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The Chinese Inventor of Bi-Hemispherical World Map

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Summary

Ancient Chinese cartographers made a great contribution to the cartography development. Unfortunately, their contribution has been buried in oblivion for centuries. There is no lack of ancient records about ancient Chinese cartography. The cause of such tragedy is the misinterpretation by the Chinese historians about the descriptions of ancient maps. Many of ancient Chinese cartographers were philosophers, mathematicians, or religionists, and were accustomed to use the jargons to describe maps. Accordingly, one of preconditions for correctly understanding those descriptions is familiarity with the relevant ancient Chinese terms. This paper will provide a typical example in this regard, and present evidence suggesting that bi-hemispherical world map was created by a Chinese cartographer in 14th century.

Introduction

Orthodox opinion suggests that the bi-hemispherical world map first emerged in Europe during the early 16th century, with the 1527 map of Franciscus Monachus being seen as an early example¹. Furthermore conventional wisdom is that Chinese cartographers and astronomers did not realize that the earth was round until Matteo Ricci (1552-1610) came to China with maps depicting a spherical earth².

In the early of 2006, a 1763 copy of “the General Chart of the Integrated World” (Tian Xia Zhu Fan Shi Gong Tu) made in 1418 was unveiled to the public; the depiction and description shown on the map indicate that the ancient Chinese had already mapped the world, long before the Europeans. As this map depicts the world as two hemispheres, several Chinese historians suggest that it is a fake because the bi-hemispherical world map did not appear until the 16th century in Europe, so the Chinese in the 15th century wouldn't have the Eastern and the Western hemispheres charted in a map like this.

In fact there is compelling evidence that the bi-hemispherical world map originated not in Europe, but in China; and was created by Chinese cartographers of the early 14th century – including the famous Yuan Dynasty scholar named Zhu Siben.

Zhu Siben was born in 1273. He practiced Taoism from the age of 14 and at 26 he left the Taoist temple under his master's order to preach amongst the people. During the next 20 years he collected and interpreted all kinds of Chinese and foreign geographic data. In 1320 he made a “Terrestrial Map” (Yu Di Tu) with a size of “seven chi long and wide” (about 2.5m square). The historical accounts record that this map was carved on a stone

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¹ John P. Snyder, “Map Projections in the Renaissance”, in *The History Of Cartography, Vol.3*, ed. David Woodward.

² Cordell D.K.Yee, “Taking the World's Measure: Chinese Maps between Observation and Text”, in *The History Of Cartography, Vol.2, book 2*, ed. J.B. Harley and David Woodward.

located at the “San Hua Temple on the Long Hu Mount”³. Unfortunately the original map has been lost.

Many Chinese researchers argue that Zhu’s Terrestrial Map only covers the Yuan imperial territories – China and its bordering regions - and has not included places outside Yuan control or the remote areas where China’s minorities lived⁴.

This article presents historical evidence suggesting that the Zhu Siben’s Terrestrial Map is in fact a world map, and that Zhu used double rings for the Eastern and the Western hemispheres, making it the world’s oldest bi-hemispherical world map.

Did Zhu Yiben Map Chinese and Foreign Territories?

Zhu Siben wrote a “Preface to the Terrestrial Map” (Yu Di Tu Zixu) in his book “Zhenyi Study Miscellaneous” (Zhenyi Zhai Zazhu)⁵, which tells us that in order to chart the Terrestrial Map, he studied and interpreted all available maps and data. He also asked “officials of the court” on foreign missions to make enquiries on the local geography to “the local administrations” and to collect extensively the geographical information and maps of these countries. Zhu Siben integrated this Chinese and foreign information into his Terrestrial Map.

Two foreign territories – to the “southeast of seas” and the “northwest of deserts” are given special notice in Zhu Siben’s Preface, in which Zhu says that although envoys on the tribute-offering missions were dispatched from the two regions to China, the long distance has made the geographical details of the two regions unclear, while some detailed information is not trustworthy, therefore Zhu Siben had no other choice but to omit some of the data (“gu yong que ru”).

