THE GEOGRAPHICAL JOURNAL

PUBLISHED UNDER THE AUTHORITY OF THE COUNCIL.
EDITED BY THE SECRETARY AND THE JOINT EDITOR.

VOL. XLVI.—JULY TO DECEMBER, 1915.

LONDON:
THE ROYAL GEOGRAPHICAL SOCIETY, KENSINGTON GORE, S.W.;
EDWARD STANFORD, LTD., 12, 13, AND 14, LONG ACRE, W.C.
1915.

PRINTED BY
WILLIAM CLOWES AND SONS, LIMITED
LONDON AND BECCLES, ENGLAND.

CONTENTS.

Authors are alone responsible for their respective statements.

July 1915.

MAPS.

August 1915.

MAPS.

September 1915.

MAPS.

October 1915.

Maps.

November 1915.

Maps.

December 1915.

MAPS.

The

Geographical Journal.

No. 2. AUGUST, 1915. VOL. XLVI.

EXPEDITION TO THE KARAKORAM AND CENTRAL ASIA, 1913–1914.*

By Cav. Dr. FILIPPO DE FILIPPI.

IN the autumn of the year 1912 the plans of a scientific expedition to India and Central Asia were submitted by me to the Royal Geographical Society, with the object of obtaining their moral and financial support towards geophysical researches and the geographical exploration of a practically untraversed region of the Karakoram.

The contributions of this Society and of various other scientific bodies, including the Royal Society and the more important Italian institutions, added to the generous support of H.M. the King of Italy and of private individuals, made it possible for me to complete, within the course of a few months, the preparations necessary to this undertaking. To the Government of Italy I am indebted for the loan of nearly the whole outfit of scientific instruments; and to the Government of India for a liberal contribution, and also for the co-operation of the various Indian technical departments and of the Kashmir Durbar. In addition to this generous assistance, Major H. Wood, R.E., of the Trigonometrical Survey, S.A.S. Jamna Pershad, and the Surveyor Shiv Lal were deputed to take part in the survey work.

Included in our programme, and forming one of its most important items, was the establishment of a series of geophysical stations for observations of gravity and magnetism, to stretch in an unbroken chain across the vast and mountainous zone which separates India from Central Asia, and to be carried on through Chinese Turkestan as far as Russian Turkestan, thus uniting in one comprehensive system two pre-existing sets of gravimetric stations, namely, that of the Indian pre-Himalayan plains carried

* Royal Geographical Society, June 14, 1915.

out by the Trigonometrical Survey of Dehra Dun, and that of Russian Turkestan and the adjoining regions. These geophysical observations were entrusted to Commander A. Alessio, second in command of the Expedition, and to Professor G. Abetti, of the University of Rome.

In addition to the pendulum and magnetic observations, our programme included meteorological and aerological investigations, and also measurements of solar radiation, all of which studies were undertaken by Professor C. Alessandri and Marchese N. Venturi-Ginori, and were to be carried out more especially at Skardu in Baltistan during the winter, and on the high plateau of the Depsang during the following summer:—that is to say, simultaneously with the geographical exploration of the eastern extremity of the Karakoram.

The exploration of the Karakoram, with its immense glaciers, was initiated by Colonel Godwin Austen in 1861–62, and since that date had been continued successively by Sir Francis Younghusband, Sir Martin Conway, Dr. and Mrs. Workman, the members of the Eckenstein-Guillarmod Expedition, H.R.H. the Duke of the Abruzzi, and Dr. Longstaff. None of these travellers, however, had penetrated further eastwards than the Siachen Glacier (77° long. E. Greenwich), and the map of that district was founded on sketches made in 1864–66 by the Surveyor Johnson, which show a group of glaciers at the source of the river Shyok in this region. These glaciers are marked as being of moderate dimensions and as not flowing beyond the confines of the valleys where they originate. Dr. Longstaff, on his return from exploring the Siachen in 1909, had followed the Shyok as far as its source, and was the first to grasp the probable size and importance of these glaciers. It was largely owing to his advice that I undertook the present exploration, and I may add that our discoveries in connection with these glaciers have more than justified his prophecies.

As regards the apportioning of our work, Commander Alessio, Major Wood, Professor Abetti and Mr. Spranger, with the assistance of Jamna Pershad and Shiv Lal, undertook the whole of the survey work. In connection with geodetic investigations I must mention the determinations of longitude by means of wireless time-signals according to a preconcerted plan. These signals were transmitted by the wireless station at Lahore and simultaneously received at Dehra Dun and by the expedition (Commander Alessio and Professor Abetti). The geological studies were entrusted to Professors Marinelli and Dainelli, and were to be continued over the whole route instead of being confined to the unexplored region of our itinerary. To Professor Dainelli fell the additional task of collecting the data for an anthropological and anthropogeographical study of the peoples inhabiting the regions traversed by the expedition, while Captain Antilli became responsible for the photographic, telephotographic, and cinematographic records. This programme, which many considered to be too ambitious and comprehensive, was carried through with complete success in seventeen months. The well-known guide Joseph Petigax, of

Sketch map
to illustrate the expedition of
Dr FILIPPO DE FILIPPI
to the
KARAKORAM
AND
CENTRAL ASIA
1913 -14.
Scale 1:6,000,000 or 1 Inch = 94·68 Stat. Miles
Route of the expedition
Routes of separate parties
Heights in feet
Pass ×
RUSSIAN EMPIRE
Kashgar
PERSIA
AFGHANISTAN
TIBET
CALCUTTA
BURMA
INDIA
Bombay
Ceylon
Andijan
Osh
Gulcha
Chadir Kul
ALAI MOUNTAINS
Terek Dawan
13000
Uksalar
Kizil Su
Irkishtan
Kan-jugan
KASHGAR
Yangi Shahr
Yangi Hissar
YARKAND
Yarkand
Karghalik
Beshterek
Kok Yar
Ak Koram
KUEN LUN
Takhta Koram
Yangi P.
Karakash
Shahidulla
KARAKORAM
Kukaliang
Bazar Dara
HISPAR
Aghil P.
Suget P. 17600
Kufelang
Aitagh
Gilgit
Arandu
BALTORO
Askole
18687
Karakoram P.
Shigar
REMO
Depsang
Skardu
7700
Kizil L. 16300
Wozul Hadur
Murgo
HIMALAYA
Kharmang
Muzaffarabad
L. Wular
Dras
Kargil
Shyok
INDUS
Baramula
Kalchi
11503
Jhelum
Zoji La
11,120
Namika La
Fotu La
LEH
Tankse
Murree
SRINAGAR
Chang La
Pang Kong
Islamabad
Rawal Pindi
RAILWAY
Chenab
MTS
Shushal
Sokar
72
74
76
78
40
38
36
34

Commayeur, was engaged to accompany the expedition. Major Wood, Professor Marinelli, and Mr. Spranger joined the expedition in the spring of 1914.

The first group of members sailed from Europe early in August, 1913. Comparative pendulum observations had been taken at the Royal Hydrographical Institute at Genoa, which became the reference station for all our gravimetrical measures; and immediately upon our arrival in India Alessio and Abetti set up a station at Dehra Dun, where they also made their first experiments of wireless transmissions of time signals with Delhi, Simla, and Lahore, using the wireless receiving station of the expedition. On September 8 we were all assembled at Srinagar, Kashmir, which became our second geophysical station; and here Dainelli made several geological excursions.

For our winter headquarters we had chosen Skardu, the capital of Baltistan, and on September 15 we started out on the first stage of our long caravan journey, which was to take us through the deep valleys, over the mountain ranges and high plateaux of Baltistan and Ladakh, and across Chinese-Turkestan as far as the Russian Transcaspian railway of Andijan.

Included in our scientific equipment was a wireless receiving station; gravimetric, astronomical, and meteorological apparatus; several pyrheliometers for measuring solar radiation; all the necessary outfit for sending off pilot balloons, including sixteen steel hydrogen-cylinders; also chronometers, photographic apparatus, geodetic and survey instruments, to which must be added a whole encampment of tents to serve as laboratories and to shelter the members of the expedition, servants, coolies, etc., in all a hundred and fifty persons, with their luggage, kitchens, general camp furniture, etc. Yet these impedimenta, considerable as they may sound, were a mere trifle in comparison with the large stores of provisions necessary for the maintenance of men and beasts during our many months' wandering over the Karakoram deserts. This extremely cumbersome but indispensable baggage was packed on the shoulders of hundreds of coolies, carried on the backs of camels, of Zanskar and Nubra ponies, of sturdy plodding yaks, or piled high on the primitive waggons of Central Asia. This journey was to last for more than a year, and was to stretch over nearly 1000 miles, not including the large areas we covered during our many and long excursions outside of our itinerary, and during our exploration of an entirely new and untraversed region.

I will spare you a description of the well-known road between Srinagar and Skardu. Suffice it to say that we crossed the Himalaya without incident by the pass of Zoji La (11,120 feet = 3392 metres); after which we found it necessary to call a halt of ten days in order to set up a geophysical station at Dras (10,020 feet = 3054 metres), where a picturesque ruin commemorates the Sikh conquest of Baltistan, about the middle of last century. Another station was set up at Tolti, a small oasis on the right bank of the Indus. On October 25 we emerged from the last

defile of the Indus into a sandy and gravel-covered plain formed like an oval basin and crossed in its greater diameter by the Indus, which flows sluggishly along a winding bed dug through the alluvial strata. This great plateau, in the centre of which lies the village of Skardu (7700 feet = 2347 metres), is encircled by a crown of magnificent peaks which seem to close it in on every side, except towards the valley of the Shigar, which also is large, smooth, and sandy, and is so constructed as to form a northern continuation of the Skardu basin. The oasis of Skardu lies at the foot of a rocky hill, whose eastern ridge is broken by a terrace above which rises an imposing fortress, the solitary memorial of the days when Skardu was under the rule of independent rajahs. This was to be our headquarters for the next three and a half months, and here we established ourselves in two small bungalows, while the surrounding huts were fitted up as laboratories and storerooms.

After a successful preliminary experiment at receiving wireless time-signals from Lahore, Alessio, Abetti, Antilli, and Ginori, accompanied by Petigax, set out at the beginning of November to ascend the valley which leads south of Skardu to the Burgi La up to Wozul Hudur, a small terrace over 14,000 feet (4300 metres) high. Here, in spite of the deep snow and the severity of the weather, they succeeded in making magnetic and gravimetric observations and in taking measurements of solar radiation, associated with the launching of pilot balloons. They also climbed a peak (16,000 feet = 5060 metres) to the east of the Burgi La, where Antilli took some telephotographic views of the distant ranges of the Karakoram. After these successful experiments they returned to Skardu, where they made various geophysical investigations and two series of radiotelegraphic experiments.

