

**A MILDLY PIRATICAL BUT MOST MERITORIOUS ENTERPRISE: AN
EVALUATION OF THE AMERICAN GEOGRAPHICAL SOCIETY'S 1:1
MILLION MAP OF HISPANIC AMERICA (1920 to 1945).**

Alastair Pearson

Department of Geography,
University of Portsmouth,
Buckingham Building, Lion Terrace,
Portsmouth PO1 3HE, UK.
alastair.pearson@port.ac.uk

Mike Heffernan

School of Geography,
University of Nottingham, University Park,
Nottingham NG7 2RD, UK.
mike.heffernan@nottingham.ac.uk

ABSTRACT

The years prior to the World War I were characterized by unprecedented increases in global trade, fuelled by developments in communications and long-distance transport. However, this 'globalization' of trade had not been matched by any parallel development of standardized topographic maps of the world. Indeed, published maps of different parts of the world were so inconsistent in style that they had become an obstacle to economic development and scientific analysis. In response, a proposal to construct a standard international map was presented at the Fifth International Geographical Congress (IGC) in Berne, Switzerland, in 1891. This paper evaluates the contribution that the American Geographical Society's Map of Hispanic America made to 'global mapping'. Detailed technical analysis of a selection of map sheets reveals the enormous challenge that faced the map compilers in achieving sufficient levels of accuracy but also demonstrates the high levels of skill and dedication that were employed to overcome them. Despite its many failings, the IMW and the Hispanic Map survived as serious international scientific projects for three quarters of the twentieth century. Perhaps their real impact lies in the wider lesson it teaches us about the potential of international cooperation. Its ultimate failure reflected the fragility of international relations during a tumultuous century in which the realities of national self-interest rather than science dominated.

CONTEXT AND ORIGINS

The International Map of the World

The specific origins of the 1:1 Million Map of Hispanic America can be traced back to the idea to create an International Map of the World (IMW), first mooted by German geographer Albrecht Penck in 1891 at the 5th International Geographical Congress in Bern. The era of continuous imperial expansion was coming to an end and many feared the twentieth century would herald an era of imperial collision, a premonition that would prove tragically accurate. For Penck and many others, this was avoidable only through determined international co-operation, particularly in science. If the world could be mapped afresh, at a common 1:1 million scale, with standard conventions and symbols, through the collaborative endeavour of all major national cartographic agencies, this would play a small part in creating new, inspirational image of a common globe and a common humanity. It would have huge value scientifically, reasoned Penck, by replacing chaos of existing national cartographic styles and conventions by at least one common, universal map (Penck, 1893).

The idealism, even utopianism, that underpinned this idea appealed greatly to Americans, both North and South, who were prominently involved in initial discussions about the IMW at successive International Geographical Congresses. However, the United States, to the surprise and dismay of other delegations, effectively withdrew, fearing the ‘entangling alliances’ so often invoked by its isolationist tendency but also by its frustration with the painfully slow progress being made by suspicious and often openly antagonistic national agencies.

The Map of Hispanic America at 1:1 Million

The absence of the USA from the IMW programme provided Isaiah Bowman, Director of the American Geographical Society, with a perfect opportunity to initiate another equally ambitious scheme of great national and international significance – a 1:1 Million Map of Hispanic America. Bowman argued that though field work had its scientific merits “there comes a time in the history of every subject when a broad and critical synthesis may be of even more value” to support “synthetic and comparative studies of a high order” (Bowman and Ogilvie, 1922, p.ix). Bowman’s aim was to provide a series of maps “of high quality so that from them and the collateral knowledge gained in their production there shall flow a series of truly scientific papers in the field of regional geography” (Bowman and Ogilvie, 1922, p.xi). Handbooks based on fieldwork were planned to accompany each map and would be guided by the knowledge gained from the compilation of the maps. This idea chimed perfectly with one of the AGS’s richest supporters, Archer Milton Huntington, heir to the great railway fortune, who was fascinated by the Hispanic world and whose wealth had already paid for the remarkable complex of museums and research institutes around 156th Street and Broadway within which the AGS was now palatially accommodated. Huntington provided an initial payment of \$25,000 to begin work on the map compilation and would eventually supply almost half the total amount, well in excess of half a million dollars (Wright, 1952).

