indeed a great promise. I will now ask you to give your thanks to Colonel Younghusband for his paper.

Sir Frank Younghusband, in response, said: I wish to thank you all for your very kind attention to-night, and for the very deep interest you have shown on behalf of myself and on behalf of all who accompanied me to uphold the great traditions of our race.

Owing to the fact that many Fellows were not able to obtain admission to the meeting on February 13, Sir Frank Younghusband kindly repeated his paper to a crowded audience on March 10.

After the paper, the President said: We have all listened with great attention to this most important and interesting address of Sir Frank Younghusband, and he has enabled us, better than we could do before, to realize the very great service he has done to geography, and the still greater service he has done to the State. We should remember that 120 years ago our first Governor-General had opened the same friendly diplomatic relations with Tibet, had established a trade, and had opened a fair for the Tibetans at Rangpur; but unfortunately his policy was neglected after his leaving India, and nothing was done, except in 1886, when there was just a chance of our sending a mission, which was not sent. All that time, until this great and important work was entrusted to Sir Frank Younghusband, Tibet was entirely neglected. Now, through the able work of this great public servant, we again have opened diplomatic relations, friendly relations, with these people. Only three days ago I received a letter from Lord Curzon, our Gold Medallist, in which he mentioned that he had had a letter from the Teshu Lama, and he looked forward to placing that letter by the side of the two letters which had been sent by the Teshu Lama in a previous incarnation to the envoys of Warren Hastings. Lord Curzon intends to place these letters side by side in his great Victoria Institute at Calcutta. The establishment by Sir Frank Younghusband of agents at Gyantse and Gartok will do what Warren Hastings intended to do, and open, in course of time, most important commercial intercourse between India and Tibet. It is difficult to express to you how strongly I feel towards Sir Frank Younghusband for these great services, and also for his extreme good nature in undertaking to read his paper to us a second time. You will join with me, I am sure, in passing a most cordial vote of thanks to Sir Frank Younghusband.

Sir Frank Younghusband: I thank you for the very kind attention with which you have listened to my lecture this evening, and I wish to express my special gratitude to Sir Clements Markham for having come here to-night when I know with what difficulty he has had to come. He probably has a better knowledge of Tibet, from his study of it, than I suppose any Englishman up to the present time. I therefore feel especially gratified at the very complimentary remarks he has been pleased to make.

EXPLORATION IN BOLIVIA.*

By Dr. H. HOEK.

Towards the beginning of September, 1903, we found ourselves, after a long and dusty journey, at Jujuy, the last station on the North Argentine railway, situated at the foot of the Cordilleras. Our little party, consisting of the leader, Dr. Steinmann, of Freiburg, Baron von Bistram,
and myself, had now the pleasant task of searching for mules and servants, one in which we received valuable aid from Dr. Moreno, the well-known Director of the La Plata Museum. We resolved to give both man and beast a trial before concluding our bargains, and for this purpose chose the virgin forest of the Cordillera de Sapla and the Rio Garrapatal basin north-east of Jujuy, through which we rode to San Pedro. This typical example of a liane forest was absolutely un trodden, and in many places we had to hack our way through with the knife. We found much to interest us in the Cretaceous formation of the Garrapatal which contains bitumen and fish fossils. The hilly nature of the region tried our mules somewhat, and they were further tortured by the pioos (sand-fleas), while we ourselves were the prey of the garrapatas or ticks. At San Pedro we reached the track of the new railway Perico-Ledesma, which at that time was working as far as San Pedro.

Our ariero (the name of an overseer of a troop of mules) appeared in a good light. A native of East Bolivia and of almost pure Indian breed, he nevertheless spoke Spanish well, could read and write, and was, moreover, quite trustworthy—a striking example, in fact, of the capacity for civilization possessed by the Quechoa Indians. The mules proving satisfactory, we bought sixteen of them, it being very expensive, and indeed almost impossible, to hire such for long journeys. Moreover, with an ariero and one's own mules one is practically independent. The export trade to South Africa has caused a considerable rise in the price of these animals. Whereas formerly one could be got for from 20 to 30 dollars, we had to give as much as 200 dollars apiece (£18) for our riding-mules. As Signor Moreno kindly proposed to accompany us as far as Rinconada, in the gold of which he was interested, we made a détour to the west instead of going straight to Yavi, the Bolivian frontier station which had been our original destination. The much-frequented road which until quite recently led from Potosi to Jujuy by way of Tupiza has been reduced to a desert by the construction of the Antofagasta-Oruro railway, so that now no facilities exist for sending things to Potosi.

