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JESUIT MAPMAKING IN CHINA

D'ANVILLE'S *NOUVELLE ATLAS DE LA CHINE* (1737)

EDITED BY

Roberto M. Ribeiro

with

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CARTOGRAPHY DURING THE TIMES OF THE KANGXI EMPEROR

The Age and the Background

Han Qi¹

At the time of emperor Kangxi, of the Qing dynasty, the substantial cartographic surveys accomplished across the country of China marked an extraordinary event in the history of world geography and cartography. Based on the information collected from Chinese and Western literature and archives, I will concisely discuss in this article the origin, the process of cartographic surveys during the Kangxi reign, and the functions of the Jesuits and of the Chinese in that development. I will discuss, as well, the influence of the collective atlas *Huangyu Quanlantu* (康熙黄舆全览图, *Complete Map of the Kangxi Reign*).

I. Background of the cartography surveys and mapping in Kangxi's reign

Affected by Yang Guangxian's anti-Christianity movement, Kangxi began in his early childhood to acquire knowledge about the West. The Belgian Jesuit missionary Ferdinand Verbiest (南怀仁 1623–88), not only taught the emperor extensive knowledge of mathematics and astronomy but also worked with other missionaries, Lodovico Buglio (利类思, 1606–82) and Gabriel de Magalhães (安文思, 1610–77), in a collaborative writing *Xifang Yaoji* (西方要纪, *Concise Introduction to the West*, 1669), which aimed at introducing the



emperor to Western geographical knowledge. Following the map made by Matteo Ricci (利玛竇, 1552–1610) *Kunyu Wanguo Quantu* (坤輿万国全图, *Universal Map of Ten Thousand Countries*), Verbiest had compiled and drawn the *Kunyu Quantu* (坤輿全图, *Universal Map*, 1674), which helped Kangxi broaden his outlook on world geography.

After Kangxi controlled the *sanfan* (三藩, Three Feudatories) and retook Taiwan, he decreed in 1686 a revision of the *Da Qing Yitongzhi* (大清一统志, *Comprehensive Gazetteer of the Qing*). In his decree, given to Le-de-hong (勒德洪), the chief of *Da Qing Yitongzhi*, he said:

Although the territory was vast, covering tens of thousands of *li* (里), the event motivated me to think of the whole country. [. . .] Now I specially appoint you as the chief official to lead officers of compilation to work diligently, aiming to gather extensive information and make the style [of the book] precise and refined. Thus the strategic positions of mountains and rivers, customs and people can be easily identified, and the maps of the territories can be drawn. Even though I have 10,000 matters to attend to, I will read all the reports in person.²

Because of its practical importance for military operations, for politics, for the inspection and harnessing of rivers, Kangxi expressed great enthusiasm for cartography and paid great heed to cartographic surveys and the charting of maps.

Many of the Catholic missionaries were talented and competent in various fields of science. They gained Kangxi's confidence and were entrusted by him with the task of cartographic surveys. On 14 November 1685, the Belgian Jesuit Antoine Thomas (1644–1709) shortly after his arrival in Beijing wrote a letter to Europe in which he mentioned that Emperor Kangxi requested that a map be drawn of the Tartar region.³ In 1678 Verbiest wrote a letter to Europe, appealing for more Jesuits to be sent to China to preach the Catholic faith. In response to Verbiest's open letter, King Louis XIV responded positively. Under the guidance of the French Royal Academy of Sciences, the Society of Jesus in France sent off Jesuits as "King's Mathematicians" to China. Five of them, namely, Jean de Fontaney (洪若, 1643–1710), Louis-Daniel Le Comte (李明, 1655–1728), Claude de Visdelou (刘应, 1656–1737), Joachim Bouvet (白晋, 1656–1730) and Jean François Gerbillon (张诚, 1654–1707), arrived in Ningbo in 1687. Through Verbiest's mediation, the Ministry of Rites submitted the following to the emperor for decision: "Of Hong Ruo's [Jean de Fontaney] party of five, it is not yet known if they include experts in calendar studies. The group will be brought to Beijing,

pending assignments; and those who are not called upon may stay if they wish." With the emperor's consent, the Zhejiang (浙江) provincial governor was thus informed. Then, the five missionaries came to Beijing. The Jesuits had brought with them "two celestial globes, two stands, two microscopic devices, three twofold microscopic devices, two star telescopes, an instrument measuring stars, three copper rings of time-measurement, an instrument measuring the sky, five astronomical pendulums, six caskets of astronomical classical books, five Western geographic maps, a small chest of magnets, totaling 30 caskets of large, medium and small sizes."⁴ Among the listed items were some gifts intended for the emperor, which included European maps, and scientific instruments for cartography and astronomy such as armillary spheres, microscopes, telescopes, and pendulums (for astronomical observations).