The 1:1 Million Map of Hispanic America was a compiled map, and therefore assembled painstakingly using extant information gathered from existing maps and other published and unpublished materials assembled from libraries, research institutes, private collections and (latterly especially) major corporations and the business sector who had commercial interest in, and knowledge of, the region. The project was overseen by Alan Grant Ogilvie, a young Scotsman who returned to Edinburgh as Chair of Geography in 1923, followed by Raye R. Platt, who led the programme and the Hispanic American Research Department until 1938 when succeeded by Charles Hitchcock who saw things to their conclusion. Beginning in 1920, it took an average of 7 staff, including compilers, editors and draughtsmen 25 years to complete the 107 maps that make up the series (Anon, 1946). The overall cost of the project was \$570,000 of which \$435,000 went on salaries and the remaining \$135,000 was spent on engraving and printing. It thus constitutes one of the most expensive mapping programmes ever undertaken and was certainly the most expensive by the time it was finished in 1945. Conservative estimates would estimate the total cost to be equivalent to approximately \$16 million today.

MAP SOURCES

The AGS entered into correspondence with governments, mapping agencies, societies, companies and individuals in order to procure as complete a set of documentation as possible. Raye Platt spent eight months in 1924 and 1925 explaining the Society's programme to the various Latin American governments and obtaining permission to consult unpublished surveys in departmental archives. It was important to make 'new friends' to ensure that the Society was notified of new material (Platt, 1927).

The AGS were acutely aware of the variability of the source data and were meticulous in their cataloguing of the sources, publishing a four-volume catalogue between 1930 and 1933 (AGS, 1930-33) that provided a map of the extent and nature of surveys for each country, together with a comprehensive list of over 8,000 entries under the headings 'Maps in scientific periodicals', 'Maps in books', 'Sheets and atlas maps (official)', 'Sheets and atlas maps (unofficial)' and finally 'Historical maps'.

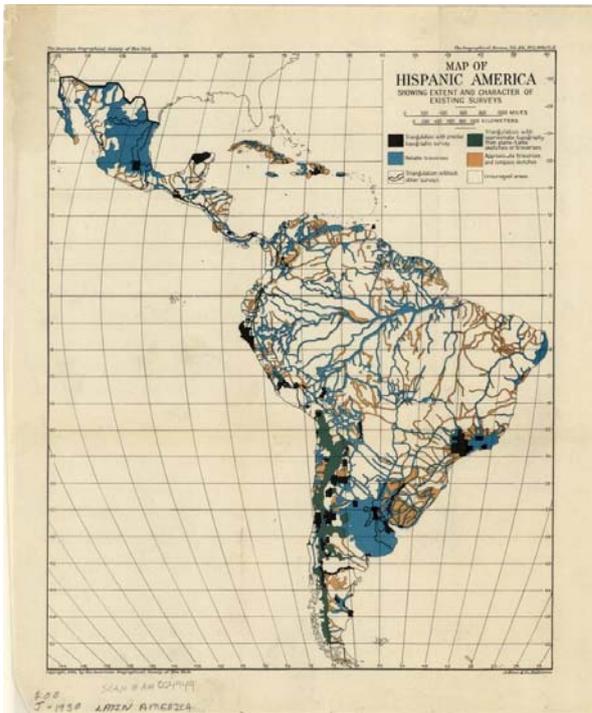


Figure 1: Map of Hispanic America showing the extent and character of existing surveys

Sources were classed according to whether they were based on surveys or derived from existing maps. Many maps were simply compilations derived from a multitude of unknown sources. Those based on surveys were further subdivided according to the survey method: Triangulation with precise topographic survey; reliable traverses; triangulation of approximate topography from plane-table sketches or traverses; approximate traverses and compass sketches. A reliability diagram, using this classification, was included on each 1:1 million sheet at a scale of 1:10 million, a significant innovation unique to the Hispanic Map. The AGS later published a ‘Map of Hispanic America Showing the Extent and Character of Existing Surveys’ (Figure 1) in 1930 (Platt, 1930). The distribution of more reliable mapping was strongly focused on the great rivers, national borders and surveys associated with agricultural settlement. For the areas labelled ‘unsurveyed’, great reliance was placed on existing compiled maps.

