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Eastern Bolivia and the Gran Chaco

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Source: *Proceedings of the Royal Geographical Society and Monthly Record of Geography*, New Monthly Series, Vol. 3, No. 7 (Jul., 1881), pp. 401-420

Published by: [Wiley](#) on behalf of [The Royal Geographical Society \(with the Institute of British Geographers\)](#)

Stable URL: <http://www.jstor.org/stable/1800070>

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Eastern Bolivia and the Gran Chaco. By J. B. MINCHIN.

(Read at the Evening Meeting, March 28th, 1881.)

Map, p. 448.

BOLIVIA, or as it was formerly called "Upper Peru," is a country quite unique in its geographical position and configuration. Situated completely within the tropics, it presents on its eastern side all that exuberance of vegetable and animal life which might be expected in such a latitude; while the western half of the country is a bleak and barren region, possessing a climate which, at least as regards temperature, might be compared to that of England or Northern Europe. Such an apparent anomaly will, however, be readily understood: the chain of the Andes may be roughly regarded as forming here a great loop, one side of which is represented by the lofty volcanic peaks which overlook the Pacific, and the other by the perpetually snow-clad summits of the "Cordillera Real," situated some 150 miles further eastward; these two ranges enclose between them a lofty plateau or table-land, broken and intersected by lower groups and ranges, and at an average height of some 13,000 feet above the sea-level.

The chief centres of population are situated on this plateau, or in the neighbouring mountain region, and enjoy a temperate and healthy climate, in some cases decidedly cold, though even during the winter months the extreme purity of the atmosphere allows the sun's rays to act powerfully. The country is well watered, and particularly in the northern part potatoes and grain are largely cultivated; here also we have the phenomena of a lake covering an area of 2000 square miles and nearly $2\frac{1}{2}$ miles above the sea-level.

The southern part of the plateau, if bleak and barren, encloses great mineral wealth: many silver mines are profitably worked at the present time, but I will only mention the celebrated cerro of Potosi, a mountain which became a proverb for wealth, and which indeed produced over 300 millions sterling worth of metal. But the mining industry has to contend with serious difficulties; in common with most of Upper Bolivia, transport to the Pacific coast is effected exclusively by pack-mules and llamas, and it is almost impossible with such means to bring up adequate machinery. The consequence is, that ores which produce less than 20% to the ton do not pay working expenses. Projects for railways have not been wanting—indeed their name is legion; but hitherto next to nothing has been done. That this is not altogether owing to a completely savage state of society appears evident from the curious fact that in Sucre, the capital, there is probably not a single house of the better class which does not possess a piano, although these instruments have to be carried on specially selected mules, across 150 leagues of desert.

Besides, on account of natural obstacles, the progress of this rich
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country has been retarded, in common with other Spanish American States, by the frequent political changes, if indeed the term political can properly be applied to what is often merely a party spirit for one or other unscrupulous agitator. It should, however, be observed, in justice to the character of the people, that probably in no country in the world can one travel with greater safety than in Bolivia (I except, of course, the completely wild parts in the east, occupied by savage tribes). During the first two or three years of my residence, I carried as a matter of course, when travelling, a revolver, but found at last that it was quite unnecessary. Highway robbery may be said to be unknown; even the remittances of silver to the coast, where a value of 40,000*l.* or 50,000*l.* is often carried by four or five muleteers, are never interfered with.

On crossing the Cordillera Real, the great eastern range of the Andes, the face of nature undergoes a complete change; the bleak scenery of the plateau here gives place to the forest-clad spurs and ravines which descend to the boundless plains of the east. This is the region which I have more particularly selected, under the term Eastern Bolivia, as the subject of my observations, partly on account of its being perhaps less generally known, and also because during the past three years I have had occasion to travel through it in different directions, and to make some original explorations.

Eastern Bolivia comprises that vast territory which extends from the slopes of the Andes to the banks of the Itenez and Paraguay, thus stretching from the 8th to the 22nd parallel, and embracing an area of some 350,000 square miles. It occupies the heart of the South American continent, and is crossed by the head-waters of its greatest rivers; it is separated from the Pacific by the high plateau and perpetual snows of Upper Bolivia, while on the north, east, and south, its boundaries are those of Peru, Brazil, Paraguay, and the Argentine Confederation. This midland position, and the fact that many of its navigable rivers are cut off from communication with the Amazons by the falls of the Madeira, explains why it has hitherto remained to some extent a *terra incognita*, at least in so far as regards civilisation and commerce.

As might be supposed, so extensive a region presents considerable variety, both as regards its physical configuration, its climate, and its productions. The more northerly part includes the forest-clad plains watered by the Upper Purús, the Aquiry, the Mayu-tata or Madre de Dios, and the Madidi, and the spurs of the Cordillera in the province of Caupolican. Further south it embraces the continuation of these spurs through the "Yungas" or warm valleys of Larecaja and La Paz, and the open grass plains of Mojos, crossed by the splendid navigable and forest-lined streams of the Beni and Mamoré with their tributaries,—plains which embrace a large tract eastward of the Mamoré, and are succeeded by rolling lands and forests extending to the Itenez. Still further south it includes the forest plains and grass lands of Santa Cruz and Chiquitos, crossed by

numerous ranges of lofty hills, and watered by many fresh and permanent streams, succeeded by a barren zone comprising some 20,000 square miles of the Northern Chaco, stretching from the Parapiti to the Bahia Negra, and presenting an almost uninterrupted extent of low thorny scrub with great scarcity of water. The extreme south of the district comprises the rich grass plains alternating with forest lands along the course of the Pilcomayo, and extends across the whole width of the Chaco.

The elevation of this region above the sea-level varies from 260 feet on the banks of the Paraguay, and 510 feet on the Mojos plains, to over 3600 in the ranges of Chiquitos, and to 11,500 at the limit of tree vegetation on the slopes of the Cordillera.

Though the annual variation of water-level of the Paraguay does not usually exceed 10 feet, yet this is sufficient to inundate the lowlands along its course; a large extent of these open lands periodically submerged is met with to the north-west of Lake Uberaba and in the Bahia Negra, which becomes covered with rich pasture on the subsidence of the river. From the 20th parallel south, to the confluence of the Pilcomayo, the Paraguay is nearly everywhere fringed with palm forests, which on the right bank extend to a distance of from four or five to twenty miles from the river.

The water discharged from the mountains during the heavy rains by the rapid affluents of the Mamoré causes this river also to overflow its banks and inundate large tracts of the Mojos pampas; while the level nature of some of the Chiquitos plains, and the consequent sluggish drainage, occasions partial inundations of a few inches in many places.

