

## **Revealing the ‘Lost World’: The American Geographical Society and the Mapping of Roraima during the 1930s**

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### *Abstract*

This paper considers a specific mapping exercise undertaken by cartographers in the American Geographical Society during the 1930s as part of a larger project to construct a 1:1,000,000 map of Central and South America, the so-called ‘Map of Hispanic America’. The particular focus is the region around Mount Roraima on the triple border point of Brazil, Venezuela and what was then British Guiana. This was one the more isolated areas of Amazonia, an apparently pristine wilderness far from the encroachments of European colonization and an area frequently depicted in the media as a ‘lost world’, bypassed by history and home to unknown species of flora and fauna that had survived from earlier geological periods. The compilation of a new and accurate map of Roraima presented several problems for the AGS cartographers whose desire to create a rational, scientific representation of the region was continually confronted by colorful myths and legends promoted by novelists, journalists and cinematographers.

**Keywords:** American Geographical Society; Map of Hispanic America; Roraima

## Introduction

The American Geographical Society (AGS) has a long and distinguished tradition of scientific research on Latin America. The Society's interest in this region, never less than substantial, was especially pronounced during the interwar period (for the preceding era, see Morin 2010). Under the energetic direction of Isaiah Bowman, a sizeable proportion of the AGS's limited resources were diverted to the compilation of a new 1:1 million topographic "Map of Hispanic America". When finally completed during World War II, the Hispanic Map was hailed as a cartographic masterpiece, "the greatest map ever produced of any one area" according to the President of the Royal Geographical Society (RGS), Lord Rennell of Rodd (Rodd in Bowman 1948: 143; see also Pearson and Heffernan 2009).

This essay outlines the story of just one of the 107 map sheets that eventually comprised the Hispanic Map. The sheet in question, which proved to be a microcosm of the wider project within which it was an integral and pivotal component, depicted the isolated Amazonian region around Mount Roraima, the steep-sided plateau or *tepui* that marked one of several Latin American triple border points, in this case between the northernmost region of Brazil, the south-easterly sector of Venezuela, and the mid-eastern border of what was then British Guiana.

## The Making of the Hispanic Map

The lavishly coloured Hispanic Map, which emphasised relief and topography at the expense of political divisions, was both a collaborative scientific project based on materials gathered from across the United States and Latin America and a creative, multi-authored work of art (Wright 1952: 300-19). Although designed to conform with the framework and conventions of the International Map of the World (IMW), first proposed in 1891 by the German geographer Albrecht Penck and hesitantly pursued by various national cartographic agencies before and during World War I, the Hispanic Map was an independent, distinctively American enterprise that Bowman believed would facilitate the systematic colonisation of Latin America's under-

populated but habitable spaces and a rational, internationally collaborative exploitation of its enormous natural resources (Pearson et al 2006).

Bowman's objectives were overtly geopolitical and almost certainly shaped by his experiences as "chief territorial specialist" in the United States delegation at the Paris Peace Conferences after the First World War. In Paris, Bowman witnessed at first hand the extraordinary power of apparently objective, scientific cartographic representations to influence decision-making during the contentious negotiations about the new geopolitical configurations of Europe and the Middle East (Bowman 1921; see also Smith 2003, 113-180; Reisser 2012). Dismayed by the overtly imperial self-interest of allied political leaders, Bowman was determined that the post-war United States, by now wedded to a policy of isolationism, should establish a more enlightened and progressive imperial engagement with the developing countries in its natural sphere of influence in South America, based in part on more collaborative forms of scientific investigation and cartographic representation. Bowman readily acknowledged that the Hispanic Map would have to be compiled using a vast array of earlier maps of South America, many directly implicated in the imperial appropriation of the continent's peoples and resources by colonising European powers, others constructed as part of assertively territorial nation-building by independent Latin American states after the collapse of European empires (see, for example, Craib 2000, 2004; Dym and Offen 2011; and more generally Akerman 2008). But in Bowman's vision, the Hispanic Map could transcend these earlier forms of appropriative cartography, whether imperialist or nationalist. This was to be a project that would underline the AGS's status as a neutral, disinterested and peaceful arbiter between mutually antagonistic Latin American governments, particularly in regard to the continent's many border disputes. In so doing, the Hispanic Map would also reinforce the benign cultural and political influence of the United States across central and South America (Schoultz 1998: 253-315; Schulten 2001). By framing an entire continent in a single cartographic image, the Hispanic Map became a significant element in the American geopolitical imagination and formed part of ~~the~~ what the

Argentinian historian Ricardo Salvator has called the “representational machine” of US imperialism in Latin America (Salvatore 1998; see also Grandin 2006).

The power of the Hispanic Map, at least in Bowman’s view, derived from its carefully constructed scientific objectivity and from its studious refusal to highlight – or even to acknowledge – the presence of human activity, including the often disputed international borders that the map was designed in part to help resolve. Bowman’s objective was a physical geographical “base map”, a *tabula rasa* vision of a continent uncluttered by the complications of human occupancy. Needless to say, neither Bowman nor any of his co-workers in the AGS acknowledged the complex negotiations that had taken place over many centuries between Europeans and indigenes in the making of the hundreds of pre-existing maps patiently assembled in New York from which the Hispanic Map was compiled (Burnett 2002). Some critics have detected a similar effacement of the complexities of human agency and human rights in more recent AGS expeditionary activities in South America conducted in Bowman’s name and based on a similar commitment to “militant empiricism” (Wainwright 2013; see also Sletto 2009, 2010).