MAP DESIGN

The AGS decided to adopt a modified form of the IMW specification which had eventually emerged from lengthy deliberations prior to the London conference in 1909. Though a final and supposedly binding specification had been published in 1913 (Service Géographique de l'Armée, 1914), the IMW Committee had been powerless to prevent local interpretations as it was keen to maintain the contribution of all participating countries thus safeguarding one of the key principles of the whole project,

that sovereign states should publish their own IMW sheets. Furthermore, no country could take it upon itself to map foreign territory unless that country lacked adequate cartographic capacity of its own.

The AGS adopted the same projection as that of the International Map. The modified polyconic projection maintained sufficient accuracy and was simple to construct. The projection, devised by Ferdinand Hassler in 1820, had a straight, central meridian that was true to scale. The projection is neither conformal nor equivalent but near the central meridian it has the characteristics of each and the scale error is less than 1% at any point within 560 miles of the central meridian. Each sheet covered 4 degrees of latitude and 6 degrees of longitude which meant that 107 sheets would have to be completed to cover the whole of Latin America, including the West Indies. The sheet numbering system was identical to that devised for the International Map.

The AGS clearly wished to avoid the lack of consistency with which the various contributors had so far adopted the original IMW specifications. The representation of relief through layer tints demonstrated this lack of consistency very graphically indeed. Though the colour scheme would later change after the first edition of the AGS sheets, the Hispanic Map never suffered from these same problems. The sequence might be described as a modified spectral scale based on the 'the higher, the darker' principle. Light colours were chosen for lowland regions, though the initial use of green for the lowest altitudes is an exception to this rule. The selection of a fine gradation of darkening shades of beige through terracotta red to brown for the highest altitude conformed to the growing consensus that this colour was most appropriate for the vegetation-free surfaces of mountainous areas (Figure 2). Clearly, such a fine gradation of colour, up to fourteen individual inks, was going to be expensive to print.

Symbolization of natural and cultural features remained reasonably constant throughout the production of the first edition. Any changes tended to be refinements towards more delicate and mimetic symbols. However, major vegetation classes such as forest and woodland were absent. Clearly, there was no confidence that information of sufficient accuracy would be available for its correct depiction and in any case it was for this type of information that the Hispanic Map was to form a base. Pecked lines were employed for un-surveyed rivers and approximate contouring. Lettering on the Hispanic Map was done by hand with serif fonts being used for cultural place names and sans serif fonts for natural features. By the 1930s lettering had become more sophisticated and a hierarchy of font styles was applied to towns according to population size.