During the whole month of November the weather was clear and peaceful, with autumnal lights and exquisite calm sunsets, reflecting a variety of the most delicate tints on the surrounding snow-covered peaks. Early in December came a few light snowfalls, but the clouds soon drifted away, and the new year was ushered in by a spell of magnificent days, when the temperature fell to zero Fahr. The heaviest snowfalls occurred in January ; the snow-line, which on our arrival at Skardu was about 3000 feet above the valley, soon descended to the level of the plain, and the whole landscape became transformed into a vast expanse of whiteness. The clouds and the mists which enveloped the crests and peaks became a serious obstacle to the carrying out of our photographic and topographic work and to the observations of solar radiation.

Dainelli, after making some interesting geological investigations in the valleys of the Sind, Dras, and Indus, had worked through the whole of November in the basin of Skardu. In December he had ascended the valley of Shigar, and also those of the Braldoh and the Basha, the two branch valleys from which the Shigar springs, investigating snouts of the three largest glaciers of the Karakoram, the Biafo, the Baltoro, and the Chogo

UPPER SHYOK VALLEY.

UPPER INDUS VALLEY, FEBRUARY, 1914.

Lungma. Finally, in January he set off on a long excursion up the valley of the Shyok, starting from the point at which it joins the Indus, and continuing as far as the village of Biandong (Ladakh). He also traced back the rivers Saltoro and Kondus as far as their glaciers. During these geological explorations he was able to make some very interesting anthropological studies, besides noting and comparing the various social and economic conditions prevailing in the districts through which he passed. These excursions, carried through with complete success, prove that it is possible to penetrate without any serious difficulty, and during the depth of winter, into the most outlandish valleys of Baltistan, carrying an equipment so light as to exclude any supplies beyond the mere necessaries for life.

On February 14 we received the last wireless signals of the Skardu series; and on the morning of the 16th we took the road across Baltistan in the direction of Leh, which is situated in the valley of the Indus at an altitude of 11,503 feet (3506 metres), nearly 3000 feet higher than Skardu. Proceeding up the Indus valley we followed the river as far as its junction with the Suru Dras, passing over the same country which we had traversed some four months previously. During this interval between summer and winter the scene had assumed an entirely new character. Thick layers of snow covered the deeply cut valley, rounding off the jagged edges of the precipices and toning down the forbidding aspect of the landscape.

A four days' march above Skardu—at Kharmang, an oasis which lies at the foot of an imposing castle—we found the Indus frozen from bank to bank, which made it possible for people and ponies to cross safely. As we advanced higher up the valley it became more and more common for us to meet with these convenient natural bridges, which serve to connect villages and districts at other seasons completely isolated. Very rarely did we find the Indus sufficiently narrow to allow of its being spanned by the picturesque rope-bridges so characteristic of Baltistan.

Above the confluence of the Suru the Indus valley narrows into a gorge, and the caravan road leaves the valley to make a large circuit among the mountains. Dainelli, availing himself of the exceptional opportunities afforded by the frozen river, set forth to inspect this part of the valley, which hitherto had rarely—if ever—been visited by travellers. On this excursion he collected some valuable anthropological and social data regarding certain groups of the Dard race who have preserved their ethnical characters with unusual purity. Leaving Dainelli to his particular studies the remainder of the party started up the caravan road.

On February 22 we took up our quarters at Kargil, a little commercial centre situated in a large basin on the road connecting Kashmir with Tibet and Central Asia. This was one of the stations at which had been accumulating the large quantities of foodstuffs necessary for the maintenance of coolies and horses during our journey from Leh onwards. To obtain a sufficient quantity of provisions—in all forty-six tons of wheat and

barley, not to mention the large supplies of rice, tea, butter, tobacco, and similar commodities—it had been necessary to tap the supplies of the whole of Baltistan and Ladakh. Altogether one thousand sacks, containing nearly thirty tons of provisions, were awaiting us at Kargil, ready for further transport. The caravan road to Leh crosses two mountain passes at an altitude of about 3000 feet, which at the end of February were naturally covered by a great depth of snow. Yet bearers, horses, and yaks, slipping and stumbling on the frozen road, and pushing through the banks of snow with patient insistence, succeeded in a little over two weeks in conveying this mass of provisions as far as Leh.

Meanwhile it had been necessary to split up the expedition into several groups. Alessio and Abetti were detained at Kargil and at Lamayuru to set up the gravimetric station, and only reached Leh on March 26, a few days after the arrival of Dainelli, Antilli and Ginori, who in the interval had made an interesting tour among the many beautiful castles and monasteries scattered over the less frequented corners of Ladakh. I myself was already established at Leh, having preceded the rest of the expedition by twenty days to organize the transport of provisions to the valley of the Shyok. This was by no means a simple undertaking. It was necessary for our considerable caravan to cross the Kilas range by the Chang La pass at the great altitude of 18,400 feet (5600 metres), and during this passage the proverbial endurance of even the Ladakh porters and beasts of burden was often put to the severest test. However, by sending ahead a large herd of unloaded yaks to tread a path through the snow, it was found possible, by the beginning of April, to transport over this frozen road nearly 3000 sacks, which were at once despatched by the Shyok valley towards the plateau of Depsang in the Karakoram. The success of the undertaking is entirely due to the devotion and competence of Rasual Galwan, our caravan leader, and the expedition's invaluable servant.

During our two and a half months' halt at Leh we enjoyed the shelter and the unaccustomed luxuries of a private house, Captain Gabriel, Joint Commissioner for Ladakh, having very kindly placed his residence at our disposal. We also remember with gratitude the hospitality of the Moravian Mission and the Leh officials, of whose kindness and courtesy we retain the happiest memories.

At the beginning of April, having completed the geophysical observations at Leh, Alessio, Abetti, Ginori, and the guide Petigax, carrying with them the whole of the scientific equipment, started out southwards with the intention of setting up a station at Moré, on the plateau of Rupshu. This expedition, which was outside our settled programme, was undertaken at the request of the Survey of India, who wished us to repeat the rather doubtful gravimetrical determinations taken in 1871 by Captain Basevi, one of their officials. However, contrary to the assurances of inhabitants who should have been familiar with the climatic conditions

of the country, the plateau was found to be covered with a deep layer of snow. Having conducted the party, not without difficulty, to the brow of the plateau 18,040 feet (5500 metres), Alessio found it impossible to transport the heavy equipment any further, so was forced most reluctantly to return to headquarters.

Dainelli, meanwhile, had followed up the valley of the Indus and had made an excursion on the Rupshu plateau in order to study its geological and morphological conditions, which are especially interesting, owing to the traces of glacial excavations and the presence of some typical closed basins containing brackish lakes. Having returned to the Indus, he crossed into the basin of the salt lake Pang Kong, where he made some interesting studies of the anthropological characters of the nomad shepherds called the Chang Pa. He then returned to Leh by way of the Chang La.

On the arrival at the end of April of the second group of members (consisting of Wood, Spranger, Marinelli, Alessandri, Jamna Pershad and Shiv Lal) our two geologists, Marinelli and Dainelli, made a further excursion into the basin of the Zanskar, a large tributary of the Indus. During this period we made a series of meteorological observations, including the launching of pilot balloons and studies in solar radiation.

On May 15 we all took the road again, and three days later crossed the pass of the Chang La by the track which had previously been trodden hard by the hundreds of transport beasts ; after which we descended in two marches to a little group of huts known as the village of Shyok. This was to be our last sight of human habitation till we arrived at the villages of Chinese Turkestan. The Shyok valley is deeply cut between the massifs of Chang-Cheen-Mo and Lingzi Thang, and rises gradually towards the Karakoram, the complicated watershed between India and Central Asia. The earliness of the season allowed us to follow the bed of the valley. Every now and then we forded the river, but were able to avoid the fatiguing ups and downs of the track which follows the left side of the valley. Our route lay across a rocky desert relieved by a very occasional patch of green, a sign of the welling forth of some mountain spring. Our transport beasts found little enough in the way of fresh pasture. Fed on dry provender, and suffering from mountain sickness, they became unfitted for the hardships of the journey. Fortunately we were able to replace them by horses and yaks drawn from other caravans which met us on their return journey from the Depsang, where they had deposited our provisions.

On May 30 we left behind us the valley of the Shyok, climbing some narrow gorges which are hemmed in by precipitous cliffs. Here we were obliged to wade for long stretches through the rushing and turbid waters which at this season of melting snow surged through the bed of the gorge. At length we emerged on to easier ground and joined the junction of the valleys which is known as Murgo. At this point the road which we had been following meets with the older track, only passable, however, in

the summer season, which leads from the Nubra valley and the Sassir pass. From thence onwards the aspect of the road grew more and more dismal. It was literally strewn with the remains of animals dead from exhaustion, mountain sickness, and starvation; carcasses of horses, asses, and camels in every stage of decomposition, from bodies surrounded by birds of prey to skeletons bleached white from long exposure.

Two marches above Murgo, and immediately under the brow of the high Depsang-plateau, we arrived at a spot called Kisil Langur (5000 metres = 16,300 feet). Here, deposited at the foot of a cliff, we were glad to find our store of provisions which, in accordance with our arrangements, had been accumulating there against our arrival. The Depsang plains were still in great part covered with snow, and the slopes and hollows so slushy and heavy as to make the choice of a camping-ground extremely difficult. However, nearly at the centre of the plateau, and in close proximity to its largest watercourse, we found a small terrace sufficiently dry for our purpose. This spot—17,400 feet above sea-level—was to serve as our headquarters and base of supplies until nearly the end of August. All around us, for a radius of 12 to 15 miles, stretched a vast and hillock-strewn plateau with shallow depressions inclining to the north-east, and merging to the east into alluvial plains which form part of the vague watershed between India and Turkestan. The edges of the plateau are uncertain and ill-defined, and shade off gradually into gentle slopes, except towards the south-west, where towers a majestic glacier-covered mountain which completely dominates the region. In the far distance, and on every side, rise a circle of lofty mountains, whose peaks just appear above the edge of the plateau. Those to the south and west are dazzlingly white from their covering of snow and glaciers, and are in startling contrast to those in the direction of Asia and Central Tibet, which have the forbidding appearance of bare rocks. The surface of the plateau is a mass of minute detritus, and is entirely devoid of vegetation, except for occasional patches of a yellowish-green plant which at first view suggests, more than anything else, some malignant disease of the soil. There can surely be few corners of the world which give such an impression of dreariness and utter desolation as this barren region of rocks and stones, which, moreover, during our entire sojourn was swept continuously by an icy wind and beaten upon by hail and sleet. The line of skeletons which marked the length of the caravan road across the plain are a fitting feature of this desolate country.

The transport of our provisions from Kisil Langur to the base of supplies, and from there to the forward depôts of the exploring parties, occupied my attention during the whole of June. Immediately on our arrival at the Depsang we had dismissed our horses, which could not have survived for any length of time at that altitude, so that the transport during the summer months was carried out by 130 Ladakh and Kargil porters. This was the maximum number available, and, moreover, it would have been difficult to have provided food for a greater number.

VALLEY OF KARBU (LADAKH), FEBRUARY, 1914.

CAMP ON THE DEPSANG PLATEAU.