The Hispanic Map project began in 1921, facilitated by a donation of \$25,000 from Archer Milton Huntington, the AGS’s main benefactor and heir to a vast railway fortune. Huntington had previously funded the vast complex of research institutes and libraries constructed on Audubon Terrace in the early twentieth century between West 155<sup>th</sup> and West 156<sup>th</sup> Street in the Washington Heights area of upper Manhattan which included the headquarters of the Hispanic Society of America, the American Academy of Arts and Letters, the American Numismatic Society and the AGS itself. Huntington was fascinated by South America and eventually provided more than half the \$570,000 total cost of the Hispanic Map. His initial bequest was used to recruit an international team of cartographers and map compilers whose salaries eventually absorbed three-quarters of the total cost of the map. The Department of Hispanic American Research, the co-ordinating office in the AGS where the map-makers

worked, was staffed by an average of seven employees during the interwar years and quickly assembled an unrivalled library and archive of Latin American maps, atlases, charts, plans and books.

The Department was directed by three men during its existence: Alan Ogilvie, a former British intelligence officer whose brief tenure in New York ended in the summer of 1923 when he returned to his native Scotland as a professor of geography at the University of Edinburgh; Raye Platt, a long-time associate of Bowman from Yale University who directed the project from Ogilvie's departure until 1938; and Charles Hitchcock, a Harvard geomorphologist and one of Bowman's successors as AGS Director who oversaw the project's final phase.

Procurement of the sources for the compilation of the Hispanic map proved to be a monumental task. For eight months during 1924 and 1925, Platt urged governments, mapping agencies, societies, companies and individuals from around the world to support the project by donating unpublished maps and compilation materials (Platt 1927). The resulting four volume catalogue, published between 1930 and 1933 was in itself a major accomplishment (AGS 1930, 1932a, 1932b, 1933; for a summary of the catalogue, see Platt (1933)). It listed more than 8,000 entries, including maps tracked down in obscure scientific periodicals and books, individual map sheets and atlas maps, together with a general map showing the extent and accuracy of the surveys for each country.

Classification of the sources was an essential part of this information gathering process. Platt and his co-workers felt that the Hispanic Map had to be transparent in its use of source materials and devised a new reliability diagram to be used on each sheet, showing their confidence levels for each sector of the image. Sources were classified according to whether they were based on primary surveys or simply derived from existing maps. Maps based on surveys were further subdivided according to the type of survey: triangulation with precise topographic survey; reliable traverses; triangulation of approximate topography from plane-table sketches or traverses; approximate traverses and compass sketches. As custodian to the largest collection of

contemporary Latin American maps in the world by the mid-1920s, the AGS was well placed to publish the first overview of the quality of surveying and mapping for the whole of Latin America and to review the wider literature on the continent's geography (Platt 1930 and 1943).

Given the sensitivity of international boundaries throughout South and Central America, the AGS set about reviewing the status of international boundaries, many of which remained undemarcated. Of the 15,000 miles of international boundaries in Latin America, Platt estimated that only about 8,000 miles had been demarcated. Some 2,500 miles had yet to be defined let alone demarcated (Platt 1924). Maps associated with the boundary disputes between Venezuela, British Guiana and Brazil would figure prominently in the compilation of the Roraima sheet.

The AGS recognized that the Hispanic Map could not be compiled solely from maps based on surveys. Atlases had been published, chiefly by European cartographers, during the nineteenth century with the support of governments eager to consolidate national identity and declare their territorial limits. The legacy of their efforts would linger on for decades after publication. For example, the work of the Italian military engineer, Agustín Codazzi, in Colombia and Venezuela would underpin much of the cartography of these countries well in to the twentieth century.<sup>1</sup> Though Codazzi undertook his own expeditions, covering thousands of miles by road and river, significant areas of his maps were compiled from earlier epic explorations such as those by Alexander von Humboldt. When considering source material, Platt was acutely aware of the temptation to rely on what he termed "mother maps" on which "fine engraving and coloring may lend an air of importance quite out of keeping with the merits of the original map" (Platt 1927: 302).<sup>2</sup> Reputations would matter little during the compilation process.

### **Promoting the Hispanic Map**

Despite Huntington's continuing generosity, securing the necessary funds for the Hispanic Map was a continual struggle. Bowman used a range of sometimes contradictory arguments to persuade potential sponsors to support the AGS's Latin American mapping. When

addressing corporate business interests, he waxed lyrical about the Hispanic Map's practical utility as the benchmark guide that would facilitate more detailed surveys of Latin America's soils and mineral resources. To trustees of educational and philanthropic organisations (including the Ford, Carnegie and Rockefeller Foundations), he emphasised the map's scientific, cultural and political importance as a cartographic "gift" from the United States to the peoples of Latin America. For officials in the US State Department, to whom Bowman sent regular briefings, the Hispanic Map was presented as a strategic geopolitical project that had direct relevance to American interests throughout the region.

By the mid-1920s, diminishing returns were beginning to set in and Bowman was finding it increasingly difficult to secure additional funding. Despite his persuasive rhetoric and tireless efforts, it was increasingly difficult to disguise the fact that the Hispanic Map was a long-term scholarly research program carried out in the cloistered, academic surroundings of a small learned society and was unlikely to have any significance until it was completed.

This was scarcely the kind of scientific endeavour to set pulses racing among an American public used to more dramatic narratives about the real and imagined geographies of Latin America, specifically the vast unexplored areas of Amazonia, in fiction, the news media and, most importantly, on the cinema screen. While Bowman and Platt were toiling away to secure funding and scientific legitimacy for their Latin American cartographic work, the newly established movie industry in Hollywood was presenting a vastly more entertaining image of the region's unexplored areas.

