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## A new digital comparison of the Chinese World Maps of Giulio Aleni and Matteo Ricci

*Keywords:* Giulio Aleni, Matteo Ricci, World Map, China

*Summary:* The cartographic contents of two world map sheets of father Giulio Aleni S.J., archived in the Biblioteca Apostolica Vaticana in Rome, are digitally analysed. The maps, printed in at least two editions starting in the year 1623, were inspired and influenced by the more famous Matteo Ricci's world map, printed in different versions, after the end of the XVI century. Although it is a later cartography, the Aleni's world map is a unique masterpiece worldwide, as it is very likely the first map of the world known at that time, written in Chinese and having a size enabling an easy use of the map itself. It is a map that merges the Western and Chinese geographical knowledge and is a relatively accurate representation, with some exceptions, of the actual outlines of continents which are depicted, as in the large Matteo Ricci's world map, from a non-Eurocentric point of view. Arriving at Macao in the Jesuits' mission in 1610 Aleni taught mathematics at the college there, while learning the Chinese language. At the Ming's court he was asked to write a geographical book describing countries depicted in the Matteo Ricci's world map (RWM). Annexed to the book, named 職方外紀 (Zhifang waiji, Geography of countries non-tributary to China) printed in 1623, he edited the two world maps with Chinese characters, definitely inspired by that of his famous predecessor, but with some significant differences. The two maps sheets (one 630 x 552 mm and the second 1230 x 642 mm in size) are analysed and the cartographic content of the Aleni's planisphere (AWM) is compared with that of RWM. Differences in continents' borders, as those for North America, Korea, Java, are assessed, together with some discrepancies between geographical terms which pose the question of the sources Giulio Aleni investigated. Some conjectures about the correct dating of the edition of the map, to be set between 1623 and 1649, are also discussed. A facsimile high-quality copy of the maps was printed by the University of Brescia to better disseminate this important cartographic heritage.

### Introduction

Two copies of the world map made by Fr. Giulio Aleni, S.J. are preserved in the Vatican Apostolic Library in Rome. This world map, edited and updated as from 1623, was inspired and influenced by the more famous, large world map of Matteo Ricci, which was printed in China in several successive editions starting from 1584 (D'Elia, 1938; Livieratos, 2016). Although it represents a later edition, Aleni's smaller world map constitutes a masterpiece that is unique to all the world, since it was the first map of the then known lands written in Chinese, published in a book and made in a size conducive to practical consultation for a general public. A fruit of combined geographical knowledge from both China and the West, the map affords a relatively accurate illustration of the actual boundaries of the continents (albeit with some exceptions), which are depicted, as in Matteo Ricci's world map (RWM), from a non-Eurocentric point of view. In this

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study, after a brief recall of the history of the Aleni World Map (AWM), we compare it with the older RWM as far as the basic geometric map elements are concerned, primarily the coastline and the reference projection. This comparison followed the mainstream digital methods and techniques applied in relevant studies, confirming the general pattern of differences found much earlier by analogue methods.

### **About Giulio Aleni: from Brescia to China**

Giulio Aleni was born in Brescia in 1582 to a family which became part of the Brescian nobility in the fifteenth century. The family name was Alenis, because of a distant connection to the village of Leno. Aleni received his education in Jesuit institutions, first in Brescia, then in Novellara and in Parma, where he became a pupil of Giovanni Biancani, a scholar of Galileo Galilei. Biancani inspired in Aleni a passion for astronomy. In 1606, he was sent to Bologna to teach literature at a school for the nobility. It was here that he read Antonio Magini's geographical works, which later became the main source of his geographical publications. In December of 1607, Aleni went to Rome to study theology at the Jesuit's Roman College, where he also had the opportunity to pursue studies in mathematics and astronomy under the tutelage of Cristopher Clavius.