In Kangxi's 27th year, on the 21st day of the second month (March 22, 1688), the five French Jesuits, accompanied by the Portuguese Jesuit Tomás Pereira (徐日升, 1645–1708) were brought to see the emperor at the Palace of Heavenly Purity. In the end, only Bouvet and Gerbillon were selected to remain in the imperial court in Beijing. Beginning in 1689, Kangxi, under the guidance of the two missionaries, studied the *Elemens de Géometrie* written by I.-G. Pardies⁵ (几何原本, *Jihe Yuanben*), which contained examples relating to cartographic surveys.⁶

During excursions, Emperor Kangxi liked to bring along the missionaries and their retinues, of whom he could inquire whenever needed. In the 1690s Kangxi made an inspection of the western part of the country. He brought along survey equipment to measure the height of the Pole Star (latitudes). Over time information and experience accumulated and laid a solid foundation for later cartographic surveys. Gerbillon sometimes accompanied Kangxi on his travels. During those expeditions, he explained to the emperor the geography of Europe,⁷ very probably with the help of maps from Europe, gifts presented to the emperor earlier.⁸ Kangxi made three expeditions to the western territory, the northeast and the south of the Yangtze River (长江, *Changjiang*). During the journeys, Kangxi ordered his associates to measure the latitudes and longitudes. In 1696, he inspected *Kalun* (喀伦) himself. He instructed his Crown Prince to measure the distance between the *Kalun* areas and Beijing with a rope and to use instruments to measure the height of Pole Star at *Kalun*.⁹ This method of measurement was acquired from the Jesuits. Such ongoing surveys formed the basis for national cartographic surveys in China, a herald of the future.

II. Standardization of cartographic surveys and the measuring system

To launch large-scale geodetic surveys, the formulation of a unified measurement system is of prime importance. In 1702, Kangxi visited Dezhou (德州) during his Southern inspection. His third son

Prince Yinzhi received orders to measure the longitudes in order to determine the *li* (里) system, a yardstick of measuring distance. Minister Li Guangdi (李光地), who was involved in this task, recorded:

In the 10th month of Renzi [Wu] year [1702], His Majesty arrived at Dezhou during his Southern inspection. [. . .] As calendar experts described, one degree in the sky, [is] equivalent to 250 *li* on ground level. Although I have not surveyed precisely, I feel that the distance should be 250 *li*. At present I have asked *San-a-ge* [三阿哥, third child] to carefully measure the distance from Beijing. *San-a-ge's* mathematical skills are extremely refined. Now at Dezhou, albeit a little inclined to the East, Gou-gu method [勾股, i.e. the Pythagorean theorem] is used to measure, making use of pegs-and-chunks to note the distance. Imprecise measurements will not happen any longer. Upon return to Beijing on the 21st, the emperor said to [my] master: "*San-a-ge* has made the measurement, which means: one degree in the sky is exactly 200 *li* on ground level." My master said: "This is so because the system used was of eight *cun* [寸—inch] of Zhou dynasty's *chi* [尺—foot], resulting that 250 *li* equals one degree. His Majesty said: Absolutely. Through this trip I have profited a lot and learned some calculation methods."¹⁰

Prince Yinzhi, a gifted and intelligent person, was good at mathematics and astronomy. Kangxi asked him while he was still a child to learn from the Jesuits. Yinzhi was highly praised by the Jesuits, and was involved in the cartographic survey. Li Guangdi apparently had a fresh memory of this matter. In his *Lixiang Benyao* (历象本要, *Concise Introduction of Calendrical Science*), Li mentioned this event again:

In the winter of Renwu [1702], the emperor rode in the imperial carriage to make an inspection of the South. He ordered the prince to bring the *Xiyang chouren* [西洋筹人, mathematician from the West ocean] on the trip. They departed from the south of Beijing city for Dezhou, a distance of more than 700 *li*. The survey and observations were conducted precisely and lasted for several weeks or a month. Precise data about the stars and earth were obtained. The conclusion was that the distance on ground level of 200 *li* equals one degree difference of the height of Pole Star. The older sources claimed 250 *li*, probably too loose an estimate. Now, the ruler used is one made by the Ministry of Works so that the ancient one *chi* equals eight *cun*, but how this came about is still unknown. I was in the retinue of the emperor and learned this.¹¹

By cross-referencing Western literature, it becomes clear that the term “*Xiyang chouren*” actually referred to the Belgian Jesuit Antoine Thomas.¹² Kangxi sent his third son Yinzhi and Thomas to some places near Beijing to measure their latitudes and longitudes. The task was to estimate the actual distance along the meridian for the longitude from Bazhou (霸州) to the Jiao River (交河), and to establish the correspondence between one degree in the sky along that longitude and the distance measured on the ground along the meridian line. Prince Yinzhi, the organizer of the survey and one of its surveyors, played an important role in this mission. Under Yinzhi’s leadership, the survey measurement undertaken by Thomas and others was very precise. The findings corrected the mistakes of China’s ancient measuring scale. Henceforth, a new rule in measurement of length was levied. Based on the yardstick, one degree in the sky equals 200 *li* on ground level. And the ruler of the Ministry of Works was adopted as a standard ruler with 18 *zhang* (丈) as one *sheng* (繩), and 10 *sheng* (180 *zhang* or 1,800 *chi*) equals one *li*. Also, the distance 200 *li* equaling one degree in longitude was formalized, and this was an innovative and pioneering act at the time, thanks to the influence of Thomas and others.

Concerning the cartographic survey in 1702, the emperor himself also recorded this case. In Kangxi’s 41st year, on the 24th day of the 10th month (December 12), the emperor instructed the grand minister Zhang Yushu (张玉书) and Li Guangdi, provincial governor of Zhili (直隸), who were in his retinue, saying:

Use survey instruments to measure the far and near distances, this is a fixed standard, absolutely no discrepancy in measurement. Should there be any mistakes, it would be due to misuse of the method, and not due to inaccuracy in calculation. By using this method to calculate the areas and calculate the farmlands, the result can be attained at once. However, one must be very careful and vigilant in the techniques so that the survey and testing can be precise and accurate. On the whole, the method used is mostly geometrical triangulation. Although the name *sanjiaoxing* [三角形, triangle] did not exist before, the mathematical method must always have it as its basis. For instance, the method of Gou-gu [Pythagorean theorem] is derived from triangle, and this method was passed down from ancient times. However it was not recorded in books. Therefore people do not know its origin.¹³

Note that here he mentioned the use of geometrical triangulation.

In Kangxi’s 50th year (1711), he inspected the embankments of Tongzhou (通州). He was accompanied by seven princes. In the second month, he took a boat from Heshatun (和韶屯) to

inspect the river. At the scene, a demonstration on how to use the instruments to measure the topography was carried out. Kangxi instructed the princes, ministers and others: "Use this to measure the sky and the earth, and to predict the eclipses of the sun and the moon. Such things are easy to calculate."¹⁴

In the fifth month of the same year, grand ministers and others were instructed:

Both the degree of the sky and the distance on the ground coincide with each other. If the ruler of Zhou Dynasty is used, one degree in the sky equals 250 *li* on ground. However, if measured by the ruler of today, one degree in the sky equals 200 *li* on ground. Since ancient times, cartographers did not follow the degrees in the sky to calculate the geographic distance, far or near, therefore there were many discrepancies and mistakes. I formerly appointed some good artists to draw the mountains, rivers and topography in the northeast region, and based on the degrees in the sky to project and calculate, and then paint the details into their maps and drawings.¹⁵

Therefore, around 1702, the standardization of the measurement system was established. During the period of map-surveying (1708–17) in the country, the standard was followed in the measurement of the northeast and Korean borderlands. After having measured the latitudes and longitudes of the places near Beijing, the capital, Kangxi inspected the Northeast and the South. He frequently ordered the accompanying missionaries to determine the latitudes and longitudes. The unification of standards laid the foundation for a full development of cartographic surveys in China.