The roaring success in American movie theatres in 1925 was Harry O. Hoyt's silent classic *The Lost World*, based on Arthur Conan Doyle's 1912 adventure yarn of the same name. This was the original dinosaur movie, a thrilling tale of unlikely species survival from a ferocious, pre-human past in an unexplored part of Amazonia directly based on Mount Roraima and the similar flat-topped plateau that comprised the Pakaraima range. The themes and techniques explored in *The Lost World* were re-worked a few years later, after the introduction of the

“talkies” in 1927, by Willis H. O’Brien, Hoyt’s award-winning special effects expert, in the even more successful *King Kong* (Erb 2009).

Although Conan Doyle’s story was a work of fantasy, and was enthusiastically embraced in those terms, it was directly inspired by the marginally less outrageous, though still contentious claims of the English archaeologist and mystic Percy Fawcett, the leader of no fewer than seven Amazonian expeditions before and after World War I, some sponsored by the RGS in London. Fawcett made several controversial claims in his lectures and publications, repeatedly insisting that he had encountered animals in the upper reaches of the Amazon that were previously unknown to science, many of which were of enormous dimensions. The principal characters in Conan Doyle’s novel, *Professor Challenger* (played in the movie by an unlikely Wallace Beery), Edward Malone, and Lord John Roxton bore more than passing resemblance to the author’s real-life friends and acquaintances, specifically Fawcett, E.D. Morel, Bertram Fletcher Robinson, and Roger Casement. Shortly after the movie was released, Fawcett disappeared on his fateful last expedition to Amazonia, along with his son Jack, an unfortunate youth to whom his eccentric father attributed divine powers. The pair had been searching for a “lost city” which Fawcett identified by the single letter Z, the last vestige, he insisted, of an ancient Amazonian civilization (Grann 2009).

Inspired by this heady mix of adventure fiction, thrilling cinema and real-life exploratory drama, both the serious and populist American newspapers went into competitive overdrive when reporting on the scientific expeditions to Latin America organised by the nation’s leading research institutions, museums, and universities, some with the active support of the AGS, endlessly recycling the themes of “lost worlds”, “lost tribes”, and “lost cities” through the late 1920s and early 1930s. While these serious expeditions were often trivialised in the process, the resulting publicity proved invaluable in generating additional publicity for the AGS’s Latin American work at the centre of which was the Hispanic Map (on this theme, see Schulten 2001).



The popular interest in Amazonia as a “lost world” presented Bowman and team of AGS cartographers with something of a dilemma. As serious scientists, they were understandably anxious to dispel the more colorful media speculations and the wilder cinematic follies about this region. And yet the scrupulously scientific project in which they were engaged was also partly dependent on maintaining the public fascination with these far-flung and isolated locations, even if this interest was more readily whetted by exciting fantasies rather than dispassionately rational scientific facts. This was the intriguing context within which the AGS set to work on the Roraima sheet in the very year that American cinema audiences were gasping with amazement at the images of dinosaurs and other fierce beasts in *The Lost World*.

### **Mapping Roraima**

The unpublished material in the AGS archives on the compilation of the Roraima Hispanic Map sheet (NB20 to give it the official designation) is exceptionally detailed.<sup>3</sup> They consist of a nine-page typewritten document entitled “Roraima Sheet – Compilation” with twelve handwritten pages of the same material, four typewritten pages of an inventory headed “Roraima Sheet - List of Maps” listing 49 maps with five handwritten pages of the same material and a “History of Exploration of the Roraima Region” handwritten in 13 pages, ordered chronologically from 1838 to 1928. A single handwritten page headed “Rivers in British Guiana” provides some additional information. These manuscripts offer us a unique insight into the compilation process at the AGS. In addition, the close scrutiny of these sources by AGS staff reveals remarkably detailed information on the accuracy of surveys prior to the publication of the sheet. These documents reveal the painstakingly slow process of compilation, which for this single sheet of the Hispanic Map extended throughout the 1930s (Figure 1).

*The Club Engenharia do Brasil Map (1922)*

On the face of it, the earlier publication in 1922 of a 31-sheet 1:1 million map of Brazil by the Club Engenharia do Brasil (CEB) provided the AGS map compilers with a perfect template for the largest Latin American country. The CEB map was a “provisional edition” of the aforementioned IMW and was intended to mark the centenary of Brazil’s independence. Publication of the complete series for the whole of Brazil caused some surprise within the AGS and in other geographical societies where many were doubtful that such a task could be completed without new survey (Hinks 1923). Rumours circulated, apparently initiated by the AGS, that the scale of the CEB map would be reduced to two million in order to complete the task by the centenary date (Winterbotham 1923). Publication of all the sheets by a private organisation, compiled under the direction of Dr Francisco Bhering, provided a stunning retort to such scepticism and strengthened the argument that private organisations were better placed than state-funded national mapping agencies to complete the larger IMW project.