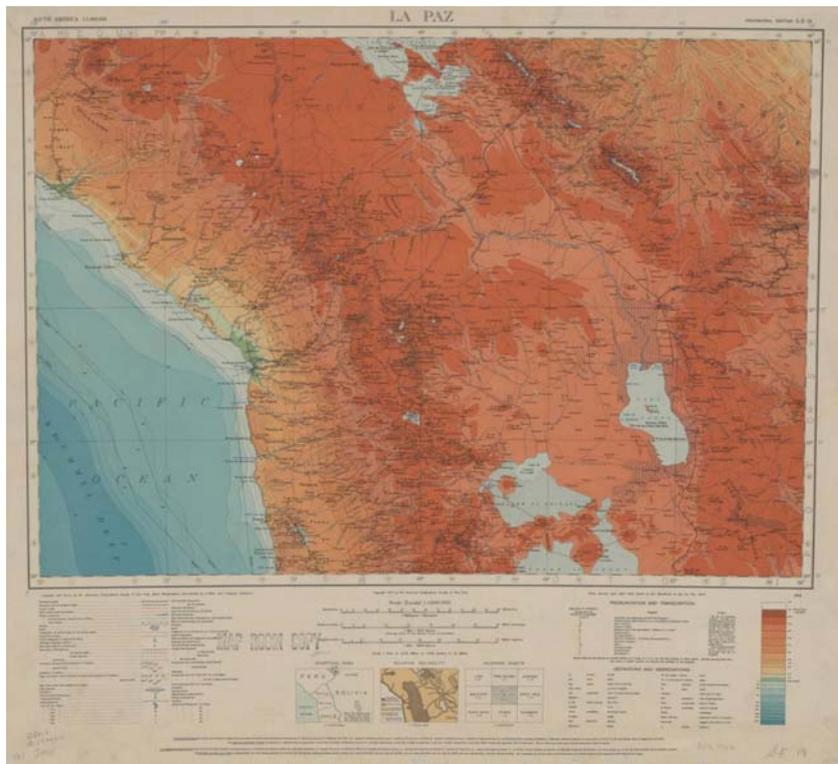


Figure 2: Sheet SE 19 ‘La Paz’

CARTOMETRIC ANALYSIS

We commence our cartometric analysis with the first of the 107 sheets to be published by the Society – Sheet SE 19 ‘La Paz’ (Figure 2). Alan Ogilvie published his ‘Geography of the Central Andes’ to accompany the sheet in 1922 which was compiled by William A. Briesemeister under his direction. As a starting point, the La Paz sheet offered, together with its adjoining sheet Santa Cruz, an opportunity to map an area at a point where the Andes is at its widest and of great natural diversity. Furthermore, the region was familiar to Bowman who had conducted field studies in the Central Andes in 1907, 1911, and 1913 thus providing first-hand knowledge of the geography of highland Bolivia and Peru as well as the lowlands on either side. It was also an area for which the cartographic sources were comparatively rich.

Ogilvie recognized the problems of creating a derived map using compilation material of such a diverse nature. Although every effort was made to collect and collate all published maps and unpublished survey material, the map was evidently not going to be uniformly reliable. Hydrographic surveys and triangulated surveys were available. British charts of the coast line based on the surveys in 1836 by H. M. S. Beagle together with the Chilean plans of small areas provided the coastal and hydrographic data for the La Paz sheet. Triangulation of all the principal peaks of the Western Cordillera south of latitude 17° was undertaken by the Chile-Bolivia Boundary Commission which published sheets between 1908 and 1912 at a scale of 1:250,000. The survey was

connected to the coast at Arica and Iquique. Two smaller surveys were based on triangulation, the French commission in the service of the Bolivian government 1902-1903 and Conway's triangulation and survey of the Cordillera Real made in 1898 and published at a scale of 1:500,000 in 1900. Other surveys regarded as reliable included the triangulation and survey of the Pampa de Salinas east of Arequipa made in 1906 together with a survey of the nitrate district in the south-western corner of the area incorporated within the 1:500,000 sheets published by the Chilean Oficina de Mensura de Tierras in 1910.

Other major sources included surveys by explorers and mineral prospectors. Such surveys, though considered sufficiently accurate as compilation material, were adjusted to conform to maps surveyed to a higher level of accuracy. For example, John B. Minchin conducted several traverses based upon a series of astronomical observations with chronometer longitudes in 1875 across the Altiplano and south eastward to Potosí, Bolivia and later of the Bolivian table land, west of Lake Poopo. Several compass traverses, a popular and expedient method of survey at the time, were adjusted to these known points. For example, the Minchin survey was supplemented by an unpublished compass traverse by A. P. Rogers from Challapata to Colquechaca together with two compass traverses by Adolfo Siles from Oruro through San Pedro to Colquechaca and from Potosí to Challapata. Use was also made of the compass traverse by Steinman, Hoek, and von Bistram 1903-4 entering the area from the east and reaching nearly to La Paz. This survey was used mainly for topographic detail as the survey was based upon just a few fixed points. According to Ogilvie, two compass sketches by Herzog in 1911 of mountain groups, the Quimsa Cruz and the Cordillera north-west of Cochabamba were accepted in almost their entirety. There were few checks on the accuracy of scale but it was believed to provide satisfactory representations of the mountains shown as form lines which agreed with known descriptions of landforms. For the area of the eastern slopes of the Cordillera Real, north of the Quimsa Cruz range, data was obtained from a compass reconnaissance and later stadia survey of the Yungas railway, a geological reconnaissance of the foothills, and a road survey.