In 1609, Aleni's request to be sent as a missionary to the Indies was accepted. Aleni's assignment to the East also responded to an appeal from Matteo Ricci, who had repeatedly asked that a missionary who was likewise a "good astrologer" and "mathematician" be sent to help him. Arriving in Macao in 1610, Aleni taught mathematics at the Jesuit college there and began studying the Chinese language. By 1613, on a trip to mainland China, he reached as far as Beijing, where he met Xu Guangqi, former secretary and minister of the emperor, as well as scientist, friend and collaborator of Matteo Ricci. With the court of the Mings, dominated by the eunuchs, the period of decadence had begun. Xu retired to his ancestral home in Shanghai and asked Aleni to accompany him. In the following years Aleni carried out his mission in Nanjing. From 1621, he lived in Hangzhou, where, under the guidance of Yang Tingyun, he acquired such a mastery of Chinese language and literature that by 1623 he was able to publish some of his most important treatises: *Geography of countries non-tributary [foreign] to China*, *A general account of Western studies*, *Map of ten thousand countries*. In 1624, he also wrote *The Compendium of psychology*, but this work would not be published until 1646, in Fujian. In 1624, Ye Xianggao retired from his office as secretary to the emperor, and invited Aleni to accompany him to his native province of Fujian, where Aleni remained until his death in 1649. While the Manchu invaded China from the north and riots broke out against the Ming emperor, Aleni continued his missionary activities and published books from a range of disciplines, scientific, philosophical, and religious, as *Discussions of Fuzhou*, *The true origin of all things*, *Principles of geometry*, *Questions and answers about the west*, *Illustrated life of our savior Jesus Christ*. He thus made a significant contribution to cultural exchanges between the two worlds. Today, Giulio Aleni is still respected and honoured in China for having distinguished himself, in the 38 years of his life in that country, by his ability to propose elements from Western culture, while at the same time sharing and harmonizing them with local traditions in a respectful and non-discriminatory way (Zürcher, 1997). While he was still alive, the Chinese literati dedicated a collection of over 70 poems to him, whom they called, "Confucius of the West", in reference to his particular attention to Asian sensibilities while he shared his wisdom. At present, it does not seem to be an exaggeration for us to call him also the "Marco Polo of Brescia", ambassador of European culture and civilization in

the Far East and in the world, and as such, a muse for the modern approach to the process of globalization. He had a dream: *“Gradually will it transpire that the learning of the sages from the East and West merge into one.”*

### The two world maps kept in the Vatican Apostolic Library

During his 38 years living in China, Aleni wrote many works in Chinese, including the aforementioned 職方外紀 (Zhifang waiji, Geography of countries non-tributary to China), the first book produced by missionaries in Chinese on the geography of modern world. Giulio Aleni was asked to write a book describing the geography of the World depicted in the RWM by the Ming's imperial court, after some early collaborators of Matteo Ricci, Fr. Diego de Pantoia and Sabatino de Ursis, organised some material for its preparation (De Troia, 2009). This work has significantly influenced the Chinese perception and understanding of the world (Masini, 1997). The first edition of the book, which contains the world map with polar projections, was printed in Hangzhou in 1623. Very few copies of the world map survive today, in two different editions: the version of the Biblioteca Ambrosiana, published in 1623 with the Zhifang waiji, the two Vatican copies (Fig. 1 and Fig. 2) and the one in the Biblioteca Braidense (Fig. 3), both of them most likely published after 1644, for the reasons discussed later.

The first Vatican copy (1a) contains two parts: the introductory text written by Aleni and the oval planisphere, which for the most part corresponds to the arrangement of the world map designed by Matteo Ricci, with China placed near the centre. Unlike Ricci, who sets the equatorial zones, the longitude and the poles in a scientific and technical perspective in the margins of his map, Aleni, in his introduction to the world map, offers his Chinese readers some concepts of philosophy and catechism. The boundaries of the continents are painted in colour by hand, and the Anatolian peninsula is associated with Asia in yellow colour, as is Cyprus to Europe, in red. This use of five colours (red, yellow, pink, blue and green) to delineate cartographic boundaries was an innovation introduced in China by Aleni, as mentioned, for instance in one of his “Dialogues” written in 1637, where he explains the meaning of colours to differentiate the five continents. Some slight differences in colouring can be noticed between the Vatican and the Braidense libraries versions. In the latter, for instance the Anatolian peninsula has the red colour for Europe and the boundary between Europe and Russia is marked less precisely. In the Vatican copy the Salomon Islands are associated, in pink colour, to the American continent instead to Asia, as in the Braidense. The second Vatican copy (1b), in black and white, is larger in height and contains three parts: besides the introductory text and the oval planisphere, there are also two polar projections in the lower area, one relative to the southern hemisphere, with the “Magellanic” continent, and the other relative to the northern hemisphere. As discussed, for instance in Yu et al. (2018), from the study of toponyms, it appears that, on the oval planisphere, the territory of the Chinese empire is called the “Great Qing Empire” (大清一統), while the sea of China is called, “Sea of the Great Ming” (大明海). In the planimetry of the northern hemisphere of copy 1b, however, both the empire of China and the Chinese Sea are called “Great Ming”. In addition, comparisons with the Ming edition of the Ambrosian copy reveal that some toponyms have been modified, while others have been omitted or added. As for the two Vatican copies, we may also note that the toponyms of the two hemispheres are considerably more numerous than those on the planisphere, including many that are not mentioned in the book, Zhifang waiji, nor in the world map of Matteo Ricci.