Although the CEB map sheets were reproduced to a very high quality by Dietrich Reimer, the prestigious Berlin publishing house, the quality of the reproduction could not hide the weaknesses in the content, notably in regard to Roraima sheet which, straddling the borders with Venezuela and British Guiana, provided little more than a speculative skeletal outline of the major rivers in these adjacent areas. Platt and his co-workers in the AGS team were dismissive of the CEB depiction of Roraima, having identified that it “was apparently a compilation of only two sources, the map of the Boundary Commission of 1889 and the official map of British Guiana of 1913.” In their view, the CEB Roraima sheet was “quite valueless.”<sup>4</sup>

*Mid-19<sup>th</sup> Century Surveys: Robert Schomburgk*

Although the AGS cartographers regularly bemoaned the quality of the maps produced by explorers and were ever mindful of the more common deficiencies of these representations,

information supplied by travellers was generally the only information on which the Society could draw in its attempt to correct the inadequacies of the CEB map sheets for Amazonia. Few exploratory surveys provided observation on altitude on their published maps, and the data given in the accompanying publications could rarely be located on their maps. Often mention was made of distant peaks but the direction was seldom given, or if given, the point of reference could not be located with sufficient accuracy to determine the location of these distant peaks with any accuracy. Rivers were too often described as narrow or broad, mountains as high or low and distances in terms of hours of travel without any unit of measurement provided. If an explorer followed a route traversed and mapped and described by previous expedition he usually failed to comment on the accuracy of his predecessor's observations.

In the absence of systematic surveys of the Roraima region using triangulation, the AGS relied instead on surveys conducted by explorers dating back to the mid-nineteenth century for all areas of Amazonia, including the Roraima sheet. Naturally, explorers made great use of rivers to penetrate deep into *terra incognita* and as a result most traverse surveys concentrated on the depiction of these vital navigation routes. Knowledge of the true location of the headwaters or interfluves of river basins was also of great importance to the delineation of many national boundaries.<sup>5</sup> In remote areas such as Roraima, the correct location of the rivers would provide the necessary skeleton upon which all other topographic elements would be hung.

Exploration of the area depicted on the Roraima sheet was highly uneven (Figure 2). Mount Roraima, a peak first described by Sir Walter Raleigh in 1596, held a special place in the mind of British adventurers, becoming a focus for expeditions following Robert Schomburgk's tantalising description of the Roraima mountain group in his *Twelve Views in the Interior of Guiana* published in 1841 (Schomburgk 1841). Though Schomburgk had not ascended Roraima, he had completed a number of journeys within British Guiana that were published by the RGS (Schomburgk 1836, 1837, 1840a, 1840b, 1840c, 1842; see also Burnett 2000). His reports were accompanied by maps compiled from his previous river traverses.

Schomburgk's surveys remained the only material available for significant areas of the Hispanic Map, particularly along the borders between Venezuela, Brazil and British Guiana. Schomburgk's maps of the border and his depiction of what became known as the 'Schomburgk line' became a key element in the protracted territorial dispute between the Venezuela and Great Britain with respect to British Guiana. Notes on the "History of Exploration of the Roraima Region" by the AGS compilers regarded Schomburgk's published maps as "surprisingly good not only in latitude but also in longitude." These depictions provided "valuable source material in many sections that have not been subsequently covered by more accurate surveys."

The most valuable contributions by Schomburgk were two later maps, published in 1847, containing much new information.<sup>6</sup> According to an AGS report: "The most important contribution to the cartography of the region is the mapping of the Cuquenam and Onuluque Rivers, part of the Cotinga, the headwaters of the Yuruani and Kamarang Rivers and the Venamo River."<sup>7</sup> However, the accuracy of the boundary demarcation was viewed with some scepticism as subsequent survey work by the French explorer Henri Coudreau (1859-1899) and the American ethnologist William Farabee (1865-1925) suggested that Schomburgk's maps were in error by as much as 30' in latitude (AGS 1933).

#### *Late 19<sup>th</sup> Century Surveys: George Dixon*

Little survey work was completed in the Roraima region in the decades that followed Schomburgk's explorations and concentrated mostly on the headwaters of rivers rising in the Gran Sabana massif and its lower river systems. Mount Roraima itself, the highest landmark within the larger massif, was the focus for expeditions by Charles Barrington Brown in 1869 (Brown 1876; Brown and Sawkins 1875); by C. R. Boddam-Whetham in 1878 (Boddam-Whetham 1879); and by Henry Whitely in 1881 and 1883 (Whitely 1884), though the mountain was climbed for the first time by Everard Im Thurn and Harry Perkins in 1884 (Perkins 1885; Thurn 1885). Further surveys continued into the early twentieth century when an astronomically

controlled traverse of the route from Holmia to Mount Roraima was undertaken, and published by the Colonial Secretary to British Guiana, by Cecil Clementi in 1916 (Clementi 1916).

In the absence of more reliable alternatives, the exploratory surveys proved extremely valuable to the AGS despite their variable quality, usually a consequence of the explorers' lack of formal training. Compilation of the area around the Barima River on the Roraima sheet, particularly where the headwaters of the river defines the national boundary, offers an insight into the process of compilation based on compass traverses provided by explorers. Traverses along the upper Barima River and its tributaries were undertaken by the British traveller George Dixon in 1894 (Dixon 1895). Dixon's account of the four month expedition made no mention of these traverses, concentrating instead on the trials and tribulations of his encountered while negotiating the treacherous and uncharted river system accompanied by his wife. The following offers a flavour of his account:

Suddenly the foremost canoe, in which I was, capsized. I just scrambled out onto a tree in time to see the second canoe carried down by the stream onto the top of the sinking one, and both go to the bottom, with five of my companions and all my worldly possessions, with the exception of some clothes, a little tea and coffee, some rice, and an old kerosene-oil tin, which were in the third canoe!