On our arrival at the plateau we had immediately started the scientific work in its various branches, which included survey, geophysical and astronomical observations, transmission of wireless signals, the measuring of bases for topographical work and experiments with pilot-balloons, etc. In the bleak and exposed locality where we had pitched our camp, at an altitude of 17,400 feet, Alessandri and Ginori, for nearly two and a half months, often working day and night, collected meteorological data, carried out aerological investigations, and also took readings of solar radiation on the rare occasions when the atmosphere was sufficiently clear for that purpose. On June 11 Marinelli and Dainelli set forth on a geological expedition in the direction of the Tibetan plateaux, taking the route of the Chipchak and Karakash valleys. After crossing a mountain pass over 20,000 feet (6100 metres) high, they joined the closed basin of the Taldat which lies to the north of the Lingzi Thang plain. Later, independently of the rest of the expedition, they explored the upper basins of the Shyok, Remo, and Yarkand.

On July 1, after a preliminary reconnaissance, we set out to explore the Indo-Asiatic watershed to the east of the Siachen Glacier. Wood, Spranger, and Shiv Lal had undertaken to survey the region which lies between the Remo basin and the Karakoram Pass, while the rest of us made directly for the glacier itself. To this glacier we have left the name of Remo, mentioned in Johnson's sketches, though the meaning and derivation of the word remain an enigma, in spite of all my efforts to find traces of it in the local dialects. We descended the western slopes of the Depsang, and here we were glad to see signs of herbage—the meagre pasture of the Tibetan antelopes and gazelles, who graze peacefully on these mountains, far away from the haunts of man. Here and there grew a starved-looking plot of heather or a low bush of "burtsé"—most valuable of plants, affording as it does the only form of fuel available in these regions.

Proceeding on our way we gained the basin of the River Shyok near the point where it joins the Chipchak, thereby taking the most direct route to the Remo Glacier. The glacier is divided into two main branches of fairly equal dimensions, which descend in gentle slopes from their respective valleys to the north and west, and join almost at right angles. Their point of junction is sharply defined by a wide streak of moraine, which we fixed upon as being our best and shortest route across the front of the glacier. On July 2 we pitched our camp a few hundred yards away from this front, which stretches through the whole width of the valley, giving the impression of a great crest of foam. On a nearer view this snout proves to be bristling with needles, pinnacles, and pyramids of ice. From the base of the glacier issue forth several rapid streams which mingle together to form the origin of the River Shyok.

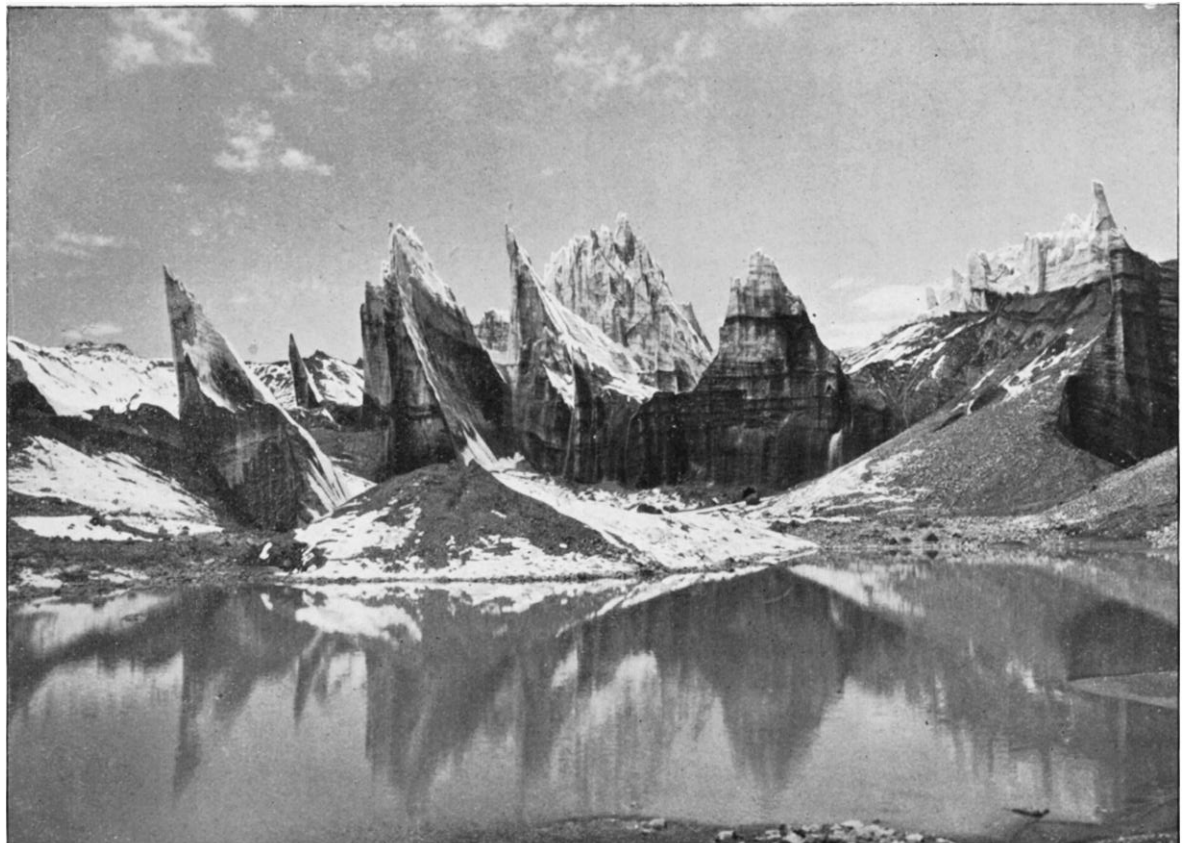
The difficulty of finding safe fords through these streams, and a heavy snowfall which continued without interruption for two days, detained us in this camp at the foot of the Remo. Finally, on July 7, we were able

to commence the work of climbing the glacier by way of the moraine, which was most irregular and obstacled. Our track was a succession of crests and hollows, tunnels and watercourses. The traverse, however, was achieved without any great difficulty, and soon we had joined the point where the glacier forks off towards the west and north.

We first explored the northern branch of the glacier towards the watershed, passing along first between the slope of the valley and the side of the glacier, and later along the marginal moraine. Near us, with a gentle slope, flowed the large ice-river. The surface is entirely formed of tall pinnacles and pyramids, which have nothing in common with the seracs of our Alps, being due to melting and erosion of running waters, and not to fractures. This valley is situated between mountain ranges of but moderate dimensions, very different in appearance from the gigantic battlements of the Baltoro Glacier. In place of the sombre and shut-in Baltoro with its dark mantle of stones, the Remo stretches out immaculately white and open, giving an impression of vastness out of proportion to its actual size. As we advanced higher up the surface became less and less broken, till at last, at 8 or 10 miles above the front, the former cracks and pyramids of ice were replaced by gentle transverse undulations. A little further on we came to a large basin which receives from the north a tributary glacier nearly as large as the chief branches of the Remo. From this point onwards the glacier changed its course and took a wide turn westwards.

We decided, before proceeding any further, to explore the tributary glacier, and here there was a surprise in store for us. It was not long before we realized that, a little above its junction with the main glacier, there flowed through a cleft in the mountain to the east a short and thick tongue, giving birth to a river which evidently did not belong to the basin of the Remo. Meanwhile, three days before us, Wood and his party had also arrived at this particular point. Through a saddle to the west of the Karakoram Pass they had penetrated into a large circus of confluent valleys which they identified as belonging to the basin of the Yarkand, one of the principal rivers of Central Asia. In following up the river they had arrived at this tributary glacier of the Remo, and thus had an excellent opportunity of connecting their survey with ours. We had thus not only discovered the source of the Yarkand, hitherto erroneously marked on nearly every map as rising near the Karakoram Pass, but we had also ascertained this remarkable fact—that it flows from the same glacier which gives rise to the River Shyok.

The small lake which S. W. Hayward in 1868 identified with the source of the Yarkand, was found to be 20 miles further up the valley, and to have practically no importance as regards the feeding of the river. Major Wood and his party had next travelled 60 miles down the valley, verifying the existence of two large tributaries which later on were to be the object of a separate exploration.



ICE-NEEDLES AND PYRAMIDS OF THE LOWER REMO GLACIER.

SOURCES OF THE RIVER YARKAND.

We climbed the northern tributary glacier to its summit, where we found a saddle at an altitude of 19,300 feet on the watershed, and then came back to the main branch of the Remo to complete its exploration.

To the west the mountains are covered with snow and glaciers, while the slopes to the east are rugged and bare. The surface of the glacier is intersected by streams and broken by innumerable pools of all shapes and sizes.

At an altitude of a little over 18,000 feet we reached the snow-level. Here the slope becomes much steeper as it leads to the upper circus, which is vast and even, and has the appearances of a plateau. The glacier fills it to the brim and overflows between low peaks which look like islands in a sea of ice. One of the saddles leads to the Siachen basin ; another, to the north, marks the watershed. The whole glacier circus is intersected in every direction by treacherous crevasses concealed under a layer of snow which gives way beneath the tread. We realized this danger when one of our porters suddenly vanished from view. Luckily the crevasse in question was narrow and not very deep, so that he escaped with nothing more serious than a fright. From thence onwards we advanced with great caution and roped together.

There was no place for us to pitch the tents except in the snow. During the last four days of our ascent the weather had grown steadily worse, even to the point of hindering us in our exploration of the basin, which we were obliged to carry out in one sole excursion.

At the end of July we spent a few hours in the company of Marinelli and Dainelli, who for the last six weeks had been making explorations over the region to the west of the Depsang. On descending from the eastern plateau they had visited the front of three glaciers—the great and small Kumdan and the great Aktash—which flow into the valley of the Shyok near its source ; after which they had taken the route up the right front of the Remo, and had climbed the glacier as far as its basin. After a brief halt at our camp on the Remo they proceeded towards the source of the Yarkand, in the direction of the valleys already explored by Wood and his party.