On September 23 we left Jujuy, passing the night at the isolated posada "Volcan." Here, stretching for about 2½ miles into the valley, is an enormous cone of débris broken off from the Cerro Cordoba (15,500 feet), on the west. This mountain I climbed the following day, being anxious to determine its height, as well as to catch a glimpse of the mountains to the west (Chani group). As it is possible to ride a considerable distance up the mountain from "El Volcan" (6200 feet), the tour can be done in a single day.

For four days we rode on through the stone-filled valley past Tilcara, Humahuaca, and the isolated house of Negra Muerta. Now and again the continuity of Palaeozoic quartzite and slate was broken by Cretaceous sandstone (Petrolifera), the fantastic forms and variegated colour of
which were very striking. Crossing the desert-like Pampa Azul, where two lacustrine terraces are to be seen, we reached Cochinoca by way of a small pass. Here we had difficulty in replenishing our larder, the Indians obstinately refusing to sell either a living sheep or dead mutton. A long ride over a plain of deposits grown with grass and tola bushes brought us to Rinconada. The “tolá” (*Lepidophyllum*, sp.) covers an immense area; in its appearance, as well as in the manner and extent of its growth, it resembles our heather. Halfway between Cochinoca and Rinconada, near the Angosta Queta, Steinmann found typical fossils of the lower Silurian age (*Didymograptus*). At Rinconada, which is famous for its gold-bearing quartz veins embedded in Palaeozoic slate, we spent a day and a half, which Steinmann and I employed in climbing to the summit of the gently undulating mountain chain in the west, the Cerro Salle Grande de San José (16,690 feet), whence we took excellent bearings of the high volcanic groups in the north and north-west. While we were there a herd of vicunas passed quite close to us. On the salt swamps of Pozuelos, the remains of the lake which once covered the pampa of Rinconada, we had to remain a day, our mules having decamped.

Bidding farewell to Signor Moreno, we crossed the Cordillera de Escaya by a high pass (13,220 feet), finding in this chain granitic laccolithe in connection with Silurian slate.

On October 4 we reached Yavi, which lies at the foot of characteristically roof-shaped mountains of cretaceous rock richly studded
with fossils. The river which flows past Yavi falls into the Rio San Juan to the north, and from the heights to the west of the town we had a magnificent view of its barren, winding, cañon-like bed.

On October 7 we proceeded over the Pampa towards the north at a sharp angle to the long Victoria chain of mountains. This mighty range is the boundary-wall between the mountains of the west and the declining high land to the east. Further north, in the neighbourhood of the Rio Grande de Cotagaita, it splits into numerous groups. The fossils found at Salitre, where we touched these hills, point undoubtedly to the Cambrian origin of the latter (*Agnostus*, sp.). Here the Victoria chain forms a kind of bay entirely filled with masses of recent débris.

Further north the convergence of these chains forms the great plain of the Pampa de Tacsará. This is drained by the Quebrada Honda, which runs in a deep gorge in the south of the plain, and passes through the western chain.

Crossing the Abra Tinunya of the western range we reached the region of Tacsará, and caught a view to the east of what are probably the culminating points of the Victoria chain, the Cerro Campanario and its neighbours. To ascend the former and fix its height, and that of the neighbouring peaks, was our ambition, which we fulfilled on October 10, after a somewhat troublesome climb over rocky ground. To our disappointment, we had only a view to the west. Some 1640
feet below us a sea of cloud blotted out the landscape; but the fact that no peaks were visible above this pall of mist allowed the inference that the Victoria chain falls abruptly to the east. The Cerro Campanario is 16,665 feet, and shows no clear trace of glacial action.

Proceeding over the Abra de Chorcoya (13,550 feet) northwards into the basin of the Rio Escayache, we crossed the Victoria range by the Abra de Sama (12,920 feet) to Tarija (6250 feet). A well-made but exceedingly steep road leads from the mountains to the tropical region of Tarija, a town formerly celebrated for its monastery which still contains the largest library in the country. Of the diluvian strata of this region and their celebrated fossils I need not speak.