(Dixon 1895: 344-5)

Despite these catastrophes, Sir Clements Markham, the RGS President, congratulated Dixon for his "extremely valuable work in helping to settle the future boundary to be demarcated between British Guiana and Venezuela" (Dixon 1895: 345). Even with this endorsement, there was little prospect of Venezuela accepting Dixon's map as his survey placed the source of the Barima River at the international boundary between Venezuela and British

Guiana some 25 miles further west of its position as shown on the official map of Guiana of 1913. Despite the fact that the Boundary Commission did not appear to have taken astronomical observations along this section of the boundary, the AGS felt that they could not shift the boundary line to match Dixon's survey as both the Venezuelan and British Guiana maps agreed on its position and, by his own admission, the accuracy of his survey was reduced "as circumstances obliged me to limit my travelling paraphernalia the barest necessities... a compass, a level, and an aneroid" (Dixon 1895: 337).

Given the dubious accuracy of Dixon's mapping of the main river, his placement of the tributaries were self-evidently very rough approximations and the AGS cartographers decided to shorten his survey of the Barima River by one third (Figure 3). The compilation notes drew attention to the strong possibility that Dixon's survey had been used in the compilation of the official map of 1913 but instead of changing its scale, the compilers of the official map had simply introduced a bend in the river near the mining settlement of Five Stars. Such contortions of geography for the sake of compromise were a regular occurrence.

Even in the most favourable circumstances, the estimated error in recorded lengths of an average traverse was often in the order of 10 per cent (Hinks 1913). Although astronomical observations could be used to check the accuracy of traverses, particularly in regard to latitude which could be easily calculated either by observation of the sun or the stars, longitude was much more difficult to establish due to the difficulty of carrying or obtaining Greenwich Time. The accuracy of calculating longitude was determined by the quality of the chronometer watches carried by the explorers. A number of chronometers or even better, half chronometer watches, were recommended to calculate the mean of their times. The tolerances for calculating longitude are very small. Just four seconds of time at the equator is equivalent to a difference of over one mile. The cost of the chronometers combined with the risk of exposing them to the jolting of transportation and constant changes of temperature made their employment by explorers practically impossible. Watches were typically used but could not be trusted for very long and

were always susceptible to breakage, as Schomburgk had found to his cost during his earlier surveys. Correct estimation of distances was also especially challenging if the route traverse was predominantly east to west as was the case with Dixon's compass traverse of the Barima River. This simple fact largely explained his overestimation of the river's length.

### *Fin-de-siècle Surveys*

Though details regarding the method of survey were rare in published accounts of expeditions, the trials and tribulations of Stanley Paterson during his survey of the lower Rio Cuchivero to its confluence with the Orinoco were an exception and no doubt influenced the decision as to whether the AGS would use the results. Despite being relatively well equipped, Paterson appeared to lack confidence in his own results:

Owing to want of practice and experience in astronomical work, I am very doubtful as to the correctness of any of these observations, and, in placing these points on the map, have usually preferred to rely on the mechanical accuracy of the plane-table rather than on the more dubious results of inexperienced astronomical observation. (Paterson 1899: 50).

Not surprisingly, little reliance was placed on Paterson's survey by the compilers of the Roraima sheet, preferring the more rigorous survey provided by Siegfried Passarge in 1903. Even here, the AGS had misgivings as the astronomical observations of longitude published in the article by Passarge were inconsistent with his own map. The AGS adjusted the map "by accepting the meridians crossing Las Bonitas and Copeta as determined by astronomical positions established in 1906 by the Comisión del Plano Militar."<sup>8</sup> However, further adjustment was required in order for the points surveyed by the Comisión to fit the latitudes as given by

Passarge. Such adjustments were inevitable given the absence of any ‘truth’, the underlying principle being that despite there being “no proof that this solution is correct...it was the only way that the errors could be distributed.”<sup>9</sup>

The river systems of the Caura and the Caroni, both major tributaries of the Orinoco, were largely unexplored despite attempts to establish permanent settlement and communications.<sup>10</sup> The AGS clearly struggled to achieve a satisfactory compromise in the final depiction of this region. They noted the famous explorations of von Humboldt with the French botanist Bonpland from 1799 onwards that provided pace and river traverses controlled by astronomically determined positions and barometrically determined altitudes for the Orinoco and some of the more remote tributaries, including the Caura. Von Humboldt constructed the first map of the River Caura,<sup>11</sup> the information being obtained from the missions in the area. Von Humboldt’s sketch map was later improved upon by Codazzi in 1840 but the AGS compilers felt that these improvements were due “only to more artistic draughtsmanship.”<sup>12</sup> More detailed mapping of the Caura resulted from both explorations upstream from its confluence with the Orinoco and explorations by those crossing the divide between the Amazon and Orinoco basins. Early explorations were undertaken by Henry Wickham (Wickham 1872) who navigated upstream for a short distance in the early 1870s and by Jean Chaffanjon, under commission from the French Ministry of Public Instruction, who published a map of his exploration of a 200 kilometre stretch of the river in his book *L’Orenoque et la Caura* in 1889 (Chaffanjon 1889). However, this map was rather primitive in the opinion of the AGS, having no scale or degree graticule (Figure 4). The later ascent of the river in 1900 by Eugène André (André 1904) did not differ greatly from Codazzi’s map as the map accompanying the article was purely for illustration of the route.<sup>13</sup> Those explorers approaching the river from the South included Schomburgk (1839) and Koch-Grünberg (1912) who embarked on what is considered to be one of the major exploits of scientific exploration in South America. However, they did not venture further than latitude 4° 30’. The AGS concluded that “the gap of thirty to forty miles between the farthest



point reached by their explorations has as far as is known never been crossed by any white man capable of mapping or describing his route.”<sup>14</sup>

Chaffanjon’s survey, despite its crudeness, was deemed to be the key reference for the mapping of the Caura, though no reasoning for this decision is provided. His sketch was adjusted to match Passarge’s survey of the mouth of the Caura and then swung 45° to avoid cutting the Rio Paragua with details added from the Codazzi and André maps. The most important conflict to resolve between source maps of the river was the position of the confluence of the Rio Erevato and the Caura. Apparently Chaffanjon and Arrowsmith depicted this confluence much further south and further from Paru Falls than shown on maps by Von Humbolt, Codazzi and André. After comparing these maps with the Koch-Grünberg maps of the headwaters of the Erevato, the AGS compilers decided to use Arrowsmith’s map which in their opinion “was found to be extraordinarily good, for the region of the Coura and Caroni rivers.” The evidence to support this opinion is not provided.

