

Map of the German Colony in the Brazilian Province of Rio Grande do Sul. Presented by Bruno Hassenstein, Esq.

The PRESIDENT stated that before proceeding with the business of the evening he had to announce that he had that morning received a letter from Dr. Kirk, respecting Dr. Livingstone, which he would read :—

“DEAR SIR RODERICK,

“Zanzibar, 29th October, 1867.

“I write now only to assure you that nothing further has reached us regarding the traveller in the Lake Regions, who must without doubt be Livingstone, since we have news of him from Quiloo as having been seen west of Nyassa, where gold is found.

“Bunduki, the native to whom the letters were given, has not yet reached the coast, being delayed, as we hear, by carrying ivory in double journeys from village to village; and he is still too far off to make it of any use sending men to receive the letters which he has in his possession. We must bear patiently these African delays, and live on the hope which these rumours encourage.

“It will be some time before we can write to Johanna; but I hope that Moosa and his companions may be well watched, and, when the time comes, severely punished for the misery they have caused. They, however, press their claims for salary, and have even sent men here in the hope of getting their wages paid.

“Mr. Brenner goes in the same vessel with me to Lamoo. I go on a short leave, the first I have had since I came out. He goes to explore the Dana River, which opens into Formosa Bay. My next letter, I hope, may be accompanied by those of Dr. Livingstone.

“JOHN KIRK.”

The following papers were read :—

1.—*Explorations in the Isthmus of Darien.* By M. LUCIEN DE PUYDT.

IN this Memoir M. de Puydt communicated the scientific results of two explorations which he made of the Isthmus of Darien in the years 1861 and 1865, having for object the discovery of a practicable line for a ship-canal to connect the two oceans. His researches in the first expedition were directed towards the line proposed some seventeen years ago by Dr. Cullen between the Gulf of St. Miguel and Caledonia Bay, which had been insufficiently explored by the international expedition sent out about that time. The result of this first journey was to confirm the conclusion arrived at by Mr. Gisborne, namely, that no practicable line exists for an inter-oceanic canal in this direction. A journey was afterwards undertaken up the River Tuyra, as far as Paya. M. de Puydt thereupon returned to France, and in 1864 he was charged by the French Government to organise another party for the purpose of examining thoroughly the low range of the Andes about 60 miles to the south of the line above mentioned, where the River Tanela discharges itself into the Atlantic, near the northern arms of the River Atrato. The expedition was formed in New Granada, and, after a toilsome

exploration of several months, succeeded in discovering a break in the Andes, at the upper course of the River Tanela, which renders possible the formation of the long desired object of a ship-canal between the two oceans. The narrative of M. de Puydt in a condensed form is to the following effect:—

I left France in December, 1864, and proceeded to Carthagena in New Granada, where I organised my expedition, composed of fourteen men. Three of these merit especial mention in consideration of the devotion with which they assisted their leader in carrying out the objects of the expedition: these were M. Ferdinand Mougel, jun., Engineer, and Messrs. Truchon and Decurey, residents of Carthagena, and who, excited by the grandeur of the project, had resolved to share the dangers of the journey.

Before finally leaving for the Isthmus I made a journey to Bogotá, for the purpose of examining all maps and documents existing in the capital that might throw light on the geography of the Isthmus. It was not till the 28th of June, 1865, that we left Carthagena, in an old coasting-vessel of thirty tons' burthen, named the *Esperanza*.

We were obliged to keep close to the shore, and to navigate only during the day, in consequence of the rotten state of the vessel, and the frequent squalls which blew from the south almost every night. In doubling the Point of Caribana, to enter the Gulf of Uraba, we nearly suffered shipwreck on a reef called Lavadera.