The only known lake of importance in the north of the territory is that called Rogoaguado, situated between the Mamoré and Beni, but its extent and position have not been accurately determined. In Chiquitos, Lake Concepcion is a sheet of water usually occupying some 30 square miles, though not exceeding ten to thirteen feet in depth in the dry season; from the mean of several observations, I found its height to be 951 feet; its rise during the rains does not exceed six feet, which is, however, sufficient to flood a large extent of level palm forest on its eastern side; on the north and south it is bounded by low hills; the San Miguel river, which drains this, forms another lake further north in the district of Guarayos. On the right bank of the Upper Paraguay, near the 18th parallel, are the three beautiful lakes, Uberaba, Gaiba, and Mandiore, fed in part by the waters of the river, and receiving, besides, streams which descend from the neighbouring ranges; with an average area of 25 square miles, they are, with the exception of the northern shore of Lake Uberaba, which is low and flat, bordered by lofty hills or picturesque and fertile slopes.

In the Chaco, between the Pilcomayo and the Paraguay, the Indians report the existence of a lake, probably near the 22nd parallel, which has not yet been visited by the white man; to the north-west of Fort

Olimpo on the Paraguay, various lakes were met with by Don Juan de Cominges, on an expedition made by him in the early part of 1879.

The eastern ranges of the Andes south of latitude $17^{\circ} 30'$ are chiefly composed of red and yellow sandstone strata, usually highly inclined, and the occasional hills met with through the Northern Chaco and the ranges in Southern Chiquitos are of the same formation; in the north and east of Chiquitos conglomerates and granitic rocks are met with; black limestone occurs in the Corumbá Mountains, and grey limestone near Lake Concepcion and in the ranges east of Santa Cruz. In the gold region of San Javier, shales, schists, and quartz rock cover a large tract of country; in the provinces of Caupolicán, Larecája, and Yungas, the spurs of the Cordillera are composed of coloured clays and decomposed shales and schists, overlying the Silurian slates; and the great plains, both of Mojos and Chiquitos, are generally of reddish yellow and sandy clays.

South American scenery is usually on a gigantic scale; the river and mountain systems are alike imposing; while the forest plains of Brazil and Eastern Bolivia, the rainless deserts of the Pacific slope, and the "pampas" of the Argentine Republic, each cover a vast extent of territory.

I shall never forget the impression produced on my mind by my introduction to Eastern Bolivia; I had entered the Republic from the Pacific coast, and it was after a residence of nearly two years in the mountainous region that I made my first journey to Santa Cruz de la Sierra. The Andes do not here sink down, as might be supposed, by gentle gradations, but terminate abruptly in the lofty rugged sandstone ridges called "la Serranía de los Incas," the furthest point reached by those ancient rulers of Peru, "the Children of the Sun," and a fitting rampart to their extended empire. It was after nine days' riding from Sucre, the capital, and on surmounting this range, that a sudden bend in the track brought me within sight of the plains, and involuntarily I checked my mule to contemplate so remarkable a view. The eye, so long accustomed to the broken outlines of the mountains, rested with a sense of relief on that immense sea, for such indeed appeared that dark blue forest, stretching out, apparently unbroken by the slightest undulation, and bounded by a horizon as sharply defined and as level as that of the ocean itself. I seemed indeed to stand on the dividing line between two worlds: behind me I pictured those endless wooded hills and barren ridges, rising in long succession to the bleak table-lands and to the silent summits of the Andes, only to sink at last 500 miles away on the shore of the Pacific; all this I had crossed, and now before me, and 4000 feet below, I beheld, spread out like a carpet, those plains which extend without interruption to the banks of the Paraguay and the pampas of the River Plate.

At a distance of some 40 miles I could clearly distinguish the broad

white bed of the Rio Grande contrasting with the dark forest, while the river itself appeared as a silver thread, reflecting the rays of the rising sun.

The rivers of Eastern Bolivia belong to two systems, as tributaries of the Amazons or of the River Plate; with the exception of the Upper Paraguay and Itenez, they nearly all take their rise among the highest summits of the Andes, and descend their eastern slope; the tributaries of the Amazons draining the mountains as far down as the 20th parallel, and, southward of this, the streams which united form the Pilcomayo flowing to the Plate.

Of the Purús and Aquiry nothing need be said, as the account of their exploration by Mr. Chandless has been published by the Society. Unfortunately they are separated by as yet unexplored forests from the populated parts of Bolivia, and consequently no attempt has been made to open communication by them with the Amazons.

The point of union of the principal head-waters of the Mayu-tata to the north-east of Cuzco, has been determined by Mr. Clements Markham; but the course of this river cannot yet be said to be known, though it appears evident that it enters the Beni, from the fact of the Peruvian colonel Maldonado having descended it till he reached the falls of the Madeira: the monks of the Cavinás Mission on the Madidi have also informed me that in an exploration made by them towards the north-east, they met with a large river whose position and direction quite correspond with this course.

The sources of the river Beni drain the La Paz Cordillera, containing the highest peaks of the Bolivian Andes. As they generally fall from the perpetual snow-line a depth of from 11,000 to 15,000 feet in the comparatively short horizontal distance of some 40 miles, they are usually in this part of their course merely mountain torrents; at altitudes, however, of from 1600 to 2000 feet above the sea-level, and long before issuing from the lower ramifications of the mountains on to the plains, they become navigable for rafts, by means of which communication and commerce are thenceforward chiefly carried on.

These head-waters of the Beni have not as yet been sufficiently examined by any person competent to form an opinion as to the extent to which they may be suitable for steam navigation: at Mapiri, 70 miles in a direct line from La Paz and 1500 feet above the sea, I found a depth of three feet with a three-mile current, at the close of the dry season; this depth cannot, however, perhaps be depended upon all the way down; and about 20 miles lower, at Huanay, lat. $15^{\circ} 29' 30''$, long. $67^{\circ} 51' 30''$, I measured a current of as much as eight miles an hour, extending over a few hundred yards. At another point, below the confluence of the Tipuani river, the channel is obstructed by a few large rocks which would require to be blown up. The La Paz affluent, or Upper Beni, is navigated by rafts from as high as La Espia in

the province of Yungas, but it presents at intervals for some distance a series of small rapids: immediately below the confluence of this with the Mapiri river, the Beni for a short distance spreads over a very wide bed, the depth in the dry season becoming consequently reduced; this obstacle to the navigation, if necessary, might be removed by the construction of a few jetties to scour out a deeper channel. Below Reyes the Beni is navigated in *gariteas* or large canoes drawing as much as four feet, which descend to the mission of Cavinass, and to the india-rubber establishments much further down; but neither the confluence of the Mayu-tata, nor the fall which is known to exist, have as yet been reached from above.