Despite the best efforts of the AGS map compilers, a recent cartometric analysis of the Roraima sheet provides clear evidence that considerable errors remained in the first published edition, particularly in the Caura, Erevato, Paragua and Caroni river systems (Figure 5).<sup>15</sup> Despite accepting the more southerly position for the confluence of the Erevato and the Caura as depicted by both Chaffanjon and Arrowsmith, the true position of the confluence was a further 32km south of that shown on the map. The results show that the AGS was right to be concerned about the unexplored middle reaches of the Caura and the Paragua with differences in position in the region of 30 to 45 km.

### *Mineral Extraction Surveys*

No precise topographical surveys of a quality equivalent to those carried out in Europe and the United States had been carried out within the neat line area of the Roraima sheet. However, the importance of this area, particularly to the British, is evident when we consider the

number of surveys and maps published by the Department of Lands and Mines in Georgetown. The work of this department was of critical importance in the exploitation of the colony and consisted of traverses, maps and geological studies of mineral regions in addition to surveys carried out in the granting of land concessions and concession limits. Not much of this material was available to the map compilers in published form. However, official maps of the colony did appear from 1842 onwards, the most useful of which was the map published in 1913 at a scale of 1:633,600. Astronomical control was not a priority in the production of these official maps and if sources were not in agreement a best fit solution was applied. The region around Mt Roraima and the boundary with Venezuela was apparently compiled from the same sources that were used in compiling the map of 1908 by the Ordnance Survey and the region of the upper Mazaruni was adjusted from C. B. Brown's map to accompany the book *Canoe and Camp Life in British Guiana* published in 1876.

The AGS clearly recognised that the positions of the sources of the principal rivers and, as a consequence, the position of the boundary with Brazil were based on the early work of Schomburgk without reference to the work of Coudreau and Farabee (AGS 1933). Very little attempt had been made to map the topography even by approximate contours or form lines. It was not until 1924 that the Department of Lands and Mines published a one-to-one million scale map with form lines which replaced the hill shading of the 1913 edition which the AGS compilers regarded as "quite meaningless". The AGS compilers were not particularly impressed by the quality of this map claiming that the map was highly generalised in terms of its topography and where a distinction had been made between surveyed and unsurveyed rivers this had been done carelessly as rivers that were known to have been surveyed were shown in broken lines.

Other maps linked to mining in the area were used in the compilation. The region around the Callao goldfield, one of the richest goldfields in the world (Humphreys 1967), was derived from a map by Munoz Tebar. According to the compilation notes, judging by the

character of the map it was based on a survey of some kind but no information could be obtained by the AGS compilers and no astronomical positions were available (Figure 6). As a consequence the area had to be plotted directly from the Munoz Tebar map.<sup>16</sup> The Mazaruni River and its tributaries below Peaima Falls were taken from a sketch map of the Mazaruni Diamond Fields published in 1925 by the Department of Lands and Mines of British Guiana. The survey was not based on astronomically determined positions and was therefore plotted on the compilation by tying it to the position of the mouth of the Merume River as plotted on the adjoining Georgetown sheet (NB21).

Cartometric analysis of the Callao goldfield shows that whilst the accuracy of the map is high in terms of relative positional accuracy, there is a systematic error or shift in a south-south easterly direction of approximately 10 km for the area from its “true” absolute position. Such an error was to be expected as no astronomical positions were available in the area and therefore the Callao mining area had to be plotted directly from the Tebar map. No matter how accurate locations were relative to one another within the neat lines of the map, all locations would “float” in absolute terms without astronomically observed fixed points.

A boundary survey provided an important and relatively reliable cartographic source as it was typically conducted as a topographic reconnaissance using various approximate methods but based on solid triangulation. These surveys provided sufficient numbers of spot heights for contours to be interpolated at a sufficient level of accuracy for publication at 1:1 million.

However, though the boundary line between Venezuela and British Guiana had been surveyed and demarcated by an award of the International Arbitration Court at Paris in 1899, the survey had provided longitude and latitude observations of fixed points but was not based on triangulation. In 1900 the demarcation of the line was completed except for a section between the summit of Mount Roraima and Mount Venamo where a deviation from the line as defined by the award was suggested by the joint commission engaged on the demarcation of the line and was approved by the two governments. Important sources for the AGS emerged from these

proceedings including surveyed fixed points along the border plus maps of the Orinoco and Essequibo region compiled for the Commission for the United States Government investigating the “true divisional line” between Venezuela and British Guiana in 1897 and an atlas provided by Venezuela submitted to the Tribunal of Arbitration in Paris in 1899. In 1916 and 1917 a second joint commission completed the demarcation of this section of the boundary. The border between Venezuela and Brazil, although defined by treaty, had not been surveyed through the Sierra Parima and the Sierra Pakaraima and little was known about these ranges. Nevertheless, the borders offered at least some locations about which the AGS could be reasonably confident.