The whole of this huge region descending to the east consists of a series of shallow folds or parallel chains cleft by the Tarija river on its eastward course. These chains are of different formation. Our descent from Abra de Same, for instance, took us over Silurian, an excellent place for finding Dictyonema being Cuesta de Erquis. The formation of the following chain is Devonian, that of the third Cretaceous, the deposits in every case lying concordantly. We spent six days in Tarija, where Steinmann succeeded in fixing the longitude by means of time signals from the Córdoba Observatory. On October 20 we left this beautiful and fertile landscape and crossed the cordillera a second time, on this occasion by the Cuesta de Escayache (12,000 feet) somewhat further to the north. After a two days' journey through deeply eroded mountainous country we reached the Rio San Juan, the northern course of which we followed until it abruptly turned eastward. Its isoclinal valley, consisting of Cretaceous sandstone, is continued to the north, and through it we passed over an unimportant pass into the valley of the Rio Grande de Cotagaita. This river, which flows for a time from north to south in the same long isoclinal valley, also breaks through the eastern side of the latter to join the Rio San Juan on its way to the Rio Camblaya. This part of the valley of the Rio Grande, also called the Valle de Cinti from the town of that name, is a spot of Eden-like beauty, that is so far as the water can be used to fertilize it, the dark red of the soil and of the sandstone walls forming a beautiful background for the green of the foliage. Vineyards are the chief product of the soil, but, owing to the difficulty of transport, nearly all the grapes are made into brandy.

From Camargo (Cinti) we proceeded north, and then north-west by way of Tacaquirá, Sivingomayo, and Otavi to Potosí. Here the great synclinal of sandstone in which we had ridden so long seems to come to an end. It is quite clear that a general surface of sandstone must originally have existed here, the remains of which are preserved only in great synclinals, ditches, and troughs. Between Sivingomayo and Otavi we crossed a second small trough of Cretaceous sandstone. For the first two days our course led through a mountainous country with
deep ravines void of protruding formation; indeed, it had rather the character of an eroded tableland.

Near Chichamayo we caught our first sight of the Cordillera de Liqui, and at Sivingomayo we reached a good starting-point for the ascent of the Cerro Liqui, the highest summit of the range, the height of which I fixed at 16,900 feet. From this point I gained a very clear idea of the orographical conditions of the surrounding country. The Cerro Liqui bears traces of former glaciers, unfortunately not very distinct, as it consists of slate which is not at all conducive to the preservation of glacial phenomena.

The following day brought us through the previously mentioned sandstone region of Otavi, the most prominent mountain of which is the Cerro Nnuqui. For a whole day we rode westward over the great Pampa of Lava to the foot of a mighty mountain range, the Cordillera de Andacaba, which, with its northern continuation of the Cari-Cari chain, we will call the Cordillera de Potosi. The map recently published by Germann represents it as covered with eternal snow, which is, however, by no means the case. Mighty moraines, up to 700 feet in height, surround the peaks of this cordillera, and this, the first unmistakable sign of former glacial action, induced us to avoid the direct route to Potosi and turn to the mountains in the north, where Señor Arzes' mine, Andacaba, gives the height of 15,378 feet, an excellent point
from which to start. We ascended the peaks Hembra de Andacaba (16,590 feet) and Anaroyo (17,100 feet), the beautiful weather allowing us an insight into the topography of these mountains, the mightiest chain we had met with since Jujuy, and one much neglected in all maps.

Riding westward on execrable paths and for a long way over enormous moraines, we reached Potosí on November 3. Of Potosí with its Cerro and its silver, I will not speak, as others worthier than I have already described it. I prefer directing your attention to a spot west of the town, where the mountain chain is cleft into a narrow ravine by a small stream coming from Potosí, and where a magnificent example of discordance, induced by folding, is to be seen. Or I would dwell on the charms of Miraflores, the beautiful watering-place whose roses and fruit trees afford such an agreeable contrast to the desert of Potosí. Hot springs and many Cretaceous fossils make this spot of peculiar interest to the geologist.

