blame anybody, it is rather the British Government.

To possess a preliminary sketch-map of a country is better than to have no map at all. I have been able to follow and draw the principal geographical and orographical lines of Bongba, and I have several geological profiles from Bongba, together with specimens of rock with dip and fall—a science which has been utterly neglected by most of the British travellers mentioned by Sir Thomas Holdich. There have been thousands of British officers in India during the last hundred years, but not *one* of them has ever tried to enter Bongba, a country of which Sir Thomas Holdich positively says that the conditions of travelling did not exclude triangulation work. Is it really possible that they and their chiefs could take so little interest in a country which was situated so close upon the Indian frontier? So, as to Bongba, and whatever the value of my maps may be, I suppose I have done more for our knowledge of this province than all those thousands of officers put together and, inclusive, Sir Thomas Holdich.

A child of a primary school in Sweden will understand that there is work enough to do in Bongba for generations of topographers and geologists—in those two sciences there is still a good deal to do even in England, Scotland, or Sweden, I suppose. But the very first traveller who, under exceptionally difficult conditions, enters an unknown country and brings home with him the first knowledge of it, should be the very last to be blamed for his work.

A PROPOSED NORTH POLAR EXPEDITION.*

By ROALD AMUNDSEN.

"By far the most important task left for geographical research to perform in the Arctic Regions is the exploration of the extent, depth, and character of the polar basin. A great part of this work could be accomplished by drifting through the unknown part of the polar basin —as the *Fram* Expedition did in 1893–96—north of the *Fram's* route."

* Royal Geographical Society, January 25, 1909.

journey, are very interesting and excite a desire to learn more of what was actually seen at this present time when changes are occurring throughout the country.

Of the opium question Lord Ronaldshay treats at some length. While acknowledging that towards the suppression of opium more has been achieved than was to be expected, he lays stress on the strength of the forces in China which are impeding the execution of the reform, and his own experience certainly proves that the cultivation of opium is being carried on in districts where officially it is reported to have been extinguished. He also believes in the existence of a party which desires the extinction of the foreign opium trade solely in the interest of native opium. The solution of the question must doubtless rest with the people, without whose co-operation the Government is almost as powerless as that of sixty years ago to effect a reform which touches the purses of such a large section of the population, not only official, but also commercial and agricultural.

Though the blood is beginning to move in the veins of China, it is a relief to turn from the contemplation of that country to Japan. In spite of the burden of present taxation, the industrial and commercial activity is depicted as immense, and only surpassed by that of the naval department, even under a restricted programme. With 12 battleships, 12 armoured and 52 other cruisers, 55 destroyers, and 78 torpedo boats, Japan has twice the tonnage and in battleships twice the number of the vessels with which she faced Russia. The construction of battleships of 20,800 tons and cruisers of 18,400 tons, with an unusual number of 12-inch guns, is being hastened to completion. Lord Ronaldshay's essays on these and similar questions are thoroughly up to date and full of statistics. The only side of Japanese activity which is left untouched is the army.

With Japan's work in Korea and Manchuria the author concludes his review of the Far East. The chapters on Korea contain the history of that unhappy country since 1904. In the chapter on Manchuria, the prominent place is of course occupied by the railway questions with China, and Japan's attitude as regards the open door to trade. As to the latter point, the charge of failure to observe her promise is held by the author to be not proven.

W. R. C.

An Asian Problem.

'The Pulse of Asia: a Journey in Central Asia illustrating the Geographic Basis of History.' By Ellsworth Huntington. London: Constable. 1907. *Maps and Illustrations.* 14*s. net.*

Is there a climatic pulse in Asia? a definite and measurable recurrence of certain phases of climate, responsive, possibly, to those laws of nature which regulate the Earth's motion in space? Mr. Huntington thinks there is, and he has spent two years in collecting evidence thereof by means of careful and painstaking observations in Central Asian regions. He is fully impressed with the fact that one of the chief factors in determining the course of history is geography, and that among geographic forces changes of climate have been the most potent. So he commences with a careful description of the physical features of five great Asiatic basins—Kashmir, Lop, Turfan, Seistan, and the Aralo-Caspian depression, noting with due emphasis the influence of infinitely varied physical environment on the habits, thought, and character of their inhabitants. He then, with the aid of a well-constructed map which leaves little to be desired in point of clearness, illustrates the change which has occurred in the great Lop basin within the last two thousand years due to the process of desiccation and its consequent results as regards the social life and character of the people. No one will dispute such evidence. It has lately received remarkable confirmation from the observations