As new surveys were conducted the possibility of an extensive revision of the sheet grew stronger. In addition, the US Government’s interest in the Hispanic Map increased during the Second World War and the AGS worked under contract with the Army Map Service on the revision of sixteen sheets of Ecuador, eastern Cuba, Jamaica and north eastern Brazil from 1945 to 1952. As a result, a revised edition of the Roraima sheet was published in 1952 which demonstrates how quickly topographical detail provided by aerial surveys could be incorporated onto existing map sheets. A new category was added to the reliability diagram of the Roraima sheet in recognition of new aerial techniques which now included ‘reconnaissance air survey’ (Figure 7). Incorporation of this new material made a dramatic difference to the accuracy and detail of the new sheet, particularly in the poorly explored tributaries of the Orinoco such as the Caura and the Caroni thus addressing those areas that had hitherto undergone the rather more spurious process of cartographic ‘amplification’ as described by Wright (1942). The combination of both boundary surveys and air surveys of the Pakaraima mountains transformed the topographic and boundary depiction of the Venezuelan-Brazilian border. The “true” geography of Roraima was beginning to take shape.

## Conclusion

The first edition of the Roraima sheet was finally published in 1940, eighteen years after the publication in 1922 of the first Hispanic Map sheet depicting the area around La Paz (SE 19). Although this was one of the final pieces in the jigsaw of the Hispanic Map, the AGS documents suggest that the compilation process for this area began in the 1920s, long before work on some of the more easily mapped regions. However, all 49 maps listed in the Roraima compilation documents pre-date 1930 but curiously there is no evidence that any later material was incorporated into the final published map some ten years later. This long delay in publication perhaps reflected the problems confronting the AGS compilers outlined above and, of course, the partial and variable quality of the information about the region. But it was also a consequence of the constantly changing nature of evidence that became available to the AGS as the slow process of compilation was underway. While the evidence was limited to inaccurate earlier sources such as the CEB map or the less than entirely reliable exploratory surveys mentioned above, progress on the Roraima sheet and on those depicting other, equally remote parts of the continent remained painfully slow as the AGS cartographers were understandably reluctant to publish some sheets that were far less accurate than others.

The onset of widespread aerial reconnaissance, including the work carried out by American mining, oil and other corporations, finally transformed the AGS's evidence base and allowed the revised edition of the Roraima sheet to be completed. Far from assisting private companies in their attempts to exploit Latin America's seemingly limitless natural resources, the Hispanic Map was increasingly dependent on the information provided by these organisations.

In his official account of the Hispanic Map, published less than a decade after the last sheets were completed, J. K. Wright, the AGS Director at the time, emphasised that the order of sheet production for the least well mapped areas of Latin American was largely determined by the availability of new aerial reconnaissance information which had the power to transform entirely inaccurate compilations into highly authoritative map sheets (Wright 1952: 309).<sup>17</sup> As he

hinted, however, there was irony here for the Hispanic Map's depiction of more remote parts of Latin America, such as Roraima, ultimately relied on new forms cartographic information that would ultimately make such traditional, meticulously compiled map projects redundant. With the Cold War, production of million-scale mapping based on aerial reconnaissance would naturally shift from private societies to military organisations. In this sense, the Roraima sheet and the wider Hispanic Map project that it exemplified underline the complexities of American geography and American imperialism in Latin America during the 1930s. In seeking to create an accurate cartographic representation of Roraima, AGS cartographers revealed the contradictory values of progressive idealism and geopolitical calculation that characterised the American imperial vision of Latin America in this period.

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## Captions

Figure 1: Sheet NB 20 "Roraima" published in 1940 with sheet dimensions 70 cm (27.5 inches) x 63.5 cm (25.5 inches). Because the neat lines of each sheet were to coincide with the meridians, the size of the map sheets varied according to latitude. Three small-scale maps were included at the bottom of the sheet showing, from left to right, a "synoptic index" (international borders),

“relative reliability”, and “adjoining sheets”. The inclusion of a reliability diagram was an innovation by the AGS and one that became common practice on small-scale maps during the 20th century. Reproduced with permission from the American Geographical Society Library, University of Wisconsin-Milwaukee Libraries.

Figure 2: Relative reliability diagram together with key sources used during compilation from sheet NB20 published in 1940 by the AGS. Most of the surveys were “reliable traverses” along major rivers. Astronomical observations are principally along the international borders. However, the sheet relies heavily on existing compiled maps. Reproduced with permission from the American Geographical Society Library, University of Wisconsin-Milwaukee Libraries.

Figure 3: The Barima River as depicted on Dixon’s compass traverse (Dixon, 1895) (top) and the AGS million-scale map published in 1940 (bottom). The international border between British Guiana and Venezuela has been highlighted on both extracts. The border on Dixon’s map shows the provisional boundary between British Guiana and Venezuela as shown on Sir Robert Schomburgk’s Map of 1875. The horizontal green hatching depicts “Gold Districts”. The headwaters of the Barima as shown on Dixon’s map were estimated to be too far west by some 25 miles when compared to later official maps published by the British and the Venezuelans. The AGS simply reduced the scale of this section of the river to accommodate Dixon’s survey. The AGS map is reproduced with permission from the American Geographical Society Library, University of Wisconsin-Milwaukee Libraries.

Figure 4: “Carte Croquis du Cours de L’Orénoque de Bolivar au Rio Meta” (scale unknown) to accompany Jean Chaffanjon’s book (Chaffenjon, 1889). Despite its basic appearance, the AGS relied quite heavily on it for the Rio Caura. Reproduced with permission from the American Geographical Society Library, University of Wisconsin-Milwaukee Libraries.