With such a variety of source material it was important that all this information be compiled within a framework of suitably accurate points. However, Ogilvie bemoaned the lack of geographical positions of sufficient accuracy, a condition that was especially serious with respect to longitude. Whilst the hydrographic surveys of the coast were deemed to be of relatively high accuracy, the positions of places to the east of the Western Cordillera supplied by Bolivian official publications differed significantly from those surveys conducted by Pentland and Minchin. Reliable points were few and far between and many of them were in areas beyond the neat lines of the La Paz sheet.

According to Ogilvie, the coastline was adjusted to the longitude of Iquique (to the south of the La Paz sheet), as provided on the map of the Departamento de Tarapacá, 1:25,000, Oficina de Mensura de Tierras, 1918. Iquique was therefore repositioned some 1' 21" east of its position as shown on Admiralty Chart No. 1278. The points

surveyed by Minchin were adjusted in longitude to conform to the accepted positions of Sucre and Oruro (the latter to the east of the La Paz sheet) determined by time signal by Steinman and Hoek. Ogilvie recognized the importance of obtaining a skeleton of high accuracy points from the Pacific Coast to the eastern foot of the Andes. The only reliable source available was P. H. Fawcett's survey carried out on behalf of the Bolivian government. His survey began at Puno on Lake Titicaca, the position of which was known relative to Arequipa, and continued across the Brazilian border, thus providing a significant number of surveyed points for the La Paz and Santa Cruz sheets. However, even when reliable surveys had been completed, it was difficult to obtain the original survey materials. Colonel Fawcett's results were published in 1915 as a preliminary map of small scale (1:3 million) and with no survey records apart from the plotted points. Fawcett's larger scale plots were made available to AGS from the RGS in London but anything beyond this was unobtainable as Fawcett had embarked on another expedition to Brazil (from which he would never return!). Fawcett's positions were therefore only accepted where they agreed closely with other surveys, and where no original survey was available. The position of Cochabamba on the eastern fringe of the La Paz sheet was a concern given the discrepancies between published maps and the co-ordinates given in the Anuario Estadístico y Geográfico de Bolivia. The position on the AGS map used the coordinates provided by the Anuario Estadístico y Geográfico de Bolivia as they agreed closely with the position of the city as shown on Fawcett's map. As a result the city was moved 13 minutes to the east of its position as shown on most other maps. Cartometric analysis of the La Paz sheet should therefore reveal how successful these adjustments were and help us to evaluate the level of success the AGS achieved in pulling together such diverse sources. MapAnalyst enables us to compare the positions of points on the La Paz 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 Hispanic Map prior to analysis. Points common to both the AGS sheet and the Digital Chart of the World were transformed