Leaving Potosí on November 11, we turned eastward, crossing the Cari-Cari chain by the Illimani pass (16,270 feet). A long descent over one of the most magnificent glacial regions imaginable brought us to San Bartolo, whence the direct route to Sucre turns to the north. Riding for the most part in an easterly direction, we crossed a narrow and somewhat deeply ridged trough of sandstone, reaching at length the northern continuation of the Pampa of Lava-Otavi, here much intersected by the northerly directed waters of the upper Pilcomayo. On the Rio Mataca (which flows north to join the Pilcomayo), at the foot of the mountainous region which forms the northern continuation of the Liqui-Nuqui group, we were for a night the guests of some friendly inhabitants, which made a pleasant interlude in our journey. Continuing eastward, we wound during two days up the heights between the separate waters of the Pilcomayo, taking special pains to understand this complicated and deeply ravined region. After climbing several high passes (Escaleras, 13,750 feet; Lampasar, 13,120 feet), we at length descended, on November 12, about 8200 feet to the Pilcomayo, which has here carved for itself a bed out of dazzling red sandstone. The combination of luxuriant tropical vegetation with the varied colours of the mountains and the remains of former settlements produces a picture full of magic beauty. Continuing north-eastward, we rode up the Rio Uyuni to Icla, where we devoted a day to the beautifully preserved Denovian fossils, amongst which the incomparable canularias are specially worthy of notice. The geography dealing with the origin and sources of the upper waters of the Pilcomayo is not of much value, and most of the maps of that part are drawn solely by imagination.

From Icla we proceeded to Sucre, passing the large Indian town Tarabuco (30 miles from Icla) and the smaller market town of Yampariáz, between which the road traverses for a whole day the
watershed between the Amazon and the La Plata. Sucre, a town now practically dead, retains nevertheless some traces of its former splendour as the seat of government. Its vehicular communication with Cochabamba has ceased, while the post road is partly in ruins and useless for carriages at the present day. For three days we followed this route as far as Finca Constancia. The country here is a paradise of beauty and may best be described as a tropical park landscape. In the valleys there reigns eternal spring. All the cultivated plants of the temperate zone thrive, in addition to such tropical kinds as sugar-canes, bananas, and chirimoya, while swarms of green cockatoos fill the air with their screams. The Finca Carapari, in particular, in the valley of the Río Grande, would be a paradise but for fever. Our enjoyment of these beauties was short-lived, for with Aiquile and Mizque we entered a higher and more barren region. The latter, formerly a most flourishing place, has been almost devastated by fever.

To our chagrin we had to spend a day at the latter place because of the rain which had set in exceptionally early that season.

Mizque is separated from the fertile plains of Cliza and Cochabamba by the Khuri chain of mountains running east-south-east. An attempt to cut a good mule-path here had been abandoned, and our ascent of the Quevincha pass (12,350 feet) was made on a wretched and very slippery path at the end of which we had to camp in the rain. Continuing next day along the crest west-north-west, we found traces of former extensive
glaciers. A steep descent brought us to Arani, in the plain of Cliza, whose waters flow towards Cochabamba, reaching the Rio Grande by a very circuitous route.

On December 2 we reached Cochabamba (plain of wells). This town, situated at a height of 8530 feet at the foot of the imposing Cordillera of Tunari, was the centre from which we made our expeditions the following month.

Our next natural goal was the mighty mountain wall to the north of Cochabamba, whose summit is the double peak of Cerro Tunari. This mountain, as well as the whole range, was, on every occasion we saw it, covered with snow, but reports in Cochabamba, always contradictory, however, deny that it is eternal.

A first attempt to penetrate the range was unsuccessful. We had endeavoured to carry a tent and provisions from Iscaipata, about 20 miles north-west of Cochabamba, to as high a point as possible, but the loss of two mules, which fell with the baggage down a steep slope on the way up, frustrated the design. Little of the lost property was recovered, and a further obstacle was made by the weather, which had become more than dreadful.

On December 14 we made another start, choosing for our ascent this time the wider valley of Llave, further to the west. At a height of 12,470 feet this valley forks, the western branch leading through a pass of 13,100 feet to Muracliata, the eastern through one of 13,788 feet to Cocapata. At the point where it divides we camped.

The next day, after climbing through a steep snow gully, Prof. Steinmann and I reached the smoother north side of the Cerro Tunari, and afterwards the ridge between the two peaks. From this point I climbed the twin summits (17,060 feet). Their height was fixed by means of a boiling-point thermometer, and was corroborated by the continuous barometrical readings in Cochabamba.