of Dr. Stein, whose more elaborate and scientifically constructed maps will be of immense service in the elucidation of Central Asian problems such as these. Nor will any student of Asiatic history question the validity of the arguments which support the proposition (not a very new one) that it was the effect of climatic changes, probably representing deficient rainfall, that, under the eternal law of necessity for existence, first set Central Asian hordes moving from their overcrowded valleys, displacing surrounding tribes and spreading in ever-widening waves of human emigration to the west and the south. At the particular period of the world's history when these tremendous human movements were most active, *i.e.* about two thousand years ago, Europe seems to have been undergoing a climatic change which we might say was "for the better." It was growing warmer and moister, and consequently more attractive to the hardy barbarian than his own sterile wastes. Thus are we relieved from a natural apprehension lest the periods of desiccation should be synchronous over the whole habitable globe. The effect of the drying up of water-supply on a pastoral community is well illustrated by Mr. Huntington when he points out that the difference between, say, 13 inches of annual rainfall and half that amount is equivalent to the difference in food-supply of fifteen sheep or of one; but he denies that the failure of moisture is to be attributed generally to deforestation, the actual amount of rainfall not being influenced by forest growth, but only its distribution. These climatic changes are said to occur in cycles, and Mr. Huntington adopts the theory that just as geological investigation has established recurrent glacial epochs at one end of the scale, and Bruckner has proved the existence of certain recurrent climatic phenomena in periods of thirty-six years at the other end, so we may look for an intermediate pulsation, the beats of which are to be reckoned by thousands of years, which will be coincident with regular fluctuations of rainfall and temperature throughout the world. It may be so, but surely it requires the evidence of a recurrent period of prosperity in Central Asia to prove it. We can only hope that the world is approaching that period in its history at which the pendulum is about to swing back. With the almost universal evidence of gradually increasing desiccation through the continents of Asia and America (especially South America), and similar indications in Western Africa and Northern Europe, we see at present no evidence of an equivalent increase of moisture to counterbalance the deficiency anywhere. Is there really a universal pulse—or are we drifting, like Mars, into eternal sterility? If the perusal of Mr. Huntington's book has not left us fully convinced of the truth of his theory, it has at least left an impression of most delightful reading. It is interesting from the first page to the last—in short, it is one of the best of the many books of Central Asian travelling that have ever been written.

T. H. H.

AFRICA.

The Congo Basin.

'George Grenfell and the Congo.' By Sir Harry Johnston, K.C.B., D.SC., etc. 2 vols., 496 *Illustrations, and* 14 *Maps.* Hutchinson. 1908. xxiv. + 990 pp. 30*s. net.*

This leading title is followed by a very long sub-title, which, in old-fashioned style, fills the whole of a page, and conveys a somewhat adequate idea of the comprehensive character of the author's truly encyclopædic work. From it the reader will at once learn that he will here find, not only an ample account of the missionary labours and geographical explorations of the "Central African Livingstone," but also some most attractive essays on a multiplicity of topics directly or indirectly connected with the main subject. Thus, with Congoland are included the neighbouring Cameroons and Fernando Pô, besides a detailed history

photographs which he has shown us to-night, and which I hope he will reproduce in some worthy successor to those great works on Uganda, British Central Africa, and the Congo, which he has given us in the past.

Dr. VAUGHAN CORNISH: I think, we must all have noticed, amongst the many beautiful photographs which Sir Harry Johnston has shown us, that by far the most beautiful were those of Jamaica, and I trust that the admirable lecture he has given us to-night will do something to turn the tide of the tourist to that beautiful island. It is most desirable that we in this country should visit the British West Indies more than we do, not merely for the delights of their wonderful scenery, but also to strengthen the bonds which unite them to the mother country.

Prof. W. M. DAVIS: I should respectfully wish to differ from Sir Harry Johnston with regard to his characterization of his earlier work as the "dry bones" of geography. He referred in this uncomplimentary simile to the extremely important matter of mapping land forms, river courses, coast-lines, and so on. Might we not make another physiological simile, and call these materials the "bone and sinew" of geography? "Dry bones" suggests something unpleasantly derogatory. "Bone and sinew" suggests something fundamentally useful, upon which the graceful forms of flesh and blood, the more lively elements of geography, are properly placed, but without which those graceful forms would have no strength or value. All of Sir Harry's descriptions were geographical, not botanical, in quality, because the plants that he pictured were presented rather as clothing the land-forms upon which they grew, and hence as essential features of the landscape than as botanical specimens. For a fuller geographical treatment, there might be added some explanation of the connection of the land-form with the plant or animal form that occupies it; without this connective tissue the treatment might drift too far towards botany. The beautiful collection of photographs has illustrated the lecture in a most excellent way, and I will, therefore, do no more than express in your name our sincere thanks for the most interesting lecture which we have listened to to-night.

The PRESIDENT: If no one else wishes to make any observations, and as the time is getting on, I think I had better conclude this discussion. We have listened to an account of an extremely picturesque region, and I think that the way in which the photographs have been selected indicates that the lecturer is himself an artist.

PROBLEMS IN EXPLORATION.

II. ORDOS.*

By W. R. CARLES, C.M.G.

IN Colonel Prejvalsky's 'Mongolia' a chapter (vol. 1, chap. 5) is devoted to the subject of the Ordos country, the steppe inclosed within the great bend of the Yellow river and whose boundary to the east and south is defined by the portion of the Great Wall which traverses Shensi and rejoins the Yellow river near Ninghsia in Kansu.

At the time that Prejvalsky wrote (1876), Ordos was regarded as a desolate waste, and classed by him with the "frightful" steppes of

* Map, p. 740.

