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Further Frontier Work on the Bolivia-Brazil Northern Boundary: Discussion

Author(s): Thomas Holdich and J. W. Evans

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the signal noted in the field. At 8 h. 30 m. 10 s. the second group commenced, ending at 8 h. 30 m. 15s., and so on until 8 h. 30 m. 45 s. At 8 h. 30 m. 50 s. one long signal was sent to denote that the preceding signals belonged to the first minute. At 8 h. 31 m. the second minute began, and the same procedure followed, but at 8 h. 31 m. 50 s. two long signals were sent to denote the second minute. The first series of signals lasted for four minutes, and after an interval of five minutes a second and similar series was sent lasting four minutes.

The Joint Commission returned to Porto Velho on December 20, when the rainy season had well commenced and further work was impossible.

Position points on the rivers Abuna, Rapiirran, and Abuna are tabulated in the following table:—

POSITION POINTS, RIVERS ABUNA, RAPIIRAN, AND MADEIRA, 1913.

Station.	Latitude.	Longitude.	Remarks.
	South.	West of Greenwich.	
<i>River Abuna.</i>	° ' "	° ' "	
Manoa. Mark "BOLIVIA"	9 40 9.4	65 26 42.3	Signals & observations on 5 nights.
" Mark "BRAZIL"	9 40 7	65 26 49 "	
Fortaleza ...	9 47 6.3	65 31 44.9	" " " 4 "
Primor ...	9 45 44.5	65 44 27.5	" " " 1 night.
Bon Comercio ...	9 45 6.7	65 55 24.2	" " " 1 "
Bon Futuro ...	9 46 45.5	66 6 17	" " " 1 "
Quemada ...	9 49 31.7	66 16 16.4	" " " 1 "
Nova California ...	9 52 16.8	66 27 7.8	" " " 1 "
Argelia ...	9 54 10.1	66 34 52.1	" " " 4 nights.
San Pedro ...	10 2 4.1	66 48 34	" " " 1 night.
Villa Rica ...	10 14 28.8	67 0 39.6	" " " 1 "
Barraca Rapiirran ...	10 20 6.7	67 11 9.3	" " " 8 nights.
Santa Rosa ...	10 36 11.5	67 24 33.2	" " " 1 night.
<i>River Rapiirran.</i>			
Boca del Rapiirran ...	10 20 16.0	67 11 19.2	Traverse from Barraca Rapiirran.
Mark "BOLIVIA" ...	10 20 14.6	67 11 22.7	" " " "
" "BRAZIL" ...	10 20 14.7	67 11 19.7	" " " "
Vista Alegre ...	10 22 9.2	67 18 53.5	Signals & observations on 2 nights.
Puente Grande ...	10 28 19.5	67 29 47.8	" " " 2 "
Station A ...	10 31 4.1	67 34 55.7	" " " 3 "
Principal source ...			
Mark "BOLIVIA-BRAZIL" ...	10 36 13.0	67 40 30.9	Theodolite traverse from Station A.
<i>River Madeira.</i>			
Station 33 ...	9 41 50.2	65 22 10.7	Signals & observations on 1 night.
Araras ...	9 57 36.8	65 18 34.3	" " " 1 "
Villa Murтинho ...	10 23 2.7	65 22 59.5	" " " 9 nights.
Mark "BRAZIL" ...	10 22 54.0	65 22 59.9	Tr.az. & distance from V. Murтинho
Villa Bella ...			
Mark "BOLIVIA" ...	10 23 10.3	65 23 29.7	" " " "
Grande Cruz ...			
Mark "BOLIVIA" ...	10 22 49.6	65 24 02.6	" " " "

All latitudes by observations of balanced pairs of north and south stars.

All longitudes by wireless telegraphic time-signals sent out from Porto Velho in lat. 8° 45' 33" S., long. 65° 54' 40"-3 W. of Greenwich.