We may conclude, then, that this new edition was not just a simple revision effected for the name of the new dynasty, but rather a new edition with a revision of its contents. The fact that in the

oval planisphere, only the denomination of the territory of China was changed from "Great Ming" to "Great Qing", and the China Sea remains as "Great Ming", while in the hemisphere both remain "Great Ming", could be interpreted as a sign of Aleni's particular attention to the delicate question of dynastic changes in the planisphere. This was a rather neglected aspect in revising the smaller representation of the Ming version of the polar projection. For a more thorough treatment of the topic, see 龔纓晏, 艾儒略 "萬國全圖" 研究 in 澳門 歷史 研究 第 14 期 (2015 年 11 月, pp. 54-72). Both Vatican copies which come from the Barberini family library are kept in the fondo Barberini Orientale. The first unit of these volumes can be credited to the collection acquired by Maffeo Barberini, then Urban VIII (1623-44). At the behest of Leo XIII (1878-1903), the Barberini library was purchased for the Vatican Library in 1902.

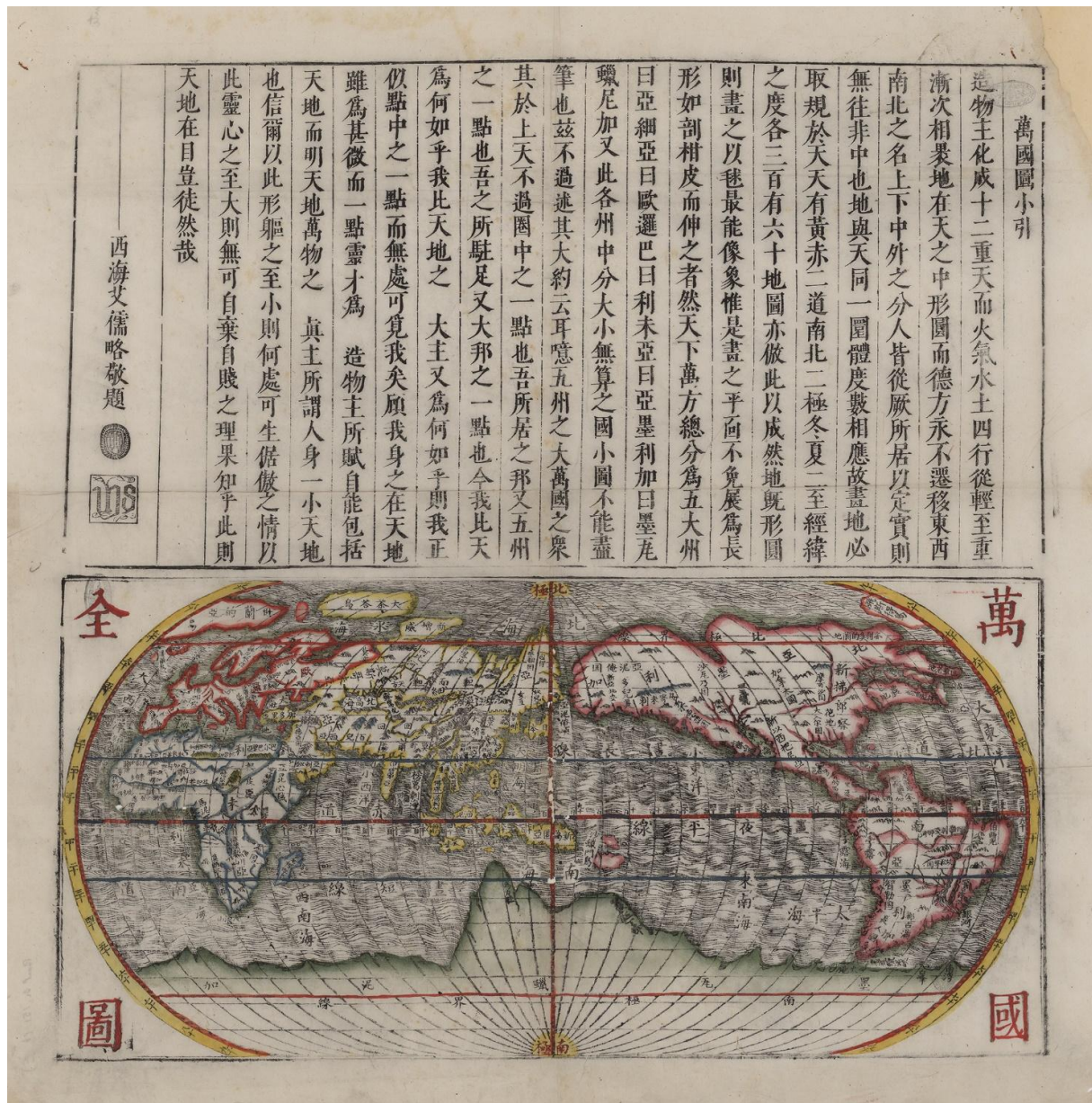


Figure 1. The World Map [Wànguó Quántú (万国全图)] of Giulio Aleni, S.J. [Ai Rulüe (艾儒略)] (Brescia, 1582 - Yanping 1649), archived in the Vatican Apostolic Library in Rome [Barb. or. 151, pt. 1 (1a)]. Size of the original coloured map sheet: 630 x 552 mm, printed on 'Chinese paper'. Courtesy of ©Biblioteca Apostolica Vaticana, Città del Vaticano.