In common with the other tributaries of the Madeira, the Beni navigation is unfortunately cut off from direct communication with the Amazons by the falls on the former river; but the exploration of its lower part, of the Mayu-tata, and of the section of forest which separates this latter from the Aquiry, is, I think, important as a possible trade route to Bolivia.

The Mamoré drains the Andes of Central Bolivia, few of which reach the perpetual snow-line. Of its various affluents, the Yacuma, a sluggish stream, and in this respect an exception to the others, is navigable to within some 20 miles of Reyes, the Chapare and Chimore to within a comparatively short distance of the important town of Cochabamba, and the Rio Grande to 60 miles from Santa Cruz. In this latter I found generally upwards of five feet depth at the close of the dry season, with a current rarely exceeding 3600 yards an hour. This river issues from the mountains in lat. $18^{\circ} 55'$, long. $63^{\circ} 23'$, where the Andes system attains its greatest width, extending from the Pacific over no less than 7 degrees of longitude; it continues for some 90 miles from this point too shallow and rapid for navigation, and below that its bed, over an extent of some 60 miles, is occasionally obstructed by numerous palm-stumps, the river having changed its course here twenty years ago, bending more to the west, and opening a new channel which separates as much as 40 miles from the former one, which has now to a great extent disappeared, becoming covered with a low vegetation. Clearing the bed of these stumps, which indeed should of themselves disappear in time, navigation might be brought to within 35 miles of the city of Santa Cruz.

The Parapiti is the most southerly affluent of the Amazons, though on some maps it has been represented as crossing the Chaco and entering the Paraguay. It issues from the mountains at a height of 2030 feet, in lat. $19^{\circ} 59' 18''$, long. $63^{\circ} 4'$, where at the close of the dry season I found a volume of 65 cubic yards per second; but entering on a very sandy region it becomes completely absorbed during some months, about 20 miles further down. In the wet season it flows through a well-defined bed as far as lat. $19^{\circ} 6'$, long. $62^{\circ} 22'$, when it spreads over the

forest, forming a series of creeks, whose waters, again uniting, cut through the southern range of Chiquitos at the Quimome Pass, forming on the north side Lake Concepcion, which in its turn drains off by the river San Miguel or Itonamas, and enters the Itenez immediately above the "Fuerte do Principe do Beira."

The Pilcomayo, having its sources in the lofty group of Livichuco, and in the "Cordillera de los Frailes," and receiving innumerable streams which flow from the barren ridges and great mining centres of Southern Bolivia, cuts through the last range of the Andes in lat. $21^{\circ} 16' 50''$, long. $63^{\circ} 25'$, and enters on the plains of the Chaco at a height of 1456 feet above the sea-level; the fall from this point to the Paraguay is, therefore, about 1213 feet, but a great part of this is evidently in the proximity of the mountains, the rapid current here giving place to a sluggish stream further down. Various attempts have been made to explore this river in its course through the Chaco; these have, however, as yet proved unsuccessful, chiefly owing to the difficulties occasioned by the numbers of savages who inhabit its margins. It becomes much reduced in the dry season, when I found a volume of only 100 cubic yards per second; during some five months it carries a large quantity of water, but as in the case of the Parapiti, it appears that much of it is absorbed; moreover, a point has been reached where the river spreads out, flowing through several channels. At the same time, the navigation of the Lower Pilcomayo may prove advantageous to South-eastern Bolivia, especially if in connection with a railway up the gorge of the river, the only practicable outlet from the great mining district to the navigation of the Paraguay and Plate. From the neighbourhood of Potosi the river has an average fall in its course through the mountains of 0.42 per cent.

From accounts given me by the Indians of that region, it appears that the Pilcomayo does not receive any tributaries whatever in its course through the Chaco.

The Itenez, rising in the comparatively low mountains of the Aguapehy Cordillera, has a sluggish stream, unlike that of other Bolivian tributaries of the Amazons. Besides the streams Alegre and Barbados, descending from the Aguapehy Mountains, it receives as tributaries the rivers Verde, Paragau, and Baures, originating in creeks in the north of the province of Chiquitos, the river Itonamas (already mentioned as formed by the waters of the Parapiti), and the river of San Joaquim, rising in the neighbourhood of Trinidad. From the north-east or Brazilian side there are no tributaries of importance.

The Itenez is navigable during the whole year for vessels with a draught not exceeding three to four feet, from its confluence with the Mamoré to a few miles above the old city of Matto Grosso.

While engaged, in 1878, in setting out the boundary between Bolivia and Brazil, and in searching for the sources of the Rio Verde, I had

occasion to make an expedition over the Matto Grosso mountains, when I succeeded in crossing this range for the first time, previous attempts having failed owing to a series of deep precipices formed by horizontal sandstone strata, which crop out on each side of the range.

The beautiful grass plateaus met with on the top of these mountains afforded excellent points of observation of the surrounding country. I noticed that the open lands of Chiquitos extend here nearly to the 14th parallel, being thence succeeded by a continuous forest, which stretches northwards as far as the eye can reach. I was much impressed by the extreme sense of loneliness which pervades these vast panoramas; the profound silence itself which reigns over them appears, more eloquently than by words, to call for the hand of man. Often indeed, on my journeys, have I stopped to contemplate some such scene, and to speculate on the time when the tide of immigration must at last reach those fertile regions, which will then offer a home and an independence to the overcrowded population of Europe, and to the thousands here who are willing to work but have no work to do.

The river San Joaquim may be navigated with great facility for some 70 miles, and the Itonamas as far as the rich province of Guarayos, while it seems probable that the communication in this direction might be extended up the river San Miguel towards Lake Concepcion by the construction of a few locks in this latter, which has a very sluggish current (900 yards an hour), and runs through a deep and narrow channel.

The extent to which the rivers Baures and Paragau may be suitable for navigation has not been determined. The river Barbados has a good deep channel, from its junction with the Itenez as far as the town of Casalvasco; while the Alegre and Verde are quite useless in this respect.

The river Paraguay, in so far as regards its tributary the Jauru, takes its source in the same group of mountains as the Itenez; it does not appear, however, that the construction of a canal to connect the two rivers, as has been proposed, would be in any way practicable, as the advantage to be gained would not be in proportion to the cost of such a work. The highest points navigable are a considerable distance apart, and separated by very broken ground. So much difficulty was experienced in 1877 in transporting the hull of a small steam-launch from the Jauru to the Itenez, that it might evidently have been carried with greater ease round the south side of the Aguapehy Mountains; the distance by this route being, indeed, over 200 miles, but the country generally being open and nearly level plain.