Some Chinese historians believe that “gu yong que ru” in Zhu Siben’s article originally means Zhu had completely rejected territories based on the unreliable information in his Terrestrial Map⁶. Several Chinese historians even praise Zhu Siben for his scientific attitude that rather goes without than have something incomplete⁷. But did Zhu Siben remove these ‘unreliable’ territories from the map completely? Or did he outline two foreign territories whilst omitting detailed geographic descriptions on the map?

Note that “gu yong” here means to “to use those”, and “que” here means to “removing doubts”. The famous linguist Yang Bojun in his “Interpretation to Analects: the Dictionary” (Lunyu Yizhu: Lunyun Cidian) defines “que” as: “verb, to reserve without explanation”. Therefore the four characters “gu yong que ru” in Zhu Siben’s Preface do not mean to remove completely the two regions – to the “southeast of seas” and the “northwest of deserts” from his map but to keep the outline of this type of land masses without retaining the descriptions in doubt.

The original Terrestrial Map was lost long ago and we can’t see its original form, but historical records during the Ming Dynasty have left some clues.

³ Qu Yong, *Tieqin Tongjian Lou Bibliography (Tieqin Tongjian Lou Shumu)*, Vol 22, and Wang Yong, *History of Chinese Geography (Zhongguo Dili Xueshi)*.

⁴ Ge Jianxiong, *Chinese Ancient Mapping and Survey (Zhongguo Gudai De Ditu Cehui)*, published by the Commercial Press in 1998 and Bai Shouyi, *Outline of the History of China (Zhongguo Tongshi)*.

⁵ See the letter No. 17 in Shiyuan Series (Shiyuan Congshu).

⁶ As, for example, Cordell D.K. Yee has concluded in “Taking the World’s Measure: Chinese Maps between Observation and Text”, in *The History Of Cartography, Vol.2, book 2*, ed. J.B. Harley and David Woodward.

⁷ Bai Shouyi, *Outline of the History of China (Zhongguo Tongshi)* and Wang Yong, *History of Chinese Geography (Zhongguo Dili Xueshi)*.

Evidence For The First Bi-Hemispherical World Map

During the Jiaping period of the Ming Dynasty (1522-1566), the Chinese cartographer Luo Hongxian new-made a terrestrial map. He “searched for three years and luckily found a map made by Zhu Siben”. In the Preface of his “Unfolded Terrestrial Atlas” (Guang Yu Tu), he gave high praise to Zhu Siben and his work in making the Terrestrial Map: “his methods of drawing maps is beyond the reach of even the smartest minds”.

Luo Hongxian’s praise for the Terrestrial Map raises a series of questions for us:

Why was Luo Hongxian so impressed by Zhu Siben’s method used in making the Terrestrial Map?

Why did Luo say “even the smartest minds” couldn’t have imagined such a way of map making?

What kind of map format might appear novel to the people of the Ming Dynasty?

To answer these questions we have to study carefully Luo Hongxian’s other comments on the Terrestrial Map of Zhu Siben word by word.

Apart from praising Zhu Siben for his advanced method in map making, Luo Hongxian also gave a description of the original look of the Terrestrial Map in his Unfolded Terrestrial Atlas, as it is highly significant both in Chinese and the world’s history of cartography the description of Luo Hongxian have been cited and quoted in many Chinese history textbooks.

As we all know the classical Chinese writings are not punctuated, to understand the classical Chinese articles correctly the modern readers have to add punctuations to them, which is called “segmenting”. The segments made by these Chinese historians in Luo Hongxian’s description of the Terrestrial Map have failed to help people understand its true meaning, while authors of some other textbooks only cited Luo Hongxian’s descriptive texts but didn’t attempt to explain it at all, as if they were intentionally avoiding the analysis of its implications. Then why is that? Is the obscurity in meaning caused by Luo Hongxian’s improper use of words? Or is it because the historians’ wrong segmenting has made the correct interpretation impossible?