Altogether we remained for eleven days in the upper basin of the Remo, first nearly buried in snow at an altitude of over 19,000 feet (5800 metres), and later a trifle lower down the glacier, where we found a patch of stones to serve as a camping-ground. During the whole of this time we were inactive, kept prisoners by the severe weather. Day after day we strained our eyes to pierce the white mist which enveloped us like a cloud. The snow fell unceasingly, now gently and softly, as reluctant to break in on that stupendous silence, now caught up fiercely by the wind as if in angry protest against the invader. The cold was severe, and some of our coolies suffered badly. They passed their days shivering in their tents, which they had pitched as near as possible to ours for fear of crevasses. It was impossible to kindle a fire or to take two steps in the open without sinking

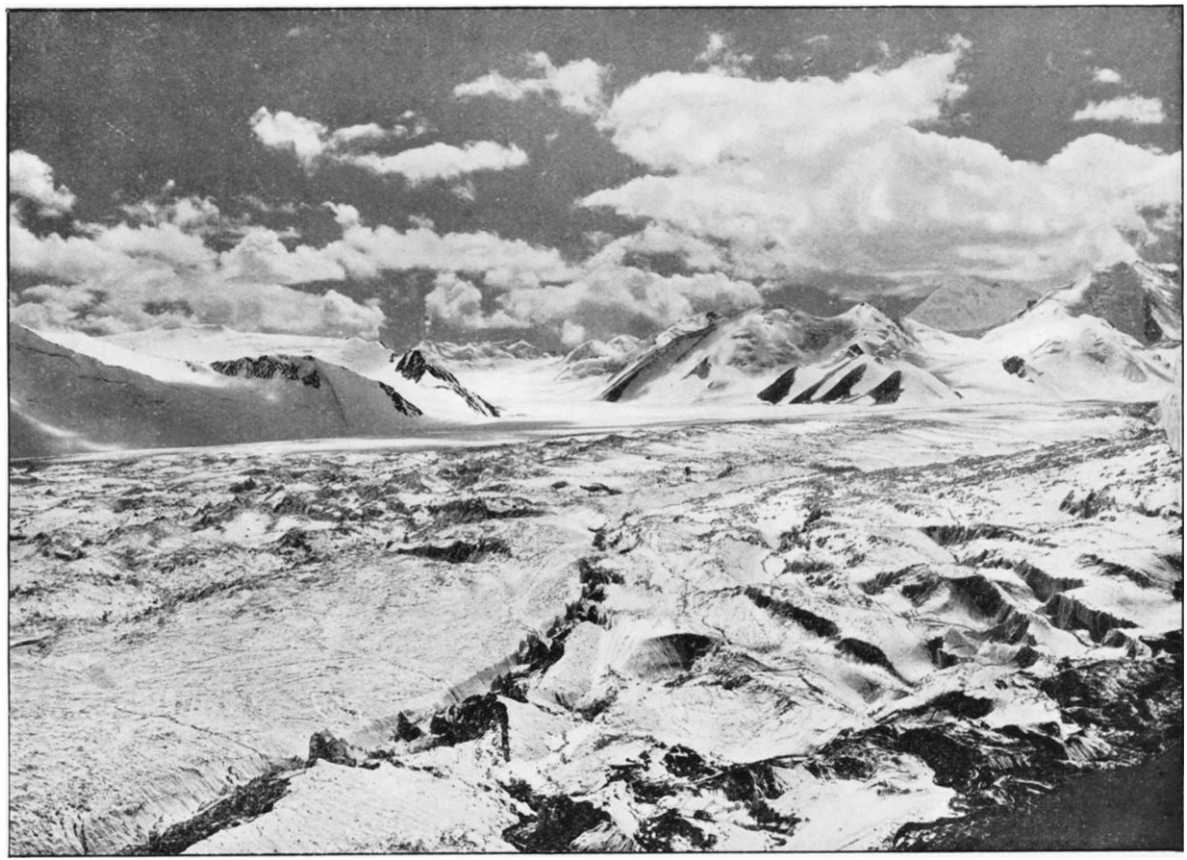
knee-deep in the snow. Though all of them felt the altitude, and many became frost-bitten or snow-blind, yet they remained perfectly disciplined, and not one of them was heard to utter a complaint. At length, having given up all hope of reaching the saddles on the edge of the circus, we began to think of our return journey, and the difficulty of transporting our heavy equipment through the increasing depth of snow.

On August 4, after folding with much toil the frozen tents, searching for the hammers, tools, and other objects, which in spite of every precaution had become buried in the snow, we struck camp and began to retrace our steps down the glacier.

Toiling heavily over the snow, groping our way through the mist, we pursued our slow and painful route, taking actually ten hours to march a distance which thirteen days earlier, before the snowstorms, we had covered easily in less than half that time. The coolies took from twelve to fifteen hours for that day's march; some only arrived at midnight, and one who got separated from his companions passed the whole night in the snow. Fortunately he was still alive when found next morning by our search party. It is quite evident that we could not have delayed our return journey any longer without serious risk to the caravan. The landscape had become almost unrecognizable from its deep covering of snow. Had we not completed the survey during our ascent we should never have been able to define the correct limits of the tributary glaciers. The mapping out of the southern branch of the Remo, made easier by our previous survey, was carried out during a two days' encampment at the edge of its upper basin, into which flow eight large tributaries, descending from high and distant saddles.

On August 13 the whole expedition was once more united at our Depsang headquarters, the different groups having each completed its particular work. The extraordinarily severe weather had not been confined to the Remo. There had been heavy snowfalls on the Depsang, the Karakoram Pass, and the adjoining valleys, with the result that the whole expedition had been hindered in its work. Even the caravan road between Central Asia and Ladakh had been for some days encumbered with snow, contrary to the records of every former traveller in those regions. It may therefore be assumed that the summer of 1914 was an exceptionally unlucky season. As we shall see later, it was to be followed by an equally severe autumn.

Our communications with Leh had been seriously interrupted on account of the floods and landslips, which had swept away part of the track. However, on August 16 came a bunch of horses carrying our mail bags, which had been accumulating for several weeks. Among the packets of letters and newspapers was a laconic wire from India announcing the outbreak of the European war. It would be impossible to describe the consternation caused by these tidings. Though neither England nor Italy was said to be involved in the struggle, yet the news came upon us as something



MIDDLE PORTION OF REMO GLACIER, NORTHERN BRANCH.

THE AGHIL RANGE FROM A SPUR OF THE UPPER YARKAND VALLEY.

infinitely tragic and ominous. In the face of this European outbreak our expedition seemed suddenly to dwindle to utter insignificance, like a wisp of straw about to be swept into a whirlwind.

When our first consternation had subsided we summoned a meeting to discuss our responsibilities in this difficult situation. We were due to set forth on our journey to Chinese Turkestan, and so for weeks, even months, might be cut off from all communication with the world. Under these circumstances Commander Alessio and Captain Antilli of the Italian Navy and Army, and Alessandri of the Reserve, decided to return at once to their country by the quickest and shortest route—namely, that of India. The departure of these members was a serious loss to our party, though fortunately Alessandri had already completed his meteorological work. Major Wood, through the liberality of the Survey of India, was preserved to the expedition, and succeeded Alessio as second in command. The geophysical work devolved upon Abetti and Ginori; and to Abetti fell also the photographic work for the remainder of the journey. In this manner we readjusted the distribution of work, and thus the expedition was able to accomplish its mission without reducing by a single item its settled programme.

On August 20 we started off from the Depsang with a caravan of sixty camels and fifty horses, which had come up from Suget Karaul, a small Chinese fort on the Indian frontier. On the morrow we crossed the Karakoram Pass, 18,600 feet (5800 metres), and entered a region of wide arid valleys with hardly a sign of vegetation. Whole days were to pass without our seeing even a blade of grass or a trace of moss or lichen. Even the weather seemed in sympathy with the prevailing dreariness. The icy-cold blizzards, the skies of leaden blackness, the mists which hung heavily over the mountains, all conspired to render our passage through this region as cheerless as can be imagined. The scenery might have outdone even the Depsang in desolation, had it not been for an occasional flame-coloured rock standing in bold relief against the surrounding drab-coloured hills.

Here we split into two parties. Spranger with Petigax and the two surveyors continued down as far as Kufelang in the Yarkand valley, while the rest of us crossed the Suget Pass, 17,600 feet (5400 metres), to Suget Karaul in the Karakash Valley, where our numbers were further reduced by the departure of Marinelli and Dainelli, who started for Italy by way of Kashgar and Russian Turkestan. At Suget Karaul we halted eleven days for the setting up of the customary geophysical station.

Leaving the encampment on September 4 we crossed a pass 16,000 feet (5000 metres) high and descended to Kirghiz Jangal in the Yarkand Valley, carrying sufficient food for a few weeks' journey and only our topographical instruments, the remainder of our equipment being sent to Yarkand by caravan. Notwithstanding the lateness of the season we were determined to make an attempt at exploring the Oprang Valley. So far as I know, Sir F. Younghusband is the only European who has set foot in

it. Ginori, Abetti, and myself, with Janna Pershad, started downstream from Kirghiz Jangal with the intention of reaching the Oprang Valley by crossing the Afghil Pass. Meanwhile Wood proceeded up the valley to join Spranger at Kufelang, and to explore with his assistance the two western tributaries of the Yarkand, which they had noted a month earlier. These two large rivers do not flow from the northern slopes of the Karakoram, but from a snow-bound chain which in all likelihood divides the basin of the upper Yarkand from that of the Oprang.

As regards our exploration of the Oprang Valley, we proceeded for five days down the Yarkand, a large turbid river, which is continuously altering its bed by fretting away its banks of gravel and sand. Our progress was slow and obstructed. During the first two days of our journey we were obliged to ford the Yarkand no fewer than eight times, and this was only possible at those points where the force of the current was lessened, either by the river widening out or by its forking off into several branches. Further down the track the valley closes into a long deep gorge, which forced us to keep to the higher ground. In places the path was so steep and precipitous that our porters were often obliged to unload the beasts and carry their packs for several hundred yards at a time. At Bazar Dara, where the Yarkand receives a northern tributary, we were forced to abandon our pack-horses, and to push on with only our saddle-horses and the sure-footed yaks.

From one of the spurs which obstructed our path we had looked forward to enjoying a magnificent panorama of the Aghil, but unfortunately heavy clouds completely enveloped the mountain crests. We could only see the glacier-covered buttresses stretching down to where, more than 3000 feet beneath us, flowed the River Yarkand, swirling and boiling between cliffs of shiny black schist. After a precipitous descent we reached the river-bank opposite to the valley by which we were to climb the Aghil Pass.

To arrive at the opposite bank was a more serious problem. After various vain attempts two of our strongest saddle-horses, with their intrepid Kirghiz riders, succeeded in swimming the river. On the further shore they found five camels which had been turned out to summer pasture. In order to see to what extent these animals would resist the current our horsemen drove them into the water, and the fact that these unloaded beasts were rapidly swept downstream convinced us that it would be impossible for our caravan to cross the river in its present condition. As the weather was consistently rainy there seemed no hope of the current abating. Moreover, even had it been possible to penetrate into the Oprang Valley, it is very doubtful whether, at that late season, we could have made a satisfactory exploration of its glaciers. As far as we could judge from our distant view of the Aghil Mountains, the range is of such dimensions that to explore it adequately it would be necessary to devote a whole season to that project alone.

Having with much reluctance abandoned this excursion, we continued

our journey to Central Asia, taking the more western of the two short cuts which lead to Yarkand city, while Wood's party proceeded, according to our agreement, along the second road which crosses the Yanghi Dawan pass. Our route lay across four mountain passes from 10,000 to 17,000 feet high, and was often of breakneck steepness. The track wound in and out of gorges full of loose boulders, through swirling torrents and down detritus-covered slopes, making very difficult going for our horses. The poor beasts slid and stumbled along, jumping painfully from rock to rock, and at the end of a day's march were usually utterly exhausted and bespattered with blood and foam.