III. The origin and process of the cartographic survey

The cartographic surveying in Kangxi's times began in 1708 and ended in 1717, and thus lasted for a decade. The map *Huangyu Quanlantu* (皇輿全覽圖, *Complete Map of the Kangxi Reign*) was finally completed. Now, the origin and process of the cartographic survey will be briefly discussed in this section.

In 1705, Antoine Thomas, Joachim Bouvet, Jean-Baptiste Régis (雷孝思, 1664–1738), and Dominique Parrenin (巴多明, 1665–1741) took part in the cartographic surveying of the surrounding areas and rivers in Beijing. Afterwards, a nationwide large-scale cartographic survey was launched because Kangxi listened to the advice of Parrenin.¹⁶ The cartographic survey began on 4 July 1708, and was done under the guidance of the Jesuit missionaries Jean-Baptiste Régis, Pierre Jartoux (杜德美,

1669–1720), J.M.A. de Moyriac de Mailla (冯秉正, 1669–1748), Pierre-Vincent de Tartre (汤尚贤, 1669–1724), Romain Hinderer (德玛诺, 1668–1744), Joachim Bouvet, João Francisco Cardoso (麦大成, 1677–1723), Ehrenbert Xaver Fridelli (费隐, 1673–1743), and the French Augustinian missionary Guillaume Fabre Bonjour (山遥瞻, 1669/1670–1714). In 1708, Bouvet, Régis, Jartoux surveyed the Great Wall. In 1709, Régis, Jartoux and Fridelli surveyed Liaodong (辽东) – Jilin (吉林), Liaoning (辽宁) – and Mongolian areas, and then surveyed Zhili (直隶). In 1710, the Heilongjiang (黑龙江) area was surveyed, and later Shandong (山东), Shanxi (山西), Shaanxi (陕西), Jiangnan (江南), Zhejiang (浙江), Henan (河南), Jiangxi (江西), Guangxi (广西), Guangdong (广东), Huguang (湖广), Fujian (福建) and Taiwan (台湾), as well as the Southwest and part of the Northwest area. For Tibet (西藏), lamas, such as Chu-er-qin (楚儿沁) who studied mathematics at the Imperial Board of Astronomy, and Sheng-zhu (胜住) from Lifanyuan (理藩院, the Court of Colonial Affairs) were assigned to go on the survey expeditions.¹⁷

In connection with the map-surveying, Kangxi made use of many experts versed in mathematics from across the country (such as Mei Juecheng-梅穀成, He Guozong-何国宗, Ming Antu-明安图 etc.), to compile the *Lüli Yuanyuan* (律历渊源, *Source of the Pitch-Pipes and Calendar*), including the *Shuli Jingyun* (数理精蕴, *Essential Principles of Mathematics*), *Qinruo Lishu* (钦若历书, *Imperial Commissioned Calendrical Sciences*), *Lülü zhengyi* (律吕正义, *Exact Meaning of the Pitch-Pipes*). Mathematicians and astronomers gathered at the Bureau of Mathematics (算学馆, Suanxueguan), the Studio for the Cultivation of Youth (蒙养斋, Mengyangzhai) inside the Imperial villa Changchunyuan (畅春园), and were guided by the missionaries. Jesuits Bouvet, Parrenin, Jartoux, and Jean François Foucquet (傅圣泽, 1665–1741) taught subjects related to mathematics and astronomy.¹⁸ Some of the mathematicians who worked at the Bureau of Mathematics also participated in the map-surveying; for example, He Guozong's brother, He Guodong, "served at the imperial court because of his skill in calendar-making." In Kangxi's 53rd year (1714), he was ordered "to travel to different provinces south of Yangtze, and measure the height of the Pole Star and the shadow of the sun. In Kangxi's 58th year, the map was completed."¹⁹

In Kangxi's 51st year (1712), some persons "proficient in drawing" were sent to survey and map the mountains and rivers of the Northeast. The geographers had to follow the estimated degrees of the sky, and then draw the maps with details. On the seventh day of the 53rd year of Kangxi (February 20, 1714), Prince Yinzhi and others presented a memorial to the emperor:

In the past, when Guo Shoujing [郭守敬, of the Yuan dynasty] was compiling the *Shoushi* calendar [授时历], many were dispatched to various provinces to observe the shadows of the sun. Therefore the results were accurate. Now, to revise the calendar books, except in Changchunyuan and the observatory, no daily observations are needed in each province. However, only in the seven provinces of Guangdong, Yunnan, Sichuan, Shaanxi, Henan, Jiangnan and Zhejiang, where there are big differences in *li* [里差, literally difference of *li*], it is necessary to dispatch someone to measure the height of the Pole Star and the sun's shadows in order to gather concrete data to understand the differences in *li* between the East, the West, the South and the North, and the radius of the sun on the sky. The imperial order was handed down, saying: Let He Guodong [何国栋] go to Guangdong, Suozhu [索柱] to Yunnan, Bai Yingtang (白映棠) to Sichuan, Gong'e [贡额] to Shaanxi, Nahai [那海] to Henan, Li Ying [李英] to Jiangnan and Zhaohai [照海] to Zhejiang.²⁰

The imperial court obviously attributed great importance to map-surveying. Kangxi dealt with the matter in person. He assigned the officers of the Imperial Board of Astronomy, of the Hall of Military Glory (武英殿, *Wuyingdian*), and provincial officials to be in charge of the surveying. The parties were escorted by military personnel. Completed maps were submitted to the imperial court by local governors. In 1716, the map-surveying was completed. Finally, the Jesuits Régis and Jartoux completed the assembling of the multiple maps. In 1718, Emperor Kangxi's atlas *Huangyu Quanlantu* was completed.

The map-surveying during Kangxi's reign, mainly national large-scale geometrical triangulation surveys and the latitude and longitude measurements, was very important. At that time, observations of the lunar eclipses and the immersions and emersions of Jupiter were used to determine longitudes, based on the tables of the French astronomer Giovanni Domenico Cassini and others. Ascertaining the latitudes was done mainly by measuring the height of the sun at noon and the height of the Pole Star. The Jesuit Karl Slavicek (严嘉乐, 1678–1735) also introduced a method to determine the latitudes. Many new instruments were used in the surveys. More than 600 sites were measured to determine the latitudes and the longitudes. This was the world's largest cartographic undertaking up until then.²¹

About the same time, under the guidance of the astronomers of the Royal Academy of Sciences, map-surveying was also conducted in France.²² The map-surveying of the missionaries naturally was influenced by the Royal Academy of Sciences, since the work was mostly done by the French Jesuits who had close contacts with the Royal Academy. They had mastered new map-surveying methods and

used the famous astronomer Cassini's tables on Jupiter. By observing the immersions and emersions of Jupiter, they could ascertain the longitudes, making the observations more precise. In Kangxi's 49th year (1710), Régis and Jartoux worked in the Northeast between the latitudes of 41 and 47 degrees, to determine the distance along the meridian line corresponding to each degree of meridian line. The findings from the surveys showed that the greater the latitude, the larger the distance along each degree of the meridian line. Therefore, it was believed the length of the meridians was certainly unequal.²³ In the early eighteenth century, there was a debate about the shape of the earth between Newton and Cassini. Newton's theory was confirmed by the data and findings of China's extensive cartographic surveys.²⁴

IV. *Huangyu Quanlantu* and Jean-Baptiste

Bourgignon d'Anville's *Nouvel Atlas de la Chine*

On 12th day of the second month of Kangxi's 58th year (April 1, 1719), the emperor issued a decree to Jiang Tingxi (蒋廷锡), a minister of his cabinet: "The *Huangyu Quanlantu* has cost me more than thirty years' effort to complete." He presented the map to the ministers.²⁵ There are five editions of *Huangyu Quanlantu*. One copperplate edition, engraved by the Italian missionary Matteo Ripa (马国贤, 1682–1745),²⁶ two woodcut editions (one in 56th year of Kangxi, one in the 60th year), one color-painted edition (now preserved in the First Historical Archives of China)²⁷ and a later woodcut edition.²⁸ On the basis of those maps, after the extensive cartographic surveys, the Jesuits still continued improving the latitudes and longitudes. They sent the relevant data and maps back to France.²⁹ Later, the French Jesuit J.-B. du Halde (1674–1743) commissioned J.-B. Bourgignon d'Anville (1697–1782), the Royal Cartographer, to make maps and compile them into *Description géographique, historique, chronologique, politique, et physique de l'Empire de la Chine et de la Tartarie chinoise*.³⁰ The book was translated into many languages,³¹ and had great influence in Europe.