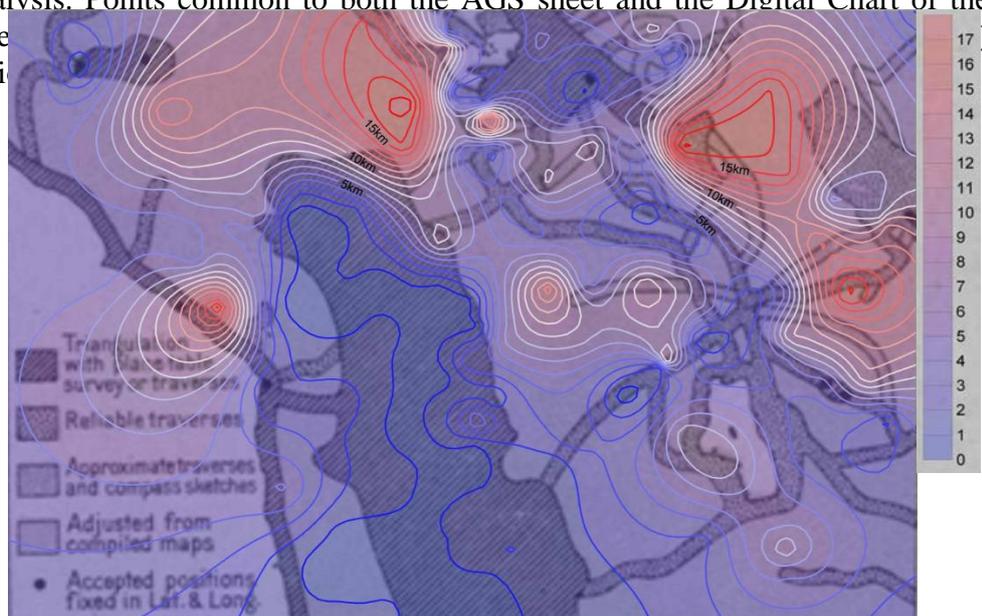


Figure 3: Diagram illustrating the error isolines (kms) superimposed on the 1:10 million reliability diagram

Results demonstrate that we can use the Hispanic Map's reliability diagram with some confidence (Figure 3). The 177 points used in the analysis yielded a mean error of 4.64km with a standard deviation of +/-4.2km. Errors within the zones labelled 'Triangulation with plane table-survey or traverses' and 'Reliable traverses' are generally smaller than those classed as 'Approximate traverses and compass sketches'. The area surveyed by the Chile-Bolivia Boundary Commission demonstrates exceptional levels of accuracy with positions of prominent peaks and major towns having a mean positional error of just 0.9km (0.9mm on the map), and an accuracy level that deteriorates to just 1.49km when we add points within areas of triangulated surveys along the coast and in the areas of Arequipa and southeast of Lake Titicaca.

However, outside of these triangulated surveys, the difficulties of establishing 'true' geographical position become clear as mean positional error is 7.8km with a standard deviation of +/-5.5km. The village of Araca in the Cordillera de Quimsa Cruz has the dubious honour of being in the wrong position by the greatest margin, some 17.4km northwest of its 'true' position, followed closely by Huacullani to the southwest of Lake Titicaca at 17.3km and Colcha to the south of Cochabamba at 16.6km.

Nevertheless, it is the broad trends with which we should be more concerned and Ogilvie's concern for longitude is certainly borne out by the results which show a consistent longitudinal drift (see Figure 4). Divergences are most significant in the Cochabamba area where, in retrospect, the decision to move its position 13 minutes further east was an overcompensation as the town was only 7 minutes west of its true position. Several other towns and villages in the area were adjusted similarly thus providing errors of similar magnitude.

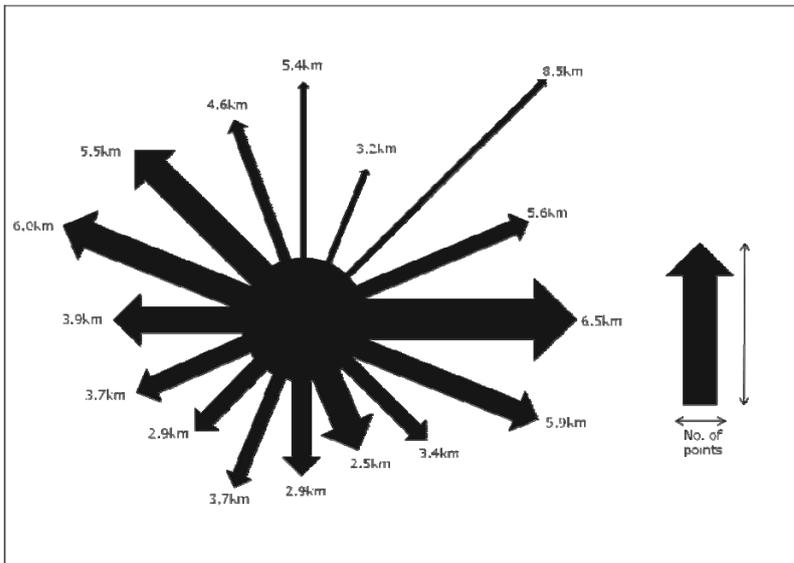


Figure 4: Distances from 'true' positions for 16 points of the compass rose. Width of arrow denotes number of points; length represents the mean distance.