But our travels in these steep and barren regions had already drawn near to their close. Little by little we began to see signs of permanent habitation, occasionally a patch of cultivated ground, and actually green bushes and trees. Finally, we turned our backs on the mountains where we had worked and wandered for so many months, and emerged into a line of oases and villages, which divides the mountains from the plains of Central Asia. We next pushed on across Chinese Turkestan, only halting thirteen days at Yarkand to take the usual geophysical observations. On October 15 we arrived at Kashgar, where we were received with hospitality by the British and Russian Consuls-General. Here, a few days after our arrival, we were joined by Wood, Spranger, and Petigax. Here also we took leave of our indefatigable workers, Jamna Pershad and Shiv Lal, who in less than five months had mapped out a territory of about 5000 square miles, working often under most trying conditions.

On October 27 we left Kashgar to cross the last belt of mountains between Chinese and Russian Turkestan. The passes were already deeply covered with snow, especially the Terek Dawan, 13,000 feet (4050 metres). However, in ten days we succeeded in covering more than 200 miles of road, and on November 7 we reached the railway at Andijan.

Two days later we arrived at Tashkent, where Abetti made a last series of observations, which definitely connected the Indian system of gravity stations with that of Asiatic Russia. Our work was completed. Before publishing any adequate reports it will be necessary to study the data we have collected.

NOTE.—In the above paper I have attempted only a superficial sketch of the territories crossed by the expedition. For a systematic account of our work, I would refer the reader to the reports published from time to time in the *Journal*. The map of the districts surveyed is in course of construction, and will be published shortly.—F. D. F.

The PRESIDENT (before the paper): We have to-night a double reason for welcoming our guest, Dr. De Filippi. We are always delighted to see and to listen to a traveller who has won one of our Gold Medals. Dr. De Filippi has crowned his many feats in mountain exploration by carrying through one of the

most completely organized expeditions that has ever entered the Himalaya. It was no mere climbing party, but an expedition completely furnished both as regards its composition and equipment for investigating the various problems raised in the scientific exploration of mountains. It comprised two geologists, two meteorologists, an anthropologist, two geophysicists, two topographers, surveyors, and an Alpine guide. Major Wood, of the Survey of India, was attached to it, and it had the hearty support both of the Italian Government and of our Indian Government, who both contributed substantially to the expenses. We welcome most cordially this and other indications that the official ban laid of late years on exploration in Central Asia will not be maintained in the future.

But we have another reason for giving to Dr. De Filippi at this moment a special welcome. He was, as you know, to have read us his paper in April, but in the crisis of his country's fortune he felt himself unable to leave Italy. As a qualified medical man he had volunteered for important service in the Italian Red Cross. Now, however, the great decision having been reached, he has, by an act of courtesy on the part of the Italian authorities, been granted leave to come to us. It is an act of courtesy which the Society must warmly appreciate, and for which we would gladly make any return in our power. I am sure you will wish me at least to beg Dr. De Filippi to carry back to Italy not only our thanks to those who have put no difficulty in the way of his coming over here, but also our most affectionate and cordial greetings to all his fellow-countrymen. Englishmen—educated Englishmen—have a feeling for Italy which might well be described by a stronger word than "affection." And it is with something more than self-interested pleasure that we have welcomed the entry of Italy at our side in this great world-war. We value at its full worth her material support; we look forward with confidence to the prowess of her gallant fleet and army. But she brings something that is of even more value than material aid, something that is an unknown quantity to our common foe. That something is moral judgment and spiritual force. Italy has proved her soul. With many inducements to traffic with unrighteousness she has preferred to risk the chances of war with a ruthless enemy, the lives of her sons, and the priceless treasures of her cities, in the cause of Law, of Liberty, and of Humanity. In this crisis of the world's history she has shown not only the enthusiasm that made United Italy, but also a dignity worthy of ancient Rome, whose traditions she inherits. From the steps of the Capitol her statesmen have denounced and laid bare the schemes and plottings of the evildoers who have bathed Europe in blood. In the streets of her cities, of Milan, Genoa, and Venice, her people have cried for judgment on the murderers of the *Lusitania*.

Let us wish all good fortune to Italy's soldiers and their gallant King. Forty years ago I incurred the wrath of certain German writers by describing the mountains of the Trentino as "Italian Alps." May this summer see my forecast verified. God save Italy.

Dr. De Filippi: I have always felt myself greatly privileged when I have been called upon to address an English audience, but more than ever on this present occasion, when our countries have been drawn into still closer sympathy, and have reunited against a common foe in the cause of the higher ideals of humanity.

I have listened with joy and pride to the kind appreciative terms with which you spoke of my country. I wish that some one of more consequence than myself were here to-night to answer you. I am not a politician, and I can only state that all Italy has hailed with immense joy and enthusiasm the decision of her King and her Government to join the mighty struggle for civilization and for the liberty of the peoples. This is the first time in history that we fight beside your glorious country. May the events prove to you that we have not forgotten our debt of

gratitude for the generous help and encouragement held out to us by England during our war of liberation.

I must add that it was with the greatest pleasure and satisfaction that I found myself able to come in person to thank the Society for the distinction they have conferred upon me, and through me on the whole expedition. No one could be more alive than myself to the high honour I have received in being made a Gold Medallist of the foremost Geographical Society in the world.

I thank you, Mr. President, and members of the Council, most sincerely and warmly on my own behalf and also on behalf of my companions, to whose unfailing loyalty and devotion the success of the expedition is chiefly due.

(*Dr. de Filippi then read the paper printed above, illustrated with a very fine set of photographs, after which a discussion followed.*)

Sir FRANCIS YOUNGHUSBAND: It has been a very great pleasure to me to welcome Dr. De Filippi here this evening, because we are friends of many years' standing, and because the region in which he has been carrying out his important scientific investigations and very interesting exploration is one in which I have myself been personally interested for a great number of years. I also specially welcome Major Wood here this evening, for I have not met him since we last parted in the heart of Tibet. Dr. De Filippi said that the Dipsang plains were, he must conjecture, one of the most desolate regions in any quarter of the world. I can entirely corroborate that impression. I have twice crossed those plains, and I have been in a good many other pretty desolate regions of the world, and as he described them I conjured up to myself the scenes I had witnessed, and especially a view of the Gobi Desert in Central Asia, which I crossed in 1887, and which my predecessor there, the great Russian traveller Prjevalsky, had described as so desolate that the deserts of Tibet would be considered fruitful in comparison. I thought of that scene and the scene on the Dipsang plains, and I came to the conclusion that the palm should go to those Dipsang plains. I do not know what it is about them. It is not merely the absence of vegetation, because one has seen that in Tibet, in the Gobi Desert, as well as in other parts of the world; but I think it is the height—the fact that any one travelling there is travelling at a height of nearly 18,000 feet, and is consequently in a state of most terrible exhaustion. It is that and the fact that the whole plain is strewn with the bodies and skeletons of these many hundreds of poor animals who have succumbed on the way.

The most interesting purely geographical statement which Dr. De Filippi made this evening was his account of the discovery of the source of the Yarkand River, and the remarkably interesting point that the same glacier which gives rise to the Yarkand River also gives birth to the Shyok River, the great tributary of the Indus. The Yarkand River is the principal river of Chinese Turkestan. I could not say what its exact length is, but it must be well over a thousand miles, and Dr. De Filippi has discovered its source in this Remo glacier, which at the same time gives birth to the Shyok River, so that while some of the water of this glacier goes off into Central Asia and buries itself eventually in the great desert of Gobi, the rest goes off south into the Indus and the Indian Ocean. Thus one and the same glacier gives birth to two great rivers, with destinations so far apart. That is a point of great geographical importance, upon the discovery of which this Society should most sincerely congratulate Dr. De Filippi. Another Gold Medallist of our Society, Hayward, had thought he had discovered the source of the Yarkand River in 1868, but exploration in those days was carried on in very adverse circumstances. Hayward and an uncle of mine, Robert Shaw, who was also a Gold Medallist of the Society, were the first Englishmen to penetrate the Himalayas of Chinese Turkestan. They were together on those plains, and were arrested by the

Yarkandis and kept under guard, but Hayward managed to elude his guards and made a dart off in the direction of the Yarkand River. After a rapid survey he thought he had discovered its source, but, as Dr. De Filippi has now established, he was in error.

Dr. De Filippi said that he thought I was the only European who had visited another great river of those parts, a tributary of the Yarkand River, the Oprang River. I did have the interesting experience of actually discovering the Oprang River in 1887 on my way from Peking, and I visited it again in 1889, but I am not the only European who has visited it, for in 1889 I came across the Russian traveller Grombtchevsky, who also made an exploration of the river, and Lieut. Cockerell and other officers have visited it in its lower reaches. But the source of the Oprang River and its upper basin still remain to be explored, and it is one of the most interesting fields of exploration still remaining in the Himalayas. I hope that when this war is over some of the officers in India may direct their attention to that region, and that whoever undertakes that interesting enterprise may be animated by the same enthusiasm, may exercise the same foresight and careful attention to detail, and may possess the same capacity for organization and for leadership which has been so eminently displayed by Dr. De Filippi in the conduct of the exploration of which he has given us an account this evening. Such an exploration, so carried out, is the envy of us who have gone before, and it should be an example for all who follow; and as a fellow-explorer I desire to tend to Dr. De Filippi my most sincere congratulations upon his splendid achievement.

The PRESIDENT: We have in this Society many travellers who could talk upon this region; some of these are not present to-night. Dr. Longstaff is serving in India, Dr. and Mrs. Workman, I believe, are not now in London. However, we have Colonel Godwin-Austen, who is the father of exploration in this region; Sir Martin Conway, and others. I will call first on Colonel Godwin-Austen.

Colonel GODWIN-AUSTEN: It has been a very great pleasure to me to be present and to hear Dr. De Filippi describe his last expedition to the Himalayas. It is a great many years since I was in that part of the world surveying under Captain Montgommerie, but it is a great satisfaction to me to find that the work which was begun by Everest and Waugh, Walker and Montgomerie, is still being carried on so ably by the officers of the Survey at the present time, and that the results of the geodetic labours of the officers of the past are leading to the more scientific expeditions that are being carried on now. The portion Dr. De Filippi described, the sources of the Shyok Valley, I never have been in myself. After surveying the Baltoro side, I was deputed to survey the Chang Chingmo, which is a large area of country just to the eastward. On the western margin of that work I can remember a marvellous view, vast in its extent, I had from a peak about 19,000 feet which overlooked the Shyok Valley, and from which I saw the great bend in the Shayok (lat. 34°), and far away to the north-west the great mass of snowy peaks rising to 24,000–25,000 feet. It is a great gratification to find that the so-called Remo Glacier is now surveyed. It is impossible to say where the name came from. Johnston had a curious way of naming peaks; sometimes he would name one after the man who went up and put a pole upon it, so that the name Remo may be the name of a man in his party who came back after visiting the glacier. I was rather surprised the first time I found a peak on my plane-table which had been named in this way. It must not be forgotten that Mr. Ryall and Mr. Johnston, although both very able surveyors, when they were in that ground had never seen such glaciers before, and I think they were perfectly staggered by the character of the country. They had not the means nor party strong enough to go into it, and their sketching of that piece of ground was very rough reconnaissance and slight indeed

Nothing was shown except the lines of main drainage. I remember when Johnston came back from his expedition to Khoten, Colonel Walker asked me to extract from him such information as was possible, and I found he, having no previous knowledge of a past glaciated country and glaciers, could not describe what he had seen. There is very much that is gratifying with regard to Dr. De Filippi's expedition, particularly, I think, that Italian officers have joined with officers of the Indian Survey in carrying out work of this kind. It is something to be proud of that we should thus be joined by able scientific men and officers of the Italian army, and I think everybody will join with me that we hope in the future that this unity of work will be continued.