Figure 5: Displacement vectors resulting from cartometric analysis. The displacement vectors are drawn to scale and indicate the difference in planimetric position between rivers located on the AGS sheet and the later Digital Chart of the World. The results demonstrate the difficulty that the compilers had in the mapping of the key river systems of the Caura, Erevato, Caroni and Paragua in the centre part of the map. The AGS map reproduced with permission from the American Geographical Society Library, University of Wisconsin-Milwaukee Libraries.

Figure 6: “Mines d’or du Yuruari, d’après la carte du Muños Tebar” at 1:425,000 scale and published in Elisée Reclus, *Nouvelle géographie universelle*, Paris, 1893, vol.18, p. 203. The AGS believed that this map was based on a survey of some sort. Though locations of towns are correct relative to one another, they were misplaced in absolute terms by approximately 10 km. Reproduced with permission from the American Geographical Society Library, University of Wisconsin-Milwaukee Libraries.

Figure 7: Relative reliability diagram from sheet NB20 Roraima published in 1940 (top) and 1952 (bottom). Note the new category “Reconnaissance air survey” and “Approximate sketches from air and ground traverses”. Advances in air survey had a profound impact on map accuracy. Reproduced with permission from the American Geographical Society Library, University of Wisconsin-Milwaukee Libraries.

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1 Other major cartographic works worthy of note include Antonio Raimondi’s *El Peru* of 1875, Mariano Felipe Paz Soldan’s “*Geografía del Peru* of 1865, Martin De Moussy’s *Atlas de la Confédération Argentine* of 1866, Theodor Wolf’s *Carta Geográfica del Ecuador* of 1892 and Aimé Pissis’ *Atlas Topográfico y Geológico de Chile* published in 1870.

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- 2 Platt (1927) recalls that Sievers' surveys in Ecuador and Peru, published in *Petermanns Geographische Mitteilungen* in 1915, had hitherto been regarded as works of great importance. However, they were found to be heavily reliant on Raimondi's maps of Peru and Sievers had only filled in rough details along his route.
  - 3 American Geographical Society-New York Records, AGS-NY AC 1, Box 135, Folder 16.
  - 4 American Geographical Society-New York Records, AGS-NY AC 1, Box 135, Folder 16 "History of Exploration of the Roraima Region", p. 11.
  - 5 See Pearson and Heffernan (2009) for analysis of the depiction of the border between Brazil and Venezuela on sheet NA20 "Rio Branco". The position of the border varied significantly between surveys conducted by the French explorer Jean Chaffanjon in 1886, Alexander Hamilton Rice in 1920 and Herbert S. Dickey in 1930 before pioneering air reconnaissance missions during the early 1940s settled the issue.
  - 6 Map entitled *Das quelland des Caroni and Cotinga*, by R.H. Schomburgk, published in 1847 at a scale of 1:1,250,000, in Schomburgk's book *Reisen in Britisch Guiana in den Jahren 1840-1844*, Leipzig.
  - 7 American Geographical Society-New York Records, AGS-NY AC 1, Box 135, Folder 16, "History of Exploration of the Roraima Region", p. 3.
  - 8 American Geographical Society-New York Records, AGS-NY AC 1, Box 135, Folder 16, "Roraima Sheet – Compilation", p. 9.
  - 9 Ibid, page 9.
  - 10 A road from Esmeralda to the Rio Erevato, a western branch of the Rio Caura, had been built and protected by a chain of military posts only to be destroyed by native tribesmen in 1776. No attempt had been made to re-establish these posts or the road since that date.
  - 11 Map entitled *Carte du Rio Caura et des missions qui ont été établies sur ses bords par les religieux de St. François, esquissée sur des matériaux fournis par les missionnaires de l'Orenoque en 1800* by Alexander von Humboldt, 1816. Scale 1:925,000. Plate 20 in the *Atlas géographique et physique des régions équinoxiales du Nouveau Continent*, Paris: Librairie de Gide 1805-1834.
  - 12 American Geographical Society-New York Records, AGS-NY AC 1, Box 135, Folder 16, "Roraima Sheet – Compilation", p. 7.
  - 13 See *Map Showing the Routes of the Expeditions on the Caura River* on page 310 of Eugène André, *A Naturalist in Guiana* (André 1904).
  - 14 American Geographical Society-New York Records, AGS-NY AC 1, Box 135, Folder 16, "Roraima Sheet – Compilation", p. 8.
  - 15 Software developed for the cartometric analysis of historical maps (Jenny 2006), MapAnalyst, enables us to compare the positions of points on the Roraima sheet with the same points depicted on a "modern" map which in this case is the Digital Chart of the World (DCW), an Environmental Systems Research Institute, Inc. (ESRI) product originally developed for the US Defense Mapping Agency (DMA) using DMA data. The relevant section of the Digital Chart of the World was adjusted to match the projection of the Roraima sheet prior to

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analysis. Points common to both the AGS sheet and the Digital Chart of the World were digitized and their positions compared using an affine (5 parameter) transformation.

- 16 “Mines d’or du Yuruari, d’après la carte du Muños Tebar” at 1:425,000 scale, in Elisée Reclus, *Nouvelle géographie universelle* (Paris, 1893) vol. 18, p.203.
- 17 There was a plan to organise an aerial survey of the Roraima region in 1930, using a new method that allowed mapping from oblique aerial photographs by Osborn Maitland Miller, one of the AGS’s most senior cartographers. However, this did not take place. See Anthony, Gleason and Platt (1931).