Alashan. But since that date more has been learnt of the Ordos, and with the advantages of a better acquaintance with it there seems reason now to modify the views entertained thirty years since, and the more readily so as circumstances have altered within that period and have considerably affected the local conditions. The territory granted to the Ordos tribes extended on the north-west to the old bed of the Yellow river (Ulan Khatun), and on the north-east beyond the river for some little distance on the road to Kuei-hua-chêng, but in the latter direction has been reduced by sale or otherwise within recent years. The "tribe" (Mong. *aimak*, Chin. *pu*) is mentioned by Gerbillon and some other writers as consisting of six *koshung*, or banners, but Prejvalsky and Rockhill mention seven by name, and Mayers ('The Chinese Government,' p. 82) gives the same number, adding that certain fragments of the Tumed tribe occupying the region near Kuei-hua-chêng are amalgamated with them, a fact which may perhaps explain the difference in number. Yule is unable to explain how the tribes got their name, Ordos, but mentions that the title was specifically applied to the body of Mongols established in eight white *ordus* or encampments behind the sepulchre of Chinghiz (which he places near the sources of the Tola and Kerulen), "and a migration of their descendants is supposed by Ritter to have caused the transfer of the name to the territory" (Prj., 'Mongolia,' 1, 181). The banners are dispersed as follows: On the north-east, Talde (Rockhill, Talat); north-west, Hangin, or Khangin; west, Otok and Jassak; south, Ushin; east, Jungar, at present the head of the tribe; and in the centre, Van or Wang.

No better text-book can be taken than the work of the great traveller, whose explorations did so much to disclose to Europe large portions of Mongolia and Tibet, of which, since Marco Polo's day, knowledge had mainly been gathered either from Chinese sources or from the writings of the Jesuit fathers at Peking, and the tale, at the time regarded with suspicion, of PP. Huc and Gabet. It is proposed, therefore, in the present paper to use Colonel Prejvalsky's book as a basis to which may be added such notes as may be suggested by more recent travels and discoveries. And it seems necessary to premise that the interior of Ordos does not seem to have been visited by Europeans until within recent years.

It is true that in 1697 Père Gerbillon, in the suite of the Emperor Kanghsi, visited that country, but the route taken only afforded him an opportunity of seeing the south-east corner and the northern frontier, for the great Emperor Kanghsi, after sending on the greater part of his company by a northern route to meet him at Ninghsia, struck across Shansi *viâ* Tatung Fu to Paotê, where some boats had been prepared for his passage across the Yellow river. The difficulties of the crossing detained the whole party there for some days, during which the Emperor not only supervised the passage, but also occasionally himself took an oar to help the crew. From Paotê the Emperor travelled south-west to

Shen-mu, where the Great Wall was reached. This was followed southwards to Yü-lin Fu, where Ordos was entered, and a south-south-west line was taken, which brought the travellers *viâ* Lake Tonghalan-nor to Anpien, near the Great Wall. Continuing to follow the Great Wall, and keeping generally to the south of it, the party reached the Yellow river at Hêng-chêng, where they crossed over to Ninghsia. It was thus but a small portion of Ordos which was traversed, and Père Gerbillon's notes on the route between Shên-mu and Yü-lin refer almost entirely to what was seen on the eastern side of the Wall. The impression which he gathered from the sandhills driven against it by the winds was confirmed by the condition of Yü-lin, for the walls and gates of the town were in places overtopped by the masses of sand. But after entering Ordos, the story which he gives by no means conveys a corresponding picture of desolation, for he tells of strips of cultivation by river-sides, of numerous streams which had to be crossed, of pheasants, and even of an extensive wood, and though reference is constantly made to sand-drifts, quicksands in the streams, juniper bushes and suchlike hardy growth, yet there is no tale of suffering from want of water or sand-storms or similar troubles of a desert.

On the return journey from Alashan, Gerbillon, after following the left bank of the Yellow river for some days towards the north, crossed it in lat. 40° 22′, and took a line thence to Toto (Tokto), which in the main corresponded with that followed by Prejvalsky in 1875 in the opposite direction. But it would seem that the river at the earlier date had its bed much further north, for Gerbillon's route took him as far north as lat. 41° without encountering the river, whose course is shown in Prejvalsky's map as just south of that parallel.

In 1845 Huc and Gabet entering the Ordos country from Kuei-hua-chêng, apparently near Tokto, continued their journey almost directly west to Shih-tsui-tzu, where they recrossed the Yellow river and entered the Ala-shan country. As the travellers passed Dabasun Nor their route seems to have lain somewhat to the south of Prejvalsky's, and their sufferings from the sands were consequently greater, though he too complains of the intense heat of the sand in summer, and of how cruelly it affected the feet of his camels.

Neither Prejvalsky nor Gerbillon on this northern route passed out of the Yellow river valley on to the Ordos steppe to the south. The valley is spoken of by Prejvalsky as from 20 to 40 miles broad, and of an alluvial clayey soil; *i.e.* between Bautu and the meridian of the west end of the Munni ula mountains (circa long. 108° 30′). Farther west it widens out very considerably, and contains two old channels of the river, of which the northern one, called Ulan Khatun by the Mongols, is well preserved. Prejvalsky judged that the river when he saw it was flowing in the southernmost course. About long. 108° several channels, 170 to 200 feet wide, separate on either bank from the river, soon uniting

again with the parent stream; only one, the Baga-Khatun, continues to flow in an independent stream for some distance to the east.