The correct definition of words is the prerequisite for a proper segmenting and understanding of the classical texts. Therefore before interpreting Luo Hongxian’s description we must first try to understand the meaning of the main words in the sentence.

In Luo Hongxian’s description of the Terrestrial Map, there is one word “shizi”, whose origin can be found in Buddhist classics. Buddhism has a term “Three Natures” and one of which is “yuan cheng shizi xing (round in complete reality)”. It has been mentioned in the classics such as “Yujia Shidi Lun” (Yogacaryabhumi), a Buddhist scripture translated from Yogācāra-bhūmi-śāstra (or Exposition on the Stages of the Practice of Discipline) by Xuan Zang at the 22nd year of Zhen Guan in the Tang Dynasty (648 AD) and “She Dacheng Lun Shi Sishiba Juan” (Annotations on the Collection of Mahāyāna śāstras in Forty-eight Volumes). In these classical works, the word “yuan (round)” is used to describe the three-dimensional spheres rather than the two-dimensional circles. The reason why Buddhist classics describe spheres to have the nature of “shizi (complete real round)” is because they want to differentiate Buddhist spheres from the circles in the secular world.

These other words in Luo Hongxian’s description can be correctly defined as the follows: “shi” in the classical Chinese is used as a determinative meaning “this” or “this way”; “ke” means “the middle” or “just”; “cong” here is pronounced as “zong” meaning “north-southern direction”, “he” means “harmony” or “equal”; “mou” means “being equal” and “chuan” meaning “cross”, “overlap”, “contradicting” or “fallacy”.

After having understood the texts in the right way, we may find that to correctly segment it will become easy, and the sentence should be punctuated as: [here the transcript in

Latin lettering from Chinese writing] *Qi tu you jili huafang zhi fa, er xing shizi, shi ke ju zong er fen, he dongxi xiang mou, bu zhi bei chuan.*

Thus the true meaning of this sentence should be:

“Zhu Siben used the method of graticule to chart his map, which was in the format of a globe, and then from the globe centre and along a north-southern direction, he divided the globe map equally into the eastern and western spheres and made them look alike and harmonious, by doing so the errors or confusion that might be caused by the two overlapping sides of the globe can be avoided.”

This description clearly suggests that the Terrestrial Map made by Zhu Siben in 1320 is a bi-hemispherical world map.

What is Luo Hongxian’s Unfolded Terrestrial Atlas?

The Chinese history researchers all agree that the making of Luo Hongxian’s Unfolded Terrestrial Atlas is based on Zhu Siben’s Terrestrial Map and supplemented with the data collected from the Yuan and the Ming dynasties. But the Unfolded Terrestrial Atlas we see today is in a rectangle but not in hemispheres. What happened?

We learn from Luo Hongxian’s Preface to the Unfolded Terrestrial Atlas that his atlas is based on Zhu Siben’s Terrestrial Map. In the Preface Luo Hongxian says he “guang” (i.e. unfolded) Zhu’s map and for that reason, he did not continue to use the title “Terrestrial Map” but named his own map “Unfolded Terrestrial Atlas”. Does “unfolded the map”⁸ mean Luo had enlarged the Terrestrial Map of Zhu Siben? Or had he broadened the coverage of the map?

The answer seems to be no. In the Preface to Unfolded Terrestrial Atlas Luo Hongxian says: “Zhu’s map is seven chi long and wide, which is difficult to handle, so I simplified it when Unfolded Terrestrial Atlas was made”. This explains neither had Luo increased the size of Zhu’s map nor broadened its coverage, but rather made Unfolded Terrestrial Atlas smaller and simpler than the Terrestrial Map. The question is why in the Preface Luo Hongxian says he “unfolded” the map, and named it the Unfolded Terrestrial Atlas?