The view to the north surprised us. The maps we had studied had led us to expect a gradual descent of the land on that side, instead of which there arose range upon range of mountains, some of which were at least 1650 feet higher than the Cerro Tunari itself. During our whole tour in the region of the Tunari we met with nothing but Paleozoic rocks. Glacial phenomena engaged our particular attention. As in the Alps, so here there are three great phases to be distinguished, a fact which later experience has since everywhere confirmed in South America, wherever we went. From the moraines of the first phase there stretch enormous deposits of fluvi-glacial origin, and these form the whole base of the Tunari range towards the south, cleft by the deep cañon-like gorges of the rivers issuing from the mountain valleys.

The week before Christmas Von Bistram and I rode through the pass Puca Puca (13,120 feet) to Colomi, and through the Abra de
Málaga (12,550 feet) into the region of the “Yungas,” working our way over roads fathom-deep in mud, through forests and tropical rains as far as the Rio Espiritu Santo (3240 feet). This road had gained a temporary importance by the action of Brazil in closing the Amazon route to the export of Bolivian gum, owing to the Acre dispute. Throughout our journey from Cochabamba through Sacaba to Colomi and Incacorral, we met with nothing but Paleozoic deposits, Silurian and Devonian slates and quartzite. Beyond Incacorral the forest vegetation makes all geological observation impossible. It was particularly striking to note how far down on the eastern slopes of these mountains the traces of the glacial epoch extend, polished and scarred

![Cañón of Upper Río Pilcomayo—Sandstone Walls.](image)

rock-faces everywhere witnessing to the action of ice. It is evident, too, that the mountains on this side were more exposed to moisture during the Ice age than the so-called “puna.”

In the mean time Steinmann had made an excursion westward to Capinote, a locality abundantly rich in magnificent Carboniferous fossils.

On December 29 we left Cochabamba for Oruro by the ordinary much-used and well-known mule track which leads through the passes of Tapacarí (13,920 feet), Confital (13,850 feet), and Incaracay (13,900 feet), past the localities of Pasaotani and Tapacarí. In addition to this path there is a carriage-road from Cochabamba to Oruro, open for regular traffic during the dry season, which leads through the village
of Capinote. I mention these well-known routes because they have been wrongly indicated on the recently published map by Germann. We stayed but a short time in Oruro, starting almost immediately for our expedition through the mountains of Santa Vera Cruz and Quimsa Cruz to Araca and La Paz. I may mention that in the immediate neighbourhood of Oruro beautiful specimens of old lacustrine terraces and tuff deposits are to be seen (cf. Minchin). We believe that there is some corresponding connection between these indications of voluminous lakes and the three glacial phases, seeing that both phenomena must be traced back to a wet and cold climate.

There exists great uncertainty as to the geography and nomenclature of the mountainous region stretching eastwards from the pampa between the valley of the Rio La Paz and the eastward bend of the Cordillera Real. This range is separated from the pampa almost through its entire length by the deep valley of Luribay, which here runs from south to north. Though a region rich in minerals and frequented, especially of late, by "mineros" (prospectors), exact details about it are nowhere to be found. Most travellers speak of a mountain "Quimsacruz," but, as a matter of fact, there is a range of mountains about 64 miles in length divided into three chief groups with numberless peaks.

During our tour in this region we localized the following mountains, all of which have been correctly indicated on Germann's map. The "Nevados of Araca," the direct continuation of the Illimani, a wild, mountainous region with beautiful peaks and numerous glaciers, nearly all of which look to the south; joining this on the south are the "Nevados de Quimsacruz" (more correctly Quimpsa, "Three"). The relatively deep gorge of the Abra de Tres Cruzes (15,160 feet) separates this group from the southern corner pillar of the whole range, the shining summit of Santa Veracruz (wrongly Velacruz). The eastern drainage of these three chains has so far been wrongly indicated on every map. On the west the Araca range drains into the Rio Araca, which itself joins the Rio La Paz before the latter breaks through the range. Ultimately the Rio La Paz receives also the western drainage of the Quimsacruz and the Santa Veracruz, which empty their waters into its tributary, the Luribay.