The valley of the Itenez is at a greater height than that of the Upper Paraguay. I found, from many observations in the neighbourhood of Matto Grosso and of the head-waters of the rivers Verde and Paragau, a mean height of 722 feet above the sea-level, while the country near the junction of the Jauru is only 525 feet; the lowest point of the watershed, about 20 miles to the south-west of the Aguapehy group, I found to be 950 feet above the sea-level.

Probably few rivers afford such facilities for navigation as the Paraguay. Besides many steamers which ply lower down, there is a monthly service subventioned by the Brazilian Government between Monte Video and Corumbá. This latter town, situated on the 19th parallel, is at a distance of 1500 miles from the sea, and yet the steamers (drawing from seven to nine feet) usually run without difficulty all the year; only during exceptionally dry seasons, and at one or two points, is there any obstacle to their passage. Steam communication, by means of smaller boats, is also maintained with Villa Maria and Cuyaba, capital of the province of Matto Grosso, some 200 miles higher up.

The mean of a great many observations gave me 348 feet as the height of the river at Corumbá, the greater part of this fall being undoubtedly due to the more rapid Paraná, the current of the Paraguay being only some 2700 yards an hour.

From its western or Bolivian side, the Paraguay does not receive any tributaries of importance north of the Pilcomayo; I found that the river Otuquis, which was supposed to enter it at the Bahia Negra, does not in reality do so, becoming absorbed in lat. $19^{\circ} 4'$, long. $58^{\circ} 15'$, at a distance of some 50 miles from the river, and terminating in a series of swamps which dry up completely every year; indeed, this occurs to a greater or less extent with the other streams which descend from the Aguapehy Mountains and the ranges of Eastern Chiquitos, the greater part of them becoming absorbed or forming creeks on reaching the lowlands adjoining the river.

The country bordering the Rio de la Plata and the Paraná, though fertile enough, is too uniformly flat to be pleasing, as it is only after some five days' steaming from the sea, and on approaching Asuncion, that the first insignificant hill is met with; but along the Upper Paraguay the monotony of the open grass lands and forests which border the river is constantly relieved by picturesque and richly wooded ranges. It is true that here, as elsewhere, distance often lends enchantment to the view, and the finest landscapes may hide a multitude of enemies. My own slumbers have never been disturbed by uneasy thoughts of snakes or panthers, though these are far from scarce; but the fortitude of an Indian warrior would be tried by the occasional attacks of the insects. In the rainy season, and especially in the proximity of large bodies of water, it is the mosquito proper which marshals its battalions against man and beast; at other times it is the *marigui*, a voracious though almost microscopic fly which disports itself by day and on moonlight nights, biting at every unprotected part of the body. In other districts the *garapata*, a kind of tick, of which there is a large but not pleasing variety, introduces itself beneath one's inner garments, and clings with such pertinacious obstinacy, as often to leave its head imbedded in the flesh when the body is torn away.

When camping for the night it is prudent to examine the ground, or one may be obliged to beat a hasty retreat before the onslaught of the

arriero ants, who send forth their tens of thousands to levy black mail on the provisions. The distribution of these and other pests is, however, far from general; chiefly due to the superabundance of rank vegetation, they disappear to a great extent where the country becomes settled, drained, and cultivated.

The *tigres*, or jaguars, rarely attack man unless when brought to bay, but they do great damage to the isolated farms, killing off the young cattle.

With the exception of two or three species of Gallinacæ and water-fowl, these forests contain few birds; but for the rifle there is often an abundance of game, the palm forests that border the Chaco, and the open grass lands generally, containing numbers of deer, ostriches, tapirs, and often wild cattle, while these and the neighbouring forests are ranged by immense herds of pigs.

Besides the mixed race of Spanish extraction, Eastern Bolivia is inhabited by many tribes speaking distinct languages, and all different from the Quichua and Aymara Indians who constituted the old Inca empire, and who do not appear ever to have descended from the mountainous region and the great table-land.

In addition to the "tame" Indians who occupy the greater part of these provinces, there are others, such as the Chamacocos near the Bahia Negra, and the Tobas and Notenes on the Pilcomayo, who have occasional intercourse with the settlements; the remainder, like the Sirionos on the Rio Grande, and the tribes on the Mayu-tata and Lower Beni, remain as yet completely savage.

Even the barren region in the Northern Chaco is inhabited by one or two wandering tribes, few in number, and I should say very low in the scale of humanity; they have occasionally made raids on the cattle farms on the Parapiti, and I met with them near the saline deposits in lat. $19^{\circ} 18' 32''$, long. $60^{\circ} 48' 4''$. These deposits are, indeed, evidently one of the chief attractions to them in a region otherwise so inhospitable. Some idea of the scarcity of water may be gathered from the fact that in 1879 I caused nearly 50 miles of track to be opened through dense, dry, thorny scrub, my object of crossing to the Parapiti being defeated, as no water could be found in the whole of this distance, even after a diligent search on either side, while borings to a depth of 26 feet were quite unsuccessful; the Indians, however, are evidently able to sustain themselves during long periods on the water met with between the vertical leaves of the cactus, or on what they can squeeze from the large pulpy water-potatoes, resources which I have myself often found useful.

The Chamacoco tribe appears to be somewhat superior. On one occasion they visited me to the number of about forty, behaving very well and evincing a good deal of intelligence. They evidently suffer much from the mosquitos along the river Paraguay, their naked bodies being scarred from these and the innumerable thorns and scratches of the forest. I

found that shirts of any description were the presents most acceptable to them.

The more open lands further south in the Chaco have not such a sparse population, Señor Cominges having met with many small villages during his expedition in 1879; while still further south, along the Pilcomayo, the Toba Indians appear to be very numerous.

The Mojos Indians are probably superior to the other races: those of Chiquitos, though capable of great improvement, are at present more demoralised by drink, and by the petty tyranny of the Corregidores; while the tribes on the Parapiti and the settlements on the Pilcomayo are only just emerging from a state of barbarism, induced by the Franciscan monks to abandon their roving life, and form villages round the Missions.