Dr. ARTHUR NEVE: At this late hour I will only say one word, and that is in defence of the unfortunate name Remo which is now thrown into the melting-pot. The natives of the country well know it by that name, and I think we may be sure that Johnston got it in the first instance from them. I know that when I was in that neighbourhood a native pointed to the Remo glacier, and he said, "That is the Remo glacier;" so they did know something about it in the olden days before our map-makers got to work.

Sir THOMAS HOLDICH: I have only a word or two to say. I think that in order to appreciate the magnificent work which has been done by Dr. De Filippi we should understand what an enormous opportunity for exploration there is in that tremendous band of mountains which frames in India to the north. For 3000 miles that mountain barrier extends from Burma to Persia. In the first section of it, that which we geographically call the Himalayas, we know nothing except the extreme ends of it. We know where the Brahmaputra parts the hills in the east; we know something about the north-west of it, but of the vast territory of Nepal we know nothing at all. In the centre section of this huge barrier, in the country where Dr. De Filippi has been, and where he has taken us to-night, you have been able to see for yourselves something of the nature of the country and to estimate its opportunities. Those amongst you who are Alpine climbers will understand the enormous conformations of Nature in that part of the world, if I say that you might take the whole of the Alps between the Rhine and the Rhone, and you might dump them down in one of those huge valleys of the Himalayas, and it would hardly affect the landscape. From there, again, the barrier passes on through the giant Mustagh or Karakoram range (dominated by that great peak to which Colonel Godwin-Austen's name is given), through the Hindu-Kush to the Persian frontier. All this country has been brought into the general scheme of scientific geography by the work of the Indian Survey. We cannot call it unknown, because there are innumerable peaks and points fixed about it which form the basis of all future exploration; but still no Indian department is so constituted as to be able to support what you may call an academic study of science over any countries which are so absolutely unprofitable as those wild mountains of which we have heard and seen something to-night. But still, unproductive though they may be, we cannot call them unimportant. It is important that we should know about them, for there is our frontier—that is, the frontier of India, the barrier against all the rest of Asia; and it is a marvellous thing that through Burma, through the whole range of the Himalayas, there should exist such a frontier and barrier of such magnificence as that of the snowy range, perfectly impenetrable, mostly uncrossed by human foot, and one which will stand at all times as a sure defence of India on the north. We may still say the same of it where the frontier leaves the Himalayas and takes to the Karakoram and Mustagh ranges. So that for the extraordinary distance of 3000 miles we have a perfectly impenetrable and effective barrier against northern aggression until we come to the extreme end of it. There, perhaps, for the narrow

space of 200 miles or so, we have an open gateway from the north, and there only. It is to me a wonderful thing that we who live in a narrow sea-girt island like this should have planted ourselves in two great countries, and taken up the protectorate of those countries, countries like Egypt and India, and find in both of them that the frontiers and barriers have been so disposed by nature that we can leave them almost to take care of themselves. We take no trouble about our frontiers. Other countries have to look after theirs very closely. But we must remember that there is that one narrow gateway on the Persian frontier, and about it I have no more to say to-night than this—that, if we cannot shut that gate and keep it shut when we like, we have missed the first and greatest lesson that this war has taught us. There is one feature about Dr. De Filippi's work which I am sure we all appreciate. We know that he took months, if not years, to prepare for it, and he collected all the scientific information that he possibly could about the wild uplands he was going to explore. He left no stone unturned to make it a success, and consequently he has been successful to a degree that we can only hope in future other scientific observers may be who follow in his steps. It is no good to start as mere travellers; men must go well armed with information, if they are to be useful. Dr. De Filippi has set us a brilliant example of what a scientific expedition should be, and yet I understand that when the first call for duty to his country reached him across those barren and wild hills, he left all his chances of further exploration and further scientific achievement behind him, and turned at once to get back as quickly as he could to serve his country; and there is surely another example for us all to think about.

The PRESIDENT: It is now my pleasant duty to ask you to give a very hearty vote of thanks to our lecturer Dr. De Filippi for the extremely interesting account of his journey, and his investigations and experiences, which he has given us. I am sorry I cannot add anything of personal experience to his narrative. I have, it is true, been in the Himalayas, and it is sometimes inferred that I and Sir Martin Conway and the Duke of Abruzzi must all have been to the same spots. An illustrated newspaper even went so far as to publish a picture of Sannu, a mountain in Sikhim, taken by Signor Sella when travelling with me, as an illustration of the Duke of the Abruzzi's exploits in the Karakoram. The region I was in was in fact about as distant from the mountains you have heard of to-night as Vienna is from Madrid, or as the Gross Glockner in the Eastern Alps is from the Monts Maudits in the Pyrenees. One point which has struck me, and which has not been noticed so far in the discussion, is the peculiar physical aspect of the mountains shown us; how much they differ both from the mountains at the eastern end of the Himalaya, near Darjeeling, and from the mountains which Sir Martin Conway and the Workmans and others have described to us. I am pleased to think my mountains, the Sikhim Himalaya, are much the most beautiful of the three. They have very, very deep valleys. You have peaks of 28,000 feet in relatively close proximity to valleys of 2000 feet. Hence you gain not only an extreme variety in vegetation but a prodigious extent of visible height. Again, the difference between the mountains of Dr. De Filippi's photographs and Dr. Longstaff's and the Duke of the Abruzzi's: in the latter you have the wildest granite pinnacles—pinnacles that exceed anything in the Alps or Caucasus—whereas round those ice-fields of Dr. De Filippi's the summit-ridges approach more to the type we are accustomed to see in views of the Arctic regions. There are no very conspicuous peaks, but any number of ridges either snowy or bare according to their exposure. Perhaps Dr. De Filippi, in adding a few words, may tell us whether it is to geological features, or to what causes he would conceive this difference between the Western and Eastern Karakoram to be due. I will not detain the meeting any longer with general remarks on the scenery

or geography of the country. I can only echo what has already been said by others on the admirable and comprehensive way in which this exploration has been carried through. I must also remind you that to-night we have only been given a preliminary sketch of the scientific results in many various branches which will be put before us whenever we have the complete records of the expedition. I will ask you to give a most hearty vote of thanks to Dr. De Filippi.

Dr. De Filippi: It only remains for me to thank you most heartily for the very kind and cordial reception you have given me. I shall leave England with the happiest memories of the welcome I have received and the generous appreciation of our work.

PSEUDO-GLACIAL FEATURES IN DALMATIA.

By Prof. J. W. GREGORY, D.Sc., F.R.S.

The Dalmatian coast has many characteristics which are also found in glaciated areas; and these features are so striking that if Dalmatia were situated in higher latitudes they would doubtless have been attributed to glacial action. Though this explanation has been suggested for Dalmatia, it has not been generally accepted owing to the absence of unequivocal evidence of glaciation.

It is true that some of the higher adjacent mountains in Montenegro and Hercegovina have been glaciated, and the suggestion has been made that at the same time Dalmatia stood at a higher level and shared in this high-level glaciation. If this suggestion were correct the Dalmatian features which resemble those due to ice action should be associated with positive evidence of glacial action. Such evidence is, however, lacking and the topographical features in Dalmatia which at first sight suggest the former glaciation of that country must be attributed to non-glacial agencies.

I. Evidence of Glacial Action.

The evidence advanced in favour of former glacial action consists of two kinds. The first consists of positive evidence, which includes ice-scratched surfaces, moraines, drifts containing ice-scratched boulders,

subject; others again have urged the fuller recognition of geography by educational institutions. I would on this occasion attach especial importance to the prosecution of serious research by individuals in any branch of the subject that is accessible to them, to the discussion of the results of such work by others of like interests, and to the publication of such studies as having a real value in promoting the advancement of scientific geography.

SIR AUREL STEIN'S EXPEDITION IN CENTRAL ASIA.*

By the first week of November, 1914, the several parties of my expedition were safely re-united at Kara-khoja, the central oasis of the Turfan depression. A two months' journey had brought us by widely different routes back from Kanchou to this north-eastern corner of Chinese Turkestan. A variety of reasons had induced me to select Turfan as my base for the geographical and archæological labours planned during the ensuing winter. From what my brief visit to Turfan in 1907 had shown me, I could hope that the ruins of Buddhist times preserved there in abundance had not yet been completely exhausted, in spite of their easy accessibility within or quite close to oases near a high-road and of the attention they had received from successive archæological expeditions, Russian, German, and Japanese.

Turfan further offered itself as the most convenient starting-place for the series of tours I wished to organize for the exploration of unknown or as yet inadequately surveyed portions of the Kuruk-tagh and Lop deserts southward. And, finally, geographical and antiquarian interests combined to make me eager for an accurate large-scale survey of the Turfan basin, for it is just there that we find exhibited, within close topographical compass and in a concentrated form, as it were, all those characteristic physical features which make its great neighbour and counterpart, the Tarim basin, so interesting both to the geographer and the historical student.

This detailed survey of the Turfan depression was started on the scale of 1 inch to the mile and with carefully observed contours by Surveyor Muhammad Yakub as soon as he had joined me after a difficult desert crossing from the terminal basin of Hami. A few days later the rapidly increasing cold, felt even here below sea-level, allowed me to send off Rai Bahadur Lal Singh to the Kuruk-tagh, or "Dry Mountains," where difficulties arising from the want of drinkable water could be met only by the use of ice from salt-springs—or of snow if such happened to fall.

* Communication from Sir Aurel Stein, K.C.I.E., PH.D., D.SC., dated "Camp Bostan-Arche, Ulughart Valley, July 10, 1915." See *Geographical Journal*, vol. **45**, p. 405.

By then the archæological labours had already commenced which were to keep me and my remaining two Indian assistants busy for the next three and a half months.

Their first scene was the ruined town known as Idikut-shahri. It immediately adjoins the large village of Kara-khoja and has long ago been identified as the site of Kao-chang, the Turfan capital during T'ang domination (7th to 8th century A.D.) and the subsequent Uigur period. Within an area nearly a mile square and enclosed by massive walls of stamped clay there rise here the ruins of very numerous structures built of sun-dried brick or clay, almost all Buddhist shrines and several of imposing dimensions. For generations past the cultivators of the adjoining villages have quarried the *débris*-filled ruins to obtain manuring earth for their fields. The excavations repeatedly made here by Profs. Grünwedel and Von Lecoq between 1902–1907 had induced the villagers to extend their destructive operations and to carry them deeper in the hope of securing manuscript remains and antiques as valuable by-products for sale to Europeans and their agents. But there still remained some ruins where the deeper *débris* strata had escaped exploitation. Their systematic clearing brought to light a variety of interesting remains in the shape of fresco pieces, fragments of paintings on paper and cloth, stucco relievos and the like illustrating Buddhist art at Turfan. We also recovered manuscript remains in the Uigur, Tibetan, Chinese, and Manichæan scripts. Among individual finds of interest may be mentioned a hoard of well-preserved metal objects, including decorated bronze mirrors, ornaments, vessels, etc. It derived special interest from the large number of coins found with it, which enabled me to fix with approximate accuracy the date of its deposit in Sung times. Our work included an exact plan of the whole site.