West of this meridian Prejvalsky came into contact with the Kuzupchi sands, which skirt the northern base of the Ordos plateau and extend westwards to Alashan. They seem to have given him the impression on which he based his judgment of the Ordos country. "A succession of hillocks, 40, 50, rarely 100 feet high, lying side by side, and composed of yellow sand. . . . The effect of these bare yellow hillocks is most dreary and depressing . . .; not a plant, not an animal is visible, with the single exception of the yellowish-grey lizards which trail their bodies over the loose soil and mark it with the patterns of their tracks. A dull heaviness oppresses the senses in this inanimate sea of sand. No sounds are heard, not even the chirping of the grasshopper; the silence of the tomb surrounds you. No wonder that the local Mongols relate some marvellous stories about these frightful deserts" ('Mongolia,' vol. 1, pp. 193 *et seq.*). However, the sands of Kuzupchi, which the Mongols say are from 14 to 50 miles wide, are not in all parts the land of death and desolation. Nearer the extreme edge, small oases may be seen covered with a variety of plants (*ib.*, p. 195). Gerbillon also tells the same story, finding occasional morasses, patches of grass or reeds, which broke the monotony of the journey. And neither he nor Prejvalsky experienced the same difficulty in finding their way through the sands as was met by Mr. Rockhill, who, crossing the river in long. 109° 30′, followed its northern bank westwards to Ninghsia ('Journey through Mongolia and Tibet'). His difficulties were increased by the numerous pits dug by liquorice-root hunters, and also by great irrigation canals, which necessitated wide *détours*.

The irrigation works on the north-west side of Ordos were mentioned by Gerbillon, and have attracted the attention of all European travellers who have followed the course of the Yellow river in that region of late years. Rockhill ('The Land of the Lamas,' p. 42) speaks of hillsides west of Lanchou as irrigated by water raised by immense wheels 50 to 60 feet in diameter, and the price being calculated by the length of a joss stick burnt during the time that the water passed over the wheel. But lower down the river, where there is not the same occasion to raise water to high levels, similar engineering skill has been displayed in the construction of canals running parallel with the river. Rockhill writes of country between Shih-tsui-tzu and Ping-lo Hsien, "For miles we followed a huge irrigation canal, from which ran innumerable ditches, leading the water all over the broad valley. This stupendous work has converted an alkaline, wind-swept, sandy plain into a fertile district, where rice, wheat, millet, and fruits of various kinds are raised in great abundance" ('Through Mongolia and Tibet,' p. 38). This irrigation seems to be characteristic of the country through which the river flows towards its northernmost point, and has apparently more

recently been extended to the north-east corner of Ordos. Prejvalsky was there only two years after the Dungan rebellion, and he speaks with astonishment of the excellence of the works and the condition in which the canals were kept, though the population had been practically exterminated.

Later travellers have told of a development corresponding with the fertility of the soil. Thus Dr. Tafel writes: "During the W.-E. course of the Yellow river it is no longer inclosed in the narrow rocky cañons above mentioned, and in the north-western corner of the bend sometimes changes its bed, and thereby forms a very fruitful alluvial country, out of which the Chinese in the last few score years have already almost completely expelled the Mongol herdsmen. By constructing new canals the Chinese are rendering colonization possible on an uncommonly large scale. Other schemes on large lines are also connected with this corner. For some time past the project has been nursed of forcing the river by large reservoirs (*Stauanlage*) to deposit the masses of sediment carried down by its waters, and thus to meet the great and ever-present danger of inundations in the plains, a danger which, as above-mentioned, is caused by the constant raising of the river-bed. But if ever Chinese construct strong canal sluices in this country, they will form on the Yellow river a Mesopotamia which will be able to feed many millions of their superfluous population" (*Z. Ges. E. Berlin*, 1908, p. 383).

In an earlier paper he had expressed the same opinion: "It is strange that in Kuei-hua-chêng and Bautu famines are of frequent occurrence, for with irrigation of the fruitful and wide alluvial plains of the Yellow river valley from Chung-wei by Ning-hsia and San-tao-ho to Kuei-hua and Ho-ku there is to be found an inexhaustible field for rice and for wheat and the two millets" (*Z. Ges. E. Berlin*, 1906, p. 356).

He follows up this statement by pointing to the absolute need of irrigation works: "In this part of the river valley it is impossible to depend upon the rain for agriculture. Rain falls too late, and does more harm than good. The people have often to wait until late in June for the first drops of rain, and then extensive cloud-bursts fall suddenly, which do more to destroy than encourage growth. It seems to me that what the people have to fear is not so much a new flooding of ground saturated with salt as the annihilation of their weak works by high swollen waters" (*ib.*, pp. 356, 357).

The fancied terrors of the Ordos steppe for some time deterred most travellers from crossing it. But Baron von Richthofen ('China,' vol. 2, p. 664) mentions that a few years previous to the time of his writing (1882) Herr Verlinden of the Belgian mission at Hei-ying-tzu had made a journey in the country, and that he found the watershed of the river on the frontier side of the Great Wall to be a swelling

steppe, in which the Chinese had advanced with their agriculture just as they had done further east.