An approximate calculation, based on tax returns and other data, shows that the province of Chiquitos and that part of Cordillera * east of the mountains, together with the town and neighbourhood of Santa Cruz, does not possess much over 90,000 inhabitants. In Chiquitos the population is at a standstill; in Mojos it is decreasing owing to the trade, which of late years has sprung up with the Amazons, and to numbers of the Indians remaining as little better than slaves in the rubber *estradas* of the Madeira. The excess of females over males is consequently large, the hands available for agricultural and other work being further reduced by the large number exclusively employed in the canoes, an evil which can only be remedied by the introduction of steam navigation.

In Mojos, trade is carried on chiefly by the rivers, all the towns and villages being situated as near these as the inundated lands will admit of, the distance at present navigated on these affluents of the Madeira falling but little short of 2000 miles.

In the provinces of Chiquitos and Cordillera communication is almost exclusively by land, yet little has been done to facilitate it, the principal roads being merely tracks from two to three yards wide, overshadowed to a great extent by forest, with a moderately good surface in dry weather, but becoming impassable in places during the rainy season.

Merchandise is transported to some extent on mules, but more generally oxen are employed both in carts and with pack-saddles. The following are the present freights:—

						£	s.
Buenos Ayres to Corumbá (by steamer)	..	..	..	..	..	5	12 per ton.
Corumbá to Santa Cruz	..	..	..	..	..	43	0 „
Santa Cruz to Cochabamba or Sucre	..	..	..	..	..	32	0 „
Santa Cruz to Jujuy (Argentine Republic)	..	..	..	..	..	38	8 „

* The Bolivian province of Cordillera is situated on the left bank of the Pilcomayo, and embraces a large part of the Chaco; it must not be taken to mean the same as *cordillera*, the word applied by the Spaniards to snow-clad ranges of mountains.

The La Paz Yungas, and certain parts of the province of Caupolican being connected by better mule roads with the high table-land, are enabled to extract their produce at a more reasonable rate. The cinchona bark, however, collected in the forest, is now only met with in such inaccessible places that it has usually to be towed up the rivers on rafts and transported long distances on the backs of Indians; the total cost of placing this article in Europe being no less than 80*l.* per ton.

The productions of Eastern Bolivia are varied and important; extensive caoutchouc forests are at present profitably worked on the Lower Beni, and it is natural to suppose that they exist to an equal extent on the Mayu-tata and Aquiry; those on the Mamoré and Lower Itenez, though giving rubber of a superior quality, do so in less quantity.

The forests of Caupolican, Larecaja, and Yungas are the home of the Calisaya and other rich varieties of cinchona bark, still to some extent collected from the forests, while the cultivation of the plant during the last few years is being attended with surprising results.

In September last year I visited this region from La Paz; skirting the high table-land and the southern border of Lake Titicaca, I followed a track running north round the base of the great "Sorata." The tracks or paths which here cross that "land of the mountain and the flood," the La Paz Cordillera, are in Spanish politely termed *caminos* or roads; they do not, however, quite come up to our notions on the subject, and would require some explanation were it possible, which I am afraid it is not, to convey even a faint idea to persons who have not seen them. With a varying width of from one to six or seven feet, they run up and down the spurs of the mountains utterly regardless of gradient, becoming steeper and steeper as they approach the summit; here leaving behind all traces of vegetation, they are almost lost on the bare rocky surface. At places the long-suffering mule clammers across slopes of loose stone, lying at the limiting angle of friction, and split by the intense cold into sharp and angular fragments. At other points it is necessary to scale what at a distance might be mistaken for a winding staircase, but which turns out to be merely a succession of natural ledges, presenting a very narrow footing, and often with steps three to four feet deep. To increase the effect one usually becomes at last enveloped in mist, for the warm damp air from far below, rushing up the ravines on all sides, forms dense masses of vapour which wreath and curl round the black rocks. The momentary rents in this disclose, now the white foam of some cascade that seems to fall from heaven itself, now some bottomless pit yawning below, or a black beetling cliff far above, while occasionally at some dizzy height the sharp outline of a snowy summit is seen, apparently unconnected with the world beneath.*

* The extreme transparency of the atmosphere in the Andean highlands strikes every traveller, and it requires some experience to be able to form a correct estimate of distances and heights, objects invariably appearing much nearer than they really are. I

On reaching the top of the pass, almost invariably at a height of from 15,000 to 16,000 feet, the track dips by a descent as precipitous and much longer on the eastern side; the barren rock again gives place to grassy hill-sides, and these in their turn to shrubs and bushes, the vegetation increasing in height and luxuriance as we penetrate the deep ravines.

The discomfort of sleeping, as I was obliged to, under the open sky, at a height of 14,000 feet, was, I thought, almost compensated by the view on the following morning; on looking towards the labyrinth of *quebradas* which dip to the valley of the Mapiri, I beheld a perfectly horizontal sheet of cloud, forming contour-lines round the mountains, and from which the lower ramifications rose here and there like dark islands in the ocean. The magical effects produced by the rising sun on this aerial lake did not, however, last long; soon commencing to dissolve, it disclosed the forest far below, losing itself in the dark-blue haze of depth and distance.

The cinchona plantations are at a height above the sea of from 1300 to 6000 feet, and are formed to some extent with the young plants from the forest, but chiefly from seed, the small plants being transplanted, when three to four inches high, to the bottom of holes six feet apart and some six inches square by a foot deep, the mouth of the hole being partially covered with a piece of bark: the young plant is thus protected till it reaches the surface-level, when the bark is thrown off, and it is able to bear the force of the sun. A year and a half from the time of the seed being sown, the plant attains a height of six to seven feet, and at the age of six years the trees are cut, each one yielding some 5 lbs. of dry bark. The cost of forming a plantation of upwards of 50,000 plants, a year old, may be calculated at the rate of 2½*d.* per plant.

The bark grown on the steepest slopes appears to be the finest, and the immediate proximity of the high Cordillera is evidently advantageous, probably owing to the greater amount of moisture in the air, the more clouded atmosphere, and frequent showers—as at equal elevations further east the quality is much inferior. The finest Calisaya district extends northward along the slope of the mountains from lat. 16° 30'. This region produces also coffee of the finest quality, but little known abroad owing to the high cost of transport, the production consequently not exceeding the demand of the nearest centres of population; indeed, very fine coffee is grown on all the eastern Andean slopes north of the 18th parallel, in the district of Guarayos, and on the ranges in other parts of Chiquitos, that produced on the lower plains being somewhat inferior. The privileged region of the “Yungas,” or warm ravines of the La Paz Cordillera, produces, besides coffee, the plant yielding the

have heard it remarked that St. Peter's at Rome is more impressive on a second than on a first visit, and this is the case with the great cordilleras—gradually there dawns upon one's mind a juster sense of their vast proportions and colossal magnitude.

coca so largely consumed by the Indian races of this part of the continent. The duty collected on this article alone by the Bolivian Government amounts to 40,000*l.* annually.