After visiting smaller ruined sites in the eastern portion of the Turfan basin, I started towards the close of November excavations in the picturesque gorge of Toyuk. There the precipitous cliffs, rising above the small stream which waters a prosperous little oasis famous for its grapes, are honeycombed by numerous rock-cut caves once used for Buddhist worship. Ruins of small cellas occupy narrow terraces where the slopes are less steep. Important finds of manuscripts had been made by the second German expedition at the most conspicuous of these shrines, as the great quantity of fragments of Chinese Buddhist texts left lying among the *débris* still attested. This had stimulated the monkey-like emulation of native searchers for antiques, with the result of terrible havoc being wrought among the ruins previously left more or less untouched. We succeeded, however, in tracing remains of small shrines lower down which had escaped such destruction owing to the heavy covering masses of *débris*. Fortunately here as elsewhere about Turfan the employment of large numbers of diggers was easy, conditions being so different from those to which my previous work at sites far away from habitations and water had

accustomed me. In the end our work at Toyuk was rewarded by the recovery of a considerable quantity of fine fresco paintings and stucco relievos. There were finds, too, of fragmentary Chinese and Uigur texts.

By the middle of December I was able to leave Toyuk for the important site below Murtuk village. There one branch of the stream watering the Kara-khoja oasis breaks in a narrow wild gorge through the barren hill range overlooking the Turfan depression from the north. A conglomerate terrace on the west bank bears an extensive series of ruined Buddhist temples partly cut into the rock face. By the richness and artistic merit of their fresco decoration they surpassed any remains in the Turfan region. In 1906 these big wall paintings representing scenes of Buddhist legend and worship in great variety of subject and style had been carefully studied by Prof. Grünwedel, a leading authority on Buddhist iconography, and a considerable selection of fresco panels was then removed to the Ethnographical Museum at Berlin. Exposed for long centuries to casual injury at the hands of iconoclast Muhammadan visitors, the frescoes had suffered even more during recent years from natives, who in vandal fashion would cut out small pieces for sale to Europeans. The near risk of complete destruction was only too obvious, and I accordingly decided to save as much as possible of these fine-art remains by careful systematic removal. Fortunately I had trained help available for this long and difficult task in the person of my "handy man," Naik Shams Din, of the 1st Sappers and Miners, and through his devoted energy and technical skill the work was in the course of six weeks successfully accomplished according to carefully drawn plans.

While it was still proceeding I could apply myself to the excavation of smaller Buddhist ruins near Murtuk, and then to a task which proved as fruitful as it was in some ways unpleasant. On the gravel-covered waste between the debouchure of the gorge descending from Murtuk and the village of Astana which adjoins Kara-khoja from the west, there extends a vast ancient burial-ground marked by small stone mounds which low lines of embanked gravel enclose into scattered groups. Below these mounds there lie tomb chambers cut into the underlying hard sandstone, with a narrow rock-cut passage leading deep down to the entrance. Most of these tombs appear to have been searched for valuables during the last Muhammadan rebellion and perhaps also earlier. But drift-sand had completely closed up their approaches, and the attention of local antique-hunters had turned to them only during the last few years. These recent operations had not proceeded far, and anyhow assured us of the absence of any local prejudices.

The systematic search we effected of very numerous tombs has conclusively shown that this cemetery belongs to the early T'ang period when Kao-chang was an important administrative centre and garrison of the Chinese holding Eastern Turkestan. Chinese inscriptions on bricks have furnished exact dates, names of persons, etc. This is not the place

to give details as to interesting burial customs revealed by these tombs or the remarkable state of preservation in which most of their contents and tenants were found. This state is fully accounted for by the Turfan climate, which vies with that of Egypt in dryness. It must suffice to record that the archæological spoil has been abundant, and strikingly illustrates the position which Turfan occupied at that period as a place of trade exchange between Western Asia and China. Finds of Byzantine and Sassanian coins used much in the fashion of the classical obolus were frequent. Equally curious is the abundance of brocades and other decorated silk fabrics showing designs usually associated with Persian work of Sassanian times. The stucco figurines, miniature household implements, articles of food, clothing, etc., deposited with the dead acquaint us with many aspects of the daily life led in Turfan at that period. There were paintings on silk, too, and manuscript records in plenty.

However interesting and to me novel this work was, I felt heartily glad when the time came to exchange this search of the dead's habitations for exploratory tasks in the desert. Towards the close of January Lal Singh had rejoined me from the "Dry Mountains," having accomplished important survey work in the face of great physical difficulties. In accordance with my instructions, he had started triangulation after reaching Singer, the only permanent habitation in that vast expanse of barren plateaus and hills, and carried it south-east to the vicinity of the Lou-lan sites in the wind-eroded Lop desert. There he had waited patiently for a week amidst icy gales, with temperatures falling well below zero Fahrenheit, until the atmosphere had cleared and allowed him to connect his triangles right across the Lop desert with high snowy peaks of the Kun-lun some 150 miles south which had been fixed by his triangulation of 1913. It was my hope to get this link with the Indian triangulation system extended later on to the Tian-shan range in the north.

Accompanied by Abdur Rahim, the experienced hunter of wild camels from Singer, who had proved so useful to us a year before, Lal Singh had then pushed into the unexplored and absolutely sterile region to the north-east of Altmish-bulak until the total exhaustion of his fuel supply obliged him to turn westwards again after having reached close to 92° long. On his return journey he picked up an old desert track once used by hunters of wild camels from Hami before certain salt springs had dried up, and followed it through to the salt marsh which forms the deepest portion of the Turfan basin. Numerous observations made there with the mercurial barometer will, I hope, permit its depression below sea-level to be determined more accurately than had been possible so far.

By the first week of February Lal Singh was eager to take the field again in the Kuruk-tagh, and by dint of great efforts we had completed the packing of our plentiful "archæological proceeds." On February 6 I started my big convoy of antiques making up fifty heavy camel-loads for

its two-months' journey to Kashgar, and on the same day Afrazgul Khan, my zealous and ever-active assistant from the Khyber Rifles, was sent off to the Lop desert for a supplementary survey of the Lou-lan region and the ancient dry lake-bed east and south. I myself was detained ten days longer by arrangements for the completion of the large-scale map of the Turfan depression and by the collection of supplementary data bearing on its extant irrigation resources. The fact that now the greater portion of the cultivated area is dependent on *Karezes* or springs tapped by underground canals, a system introduced into Turfan only in the eighteenth century, clearly proves the diminution which has taken place since Buddhist times in the water-supply above ground. A detailed survey was also made of the curious site of Yar-khoto, where a maze of ruined dwellings carved out of the loess soil of an isolated and naturally strong plateau represents the remains of the Turfan capital of Han times.

On February 16 I set out myself for the Kuruk-tagh, and after securing from Singer Abdur Rahim's youngest brother as guide, visited several localities in the mountains westwards where traces of earlier occupation were reported. In the course of this tour I was able to map a good deal of ground which had remained still unsurveyed. By its succession of remarkably rugged ranges and deeply eroded valleys it presented a striking contrast to the plateau-like character borne by most of the Kuruk-tagh eastwards. The presence of scanty grazing in the higher valleys and even of some tree-growth helps to explain the reference which the Han Annals make to the westernmost Kuruk-tagh as a sporadically inhabited region.

By the first week of March I had made my way south-eastwards to the salt spring of Yardang-bulak at the extreme foot of the Kuruk-tagh, where it overlooks the dried up ancient river-bed first traced by Dr. Hedin which once carried the water of the Konche-darya to the Lou-lan sites. The ice-supply taken from there allowed me to make a tour in the waterless desert south. There I mapped the ancient river-bed, still clearly distinguishable between the belt of dead trees lining its banks, over the last portion of its course left unsurveyed last year. I also explored two ancient cemeteries of small size on clay terraces rising above the wind-eroded riverine plain. The finds closely agreed with those made in graves which I had examined the year before in the extreme north-east of Lou-lan. The bodies undoubtedly belonged to the autochthone population of herdsmen and hunters inhabiting this tract until its final drying-up in the fourth century A.D. The objects found with them strikingly demonstrated the difference in civilization and modes of daily life between the semi-nomadic Lou-lan people and the Chinese frequenting the ancient high-road which led along the dried-up river westwards.

On my return to Yardang-bulak I was greatly relieved by Afrazgul safely rejoining me. He was a week overdue, and, considering the forbidding nature of the ground my plucky assistant and his three Turki followers

had to traverse, there had been cause for anxiety. After gaining Altmish-bulak by the most direct route, and taking his ice-supply there, he had explored certain ancient remains in the extreme north-east of the once watered Lou-lan area which on our hazardous march of last year we had been obliged to leave unexamined. He then retraced the ancient Chinese route to the point where it crossed the dry lake-bed of hard salt, and thence surveyed the shore-line of the latter until he reached the edge of the area where the spring floods of the Tarim finally lose themselves in lagoons and marshes. From there he turned north, and, after tracing more ruins along the ancient dry river branch discovered last year, gained the foot of the Kuruk-tagh across an area of formidable high dunes. Apart from interesting archæological finds Afrazgul brought back from this exceptionally difficult exploration a detailed plane-table survey which, in conjunction with last year's mapping, will help to show the so-called Lop-nor problem in a new light.

Then we moved west to Ying-pên, where the Turfan-Lop track crosses the ancient bed of the Konche-darya. A short halt there enabled me to explore the remains of an ancient fortified station and neighbouring small temple site, first noticed by Colonel Kozloff and Dr. Hedin. Finds of fragmentary Kharoshthi records on wood and of coins proved that the ruins dated back to the early centuries of our era when the ancient Chinese high-road passed here. The station guarded an important point on the route, and must have held a Chinese garrison, as proved by the remains which came to light from some well-preserved tombs near by.

Starting from Ying-pên for Korla, I first traced in the desert westwards the ancient bed by which the waters of the Konche-darya had once passed into the " Dry River " of Lou-lan. I then explored the remains of an ancient line of watch-stations extending along the foot of the Kuruk-tagh, on a route which Dr. Hedin had first followed in 1896. The constructive features observed in these watch towers, some of them remarkably massive and well-preserved, showed the closest resemblance to those with which I had become so familiar in the course of my explorations of the ancient Chinese *Limes* of Kansu. It appears to me, hence, highly probable that these towers were built soon after the date (*circ.* 100 B.C.) when the Emperor Wu-ti established his wall and line of posts along the route leading from Tun-huang towards Lou-lan. But the line marked by these towers must have continued to serve as a high-road down to T'ang times, as was proved by the finds we made in clearing the refuse heaps near them. Distinct evidence showed that the towers had been intended chiefly for the communication of fire-signals, as mentioned in the early Chinese records from the Tun-huang *Limes*. This purpose is easily understood, as it was mainly from the direction of Kara-shahr and Korla that the Hun raids must have proceeded which we know to have threatened more than once the Chinese hold upon Lou-lan and the security of the route leading through it.