From Oruro we proceeded to Caracollo, and, turning east, passed the Cordillera at its eastward bend, where it becomes lower. After a four days' journey through the villages Colquiri and Ichoca, on the eastern side of the Veracruz range, we found ourselves at Quime. From here a relatively good road led over the Abra de Tres Cruzes (15,160 feet) to Yaco, whence we turned northward between the Quimsacruz range and the valley of the Rio Luribay, crossing several passes. After that, turning somewhat east, we passed the watershed of the Abra de Cairoma (13,225 feet), and reached the upper valley of the Araca.
On the eastern side of these mountains (Inquisive, Ichoca, Quime) vegetation and landscape have the character of the "Yungas," while the western side is puna-like in appearance, arid and sterile. The mountains themselves are high alpine and of a charming beauty. Their structure seems similar to that of the Illimani, a granite nucleus surrounded by Palæozoic deposits, whereon lie concordantly Cretaceous sandstones. As regards the height of the summits, I can only speak with certainty of those of the Araca range. Near the mine Viloco (13,290 feet), I climbed a rocky point from which was visible an overwhelming view of Illimani's rock wall rising sheer out of the depths of the La Paz valley. I fixed the height of my peak at 17,720 feet, and estimate the neighbouring snow-clad summits at close on 16,690 feet.

On January 4 we descended into the valley of the Río La Paz, whence we climbed the Finca Cotaña; but I shall not venture to describe either it or the road to Cohoni and La Paz, as I cannot hope to equal Sir Martin Conway's beautiful description of this Bolivian high-level road. Moreover, our later experiences, our journey to Peru, our ride through the desert from Tacna to Coro-Coro, and my ascent of Cerro Tacora (19,900 feet) form another story.

I append a résumé of the scientific results of our (Dr. Steinmann's) expedition.
EXPLORATION IN BOLIVIA.

The map has been improved in the topography of the following districts. The northern end of the Cordillera de Victoria; the Pampa de Tacsara between Yavi and Tarija; the Cordillera de Liquí; the mountains in the east of Potosí, called the Cordillera de Potosí, and divided into the groups of Andacaba and Cari-Cari; the head of the Pilcomayo between Mataca and Icla; the range of the Cerro Tunari north-west of Cochabamba; the ranges of Santa Veracruz, Quimzaoruz, and Araca, which form the continuation to the south of the Illimani group.

The height of about two hundred and thirty points has been determined by means of five aneroid barometers, which were regularly checked by boiling-point thermometers. The latitude of a great number of places in southern Bolivia was fixed, as also the longitude of Tarija and Potosí, the latter by telegraphic time-signals from the observatory of Córdoba.

As to the geology, I must confine myself to a very rough sketch of the general results.

The sediments found in South and East Bolivia are Cambrian, Lower Silurian, some traces of Devonian and carbon, and as the most recent marine deposit the deep layers of red Cretaceous sandstone, which under ordinary circumstances is only preserved in troughs and folds.

This entire system of sediments lies concordantly, with the exception of some places where differential movements caused by the folding process have disturbed the original concordance. The tectonic occurrences are very plain and simple. On the whole, we observe a folding structure on broad lines and of great dimensions. Nowhere do we meet with the complicated conditions reigning in the Alps. We were specially interested in the witnesses of former glaciation, and we have been able to establish three phases which correspond exactly to those of the Alps and North Europe. The necessary proofs were furnished by moraines in a state of more than excellent preservation. The more one approaches the equator the higher the snow-line, the greater, also, the elevation of ancient glaciation. We found it at 9515 feet in the Tunari, the Quimzaoruz, and the Araca mountains. It is worthy of notice that the eastern sides of the mountains have always been exposed to greater moisture, and that therefore they show the remains of former glaciation at a lower level than on the western slopes. On the other hand, we observe that even the most southerly of the isolated volcanoes have borne ice-caps; thus the Cerro Tacora, which has a belt of enormous moraines as far down as 13,780 feet.

The lower level of the glaciation descends as we proceed further south, and thus keeps more or less parallel to the snow-line of to-day. Near Cochabamba it lies between 9190 and 9515 feet.

A former glaciation of Brazil is, of course, out of the question. Such
speculations as have appeared on the subject were due to a misinterpre-
tation of certain phenomena.

Before the paper, the CHAIRMAN (Colonel G. E. Church) said: Our paper this
evening is on a very interesting section of South America, through the northern
part of the Argentine Republic, and skirting the foot of the hills of the Andes and
various points in Bolivia. I will now call on Dr. Hoek to read his paper.