In 1799, an official called Zhang Xuelian wrote in an article when republishing Luo Hongxian’s Unfolded Terrestrial Atlas, which says that “according to the History of Ming: Literary Chronicle (Ming Shi: Yiwenzhi), Luo Hongxian had unfolded the map of Zhu Siben... and used kaifang to make the map extremely accurate”. “Kaifang” described in the preface refers to the extraction of the Chinese ancient mathematics. It has a broad meaning and refers to a wide variety of computing methods, including the method of “hua yuan wei fang (turning round into rectangle)”. The earliest description of this method can be seen in the famous Chinese ancient mathematical book- Nine Chapters on Mathematical Art (Jiu Zhang Suanshu) that was authored during Qin and Han periods (300BC-100AD). In 16th century, a mathematician Cheng Dawei gave a mathematical definition of the word “guang” in his work: General Survey of Algorithm (Suan Fa Tong Zong). The definition of guang is “horizontally wide”. From the above explanations we may now understand that “guang the map” by Luo Hongxian actually means that he used the extraction to the turn sphere map of Zhu Siben into a rectangle map of his own.

⁸ Luo Hongxian in Preface to Enlarged Terrestrial Atlas says: “I therefore unfolded its map to consist of many copies. Its original descriptions prevail, and those couldn’t be recorded due to limited space were contained in other sheets. I resided in the mountains and was short of means and the atlas was an accomplishment of efforts of more than ten years”.

Which Echoes Remain of Zhu Siben's Terrestrial Map?

Although it is impossible to see the original Terrestrial Map of Zhu Siben, from the old maps and historical records we may still catch a glimpse of how it looked.

Yao Jiheng (1647-1715) is a bibliographer and book collector in the Qing Dynasty, in his "Haogu Hall Bibliography" (Haogutang Shumu) he included "Zhu Siben's Terrestrial Map of the Yuan Dynasty" – from this we may learn that the original copy of Zhu Siben's Terrestrial Map was still extant during 18th century.

In 1730, a book called "Records of Sights and Sounds of Overseas States" (Haiguo Jianwen Lu) authored by Chen Lunjiong, included a map under the title "Comprehensive Map of Four Seas (Si Hai Zong Tu)" (fig.1). It is a map of the eastern hemisphere and contains many early geographic errors, some of which were often seen in the maps made before the 16th century and couldn't have originated from the European cartographers.

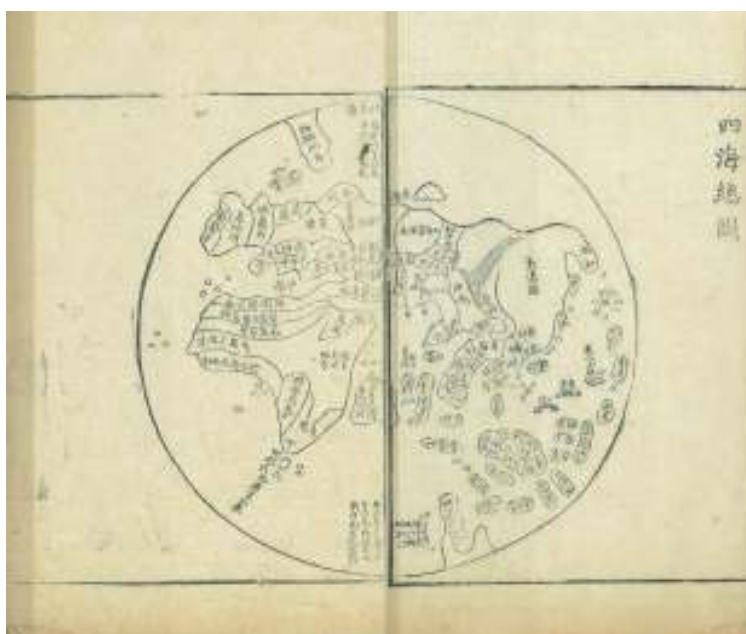


Figure 1. Comprehensive Map of Four Seas.