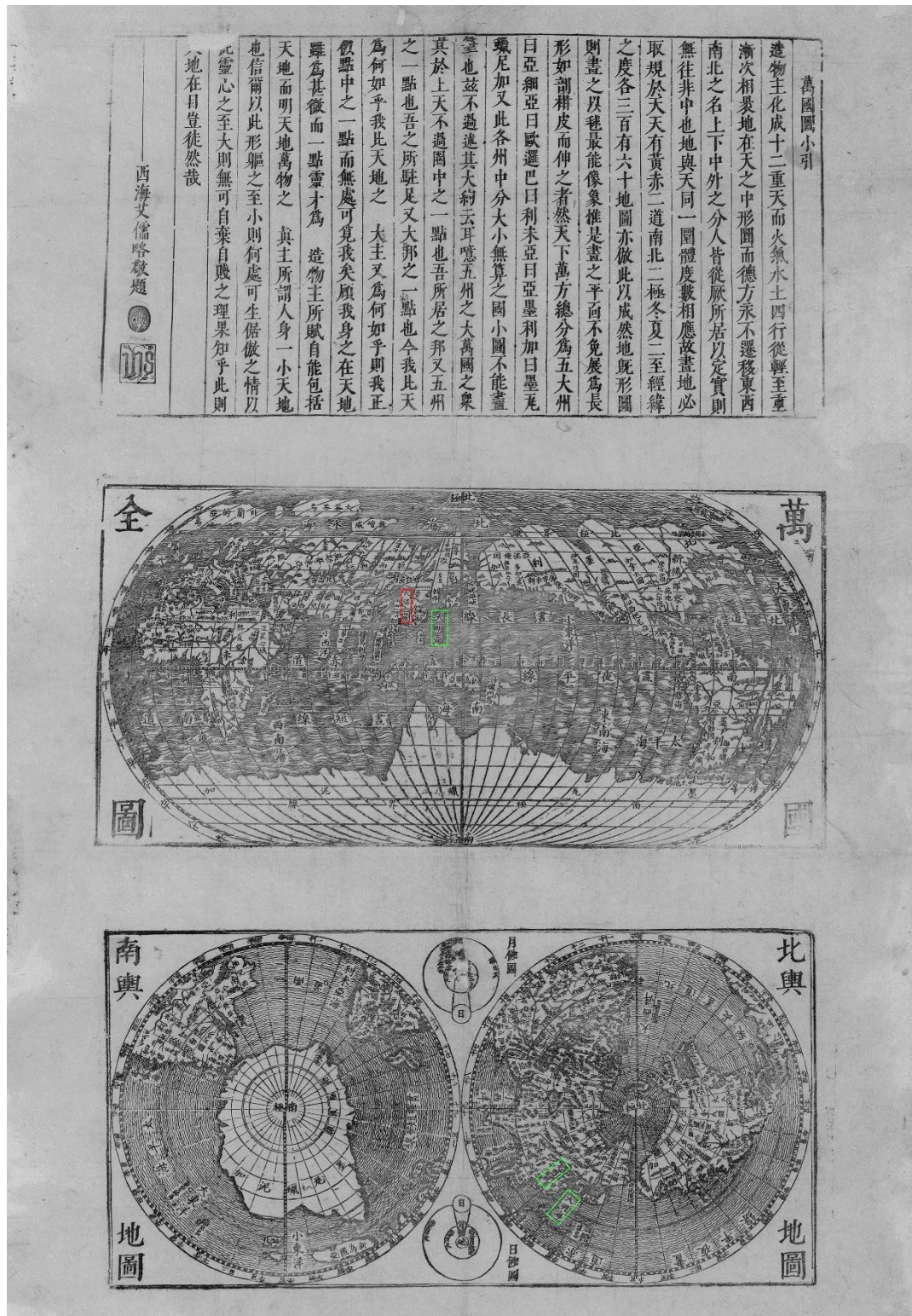


Figure 2. Map sheet with the description (top) of the Giulio Aleni World Map (centre) and, at the bottom, the Northern Hemisphere [Běiyǔ Dìtú (北輿地圖)] and the Southern Hemisphere [Nányǔ Dìtú (南輿地圖)], kept in the Vatican Apostolic Library in Rome [Barb. or. 151, pt. 2 (1b)]. Size of the original map sheet in black and white: 1230 x 642 mm. Courtesy of ©Biblioteca Apostolica Vaticana, Città del Vaticano. In the red rectangle it is shown the Quing dynasty ideogram. In green the Ming dynasty ideogram.