After the paper, the CHAIRMAN said: We have the pleasure of having with us
this evening Colonel Suarez, charge d'affaires of Bolivia. Perhaps he will favour
us with a few remarks.

Colonel Suarez: I have listened with great pleasure to the very interesting
lecture about Dr. Hoek's travels in Bolivia. I am very pleased indeed that some
interest is being taken now in South America. It is not very long ago that I was
invited to a country house in England, and when I arrived there I only found
the ladies of the house-party. They were all staring at me, and I could not make
out what was the reason. But soon I discovered it. One of the ladies of the
house-party brought me her album, and asked me to write my name down and the
country from which I came. I did so, and after having written "Bolivia," she
asked, "Something else?" I said, "What?" "Something else?" I said,
"South America?" "Yes," she said, "that is what we want." And then the
lady of the house told me they had been discussing at length where Bolivia was;
some said it was in South Africa, and some in Bohemia. When she told me this, I
found out they expected to see me dressed in feathers. That is why I am so very
thankful to Dr. Hoek, Colonel Church, and Sir Martin Conway, who have travelled
there and given you some idea of Bolivia. You will see we are not quite in
the state in which things were originally found. I hope at no distant date the
country will be opened up with railways, and I dare say Messrs. Thomas Cook &
Son will be selling you tickets and taking you over to make a few excursions
up the mountains. I may tell you we have all sorts of climates there; you can
choose your own. We have not such a pretty climate as you have in England,
where in a few hours you have five or six changes; but, all the same, I think we
could offer you some very nice climates indeed. I heard Dr. Hoek's remark that
the principal industry is mining. It is so; but I may tell you that we also have
indiarubber. The indiarubber that comes from Bolivia they call Para rubber,
because it passes through the port of Para; the best comes from Bolivia, and is
then shipped to Europe. We also have great opening for agriculture, as to which
Colonel Church will be able to inform you, for he was in Bolivia some years
ago, and he took great interest in that country, and I hope he will still do so. In
conclusion, I have only to thank Dr. Hoek for his lecture on Bolivia.

The CHAIRMAN: I also see our well-known friend, Señor Aramayo, late Minister
of Bolivia.

Señor Aramayo: I thank you for calling upon me to say a few words on this
occasion, but I have nothing to add to the feelings already expressed by Colonel
Suarez on behalf of Bolivia. I have only to say that I thank Dr. Hoek for his very
interesting lecture to-night, which has instructed me on many points respecting
the geology and geography of my own country; and I am sure it is very satis-
factory to see that the exploration conducted by my old friend Dr. Steinmann has
been so successful in Bolivia, and has given an opportunity to this Society to hear
a good deal of the interesting resources of the country.