For instance, this map didn't include the Scandinavian Peninsula and the Baltic. It confused the Persian Gulf with the Red Sea, and made the Suez isthmus and Gibraltar Channel much wider than in reality. Among these mistakes the most noticeable are the two misplaced big land masses. One is V-shaped and located to the northwest of the China another is to the southeast of China – what we all know is no modern maps have shown any continent at the above two positions. In the Comprehensive Map of Four Seas the names of most of the foreign places are given, only except for these two landmasses – on the land at the northwest we can see four characters "shi bao lan rou", and on the southeast we read five: "ren ji bu dao chu (land without human traces)". The positions of the two land masses on Comprehensive Map of Four Seas are exactly the same as that of the two regions to the "northwest of desert"⁹ and the "southeast of seas" charted on the Terrestrial Map of Zhu Siben; furthermore, these two land masses have been sparsely annotated in a way that is much like "gu yong que ru (keeping the outline of land masses without retaining the descriptions in doubt)" described in the Preface to the Terrestrial Map.

⁹ "Deserts" in Zhu's preface refers to the Taklimakan Desert, which is located to the northwest of China.

The presence of these two land masses on Comprehensive Map of Four Seas and its time of making have suggested its origin from the Terrestrial Map.

The 1798 “General Maritime Map” (Huan Hai Quan Tu) which was included in the “Coastal Map of Seven Maritime Provinces (Sheng Chao Qi Sheng Yan Hai Tu)” (fig.2) is also believed to have some remnants of Zhu Siben’s Terrestrial Map.

The General Maritime Map has some explanatory notes on its left side that tell us that it was based on an “old terrestrial map (jiu yu tu)”, which was based on an “ancient map (gu qian tu)”. The interesting thing is the term of “ancient map (gu qian tu)”. “Gu” in Chinese means death or passed. In 1798 China was ruled by Qing Dynasty, which did not allow any person to call anything of this dynasty as “ancient”. Any person who misused this term would be thought to be cursing the Qing Dynasty to die and would be prosecuted for his error. Thus we may see that the so-called “ancient map (gu qian tu)” described in the notes was earlier than Qing Dynasty. Additionally the notes continue to tell us that the General Maritime Map is only “a half size of the old map”, while the latter consisted of two spheres and “shall be viewed comparing each other”.



Figure 2. General Maritime Map.

Some Chinese historians argue that the General Maritime Map is based on the Comprehensive Map of Four Seas collected by Chen Lunjiong in his “Records of Sights and Sounds of Overseas States”, and charted with reference and modifications to other maps. If we compare the two maps, we may see they are indeed quite similar to each other. For example, General Maritime Map also contains two land masses on the northwest and southeast of China, the shapes and notes of the two land masses are almost exactly the same as the Comprehensive Map of Four Seas.

But if we study them carefully, we may find lots of differences between the two. The main three differences are as follows:

1. Firstly, General Maritime Map has a round frame on which the 24 directions are marked; while on Comprehensive Map of Four Seas, there are none.

2. Secondly, at the bottom left of General Maritime Map there is an outline of a land mass not to be found on Comprehensive Map of Four Seas.
3. Third, in General Maritime Map, the northeastern corner of Asia is protruding outside of the frame, but in Comprehensive Map of Four Seas it is kept inside the sphere.

Based on these comparisons, it seems likely that General Maritime Map is not a blueprint for Comprehensive Map of Four Seas, but the two maps have a common origin, which is “ancient map (gu qian tu)” described in the notes of General Maritime Map. Such “ancient map (gu qian tu)” could be a copy of Zhu Siben’s Terrestrial Map or a map with the influence of Zhu Siben’s Terrestrial Map.

Not only can we see the influence of Zhu Siben’s Terrestrial Map on the Chinese ancient maps, its influence can also be traced in a map made by Europeans in the early 15th century. This European map is the 1415 Di Virga World Map (fig.3). This map contains areas of Asia with names used in the Mongol dynasty; some rivers and cities have similar names as those in “The Travels of Marco Polo”, and it shows that before the map was drawn the cartographer had referred to the maps made by Yuan scholars.