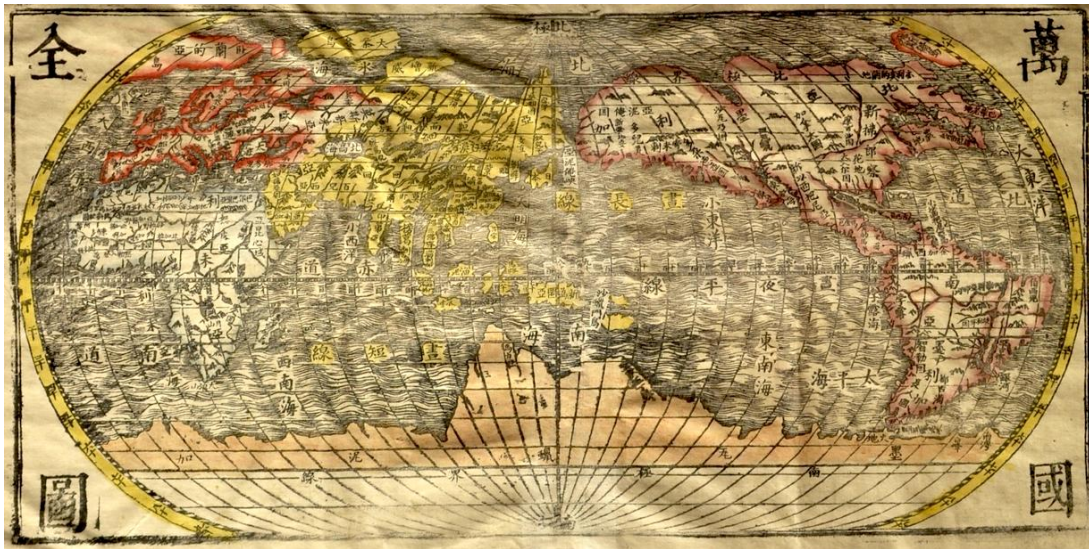


Figure 3. The edition of the Aleni World Map kept in the Braidense Library in Milan (in: Feng and Cretti, 2011, courtesy of Biblioteca Braidense).

### The AWM vs RWM digital comparison with respect to the Caraci-Muccioli model

Considered the AWM as a “meta-WM” of RWM, both were already put in an analogical pictorial comparison by Caraci & Muccioli (1938) and Lu (2015). Here we have revisited this comparison digitally deriving a new relevant map (Fig. 4). From the digital comparison of