On the 7th July we arrived at Pisisi, a little village near the mouth of the Turbo, on the eastern coast of the gulf. Being so near the site of our intended operations, I hoped to be able here to obtain some information about the country which might be useful to us; but it was impossible to learn anything. The inhabitants said the district was inhabited by wild Indians, commanded by a Cacique of savage temper, and hostile to all strangers. They said that none but Indians of the same tribe could enter their rivers or villages without running imminent danger of life. A more important piece of information was that the River Tanela, which I was in search of, had no existence, the name being simply that applied to one of the thirteen mouths of the Atrato. I was, however, so convinced my informants were wrong—having ascertained by old maps that this river existed as an independent stream—that I gave no heed to their warnings. I ordered the pilot of our vessel to obey my orders without a word of opposition, and to follow the route I should point out.

We left Pisisi on the 10th July, crossing over with a good breeze to the mouths of the Atrato, two of which (Boca Grande and Boca Tarena) we passed, and found them so silted up that there was no

longer sufficient depth of water to enable the canoes of the Indians to enter them. In the afternoon we cast anchor off the mouth of the Tanela, and, at a distance of two miles from the shore, seen through a glass, the coast appeared like a long hedge of mangroves, sheltered behind a bar of sand, on which the sea broke with great force. To the west rose a chain of hills, terminated on the south by the Peak Tarena, and on the north by the Peak Gandi. A group of islands bounded the view off the coast towards the north.

We proceeded now to disembark to make a preliminary examination of the river, I. M. Mougel, M. Truchon, and four good paddlers in our small boat, all well armed. We passed the bar, happily in safety, and at the bottom of a calm and beautiful little harbour found the mouth of the river, about 22 yards wide, and not visible from seaward. Paddling up the stream we found it near the mouth three fathoms deep, and, six miles upwards, one and a half fathom; but the water was below its mean height. Its direction is generally w.s.w. to a point where there is a confluence of two streams, the more northerly of which descends from the Sierra de Estola, and the more southerly has its source between the buttresses of the Sierra de Mali.

Existing maps erroneously represent the Tanela as having two mouths. It has but one, but the nature of the ground shows that it may have formerly had two or more mouths. The immense sedimentary deposits of the Atrato have gradually filled the whole of the bottom of the Gulf of Uraba, forming level sand-banks, supporting a growth of mangroves, and traversed by numerous channels more or less navigable.

Before penetrating further into the country towards the Cordillera it was necessary to make an extended survey of the river, and especially to ascertain the disposition of the Indians of the village of Tanela, who were reputed hostile to all strangers. The position of the village had also to be ascertained, as it was unknown.

On the 11th July I re-entered the river with a strong party. Beyond the point reached the day before it becomes broader in places, and its bed is encumbered with débris of rocks. A deserted *rancho* or hut was met with, under which were two small boats, and a short distance beyond there was another hut, surrounded with banana-trees, and also deserted.

On the following day, towards evening, we reached the confluence of the two streams before mentioned. From the sea to this point there are no less than seventeen obstructions in the shape of rapids or falls; but all of slight inclination and easy to surmount, either by towing or poling. At the confluence there is a rapid with an

inclination of nearly 5 feet, which is a much greater obstacle. In the season of rains these rapids and falls would all disappear with the elevation of the water a few inches above its present level.

Leaving the smaller of the two branches to the left, we ascended the northern stream in search of the Indian village. The Indians of the Tanela are expert navigators, and their canoes, constructed of single trunks of trees, are remarkably well made. Their huts are formed entirely of bamboo and are extremely neat, the roof being covered with palm-leaves artistically woven together. We slept in a hut of this kind on the night of the 12th.

On the evening of the following day we arrived at the village. The inhabitants were all out on the bank of the stream, and as soon as we came in sight a canoe manned by three Indians put off and advanced towards us. One of the men was Nusalileli, Cacique of Tanela; he gave us a most friendly reception, and invited us to rest for the night in his village. We received there the frankest hospitality, but it was impossible to obtain from the Indians the least information about the interior of the country, the paths, or the situation of certain points we wished to know.