A fine quality of cacao is grown in the warmest ravines at altitudes below 2300 feet, on the inundated lands in Mojos, along the Mamoré, and in the district of Guarayos in Chiquitos. This article, as well as coffee and *coca*, besides being carried to all the principal towns of Bolivia, is exported on pack-mules to the north of the Argentine Republic, and, excepting *coca*, even to Corumbá and Buenos Ayres by the River Plate.

The cultivation of the sugar-cane is nearly everywhere carried on, a great extent of the richest land for this being met with at many points throughout the territory. Near Santa Cruz a fine steam-mill has been working for the last five years, but with this exception the cane is crushed in the primitive vertical wooden mills of the country, worked by oxen.

Among the mountain ranges on the Pilcomayo the vine flourishes, and vineyards are in course of formation which promise good results. Certain parts of Mojos and Chiquitos produce a fine-flavoured tobacco, and white and brown varieties of cotton grow wild on nearly all the lower plains, being employed by the Indians in the manufacture of light stuffs, much used in the country, and extremely durable. Rice and maize are largely grown, and mandioca replaces the potato, which is scarce except in the country immediately bordering on the Andean highlands, or in the neighbourhood of the Paraguay, where the facility of the navigation allows of its being brought from down the river.

Indigo is cultivated, though to no great extent, by the Indians for dyeing their cotton-stuffs, and vanilla is found in the lowlands of Northern Chiquitos, along the courses of the rivers Paragau and Baures, and in the district of Guarayos. A low species of cactus, the fibres of which may be employed in the manufacture of paper, covers immense areas in the barren region of the Northern Chaco. Copaiba trees, and the *pessoe*, which produces an oily fruit, abound in Southern and Eastern Chiquitos; the mapajo or vegetable silk, is everywhere abundant south of the 17th parallel; and in the neighbourhood of Matto Grosso I met with the Paraguay-tea plant.

Many kinds of medicinal plants exist, among which in Central Chiquitos there is an interesting bulb regarded as a perfectly efficacious antidote for snake bites. The forests of these regions contain some valuable woods, but the cost of land transport prevents their being utilised, except in the neighbourhood of the river Paraguay, where some trade is carried on. Curupay, the bark of which is used for tanning, is met with in all the forests of Chiquitos and in abundance on the Pilcomayo. Along the Rio Grande I saw numbers of mahogany trees from three to seven feet diameter.

In the rivers Tipuani, Challana, Cajones, and others which descend from the high Cordillera, very rich gold deposits exist which, in spite of the rugged nature of the country and the impossibility hitherto of obtaining adequate machinery and materials, have at times yielded largely. The gold in this case is found collected on the "bed rock," usually met with a few yards below the river-beds, and is also disseminated through strata in the adjoining mountains. Gold deposits also exist at San Simon on the Itenez, in the Caparus group, and in the low hilly district of San Javier on the right bank of the river San Miguel, where mines are at present worked in a primitive fashion. In the province of Caupolicán, and in the mountain ranges on the Pilcomayo, various petroleum springs exist, which have not yet been scientifically examined, but which later on may prove of importance. In the Corumbá Mountains there are great deposits of iron ore, and the fine black limestone found there is an important article in the trade of that town.

Cattle-breeding is a profitable industry in Eastern Bolivia, and capable of great development; the "pampas" of Mojos present a vast extent of the finest grazing country. Could the falls of the Madeira be avoided, either by a railway round them or by opening communication with the Amazons by the Aquiré and Purús, a ready market would be found in the Brazilian provinces along the great river. In the same manner, were roads opened up to Cochabamba and Lake Titicaca, the Andean table-land, and even the Pacific coast by the Puno and Mollendo railway might be cheaply supplied with meat. In the provinces of Chiquitos and Cordillera the estancias, situated mostly on the headwaters of the Paragau and Baures, round Lake Concepción and along the Parapiti, contain 120,000 head of cattle; but besides these, there are large tracts of fine grazing country to the north-west of Lake Uruubá, in the palm forests that fringe the Paraguay, and in the south of the Bolivian Chaco along the course of the Pilcomayo. The price of cattle in Chiquitos is from 25 to 35 shillings a head; in Mojos it is somewhat lower. The value of the articles exported annually from the Yungas of La Paz, Larecaja, and Caupolicán exceeds 1,000,000*l.*, the most important of these being cinchona bark, coffee, cacao, and coca. Mojos exports annually some 560 tons of cacao, cotton-stuffs, &c., to Cochabamba and Santa Cruz, the river freight amounting to 3000*l.* The exports of Santa Cruz, consisting chiefly of sugar, coffee, chocolate, and hides, to Upper Bolivia, and of cattle to Corumbá, amount annually to a value of 65,000*l.* Cattle and sugar are also exported from Chiquitos to the Brazilian provinces, and from Cordillera to the Argentine Republic.

The imports of the eastern district consist chiefly of foreign merchandise, and flour, potatoes, salt, &c., from the highlands; while the southern provinces import, in addition, horses, mules, and donkeys from the Argentine Republic.

With the exception of some of the deeper ravines in the Cordillera, and of certain points on the Itenez where intermittent fevers prevail, the climate of Eastern Bolivia, though tropical, is salubrious. This is probably due to the large extent of open country, and to the ventilation of the atmosphere by the frequent winds; the effects of the warm breezes from the Amazons being, moreover, constantly counteracted by the cold, dry, and refreshing southerly gales.

The mean temperature in Western Chiquitos is 70° F., the thermometer frequently falling during the prevalence of southerly winds as low as 44° F., and seldom exceeding 90° F. The fall of temperature on a change of wind is very rapid; I have observed the mercury, on such an occasion, sink 23° in less than fifteen minutes. The banks of the Paraguay and Itenez are warmer; in Caupolican, Larecaja, and Yungas the great range of altitude gives, of course, a corresponding variety in the temperature.

The wet season is well marked, usually commencing about the middle of December, and lasting till April, while there are occasional showers during the rest of the year. The rainfall appears to be nearly uniform, with the exception of the Northern Chaco, where it is evidently less, probably owing to the moisture brought down by the northerly winds becoming discharged in the mountain ranges of Chiquitos.