AWM and RWM some differences are evident, but the general pattern complies with that drawn by Caraci and Muccioli.

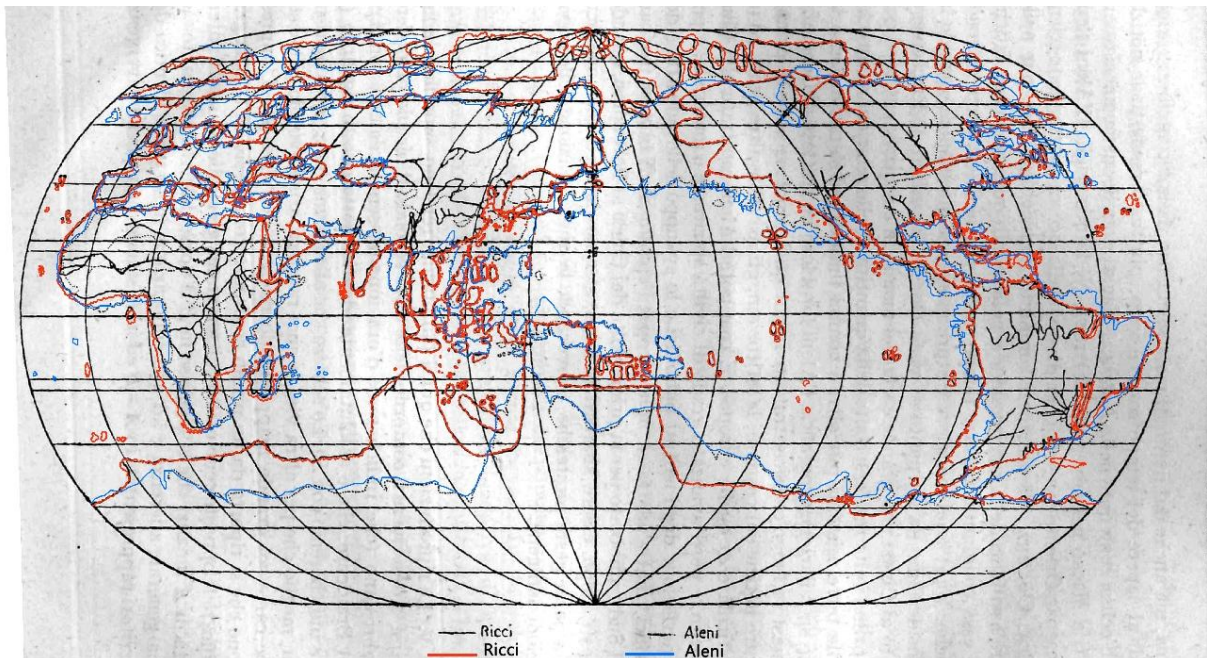


Figure 4. The digital comparison of AWM (blue coastline) vs RWM (red coastline). The coastline pattern is generally close to the Caraci-Muccioli pattern (AWM: black dotted coastline; RWM: black coastline)

The comparison process was based on considering as control points the intersection of the meridians and the parallels of the oval graticules used as reference projection.