We left Tanela on the 14th, the Indians refusing to accept any recompense for the hospitality they had given us. Although we had not succeeded in overcoming their distrust with regard to the objects of our journey, I was convinced that we had nothing to fear on the score of opposition by force to our movements.

My plans were now finally arranged. I resolved to disembark from our large vessel all the *matériel* and provisions, ascend the Tanela as far as the confluence, construct a hut at that point to serve as basis of operations, and commence from there to open a path through the virgin forest, guided by the compass, and pursuing the direction of the southern branch, which would probably lead towards the Pacific slopes by some one or other of the depressions or transverse valleys of the Cordillera.

The execution of this plan was commenced without delay. Unfortunately an accident occurred to delay its progress. One of our canoes, carrying M. Truchon and six men, was capsized in passing the bar, at the moment when a sudden squall compelled me to weigh anchor and remove the larger vessel. Happily no life was lost; but our party became divided for many days. It was not till the 24th that we were enabled to commence operations in the forest of the Tanela. The whole of the expedition, with provisions and tools, were then ashore. I now put in execution a plan I had conceived to prevent the desertion of our ten labourers, who were chiefly half-castes, having great dread of the Indians, and likely to abandon us

on the first sight of a conflict with them. I made a signal to the pilot of our vessel to hoist sail and leave us for Pisisi, to return for us in September. Our men were stupified at the spectacle of the departure of the vessel, but they now knew that they had no help for it but to march onward and perform their duties.

The Indians aided us to construct our huts; our relations with them, in fact, were most peaceful. In order to avoid repetition, I may say that this state of things continued up to the end of my exploration.

Five days afterwards we commenced clearing our path. We had scarcely begun when a body of 19 Indians, tattooed and armed, from two other villages, came to visit us, and tried, by all sorts of lying stories, to dissuade us from our enterprise; but finding all their efforts vain to shake my resolution, they left us. A second body of Indians still larger, and headed by their Cacique, came on the 10th, and we could not get rid of them until after a debate which lasted three hours, when they found that all their descriptions of the obstacles that lay in our way were powerless to prevent us going on with our project. During these disputes the work of exploration was not interrupted, except by attacks of fever from which some of us suffered. After eighteen days had thus passed, I made a short excursion out of the path our men had laid open, with a view to ascertain the nature of the upper course of the northern branch of the Tanela. The stream, which I found without much difficulty, was running in a rocky bed and interrupted by falls of three or four feet in height. A storm which swelled its volume so considerably that I was obliged with my two men to spend the night on its banks, convinced me that the river receives the waters of the rains which fall on the broad plateaux of the salient ridges of the Sierra de Estola, where it takes its rise. The southern branch does not rise in the mountains, as is proved by the fact that a heavy rain of fourteen hours' continuance did not perceptibly affect its volume.

During the two following days I tracked the course of the southern branch as far as the foot of the slopes of the Mali Mountain. I was able myself to see, on mounting an elevation, through the opening in the forest caused by the river, the two summits of Mali and Estola sloping abruptly and leaving between them a breach in the form of a **V**, beyond which nothing was visible to the western horizon. During many days' wading through water and swamps I succeeded in examining all the undulations of the district, and I was convinced that the object so long desired—the discovery of a break in the Cordillera of the Isthmus—was within my reach.

After observing with accuracy the bearings of the path we had opened through the forest, I departed on 25th August with M. Decurey and five of our best men, loaded with our hammocks and provisions for five days. M. Truchon remained in command of the party, with the instructions that if I did not return by the end of the month he was to proceed without me to the sea-coast.

We on our parts committed ourselves to the task of penetrating the forest towards the west, perhaps to perish, perhaps to discover a path to the shores of the Pacific.