The late Professor Orton, who died three years ago while engaged in his self-imposed task of exploring the river Beni, remarks in one of his interesting articles on South America, "Many may be surprised to learn that this continent, with only 25,000,000 of people, gives a foreign trade of 100,000,000% in exports and imports, which is nearly 9 per cent. larger than the total foreign commerce of India, and three times that of China, and yet only the margin of the continent has been developed, the great heart is as wild and prolific as nature could make it."

If, then, South America is of such importance under these circumstances, what may we not expect when her vast interior becomes opened up, and when the tide of immigration, spreading over and utilising her boundless pampas and inexhaustible forests, reaches at last to the fertile slopes of the Andes. The Argentine Republic and Brazil are making efforts to prolong their railways in this direction, and the latter country has done much to foment the already important navigation of the Amazons and River Plate. Bolivia may, then, look forward to a not very distant future, when those obstacles being at length overcome which have hitherto isolated her from the civilised world, her rich and varied products may find a rapid and easy exit to the ocean.

The construction of the Panama canal will undoubtedly give an immense impulse to trade in the Pacific, which will then be independent of the long and sometimes even dangerous navigation by way of the Straits of Magellan; Bolivian territory on the western slope of the Andes will feel the full influence of this beneficial change. And thus it is to

be hoped that a country, at present poor and needy, while possessing such vast resources and natural wealth, may at last be enabled to take the place which is expected of her in the scale of nations.

I append a list of the geographical positions and heights of some of the more important points. The longitudes of a few places have been determined, for the sake of reference, by occultations of fixed stars; these are marked with an asterisk (*). The others are from observations with excellent marine chronometers, transported in a light hide box, slung from a horizontal pole, and carried by two Indians on foot. I found this system give admirable results, as the movement was easy, and the instruments could not be rapidly turned; one of them, on a journey of a month's duration in the Chaco, indicated on its return only three seconds variation over its established error, and on another occasion, after passing over more than 500 miles in the province of Cordillera, its variation was only two seconds.

The heights have been calculated with boiling-point thermometers by Casella, corrected at the Kew Observatory, the observations having been repeated at intervals whenever possible.

Name of Place.	Latitude.	Longitude West of Greenwich.	Height in Feet above the Sea-level.
	° ' "	° ' "	
Santa Cruz*	17 46 55	63 5 34	1450
Lake Concepcion .. .. .	.. .. .	.. .. .	951
San Jose (Chiquitos)	17 50 40	60 40 19	974
Cerro Chochis .. .. .	.. .. .	.. .. .	3914
Santiago*	18 20 14	59 31 24	1916
Corumbá*	19 0 3	57 37 45	459
River Paraguay, lat. 19° .. .. .	.. .. .	.. .. .	348
San Miguel	16 41 52	.. .. .	1463
Santa Ana	16 36 38	60 37 0	1512
Matto Grosso	15 0 4	59 52 20	..
Head-waters of River Verde, boundary pillar*	15 5 50	60 28 32	695
San Matias	16 21 12	58 17 0	485
Santo Corazon	17 58 30	.. .. .	908
Salinas de San Jose	19 6 38	60 51 49	955
„ de Santiago*	19 18 32	60 48 4	751
Cerro San Miguel	19 18 10	60 34 22	2560
River Parapiti loses its bed	19 6 0	62 22 0	1410
Cerro Curundaiti	18 59 0	61 58 0	..
Cerro Cortado	19 33 0	62 12 0	..
Saipuru	19 31 22	63 6 11	2854
Parapiti (mission)	19 59 18	63 0 54	2053
San Francisco (mission)	21 16 50	63 20 0	1479
Lagunillas (town)	19 38 54	63 33 34	3353
Bivosi (village)*	17 13 35	63 9 0	..
Higuerones (head of navigation on Rio Grande)	16 38 45	63 20 45	..
Mouth of Bahia Negra*	20 8 38	58 8 22	318
El Huanay (town)	15 29 30	67 51 30	1466
Sorata (town)	15 45 50	.. .. .	8720
La Paz (city)*	16 29 59	67 59 45	11952
Cochabamba (city)	17 23 38	66 17 30	8396
Sucre (city)*	19 2 45	65 17 0	9183
Totora	17 44 41	65 14 0	9452
Mapiri .. .. .	.. .. .	.. .. .	1500

In introducing the author of the paper, the **PRESIDENT** said that Mr. Minchin had not simply travelled through Bolivia as a visitor, but had spent seven years in the country, three of which had been passed in the great plain between the Andes and the borders of Brazil. Though the country had been so long inhabited by a people of European race, it was still but little known to Englishmen.

On the termination of the paper—

Mr. E. D. MATHEWS, C.E., thought the geographical world was greatly indebted to Mr. Minchin for the information that he had afforded about this little-known country. He had met Mr. Minchin in Bolivia, and could bear witness to the extreme care and minute accuracy with which he took his observations. It was therefore to be hoped that the maps of the district would be substantially added to by his paper. Bolivia had three outlets or routes of communication with the outside world, but one—that by the Pacific—was of so little value that it might be left out of consideration altogether. The slope on the western side of the Andes was so steep that the export trade by that route could never reach a large amount. In addition to this, the coast-line was at present in the possession of Chili, and probably Chili would act wisely in keeping it. The remaining outlets were northward by the river Madeira, and southwards by the river Paraguay. Mr. Minchin had stated that there was a very large sandy desert in what was generally known as the Gran Chaco, and that it was subject continually to inundation. That showed that the Paraguayan route would never be very useful. He himself was an advocate of the northern route, and he thought Mr. Minchin might have mentioned in his paper what was really a great calamity which happened about a year ago, namely, the winding-up of the scheme of the Madeira Railway by the division of a large fund which had been deposited in the Bank of England, among speculators who had bought up the old bonds of that undertaking. That had thrown the country back for at least fifty years. The rapids on the Madeira, a short distance from Cochabamba, were a great obstacle to navigation, and it had been proposed to make a railway there. He had been pleased to hear such a favourable account of the trade and resources of Bolivia. Its climate was so varied, its products so many, and of such excellent quality, that if an export trade could be opened up, the country would become one of the most prosperous in South America. Notwithstanding the fevers and the insects, any one who was willing to work could not find a better scope for his energies than Bolivia afforded.