The PRESIDENT (before the paper): Last week we had a discursive debate on the principles upon which frontiers—ideal frontiers—ought to be delimited, in which our eminent geographical professors somewhat disagreed. To-night we

turn to a more certain subject, the actual delimitation of a frontier—that between Brazil and Bolivia, which runs through some of the least-known portions of South America. I have no doubt that we shall be shown that it has been settled upon very excellent grounds, and will therefore prove very practical. The officer who is going to lecture to us, Captain Edwards, is not unknown to you. In the course of last year he described to us the delimitation, the first half of the delimitation, of the same frontier; to-night he is going to give us the details of its completion. Captain Edwards had his training in the *Conway*, from which he passed first in the list. He joined the Royal Naval Reserve, he has served in the Royal Navy, and obtained the Society's Diploma in surveying. In 1908 he entered the Nigerian service, from which he has obtained three years' leave in order to take part in this important boundary delimitation. In a few days, I understand, he is going back to take up his duties in Africa. He has kindly found time to give us an account of the last part of his survey work, and I now ask him to read his paper.

The PRESIDENT (after the paper): I have a letter from Colonel Suarez, who represents Bolivia politically in this country, in which he expresses his regret that, owing to severe indisposition, he is unable to attend the lecture to-night, and he adds that the Commission under Colonel Ovando has completed its task in regard to a portion of the Madeira, and has returned to La Paz *viâ* Buenos Aires, together with the engineers, in order to make the map of the completed work. I will ask Sir Thomas Holdich, who is an authority on South American boundaries, if he will add something.

Sir THOMAS HOLDICH: I think, to begin with, we may take it as a great compliment, not only to this Society, but to our country generally, that English officers should once again have been called upon to undertake the duties of boundary arbitration, in defining an international boundary between two great South American republics. I understand that in case of any disagreement as to the position of the boundary arising between the two parties engaged in demarcating, the final court of appeal is this Society; which, I think, says a great deal for the general belief, in South America at any rate, in our spirit of fairness. I have never heard of any other country being appealed to in quite the same way. I have had the advantage of reading Captain Edwards's paper as well as of listening to him to-night, and I can assure you he has not told you half his story. In order really to appreciate the difficulty of the problem that was before him when he set out to demarcate that boundary, you must try to realize what is the extent and the impenetrability of those vast forests which cover the land from the sea to the sources of the Amazon. There is nothing, so far as I know, but deep and impenetrable forest as far as the tangle of foothills which ascend to the great divide between the Pacific and the Atlantic. Above the foothills there are a few open grass spaces. The only right of way that exists amongst these forests is afforded by the rivers about which Captain Edwards has told us to-night. You have seen what the difficulty is of navigating those rivers, and you have heard how it was accomplished. The rivers themselves practically afforded the only means of making any survey of the country at all, for I take it that it is only along the rivers of such a country that a traverse can be successfully run. If you look at your map you will see that the rivers generally have a trend southward and eastward from the mouth towards the source; consequently, the only method by which an efficient check could be brought to bear on those traverses was by means of longitude determinations; and the great feature of this expedition to my mind has been the introduction, so freely and so successfully, of wireless telegraphy for this purpose. Just as

modern development in scientific apparatus has so largely modified procedure in military affairs, so has it, indeed, in scientific matters such as this completion of an important survey. I think that the results of the work accomplished by Captain Edwards and his colleagues in this very peculiar and very remarkable boundary demarcation will give us new ideas and a fresh start in the process of similar demarcation in future. On the whole, I am inclined to think, from what I have read as well as what I have heard to-night, that no boundary demarcation which has ever been undertaken has so thoroughly well illustrated those peculiar qualities of courage, of determination to win through in spite of all difficulties, and that perhaps rather rare quality of resourcefulness which this country now seems to expect from British officers everywhere, no matter what sort of work there may be in front of them.