### The AWM vs RWM digital comparison with respect to the coastline and the graticule

Of basic importance in studying the cartographic relation between the AWM and the RWM, as far as the geometric part of the representations is concerned, it is the comparison of the two maps with respect to the two cardinal geometric elements of the maps, the *coastline* and the *graticule* of projection reference. To do so, we properly analyzed digitally the two coastlines under: a) an optimal affine fitting transformation and b) a higher order polynomial transformation. The procedure for the comparison is based on the following computational chain: The AWM was fitted on the Agnese graticule, which is the reference model of the oval projections (Livieratos, 2016); the RWM was then fitted on the AWM, since the AWM and the RWM graticules are identical. In this way the AWM and the RWM coastlines are both referred to the common reference, the Agnese oval projection. The results of the comparison are depicted in Fig. 5 and Fig. 6 respectively.

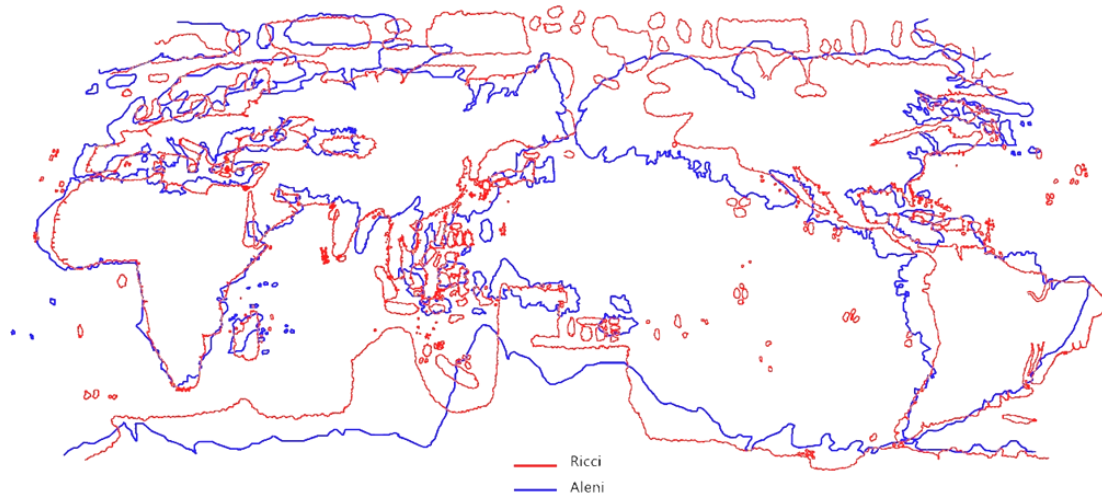


Figure 5. The AWM vs RWM coastline comparison under affine transformation and common oval projection (Agnese) reference.

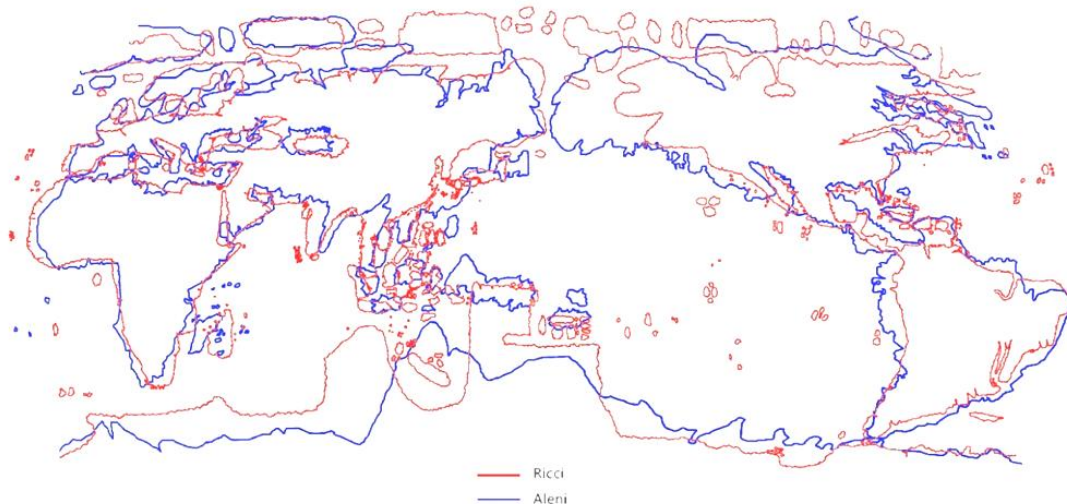


Figure 6. The AWM vs RWM coastline comparison under third order polynomial transformation and common oval projection (Agnese) reference.