Mr. READER HARRIS said he felt a certain pride in the fact that it was upon his invitation that Mr. Minchin first went to South America, and he could bear his testimony, as Mr. Mathews had done, to the care with which he took his observations and calculated them out on the spot. There were very few countries in the world less known than Eastern Bolivia. A good many years ago, when he first intended to go to that country, he applied to a member of the Royal Geographical Society to obtain information as to the best route to follow, and the answer he received was, "You cannot do better than go by Dover and Calais." The gentleman evidently did not even know where Bolivia was. The area of that country was about 500,000 square miles, or as large as England, France, Spain, and Portugal put together. Its average elevation was about 10,000 feet above the level of the sea. Although Mr. Mathews had said that the trade never would go to the Pacific, yet it had gone there, and was going there now; in fact, at the present time it was the only route, but he believed that in future the route which Mr. Minchin had described would successfully compete with it. At present some traffic passed through the Argentine Republic via Tupiza. He had travelled along part of the route himself, and found it a very bad road, made to a great extent through river beds. Next there was the route from Cobija to Potosi, the objection to which was that it was principally a desert without water, and occupied from a fortnight to three weeks to traverse.

The chief outlet for many years had been through Arica and Tacna, to which there was an excellent road. Beyond that there was a railway from Mollendo through Arequipa to Lake Titicaca; but the route ended at the lake and did not enter Bolivia, to reach which a journey had to be taken in a small steamer, and afterwards in a coach as far as La Paz. Of course the great objections to all these routes were the difficulties and expenses connected with trans-shipment, which were very serious. The aim of all who wished well to Bolivia was to get a route with the fewest possible trans-shipments, and he thought it would be found on the eastern side of the country. Mr. Minchin had stated that a steamer drawing nine or ten feet of water could go up to Corumbá, while vessels of less draught could pass up still further, and from Corumbá to Santa Cruz the country was level. He thought the time was near at hand when a road or railway would be constructed from the navigable part of the Paraguay river to the two centres of trade. Only last autumn the Bolivian Congress granted a considerable concession to a company to be formed in Europe for the colonisation and opening up of Eastern Bolivia. It was a remarkable concession, because the territory was practically conceded for a term of years, the duties of the company being, to a great extent, confined to making roads in their own district. Very soon he hoped to see that company in active existence. The scheme would provide for any number of emigrants, and would be a step in the right direction towards missionary enterprise in South America. At present there were no Protestant missions in Bolivia, but the concession granted liberty of religion. The opinion he had expressed as to the south-eastern route being the best, was shared in by every traveller who had visited the neighbourhood.

Mr. CLEMENTS MARKHAM said it was a very great satisfaction to him to have heard a paper read describing the exploration of a region in which he had long taken a deep interest, the more so as the observations for latitude, longitude, and elevation had been taken with great care. It had always been considered very difficult to penetrate to the eastward of Bolivia. In the year 1777 a treaty was made between Spain and Portugal, when it was arranged that an international commission of the two countries should go and measure the boundary. The Spanish commissioner found his way to Santa Cruz de la Sierra, and waited there for many years till he died of old age, but his colleague never arrived. At last Count Castelnau and others explored the course of the Madeira, and valuable light had been thrown on that region by Colonel Church. He himself once tried to penetrate through the forests, and met a fine old Italian monk, who had lived there for many years, and who looked forward to the very thing happening that Mr. Harris had prophesied, namely, that the products of the Eastern Cordilleras should find their way down the Amazon to the Atlantic. It was to be hoped that the desire of the old monk would be realised by the new company which was being formed. The monk made a long journey to Cuzco to publish a little book on the subject, in which he expressed a conviction that in the years to come the rivers at the sources of which he had been working, and which flowed down to the Beni, would be thoroughly explored, and a flourishing trade be established from the eastern slopes of the Cordilleras to the Atlantic. Such men as Mr. Minchin were the pioneers who would eventually lead South America to this wished-for consummation.

The PRESIDENT said he was sure the Meeting would agree in passing a cordial vote of thanks to Mr. Minchin for his interesting lecture. During the last five years, four papers only had been read before the Society on South America, but meanwhile very numerous addresses on various parts of Africa had been delivered, and listened to, often, by crowded audiences. He had asked himself why it was that the interest of Englishmen was almost exclusively confined to the continent of Africa. He supposed it had partly arisen from its being the scene of the labours of missionaries

such as Moffat and Livingstone, whose adventures and spirit of self-sacrifice had roused attention to the country. In addition to this, the fact that South America was in the hands of white people, whose possessions Englishmen were bound to respect, and not in the hands of black people, whose possessions they were not in the habit of respecting, might have had something to do with the difference in the interest manifested in the two continents. Whatever was the cause, it certainly was a fact that very little public attention had been directed to South America. Bolivia had, with great justice, been called a *terra incognita* by Mr. Minchin, and it would probably be casting no reflection on those present if he said that, in all likelihood, by far the greater part of the information given in the paper was as new to them as it was to himself. Many of them remembered what a flood of light was thrown upon a great part of the South American continent, to the north of Bolivia, by the interesting book written by their Assistant Secretary, Mr. Bates. All those who read with admiration the account of those eleven years of the life of a naturalist on the Amazons, would recollect how much the deficiency of supply of animal food was felt in that region. It now appeared that thousands of cattle roamed through the rich grassy plains of Bolivia, and all that was needed was the means of connecting that country with the populations on the banks of the Amazons. Mr. Minchin had told him that the hides and tallow were utterly wasted; while, on the other hand, it was well known that myriads of cattle were slain on the great pampas of La Plata, simply for the sake of their hides. From what Mr. Harris had said, it appeared to be certain that in future a great deal more would be heard of Bolivia. Much of the value of Mr. Minchin's paper consisted in the figures and appendices, which could not be read to the Meeting, though they were of the highest importance to the scientific geographer.

GEOGRAPHICAL NOTES.

Exploration of the River Beni in Bolivia.—Dr. Edwin R. Heath, who some time ago went to South America to explore the Beni and other rivers of Bolivia, in continuation of the work of the late Professor Orton, has sent to the United States an account of a successful journey which he made last autumn. On September 27th he started in a canoe from Cabinas, a rubber camp on the Madidi, an affluent of the Beni from the left bank, and after various delays in his journey, on October 8th discovered a new river entering the Beni from the south. Four hours later on the same day he reached the confluence of the Madre de Dios with the Beni. By rough measurements he found the breadth of the latter to be 735 feet, and that of the former 2350 feet. It is satisfactory to learn that Dr. Heath here took careful observations for latitude and longitude. Early on October 9th he passed the mouth of a river, about the size of the Yacuma, coming in from the north, and this he named the Orton. Continuing his descent of the Beni, he passed some large islands, and on the morning of October 10th came to a line of rocks obstructing the river. A mile further down the main fall was reached, where there is a perpendicular drop of 30 feet. The

H. Sharbau, R. G. S., del.