We pursued our course towards the ridge of Mali. On the night of the 26th we slept at the foot of the range, and on the morning of the 27th ascended the mountain at an altitude of about 1300 feet above the plain. On the side of the Pacific the slope was almost perpendicular, and a splendid view was obtained of the limitless wooded plain, through which flows the Tuyra and its affluents. From this sea of verdure emerge the peaks of the chain which limits the course of the Chucunaque, and which extends towards the N.N.W., fading away in the blue distance.

It was clear that we had here attained the most westerly limit, in this district, of the chain of mountains which separates the Atlantic from the Pacific slope. It remained now to ascertain whether, at the foot of this same Peak of Mali, the waters of the Tanela were still to be found with the same slope and current.

By the help of our hands, or gliding down on all fours, we made rapid way through the dense masses of ferns and underwood in our perilous descent to the foot of the Peak. I here found, as I had expected, the river, much diminished in volume, and running in a zigzag course between the slopes of the two mountains. It ran alternately west and south, thus giving a general direction to the passage through the Cordillera of s.w. I continued walking in this latter direction with M. Decurey, sometimes wading through the water, at others climbing along the face of the slope, until at length we arrived at the end, where the same spectacle opened to our view as that which we had beheld from the summit of Mali. The prospect towards the west was boundless; the great plains of Darien stretched away to the horizon without any obstacle intervening to intercept the view. The Tanela had become a mere rivulet, fed by threads of water which descended the slopes on both sides, and hidden with shrubs and fragments of rocks.

It was clear we were here on the culminating point—the watershed of the Atlantic and Pacific, where the Nique chain of mountains was depressed to its lowest elevation.

In returning to our encampment I traced downward the course

of the Tanela in order to make doubly sure that we had not wandered away from the desired line by the *détours* made in climbing the Mali. In the evening of the 28th of August we rejoined our friends, and celebrated the successful result of our difficult enterprise and the discovery of what had been deemed impossible by so many even among those who were most competent to judge. On the 3rd of September we made sail for Carthagena.

It is necessary here to state that, in descending the Tanela, I made a series of observations on the rapidity of the current of the stream, at all the points of its course. These observations, which I am aware do not lead to a positive result regarding the facility of making a ship-canal across the Isthmus, and which can only be accepted as a temporary substitute for a proper series of levelings, have been submitted to an engineer for calculation. The height of the watershed between the two oceans, resulting from the slope of the Tanela as shown by its current, was found to be little more than 100 English feet (30·79 mètres), and the length of the line having this altitude is only 5 miles. Allowing for deficiencies in the data furnished, we may calculate the maximum altitude of this lowest depression in the Cordillera at about 140 feet. As to the employment of a barometer for measuring low elevations in tropical countries, it is well known to be of very little use, and more accurate results than those here given cannot be expected, unless a set of levels by competent engineers be undertaken. The humidity of the climate, the strong electric tension, the abrupt variations of atmospheric pressure, and the want of tables for correction of error special to these regions, would have rendered the results of barometrical observations very doubtful.

Having concluded his narrative, M. de Puydt enters into various details concerning the geography, climate, ethnology, and natural productions of the Isthmus of Darien. He remarks that the best maps are very incomplete as regards the number, position, and course of the numerous rivers, and he enumerates the affluents of the Tuyra, the great stream which discharges itself into the Gulf of St. Miguel on the Pacific side, and which will form portion of the ship-canal which he advocates along the line he has explored.

The Cordillera of the Andes along the Isthmus, he says, is quite erroneously represented on all maps. The mountains, according to his observations, form three parallel chains; of these the most westerly and highest is the Sierra de Estola, which forms a continuous ridge, except at the source of the Tanela, where it is abruptly depressed as he had described. To the south of the gap

it takes the name of Sierra de Mali. The second chain, commencing at Cape Tiburon, follows the sea-coast, forming in some places precipices facing the sea. It is traversed by numerous narrow valleys, through which streams flow, and terminates abruptly at Peak Tarena at the mouth of the Tanela. The third chain, south of Cape Tiburon, forms a line of precipitous islands parallel to the coast.