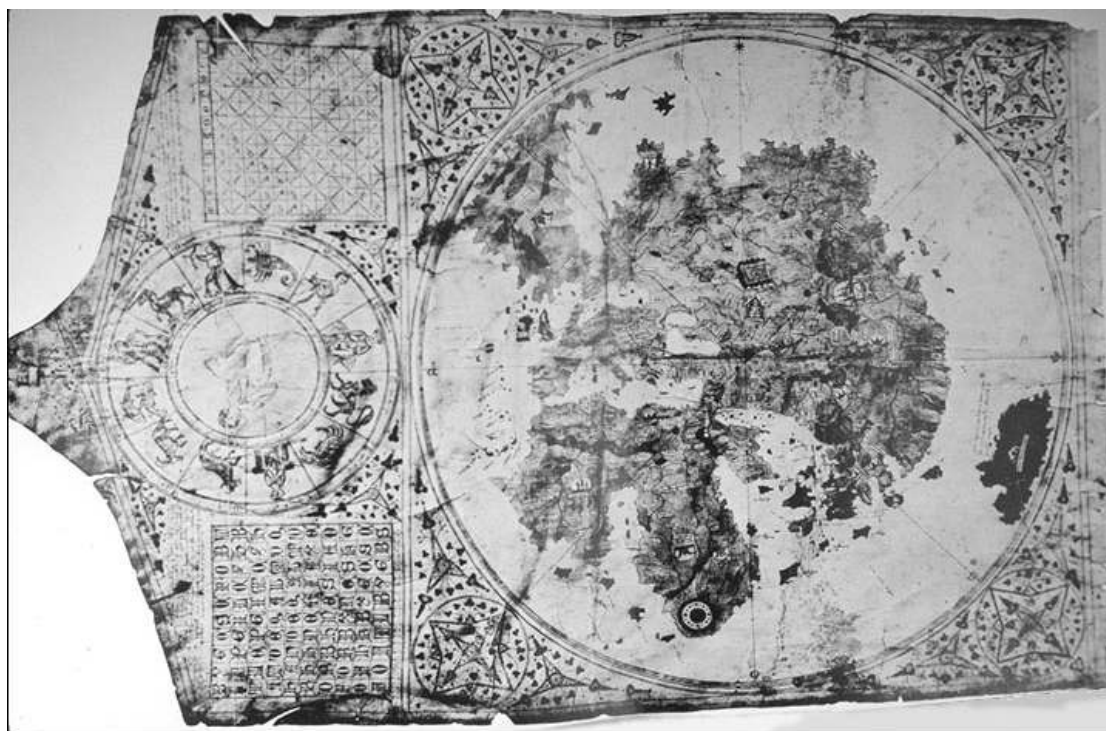


Figure 3. 1415 DiVirga World Map.

If we place the 1415 Di Virga World Map together with General Maritime Map or Chen Lunjiong’s Comprehensive Map of Four Seas, we will find that they resemble to one another amazingly - in particular they all include landmasses on the northwest and southeast of China. What requires special notice is there can be seen a remark on the V-shaped land on the upper left of the 1415 Di Virga World Map that says: “the known furthest extreme of the world”. This remark could not possibly be written by a European, because if we look at the map it is easy to see the furthest part from Europe is not the V-shaped land, but China, so obviously this remark is originally from the ancient Chinese. This suggests that when making the Di Virga World Map, the map maker copied the Chinese map and left this remark unchanged.

Did The Chinese Navigate The World in the Yuan Dynasty?

The creation of the bi-hemispherical map by Zhu Siben clearly reflects the development in Chinese navigational range and technologies in the Yuan Dynasty. As early as in the Tang and Song dynasties, Chinese had made big advances in navigation and had laid down foundations for the later expansion of maritime trade in the Yuan Dynasty.