Further use of the software can also throw light on the degree of similarity between source materials and the AGS sheet. For example, Ogilvie makes it clear that substantial reliance was placed on Minchin's survey of 1882, a fact confirmed by the analysis of his map in comparison with the AGS sheet. Differences between the two sheets are minimal. Cartometric analysis thus substantiates Ogilvie's misgivings regarding the variable accuracy of the source material and the reliability of the known points. So thin was the coverage of reliable survey data that the compilers had very little information with which to corroborate plan positions and therefore were compelled to rely on the notional accuracy of the survey methods employed and the reputation of the individual or agency that undertook the work. That the reliability diagram conforms so closely to the cartometric results suggests that the compilers' faith in their own judgement of source quality was not misplaced. The consistency with which the AGS staff succeeded will be assessed as more sheets are analysed.

CONCLUSION

To celebrate the final completion of the Hispanic Map, the AGS organised a lavish dinner on 19th December 1945 in the Rainbow Room of the Rockefeller Center in New York, an event attended by diplomats, ambassadors, government officials and heads of educational and research institutes from across the USA and Latin America, including Assistant Secretary of State Spruille Braden who made a powerful speech in praise of the map and the Society and concluding with a rousing call for 'a millionth map of statesmanship to guide us in every field of international endeavour – social, economic, and political'. Bowman used his acceptance speech to wax lyrical about cultural significance rather than the map's practical utility. The Hispanic Map was a genuine work of art whose lines, colours and symbols were, Bowman claimed, more than mere cartographic conventions; 'they are inciters of the imagination that bathes all records

with interest... Thus science, art, history and imagination meet on this map, and all of them went into its making and were part of its inspiration’.

However, like any project conceived and executed over such a long period of time, it was ultimately superceded by the very technologies and practices that had enabled it to come into existence in the first place, notably so in the case of aerial survey and reconnaissance which provided a new source of data to begin with but which ultimately compromised the need for this kind of painstaking map compilation.

ACKNOWLEDGEMENTS

This research is funded through the Helen and John S. Best Research Fellowships and the McColl Research Fellowships, AGS Library, University of Wisconsin-Milwaukee. Many thanks to all the staff of the AGS Library for their invaluable and continuing support.

References

AGS (American Geographical Society) (1930-33), *A Catalogue of Maps of Hispanic America including maps in scientific periodicals and books and sheet and atlas maps with articles on the cartography of the several countries and maps showing the extent and character of existing surveys* (4 volumes, AGS; New York, 1930-33). Volume I: Mexico, Central America, West Indies (1930); Volume II: South America, Columbia, Ecuador, Peru, Bolivia (1932); Volume III: Venezuela, the Guianas, Brazil, Paraguay (1933); Volume IV: Argentine Republic, Chile, Uruguay (1932).

Anon, (1946). ‘The Map of Hispanic America on the Scale of 1:1,000,000’. *The Geographical Review*, 36, 1-28.

Bowman, I. in A. G. Ogilvie (1922). *Geography of the Andes: A Handbook to Accompany the La Paz Sheet of the Map of Hispanic America on the Millionth Scale*. Map of Hispanic America Publication No.1. New York; The American Geographical Society, 1922, p. ix.

Ogilvie, A.(1922). ‘Geography of the Andes. A Handbook to Accompany the La Paz Sheet of the Map of Hispanic America on the Millionth Scale’, American Geographical Society Map of Hispanic America Publication No.1, New York; The American Geographical Society, 1922.

Penck, A (1893) ‘Construction of a map of the world on a scale of 1:1 million’ *The Geographical Journal* ,1, 253-61

Platt, R.R. (1927). ‘The Millionth Map of Hispanic America’. *The Geographical Review*, 17, 301-308.

Platt, R.R.(1930). 'Surveys in Hispanic America: Notes on a New Map Showing the Extent and Character of Surveys in Hispanic America'. *The Geographical Review*, 20, 138-142.

Service Géographique de l'Armée (1914). The specifications were published as *Résolutions. International Map of the World 1914 Carte du Monde au Millionième: Comptes Rendus des Séances de la Deuxième Conférence Internationale, Paris, Décembre 1913*, Paris: Service Géographique de l'Armée, 1914.

Wright, J. K. (1952). *Geography in the making: The A.G.S. 1851 – 1951*. New York: American Geographical Society.