I reached the large oasis of Korla on the last day of March, and there I was soon joined by my several surveying parties. Lal Singh had had to contend with exceptional difficulties, both from the very broken nature of the ground and adverse atmospheric conditions—all through March we had suffered from a succession of dust-storms. Yet he had succeeded in carrying his triangulation from Singer through the western Kuruk-tagh to the snow-covered peaks north of Korla. Thus the Tian-shan range has been linked with the system of the Trigonometrical Survey of India.

After a short and much-needed rest at Korla, we started in three separate parties for the long journey to Kashgar. Lal Singh was to keep close to the Tian-shan in order to survey as much of the main range as the early season and the available time would permit. Muhammad Yakub was sent with the camels across the Konche and Inchike rivers to the Tarim, the course of which he was to survey to the vicinity of Yarkand. I myself was compelled by antiquarian reasons to keep to the line of oases which extends along the south foot of the Tian-shan, and through which the great caravan route passes just as it had in ancient times. This journey, over 900 miles in length, offered plentiful opportunities for interesting observations on the historical geography and the present physical conditions of this northern edge of the great Turkestan desert basin. This is not the place to record them. But I may mention at least that remains of the ancient Han route could be traced as far as Kucha.

Making this historically important oasis my base, I spent some busy weeks in surveying, with Afrazgul's help, both its actually cultivated area and that which numerous ancient sites scattered in the scrubby desert around prove to have once belonged to it. This survey, attended also by archæological finds of interest, has convinced me that the area under cultivation in Buddhist times was greatly in excess of the extant irrigation resources, of which we secured careful measurements. That the discharge of the rivers irrigating Kucha has diminished considerably since T'ang times seems to me quite clear. But to what extent this "desiccation" was the direct cause for the abandonment of once irrigated areas and at what particular periods it proceeded are questions to which the antiquarian evidence at present available does not supply a definite answer.

At Aksu I was met by Lal Singh, who had managed at three points to carry his plane-table survey up to the snow-covered watershed of the Tian-shan. Sending him westwards by a new route between the unsurveyed outer ranges of Kelpin, I moved by rapid marches to Kashgar, where I arrived on May 31. Colonel Sir Percy Sykes, who had temporarily replaced there my old friend Sir George Macartney as British Consul-General, offered me the kindest hospitality and help. The safe repacking of my collection of antiques, some 180 cases, for its long

journey across the Karakoram to Kashmir, and a host of other practical tasks, kept me hard at work all through June. In the meantime I had the great satisfaction of receiving through the kind offices of H.E. Sir George Buchanan, H.B.M.'s Ambassador at Petrograd, the final permission of the Russian Government for my long-planned journey across the Pamirs and through the mountain tracts north of the Oxus. In a few days I propose to set out on this journey, which is to serve mainly researches on the historical geography and archæology of those regions. In the autumn I hope to follow them up by similar work in easternmost Persia.

[The following is an extract from a letter dated "Camp Kara-Chem, Pamirs, August 8, 1915"]:—

I was able to start for the Pamirs by the first week of July. On my way I stopped for "daffar" work at Bostan-arche, a delightful spot below the Ulugh-art, with fir forest and quite alpine surroundings, which would make a splendid "hill station." I made my way north to the Alai, and am now proceeding from there along the grand snowy range which forms the western rim of the Pamirs towards the Great Pamir source of the Oxus. I propose to follow the latter down through Wakhan to Khorok, and thence to visit Roshan, Darwaz, Karategin before going to Bokhara and the railway. About the end of October I may hope to reach Meshed. The winter I propose to spend in Seistan, and by March I hope to return to India, if all goes well. I have asked for furlough to take me home in the spring and enable me to complete "Serindia," the final report on my second journey. I have met with nothing but kind help since I crossed the Russian border, and feel elated by the chance of seeing so much of new and fascinating ground. Some of it is decidedly rough to travel over, but my leg has so far stood the climbs and long marches quite well.

FURTHER NOTES ON THE PHYSIOGRAPHY OF PORTUGUESE EAST AFRICA, BETWEEN THE ZAMBEZI RIVER AND THE SABI RIVER.

By E. O. THIELE, M.Sc., F.G.S.

Introduction.

Some of the major physical features of a portion of Portuguese East Africa south of the Zambezi River, and their probable relation to tectonic factors were described recently by Mr. R. C. Wilson and myself in this *Journal*.* The observations embodied in that account had then extended over three seasons of field work in connection with the mineral

* *Geogr. Journal*, January, 1915.

Urema was that they may represent the site of a filled-up lake or series of lakes. It must be admitted, however, that at present there is not much field evidence in support of this view. No lake terraces have been observed, and nothing is known concerning the nature of the deposits underlying the superficial cover of sand and clay.

Summary of Conclusions.

The coastal lowlands form an imperfectly belted coastal plain 80 to 100 miles in width. Its innermost longitudinal lowland has no eastern wall in the central portion, for the middle upland belt of limestone rocks, which is well developed in Sheringoma and Western Sofala, is replaced by the low plains of the Pungwe in the central portion.

Downwarping of this region may be the explanation of this feature, probably causally connected with the heavy sedimentation in the vicinity of the Pungwe estuary. Though the belted structure of the lowlands may account largely for the features developed, it is certain that in the Urema region, and probably in the Buzi depression to the south, it has been assisted by tolerably recent faulting.

The line of this depression being a direct continuation of the Nyasa-Shire tectonic line suggests the probability of a synchronous control. The surface features here, however, are affected to a much less extent, indicating probably that the strength of the tectonic dislocation was dying out to the south.

TWO IMPORTANT MAPS FROM THE SURVEY OF INDIA.

TIBET AND ADJACENT COUNTRIES, 1 : 2,500,000.
CARTE INTERNATIONALE DU MONDE AU 1,000,000e. North E. 43, BOMBAY.

A GOOD map of Tibet and the adjacent countries has long been needed. Since the last edition of the Society's map of Tibet was published in 1906 much fresh information has been obtained which could scarcely have been shown upon the relatively small scale of that map. Moreover, it would hardly have been possible to undertake successful revision, inasmuch as the officers of the Survey of India have done far more than any others in the exploration of Tibet, and an important part of the new information remained inaccessible in the Survey Office at Dehra Dun. There alone was it possible to undertake the task of compiling a map such as that now under review.

The new map, on the scale of 1 : 2,500,000, is bounded by parallels 44° N. and 26° N. and by meridians 72° E. and 102° E., and is printed

in four sheets. The projection is not stated, but it is apparently a conic with two standard parallels.

It is needless to say that the compilation has been carried out with great care and skill; that the selection of place-names has been made judiciously; and that the map is full of new and interesting material. The feature which will provoke most interest and arouse most discussion is the representation of relief. The scale of layer colouring running up to a brilliant red is already familiar in the publications of the Survey of India; and when extreme heights are not too frequent the effect is excellent. It must be confessed, however, that when the country to be represented is Tibet, and the whole central part of the map is covered with brilliant red, there may be two opinions as to the wisdom of the choice of colour scale.

The problem which the Survey of India have set themselves in the production of this map is the representation of the most violent relief upon the surface of the Earth. The ground to be shown ranges from Mount Everest, 29,000 feet above, to the depression south of the Tian Shan range, several hundred feet below sea-level. Moreover considerable stretches of the country are under perpetual snow, which, in accordance with the recent decision of the International Map Conference, is left white, whereby the contrast is greatly exaggerated in spite of the blue form-lines which are where possible shown upon the snow. Where the snowline descends below 15,000 feet none of the brilliant red appears; and thus the great mountain Tengri Khan, 23,600 feet high, is not made sufficiently conspicuous. It is doubtful whether a solution can be found to reconcile the conflicting ideals of representing increasing height by increasing intensity of colour, and at the same time showing the limits of perpetual snow.

Contours are drawn and the layer tints are changed at 250, 500, 2000, 3000, 6000, 10,000, and 15,000 feet. The colour scale approximates in its lower ranges to that of the London Conference of the International Map; in the higher ranges to that which was adopted at the Paris Conference of 1913, but with a tendency "vers le rouge" rather than "vers le marron," which latter found more favour in Paris. The yellow tints of the old London colour scale have a decided use on this map and form a pleasant transition between the green and the brown which is lacking in the second map to be described.

The map is described as a rough provisional issue, and may therefore be discussed as an experiment, in the hope that variants may be produced for comparison. It would, for example, be very interesting to see the effect of hill shading, especially on the snow; or to try to carry the contours right up at a uniform interval, even though the interval must necessarily be a large one, and auxiliary contours would be required below 2000 feet. It might be worth while to try red contours on the snow above 15,000 feet, or alternatively, white contours cut into the red, to

maintain the colour scale while indicating the snow. Progress in the experiment must be gradual, as contours become more precise.

In view of future editions it may be noted that the limits of snow seem to be incorrect about the Shyok Valley and east of Kangchenjunga; that the large title breaks into the mountain range unnecessarily; and that the numerous spaced-out names might perhaps be shown to more advantage as an index diagram. The name "Chinese Empire" survives though the date of the map is 1914.

The first Indian sheet of the International Map should receive a cordial welcome. An attached memorandum explains that the Survey of India was already committed to a series on the scale of 1/M, but covering $4° \times 4°$ instead of $4° \times 6°$, and with heights in feet instead of metres. These form the key to the whole system of numbering and arrangement of the Indian topographical maps, and this series must be maintained. Happily the Indian Government have not hesitated to undertake also the sheets of the International Map falling within its sphere; and they are to be congratulated on this important resolution.

The Bombay sheet under notice was engraved in accordance with the characteristic sheet of the London Conference, 1909; but the scale of layer colours has been changed to accord with the intentions of the Paris Conference of 1913, whose report is not yet published. "It is the first engraved sheet printed at Calcutta in colours from separate colour plates, a process which in the climate of Bengal presents certain difficulties not met with to the same extent in Europe." The result requires no apologies. It is an excellent specimen of clean-colour printing, of a region which does not lend itself to a pretty result: a high plateau falling steeply to the sea.

Contours are drawn at 100, 200, 300, 400, 500, 600, 800, 1000, 1200, 1500 metres; but the layer tints are not changed at 800 and 1200. The gauge of lettering for the lowest class of towns, which is left to discretion, is perhaps rather small for legibility; and the sign for ports with regular mail communication is used somewhat freely: it may be doubted whether local mail services need be shown with this rather heavy sign. These are small points of interpretation in which there is divergence of practice. In general the Bombay sheet conforms as closely as may be to a scheme which was undergoing revision while the engraving of the map was in progress. Further sheets of this most valuable series will be awaited with interest: in particular the sheets covering the area of the map on a smaller scale noticed above.