Dr. J. W. EVANS: I have listened with great interest to the paper to-night, especially as some dozen years ago I passed through more or less the same ground. It is true that I have not been up the Abuna; but I have bivouacked close to the mouth, where it joins the Madeira. I was chiefly engaged in the parallel rivers more to the southward, the Orton, and next to that the Manutaba (Madre de Dios), and then the Beni. What has struck me is the contrast between these rivers and those on which Captain Edwards has travelled—that is to say, the Abuna and Acre. Above the cachuela or rapids of Esperanza there could not be a river more healthy and more pleasant than the Rio Beni. From where it leaves the foothills of the Andes over about 400 to 500 miles down to this point there is no fever. I passed through a number of rubber properties on the Madre de Dios and on the Orton, and found these rivers equally pleasant and healthy, though the latter runs close and parallel to Abuna. I heard, however, a good deal of the evil reputation of the Abuna and the Acre. Those who leave the Orton to make their way across to those rivers in order to look after rubber thought they took their lives in their hands, and if they got back to the more healthy regions to the south were very thankful. There are so many interesting points in the lecture that it is impossible to touch on all of them. I cordially agree with Sir Thomas Holdich in his expression of the importance of the introduction of the wireless telegraphy for determining longitude. Those who have made great preparations to observe an occultation which was obscured by cloud at the last moment, or have found they have left their chronometer behind where there was nobody to wind it up, will appreciate the advantage of wireless telegraphy. With regard to the Indians, I admit that the Pachaquaras, or Pacaguaras, as they are often called, have a very poor reputation, but some of the other tribes are very pleasant fellows indeed. I have travelled alone with them, and they seemed quiet, sensible, and quite cleanly people, and found that if you treated them well they treated you well. I should like to say, in conclusion, that I must congratulate the Government of Nigeria on possessing such a capable officer as Captain Edwards has proved himself in the interior of South America.

The PRESIDENT: If there is no one else who wishes to say anything I will wind up the discussion in few words, for the country described is one of which I have no personal knowledge. Like most of our older Fellows, my impressions of the Amazons are derived mainly from our dear old friend who used to sit at this table, Henry Bates. It seems to me that from the picturesque point of view the Amazonian forest must be one of the most depressing regions in the world. Those hundreds of thousands of miles of forest with no hills must be a dreadful weight on the mind of the traveller. A forest with hills or mountains is a living thing, but when you get a forest on anything approaching a dead flat its monotony

becomes almost appalling. Our ideas of this region were refreshed this year by Mr. Roosevelt, and I think we must have been struck by the similarity in many respects in the descriptions of the rivers given us to-night with that Mr. Roosevelt gave us in his lecture on the River of Doubt, which we can now read at greater length in the very interesting volume he has just presented to our Society. It seems to be a country engrossing for the zoologist. Mr. Roosevelt's book is full of the extraordinary and interesting animals he came across. But if it is a paradise for the zoologist, it seems to be still more so for the entomologist, though the ordinary traveller may not regard it in the same light. We can hardly hope that the boundary now laid down, which I have no doubt will prove an excellent boundary between the two states, will fulfil one requirement which our professors suggested a week ago. It is hardly likely to be a meeting-place of nations, but as a dividing-place between nations, which after all has been hitherto the idea of a boundary, it appears to be admirably suited. It is a source of pride to ourselves, to our Survey officers, and to this Society, that Englishmen should be selected as the best fitted to do this sort of work for other countries. We have all listened to Captain Edwards's lecture with the greatest interest, and have got many new impressions from it. I will now move a vote of thanks to him, which I am sure you will accord unanimously.

SIR AUREL STEIN'S EXPEDITION IN CENTRAL ASIA.*

As soon as a short halt in the Tun-huang oasis had allowed men and animals to recover from our trying winter campaign in the Lop-nor desert, I started by April 2 for the explorations planned eastwards. Their objectives lay mainly in the deserts which fringe on the south and east the vast region of barren hills known as the Pei-shan Gobi. The distances to be covered were great, and short the available season before increasing heat would stop work on waterless ground. So but little time could be spared for my renewed visit to the cave temples of the "Thousand Buddhas" near Tun-huang, which in 1907 had yielded so much antiquarian and artistic spoil. But rapid as my visit had to be, it proved once more fruitful.

Ever since my first discovery in 1907 of the ancient Chinese *Limes* to the west and north of Tun-huang, I had been anxious to follow up its line as far as possible eastward, and to explore whatever ruins might have survived along it. The work was successfully started, when, after striking across a difficult belt of salt marshes, we came upon the ancient border wall halfway between Tun-huang and An-hsi. From there we were able to follow its line for close on 250 miles eastwards. Along almost the whole of this distance the wall, with its watch-towers and small military stations, had been built across what already in ancient times was absolutely sterile desert. The immunity from human interference thus assured had helped greatly to preserve its remains; but the wall owed even more to its remarkable method of construction. Built of carefully

* Communication from Sir Aurel Stein, K.C.I.E., PH.D., D.SC., dated Turfan, November 22, 1914. See *Geographical Journal*, vol. 44, p. 69.
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