The Gulf of Uraba into which the eastern or Atlantic end of the future ship-canal will open, has, throughout, to within two miles of the eastern side, a minimum depth of 10 fathoms. The climate of the Isthmus is generally healthy; the depressions in the Cordillera and the numerous streams of water producing a free circulation of aërial currents between the two oceans and dissipating miasma. The seasons of the two coasts, however, do not exactly coincide, and M. de Puydt gives further details on this portion of his subject. The low lands near the coast, and particularly those formed by muddy deposits, are the only unhealthy places, and the vast multitudes of mosquitos render them almost uninhabitable.

The paper will be published, with the author's map, in the 'Journal,' vol. xxxviii.

The PRESIDENT said M. de Puydt had given them a very well-written and attractive description of a country which was very little known to geographers. This gentleman was not known to him personally; but the merits of his work had been brought before him by Mr. Archibald Peel. A map of the exploration had been given by the author, and he (the President) had felt it his duty to call the attention of geographers to several features in it which were new. When M. de Puydt ascended the Tuyra from the Pacific, he ascertained the whole character of the flat and undulating region which lay to the west of the great Estola chain of the Andes, and was convinced there was to be found in that direction a depression in the range. Fitting out a small vessel at Carthagena, in his subsequent expedition, he determined, in the first place, that the little River Tanela was not, as the natives told him, one of the mouths of the Atrato River, but was an entirely independent stream, having its source to the west in the chain of mountains which he had previously described. After having ascended two branches of the river, and found that the southern branch was the one which led most distinctly from the mountains, he discovered that it flowed through a pass, or gap in the range, and by calculating the velocity of the current and rapids, he had determined that this gap between the mountains of Estola and Mali was not more than from 117 feet to 132 feet above the level of the sea. If this calculation had been verified by a series of correct observations, it would be a most important discovery with respect to the chain of the Andes. He told us that the hills near the depression were 400 mètres and 500 mètres in elevation; but he did not tell us that he himself ascertained the altitude of the mountains, or that the altitude was fixed by any accurate observations. At the same time, if these were approximations to the truth, the gallant manner in which M. de Puydt had carried out his expedition, under great difficulties and with very small resources, was certainly deserving the approbation of all geographers. It was not to be imagined, if any canal was

to be established between the Atlantic and the Pacific, that the port upon the eastern side would be at the mouth of the little River Tanela: this would be impracticable, on account of the bar; therefore it was probable that the port of Escondido, a little to the north, would be the port from which the canal would have to be made. The question of crossing the Isthmus had been discussed by the Society on former occasions, and had excited the attention of geographers, civil engineers, and the world at large. But this was an account of an entirely new exploration which had been brought before them, and he begged to return the thanks of the Society to M. de Puydt for his communication.

Mr. G. W. HEMANS, C.E., said, as a civil engineer, he had listened with great interest to the paper which communicated the supposed discovery of what had been sought after for many years, more particularly by the expedition conducted by the late Mr. Lionel Gisborne—a great depression in the Andes of the Darien Isthmus; the data, however, which had been obtained by that exploration were, in his opinion, hardly commensurate with the expenses of such an expedition. He could not agree with the author of this paper in his idea that any measurement of heights could be determined by the velocity of water flowing from them; he did not believe that the most careful observations on the velocity of seventeen rapids could enable him to arrive at anything like a true measurement of the height of the pass. Considering the position of that range of mountains, and its elevated appearance so near to the Isthmus of Darien, it appeared to him unlikely that any depression would be found so low as 30 or 40 mètres. It was to be regretted that an explorer of so much activity and energy should not have taken the trouble of carrying with him even a pocket aneroid, which, without the trouble of barometers, would have given something like a scientific approximation to the real height of the pass.