The numerical results of the fitting process on the common reference of both AWM and RWM are very close as far as the residuals are concerned. This holds for both the transformation models



used, the affine and the third order polynomial, the second presenting a slight major overall consistency in the average numbers.

When the comparison of AWM and RWM is based on the optimal fitting of the common reference (Agnese) oval projection and not on the coastlines, then the image in Fig. 7 is obtained, comparable to the Caracci-Muccioli model. This strengthens the Agnese hypothesis about the graticule typology used in the two maps under comparison.

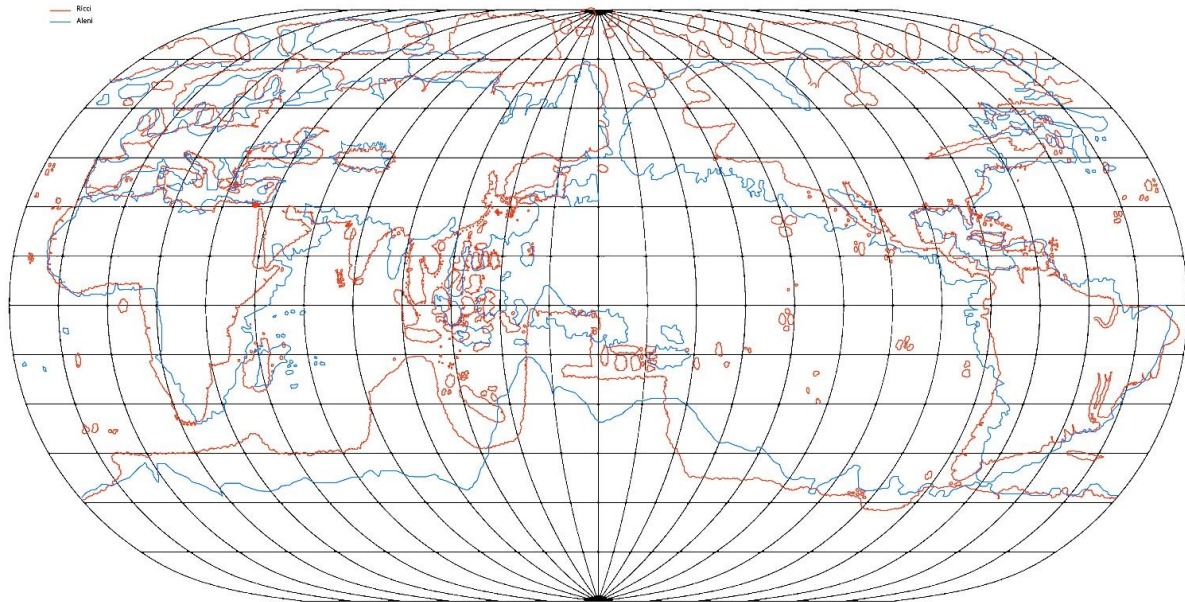


Figure 7. The AWM (in red) vs RWM (in blue) comparison referenced to a common oval projection (Agnese).

## Conclusions

The major conclusion of this preliminary study is that the Caracci-Muccioli comparison model of AWM vs RWM is generally still valid, as the digital analysis has shown regarding the basic geometrical elements of the maps. This is the case, naturally with some expected alterations, which do not change the overall pattern of the differences. The analysis confirmed the common reference projection used in both cases, reflecting strongly the Agnese legacy and demonstrated the major differences of the AWM and RWM coastlines. About the possible sources of geographical knowledge explaining the improvements of AWM compared to RWM, especially in the coastlines of North America, shifted westward, and Pacific Ocean islands as New Guinea it has to be considered that Giulio Aleni kept written contacts with Giovanni Antonio Magini and had access to the Ortelius Atlas (De Troia, 2009), but further investigations are needed.

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