M. Obruchev, who visited western and southern Ordos in 1893, found that in its western division "a northern and southern part must be distinguished." In the former "the plateau was covered with flat hills running in different directions, and rising only some 660 to 1300 feet above the surface. They consist of soft sandstones, mostly horizontal, which are covered, especially in the neighbourhood of the Yellow river, by low hills and *barkhans* of sand. The southern part, down to the southern frontier of the Ordos, consists chiefly of *barkhans* with more or less wide, flat depressions between them, which the Mongols name *chaidams*. These are often bottoms of dried-up salt or fresh-water lakes. Similar sands cover the low left bank of the Yellow river as far north as the Khana-naryn-ula range.

"In the south of the sandy regions of southern Ordos the country rises higher, and there begins the loess plateau of eastern Kansu and northern Shensi. On looking upon it from the plains of the Ordos, it has the aspect of a flat swelling, 1000 to 1300 feet of relative height, divided by ravines into separate parts, named 'mountains' by the natives. On our maps, a range, Lu-guan-lin or Bo-yui-shan, is marked, but in reality it* does not exist. While crossing this region from east to west, and again from north to south, M. Obruchev saw no range, and only found a loess plateau, divided by a labyrinth of ravines into a number of table-topped hills, all of nearly equal height. The slopes of the ravines show loess, which covers the same soft sandstones as in the Ordos. This ravined plateau has a width of about 130 miles from the Ordos plains to the neighbourhood of Tsin-[K'ing]yang-fu. Its northern part is very difficult to travel upon, on account of the ravines which one has continually to cross. In its middle, from Tsin-[King]yang to about Lin-tai, the plateau is less ravined, and is divided into table-like masses 7 to 27 miles wide. The road crosses for hours a plain covered with cornfields and villages, and then, all on a sudden, one sees a wide river-valley, cut in 1000 to 1300 feet deep into the plateau. The immense amphitheatres thus formed have their slopes in numerous small loess terraces, each of which is about 15 to 20 feet wide.

"The passage from the northern to the middle part of this plateau is gradual, but not so from the middle to the southern part, which may have a width of about 50 miles. Again one meets here the same countless ravines, but some order is seen in their orientation from north-west

* Dr. Tafel says that he was unable to discover a range under the name Lu-kuan-ling, but that there is, where Dr. Bretschneider's map shows it, a long though not very high line of mountains which extends from Ching-pien along the Wall to the West (*Z. Ges. E. Berlin*, 1906). It may here be remarked that Rockhill and Tafel found similarly that the range of mountains stretching north of Kuei-hua-chêng and Bautu, which is marked Yin-shan in the maps, was not known by that name, and was generally called Ta-ching- or Ching-shan.

to south-east. Two ranges, separated by the valley of the Tsin-yai[King-yang?] river, may be distinguished, and from beneath the loess one sees the rocks *in situ*, which rise to the height of the plateau, and are covered on their tops with but a thin sheet of loess" (*Geogr. Journ.*, 1895, vol. **5**, pp. 263–264).

With reference to this region and the range shown in the maps as the Lu-kuan-ling, Dr. Tafel remarks, "If one examines this natural boundary wall, one finds nearly on the level of An-pien Hsien, to the north and south of the mountain range, some horizontal Upper Carboniferous strata of uniform height, while the range proper is covered by a gigantic loess wall of over 500 metres in thickness. Corresponding with this huge pile of loess, the mightiest which I have ever met, the country is extremely difficult to traverse. From the north one has soon reached the ridge, but on the south narrow loess ravines with vertical walls are cut in deep and wide. Most of the ravines belong to the valley system leading towards King-yang. . . . Some roads from north to south pass over this range; one of the most important was travelled by Obruchev. My attempt to travel in the mountains following their strike failed. They are absolutely without any track for beasts of burden and, without a clever guide, one may seek a long time for water.

"From An-pien Hsien to Ning-hsia-Fu I did not follow the high-road, for this route had been taken by several travellers, but I sought by several circuits for the northernmost traces of the Liu-pan-shan, which one has to cross on the old commercial road from Lan-chou to Hsi-an Fu. I soon struck on the Lo-shan, a range running nearly south, which rises some 800 metres above its surroundings. It was followed by similar formations, *e.g.* Hsi-ku-shan and Niu-tou-shan, which exhibited very complicated and perplexing circumstances in their configuration (*gequälte Lagerungsverhältnisse*). Later on I crossed the Alashan at two different places. The traces of pressure on this wall of the Ordos are much more marked than elsewhere. Some transpositions and flexures south of Ning-hsia seem to point north 10° east. The general character of the formation of the mountain was very difficult to ascertain. Metamorphosis of the strata occurs frequently. Owing to this I found fossils only in a few places, and then in a bad condition. It is due to this cause that wide steppe-valleys extend between solitary rocky mountains of 800 to 1200 metres high and conceal the connection. I formed the impression that east of a line running from Ku-yuan to Ping-liang Fu the whole country is sunken towards the west, and that a similar depression has been formed near Chung-wei on the line of the east-to-west course of the Yellow river. . . . Both above and below Chung-wei the river has to break through the eastern outlines of the Nan-shan, which have a strike of about north 50° to 65° west. It is the wildest part of the navigable portion of the Yellow river; on account of the narrow bends and hidden rocks, boats cannot be used, but only rafts,

and by preference rafts of yak- or deer-skins. This country is also covered by mighty masses of loess, under which there are generally chains of granite" (*Z. Ges. E. Berlin*, 1906, pp. 363–365). In a letter of recent date, Dr. Tafel speaks of the fault on the west of Ordos as extending from Lo-shan and Niu-tou-shan in Kan-su to Ala-shan and Yin-shan on the north-west of the Yellow river, and constituting the most interesting feature of the country through which he travelled.