According to the “History of the Yuan Dynasty”, Kublai Khan, founder of Yuan Dynasty, had issued orders to attract foreign merchants to trade with Chinese; the emperors of later generations also sent envoys to visit and explore the foreign lands. It was the open policy of the Yuan Dynasty that made Chinese navigation one of the most advanced in the world, and their sea-faring capabilities may have surpassed the imagination and knowledge of Chinese historians. Zhu Siben, in a poem named “The Geology of Beihai (Beihai Shi)” wrote: “the south and east of the Four Seas are very close to China, where people can be seen and heard; the west sea is thousands of miles away but the merchants or messengers can sometimes reach. Only the north sea I totally have no idea about”¹⁰. Wang Dayuan, the navigator in the Yuan Dynasty wrote a book named as “A Brief Description of Island Foreigners (Dao Yi Zhi Lue)”. This book recorded a preface written by Wu Jian, which says: “The four seas are encircling China and those foreign countries are numbered in thousands. Apart from the north sea that is blocked by horrible wind, the east, west and south seas all can be reached by navigations.” These two documents tell us the same, that is, except for the waters to the north of the Bering Straits, the Chinese navigators in Yuan Dynasty could almost go to everywhere of the world.

“The Account of The Customs of Cambodia” (Zhenla Fengtu Ji) and “A Brief Description of Island Foreigners” (Dao Yi Zhi Lue) are two travelogues that have been passed down to the present time. The former has a detailed traveling account but only focuses on one country; the latter was written by Wang Dayuan who made two sea trips and spent eight years traveling. The number of countries described in his book totaled more than two hundred.

Many other historical works record communications between the Yuan people and the foreign countries. The scholar Xie Zhaozhe of 16th century wrote in “Investigations on the Five Categories of Things” (Wu Za Zu): “the Yuan Dynasty during its prosperous time accepted the tributes offered by thousands of foreign countries, it can be said that even in the remotest corners of the world, there couldn’t be found a country that was not subservient.” It is just because the navigators of Yuan Dynasty reached almost all the continents of the world, the globe in the modern sense could be found in the imperial court of Yuan Dynasty.

According to the “History of the Yuan Dynasty: Astronomy Chronicle”, in 1267, a scholar named Jamal-al-Din made a wooden globe in China. There are many small boxes drawn on the globe to measure distance, which is similar to Zhu Siben's hua fang method (i.e. the graticule). But what “History of the Yuan” will tell us about the globe is more revealing than these small boxes.

History of the Yuan Dynasty described the surface of the globe as 70% covered in green showing the waters and 30% in white to stand for the lands. The result from the modern geographic surveys shows that the oceans and the lands take up respectively 71% and 29% of the earth. How could the land-water proportion of Jamal-al-Din’s globe be so close to the result of the modern geographic surveys? Could it be a coincidence? Or it was a lucky guess by Jamal-al-Din? The chances of such a coincidence is rather small, and

¹⁰ Zhu Siben, Poem Manuscript of Zhenyi Study Vol. 1 (Zhenyi Zhai Shi Wen Gao), Wan Wei Bie collection.

suggest that during the Yuan Dynasty, the ancient Chinese had surveyed the earth and learned that the water to land area ratio is seven to three.

Conclusion

The bi-hemispherical world map created by Chinese cartographer Zhu Siben in the early 14th century was of crucial importance in the history of cartography, and reflects the history of world exploration. It shows that Chinese cartographers drew the first bi-hemispherical world maps, and suggests that Chinese navigators sailed the oceans and mapped the world before Zheng He's navigation in the early 15th century.

Chinese scholars seem to have misinterpreted descriptions of Zhu Siben's map, and this has been explained in terms of punctuation and linguistic errors.

The echoes of Zhu Siben's map in later Chinese and pre-Columbian European maps, also show that the original, which seems to have been extant as late as the 18th century, was influential for successive generations of cartographers.

It is now time for historians to seriously reassess this key chapter in China's cartographical legacy and lasting influence.

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