Captain BEDFORD PIM quite agreed with what had fallen from Mr. Hemans with reference to the mode in which the height of the pass had been obtained by the explorer. It was not his intention to enter into any criticism upon the exploration, because there was a practical difficulty in carrying out the canal scheme across that part of the Isthmus of Darien, which he thought was insurmountable. By the Panama Railway concession, which had just been passed, dated the 16th of August, 1867, reforming the contract of April 15th, 1850, the Government of New Granada had bound itself not to construct, or to concede to any person or company the right to construct, a railway or an oceanic canal in the territory to the westward of a line drawn from Point Escoces on the Atlantic to Point Garachine on the Pacific, which would include the Pacific terminus of M. de Puydt. So that, without the permission of the Panama Railway Company, it was impossible for any one to make a canal, even supposing it was a dead level from one ocean to the other. He understood from the paper that a company had been formed in Paris to make this canal. It seemed to him most important, and it was a duty, on his part, to point out this difficulty. Then, again, there were difficulties in respect to the "physical geography of the sea" on the Pacific side, which had more than once been pointed out by Captain Maury himself, and which seemed to be too little considered in all transit schemes. To revert to M. de Puydt's loose way of ascertaining the height of the country by the velocity of the rapids, he could give an example in his own experience of exploration in Nicaragua to show its fallacy. At San Carlos, the point where the Lake of Nicaragua flows into the River San Juan, and which is 130 feet above the ocean, the current is very sluggish; in fact, so much so, that it is called "Aqua Muerta," or dead water; while half-way down the river, where the current was at least four miles an hour, the elevation was only 80 feet above the sea. But, according to M. de Puydt, the elevations ought to have been exactly the reverse.

The PRESIDENT said the author of the paper did not tell us that he took either aneroids or other instruments with him ; and of course his heights could not be relied upon. But he must say the paper was calculated to excite public interest in the region explored, and to create a desire for proper survey of this region.

2.—*Notes on the Physical Geography of the Belize River.*

By S. COCKBURN, Esq.

[Extracts.]

As one of the Commissioners in the late expedition up the River Belize, it struck me that I might take the opportunity to make, in passing, some observations on the physical aspect of the localities we had to visit, which, though not the immediate object of the Mission, might still, I thought, prove not altogether devoid of interest. Unfortunately I took with me no instruments save a portable aneroid barometer, which, however, behaved very well, and enabled me to arrive at conclusions with tolerable accuracy, though the whole perhaps would require verification ; for, in the absence of any statistics on the subject, I had solely my own observations to rely upon : the deductions therefore are the very best approximations possible, and can only serve as a basis of comparison on any future explorations.

The maps of the country are very incorrect, but on careful admeasurements of several Spanish maps of Guatemala, &c., I make the watershed of the river 90 miles by 30, equal to 2700 square miles, and, allowing 100 inches of rain to fall over that area annually (by no means too much, for it often rains in the interior, the mountains and forests attracting the clouds, when not a drop falls here, and the average rainfall in Belize for the last four years is $67\frac{1}{2}$ inches), it will give no less than 39,128,161,745 gallons, equal to 17,467,929 tons.

I find the length of the river from Belize to the fork at the "Branch," allowing for sinuosities, to be 150 miles ; the two branches to their imaginary source, estimated at 30 miles ; the creeks, many of which are now dry, 220 miles. Then at "Orange Walk" it is 187 feet wide, and 3, 6, 9, 6, 3 feet deep at different parts across. At "Young Girl" it is 180 feet wide, and 6, 10, 6 deep. Higher up, at the "Branch," it is 100 feet broad, and 3 and 6 deep ; and lower down it is 200 feet by 8, while at the "Haulover" it is 600 by 10, and from the new road across it is 420 by 12, and at the Belize Bridge it is 121 feet from side to side, by 8, 11, 6 deep. Besides these there are some pools and basins 20 and 25 feet deep. Taking the mean of all these measurements (allowing only