The altitudes which Obruchev gives are 3180 feet at San-tao-ho (Rockhill, 3450 feet), from which place the level gradually rises to 4900 to 5000 feet, for the flat heights of northern Ordos, and 4300 to 4600 for southern Ordos (Borobalgasun, 4340 feet); *ib.*, p. 264.

Obruchev's explorations in the south and west were supplemented in 1884–5 by a journey made through the whole length of Ordos on its eastern side by his fellow-countryman Potanin, who mentions "their holiest place is a collection of felt tents called 'Edjen joro,' reported to contain the bones of Chinghiz Khan. These sacred relics are entrusted to the care of a caste of Darhats numbering some fifty families. Every summer, on the twenty-first day of the sixth moon, sacrifices are offered up in his honour, when numbers of people congregate to join in the celebration, such gatherings being called *tailgan*.

"On the southern borders of Ordos are the ruins of Borobal-gassun, said to date from Chinghiz Khan's time" (*Proc. of R.G.S.*, 1887, ix. 233).

It is to Obruchev and Potanin that we are indebted for the maps of all that portion of Ordos which lies to the south of the Yellow river valley. Unfortunately, their works have not been translated from the Russian. But the loss is in part atoned for by the account of Dr. Tafel's journey through eastern Ordos (*Z. Ges. E. Berlin*, 1906, pp. 360–365). Travelling from north to south, he saw hardly a single yurt, and seldom had need of his Mongol interpreter, for the people were more than half Chinese. The ground was sown by them with millet, vegetables, buckwheat, and many kinds of barley. Wheat could apparently (*angeblich*) not be cultivated on account of the late rainfall. The main danger for agriculture consisted in the north-west storms, frequently prevalent even in May, which carry away the young seedlings. Indeed, agriculture he found in Ordos to be almost entirely dependent on summer thunderstorms in places where irrigation could not be introduced, as in the southern oases, *e.g.* near the sources of the Yü-lin river.

Coming into the plateau from Bautu, he first had to pass the Yellow river plain, some 16 miles wide, which in its southern portion is a barren steppe. Then, in the ascent, he had to cross a fairly broad zone of immense sand-dunes, some in ridges, others in *barkhans*, before reaching a hilly country (*Hügelland*), which had once been a desert. During three days' march he saw no sign of sand, nor of loess until he reached Yü-lin Fu. Herds of thousands of sheep and hundreds of camels were grazing on the slopes and hills which had not been cultivated. South

of the rich pasture land, on which the Prince of Wang has established his residence, he came on fine yellowish red sands, steadily increasing in depth towards the south. These at first were covered by bushes, but near Jassak were piled up in huge *barkhans*. Then came a hilly land with broad flat valleys, some of which were blocked up by sand, and near Bortai temple was a large saltpetre lake, the products of which are carried for sale to Chih-li and Honan. As he approached the Great Wall at Yü-lin, the masses of sand grew bigger and more naked, with only occasional oases, which were utilized to the utmost by Chinese. Yü-lin, a few miles to the south of the Great Wall, was half buried under the sand; the same vast sands extended from Yü-lin to Huai-yuan, and, with some interruptions to Ning-tiao, near which some large Belgian Roman Catholic missionary colonies are established.

Dr. Tafel mentions that it is only on the east of Ordos, in the country of the Jungar, Wang, and Jassak, that there is grassland, connected along a broad front with Chinese agricultural land, a fact which cost the Jungar prince the greater portion of his district. A short time since his lands had extended across the Yellow river eastwards, almost as far as the towns Horinkar and Ching-shui-ho. But, on one ground or another, Chinese are constantly ousting the Mongols from their possessions, if their lands are worth having, and driving them further north, and the respect entertained by the Ordos Mongols for the Chinese is such that they do not venture to protect themselves against the frauds which are practised upon them.

In 1872 Richthofen concluded, from the scanty information which was then in his possession, that the Ordos country has an "elevated southern rim which is approximately indicated by the line of the Great Wall, and divides the headwaters of several affluents of the Yellow river from a plateau without outward drainage covered with pasture. Those rivers which descend towards the south, east, or west have their origin in a great number of deep gullies, cut precipitously into loess. . . . The plateau diminishes in altitude towards the north" ('Letters to Chamber of Commerce at Shanghai,' p. 30).

The altitudes given by Obruchev for west and north-west Ordos seem, however, opposed to this conjecture. But so much remains still to be learnt regarding this country that it is not yet possible to judge how far Richthofen's supposition is justified in other respects.