The CHAIRMAN: With your permission, I will occupy a few minutes of your
time. I have read Dr. Hoek's paper carefully, and he is to be complimented
on the information of varied character it contains. Once we get the accurate
map of his travels, it will be a great advantage to the geography of the region of which he has treated. But his paper once more opens the old question of the glaciation of South America—an ice age, of which he says there were in the Andes three marked epochs. We know that, so far as North America is concerned, the ice-cap extended south to about 35° N. lat. This paper brings forward prominently an ice age on the southern half of the continent, where glaciation extended north at least as far as 17° S. lat., at a point in the valley of the Amazon at about 5000 feet above sea-level, north of Cochabamba. Here Dr. Hoek found numerous evidences of glacial action. The theory of Agassiz as to the glaciation of the Amazon valley and of all Brazil has been, to the satisfaction of most people, completely demolished by the studies of the geological section of the Brazilian Government, and especially by the eminent geologist, Dr. John Branner. He has gone very thoroughly into this ice question, and finds that the crystalline rocks of Brazil, from Rio de Janeiro to the Amazon, are subject to a softening process. In the case of gneiss, granite, and diorite, the decomposition sometimes reaches a depth of more than 300 feet, and hard felspathic-porphyry is decomposed from 12 to 15 feet deep. Some of the Miocene rocks are decomposed to a depth of 370 feet, and in the carbonaceous formation as deep as 400 feet. This process splits off immense masses from the slopes of the mountains, and these are broken into fragments, large and small, which exfoliate on their edges and form boulders, that are piled up in such profusion that well may they be taken for moraines. This was true of a mass of dioritic boulders that Agassiz found 400 or 500 miles up the Amazon, on the north side, and which he took as morainic formation, but which was afterwards discovered to be composed of boulders of decomposition. Similar deposits may be found all along the coast of Brazil inland, and have all been proven to be of the same nature. Such softening of the rocks in the South American tropics goes on at a much greater pace than it does in the temperate zone. For instance, the amount of nitric acid and carbonic acid in the atmosphere, and especially the former, is very great, and is said to be formed from the electric discharges of the atmosphere, and this helps the decomposition process. Again, something which seems to have deceived a great many geologists, and made them think they were looking upon traces of glacial action, is the "fluting," examples of which are numerous in the Brazilian rocks. A drop of water trickles down, and ultimately a little stream forms a groove, until finally in the course of ages it grows deeper and deeper—anywhere from 6 inches to many feet. If my statements be correct, one has to accept the glacial theory with reference to Brazil and any part of the Amazon valley with reserve; but I have no doubt that the eminent gentlemen who have made these geological examinations now under discussion thoroughly understand that their views are in conflict with the geologists who have so exhaustively studied the problem of South American glaciation in Brazil. Dr. Hoek has been examining the slopes of the Andes—what shall I say? from 22° S. lat. up to 17°, where he found glacial action at a very low elevation, at the Amazon base of the Tunari range. This point is 380 geographical miles nearer the equator than Rio de Janeiro, in the vicinity of which the mountains rise to the elevation of 10,040 feet, mountains of such friable material that, had they ever been glaciated, they would have melted like sugar. It seems doubtful if any isothermal lines could ever have compensated for this difference of latitude and great elevation. But the glaciation of Brazil having been disproved, query, do we not require still further knowledge regarding these supposed glacial evidences reported from Bolivia before we can thoroughly accept the views set forth in Dr. Hoek's paper? May not his moraines also be boulders of decomposition? I do not assert that they are; but the question is interesting, and so able and devoted a scientist as Dr. Hoek will, I feel certain,
make it more so in the future. I have simply thrown out a few ideas; but I may say to Dr. Hoek I am not a professional geologist, only an amateur; but the two sides of the continent seem to be so in contradiction that we hope we shall have more information from Dr. Hoek himself. I was going to ask him to give it to us now, but, as he seems to be a little shy of his good English, we must hope that he will favour us in some other form later on. In any event, I think I express your sentiments in thanking Dr. Hoek most heartily for his paper, and also the very excellent mouthpiece he has brought with him, who, I may say, has adorned science with the eloquence of poetry.

A TRIP INTO THE CHILI PROVINCE, NORTH CHINA.*

By the Rev. JOHN HEDLEY.

It had long been my desire to take a trip through the Great Wall of China, and see for myself at least a part of that large tract of country known as the Chili Province. My travelling companion was Mr. R. J. Gould, sub-agent of the British and Foreign Bible Society in Tientsin, and the primary object of our journey was the dissemination of Scriptures. We started off from this ancient city of Yung-Phing fu (Eternal Peace), whose history can be traced back for 3000 years, on October 19, 1904.

Not only did we travel without escort, but without firearms of any description whatever, and when it is remembered that the district is proverbial for lawlessness, it says something for the local government that we were not once placed in any position where firearms would have been of value. The friendliness of the people was most marked.

On October 22 we passed through the wall at Lâng-ko (Cold pass). Lâng-ko is the only pass for some miles round possible for vehicular traffic. Several other passes, as Liu-chia-ko and Tao-lin-ko, are in the vicinity, but boulders lie so thick that it is impossible for carts or barrows to get through. Animals and foot-passengers, however, use these passes regularly, and so reach their destinations quicker than would be possible were they confined to only one exit. At all these places custom houses are found, and taxes levied on goods passing to and fro. Books alone are exempt from duty, so we got through without any delay on that score. The pass at Lâng-ko, through which the Sha Ho (Sand river) flows, no longer boasts the tower that once spanned the river, its place being taken by a sort of barrier made of inverted poles across the stream. The tower was destroyed by floods in the year 1850, and of course there has never been any attempt made to replace it. A very fine specimen of the ancient towers still stands at Liu-chia-ko, some 10 miles east of Lâng-ko, of which a print was recently sent to the R.G.S.

* Map, p. 588.

No. V.—May, 1905.]