In a note on the Kuzupchi sands (Prj. 'Mongolia,' 1, 193) the fact that their subsoil is composed of the same hard clay as the valley of the Yellow river is referred to as confirming the hypothesis that Ordos was once the bed of a lake which forced a way for itself to the ocean by the present channel of the Yellow river (Ritter's 'Erdkunde von Asien'). The character of the surface of the plateau, the water-basins still in existence, and the gentle gradient of the country seem also inclined to favour this theory.

The geological features of the country traversed by Obruchev and Tafel are described by those travellers, but hitherto no one has visited the country intervening between their routes. There is, therefore, plenty of ground awaiting explorers who are looking for fresh fields of discovery, for Huc and Gabet's route traversed only the northern side of this field.

If other inducements are necessary in order to attract travellers to this country, surely the solution of the problem of the burial-place of the great Chinghiz Khan and the collection of all the interesting legends associated with his presence in the Ordos country are sufficient. The story of the death of the great conqueror as told in the Mongol annals (Howorth's 'Mongols,' part i. chap. iii.) attains to a height of poetry which is unexpected in such a people. The removal of his body to its resting-place, the destruction of all the folk who were met on the long and toilsome journey, the mystery attaching to the place of burial, and the legend of the coffin of steel suspended in mid-air in a mausoleum of loadstone, have one and all their fascination for the reader. Indeed, it seems extraordinary that no one hitherto has penetrated through the veil which surrounds the place where his body rests. According to tradition, the body was buried near the sources of the Onon, Tola and Kerulen, in the neighbourhood of the present town of Urga.

"But Père David, who travelled in the Ordos country in 1866, tells us that the Mongols there still preserve most carefully the mortal remains of the famous Chinghiz Khan *bogoto*. They are enclosed in a large silver chest, which they do not readily show to strangers." (Chinghiz-Khan, Howorth's 'Indian Antiquary,' 1887, p. 96.) M. Bonin, thirty years later, visited Yeke-Etjen-Koro (*la demeure du grand Seigneur*) in Ordos, and saw the tomb, the silver coffin said to contain the ashes of the great Mongol, and copies of relics, such as his saddle and sword, which are preserved in the camps of different Ordos tribes, but he does not pronounce an opinion on the authenticity of the coffin. But the ceremonies observed at different dates during the year—among them is the burial of a man up to his shoulders in the ground during the three days through which one of the festivals lasts—have a flavour of reality which seems hardly in character with an elaborate attempt to withdraw attention from the real place of burial by a duplication of stage properties. (*Revue de Paris*, February 18, 1898, pp. 831–835.)

The interesting account given by M. Bonin of the Great Khan's tomb attracted Comte de Lesdain to visit the same place when on his way in 1904 to Tibet. He found near Ho-k'u floods on the same scale as had confronted Huc in 1845. Travelling thence through Jungar, he succeeded in discovering the sacred spot, in spite of the reticence of those whom he asked for information, but was unfavourably impressed with the tomb (?) and its surroundings. In his journey westwards to the Yellow river near Ning-hsia, he passed through the territories of the

Princes of Wang, Ushin, and Ottok, and noticed, as other travellers in Ordos have done, the non-existence of the lakes marked in Chinese maps as formerly existing, which now are frequently mere depressions with saline incrustations ('From Pekin to Sikkim, Lesdain').

My object in writing the present paper is more especially to urge the occasion for some systematic series of observations of the rainfall of this region and the study of the engineering works which have already been undertaken in this portion of the valley of the Yellow river, to reclaim waste lands and to act as a check on the inundations which devastate the plains of China. It is a welcome surprise to me to find that some scheme of the latter nature has already been entertained by Chinese who inhabit that region, but of course the matter, if practicable, must necessarily assume such large proportions that it can be properly taken in hand only by the Government. Whatever work is done in this region which facilitates the irrigation of the country, produces such good results that, even on this ground alone, it is worthy of careful consideration.

With every extension of railway towards Shensi from the coast, the development of the trade from the Far West is bound to increase. Even in the present day M. Bonin and other travellers are struck by the importance of the caravans which are met near Kuei-hua-chêng carrying wool, skins, and other products of the West to Tientsin for export. The route *viâ* Kuei-hua to the West is the easiest for carriage by animals, and will be the easiest for the construction of railroads. M. Bonin has established the possibility of steam navigation on the Yellow river between Bau-tu and Ning-hsia, and a certain amount of trade by skin boats, rafts and scows has always been carried on by Chinese from Lan-chou Fu to Ning-hsia, and from Bau-tu to Honan. But no full development of commerce along this route can be obtained so long as the population is liable any year to destruction by famine. When the spring winds blow away the young corn which is coming up through the light loess soil of north Shansi and the Ordos steppe, famine stares the farmers in the face, and the provision of a large granary in irrigated lands in the far-away valley of the Yellow river may save millions of lives.

The changes of course of the Yellow river in that region seem to have furnished a providential means of guarding against inundations in the south. The old northern channel, called Ulan Khatun by the Mongols, is spoken of by Prejvalsky as well preserved, "1190 feet wide and very distinctly discernible, although completely dry and grass-grown. . . . There are two lesser arms between the former and present channels of the Hoang-ho, which dry up during the hot weather, but are full of water at flood-time. Besides the main river and its channels there is no water in the valley, except in wells, which are invariably very deep. The streams which rise in the border range (on the north) disappear immediately in

the soil, not one of them flowing as far as the Hoang-ho" ('Mongolia,' 2, 11–12).

In comparing the Yellow river with the Yangtse, we cannot fail to be struck by the great natural provision against floods which the latter river enjoys in the immense reservoirs of the T'ung-ting and Poyang lakes. Equally strong is the feeling that it is the absence of such provision which makes the Yellow river a curse instead of a blessing to the low lands which it traverses on its way from the mountains to the sea. If this can be furnished by artificial aid supplementing the natural resources which seem to present themselves for utilization in north Ordos, the gain to China must necessarily be immense.

But I write as a layman who has no engineering knowledge and no personal acquaintance with the country under review, and solely in the hope of directing attention to it, if possibly some good may outcome.

SOME CARTOGRAPHICAL DOCUMENTS OF THE AGE OF GREAT DISCOVERIES.

By EDWARD HEAWOOD, M.A.

Such has been the impetus given, within recent years, to the facsimile reproduction of early maps, that the student may hope soon to be in possession of all the most important documents of the kind, brought out, too, in a style very different from that with which an earlier generation had to rest content. Dr. Ravenstein's monograph on 'Martin Behaim and his Globe,' * accompanied by a full-size coloured reproduction of the latter in gores, is a fitting crown to a life of activity in the cause of geography. Many as have been the author's previous contributions in this field, there is none which brings out so forcibly alike his wide range of information and his critical judgment in dealing with his material. It is fitting that these qualifications should have been brought to bear on one of the most interesting cartographical questions of the fifteenth century, and one in regard to which students have hitherto had to depend on but imperfect aids. The globe and its history, as well as that of its author, have now for the first time met with adequate treatment, and such is the thoroughness with which the task has been performed, that Dr. Ravenstein's study, if not the last word on the subject, must always remain the foundation on which all future work must be built.

The reproduction of a globe-map must always present greater obstacles than that of a plane-map, and in the case of Behaim's globe the destructive work of time has added to the difficulty, and is no doubt

* 'Martin Behaim: His Life and his Globe.' By E. G. Ravenstein. With Facsimile, Maps, and Illustrations. London: G. Philip & Son. 1908. Price £3 3s.

Published by the Royal Geographical Society.

Published by the Royal Geographical Society.

and scholarly work does the highest credit to Mr. Hotz, and is an important contribution to the history of Persia in the seventeenth century.

DONALD FERGUSON.

THE ROUTE OF THE BAGHDAD RAILWAY.

'The Short Cut to India: the Record of a Journey along the Route of the Baghdad Railway.' By David Fraser. Edinburgh and London: Blackwood. 1909. *Price* 12*s.* 6*d.* *net.*

Mr. Fraser's bright and picturesque volume is a timely reminder that the long-pending question of improved communication between Europe and the East is in speedy prospect of settlement. The much-talked-of Baghdad railway is for the moment hung up—near the head of the Gulf of Iskanderun—so far as construction is concerned, but guarantees for the prolongation of the line through four more sections have been allocated to the Germans by the Turkish Government; and this fact should serve to convince us that this great undertaking may soon emerge into a region where its bearings and future possibilities will possess a very considerable interest for Great Britain. Whether the future terminus will be Bussorah or Koweit is in itself a question of no small moment. The former is the more important port, and Mr. Fraser is of opinion that probably in the end it will be definitely chosen as the terminus. On the other hand, Koweit would appear to be the ultimate objective point favoured by the Germans, and the reason for this is not difficult to conjecture when we bear in mind that it would also form the terminus of the suggested British railway from Akaba to the head of the Persian gulf, a project which is beginning to attract a good deal of attention. In helping the Government to decide upon a distinct line of policy with reference to these two undertakings, Mr. Fraser's book will supply much useful and recent information. Although he does not touch on the trans-Arabian project, a great many of his comments and arguments apply equally if not with even greater force to that route. For instance, speaking of the acceleration of the Indian mails, the author points out that if once the Baghdad railway were constructed, the reduction of time would amount to three days as between London and Karachi. On the other hand, the saving would be no less than seven days if the Indo-Egyptian railroad were carried out in its entirety. This fact of itself goes to prove that there is more than one "short cut" to India. However, one can but feel grateful that the topic is brought forward at all, no matter what the precise alignment is. The route actually traversed by the author was by rail from the Bosphorus to the rail head at Eregli, and thence by way of Aleppo to Diarbekir, and thence down the Tigris to the Gulf. But while crossing through the northern part of the Mesopotamian country, he was set upon by a robber and seriously wounded. This unfortunate incident led to Fraser being conveyed first to Urfa for treatment at the American Mission, and then back to Aleppo, where he was for seventeen weeks a convalescent in the house of the Rev. W. M. Christie. The author was thus much handicapped in his further journey southwards, but nevertheless he contributes much interesting information regarding the riparian districts, and especially about the project of reorganizing the irrigation works in lower Mesopotamia, an undertaking of vast importance which has been entrusted by the Turkish Government to Sir William Willcocks. As an up-to-date picture of a region now entering into the very forefront of international politics, the work is sure of a large circle of readers.