In 1737, d'Anville's *Nouvel atlas de la Chine* was published exclusively in The Hague, Netherlands.³² The atlas included maps of China and neighboring countries (1734), of China alone (Han areas), northern Zhili, Jiangnan, Jiangxi, Fujian, Zhejiang, Huguang (湖广), Henan, Shandong, Shanxi, Shaanxi, Sichuan, Guangdong, Guangxi, Yunnan, Guizhou (贵州), Tartar (鞑靼) (1732), Korea, Tibet etc., and maps of some parts of Northeast China, totaling 42 maps.³³ Those maps either in du Halde's book or in the *Nouvel atlas de la Chine* were the world's most precise and most authoritative China maps before the 20th century. They were widely quoted and affected Europeans'

perspectives on the geography of China. Regrettably, Kangxi's atlas *Huangyu Quanlantu* was kept in the palace and its influence was not widespread in China. This limited Qing scholars' views of geography in China.

Notes

1. The author is Professor in the Institute for the History of Natural Sciences, Chinese Academy of Sciences. Professor Han Qi's essay has been translated from Mandarin Chinese into English by Annie Lam.
2. *Shengzu Shilu* (圣祖实录) (II), *Juan* 126, Kangxi 25th Year (Beijing: Zhonghua Book Company, 1985), 342–43.
3. Mme. Yves de Thomaz de Bossière, *Un Belge mandarin à la cour de Chine aux XVII^e et XVIII^e siècles: Antoine Thomas 1644–1709* (Paris, 1977), 67.
4. Qi Han and Wu Min (eds.), *Xichao Chong Zheng Ji, Xichao Ding An (Wai San Zhong)*, (《熙朝崇正集》, 《熙朝定案》(外三种)) (Beijing: Zhonghua Book Company, 2006), 168–69.
5. Ignace-Gaston Paradies, *Éléments de Géométrie, où par une méthode courte & aisée l'on peut apprendre ce qu'il faut savoir d'Euclide, d'Archimède, d'Apollonius, & les plus belles inventions des anciens & des nouveaux Géometre*. (Paris: Sebastien Mabre-Cramoisy, 1671).
6. Qi Han, "French Jesuits' scientific activities in China during the Kangxi reign," *Gugong Buowuyuan yuankan*, No. 2 (1998): 68–75; "The Mathematical Education and Its Social Context during the Kangxi Reign," in *Faguo Hanxue (Sinologie Française)* (VIII) (Beijing: Zhonghua Book Company, 2003), 434–48; and "The Jesuits and the Transmission of Mathematical Knowledge during the Kangxi Reign," in *Aomen shi xin bian (New History of Macao)* (III), (Macao Foundation, 2008), 967–86.
7. Mme. Yves de Thomaz de Bossière, *Jean-François Gerbillon, S.J. (1654–1707): Mathématicien de Louis XIV, premier supérieur general de la Mission française de Chine*. (Leuven: Ferdinand Verbiest Foundation, 1994).
8. The First Historical Archives of China still preserves the maps of France, probably those presented to the imperial court during Kangxi's reign.
9. *Kangxi yuzhi wenji* (康熙御制文集, *Collected Writings of the Kangxi Emperor*) II, *Juan* 19: "From *Dushikou* to *Kalun*, the distance is 800 *li* by rope measurement. [. . .] The Crown Prince can delegate a person to measure by rope. In *Kalun* area, instruments were used to determine the height of the North Pole Star. It was five degrees higher than Beijing. Based on this data, the distance should be 1,250 *li*." In Kangxi's 36th year, on 5th day of leap month of 3rd month, the Crown Prince decreed: "I used the instruments to observe the North Pole Star, it is one degree twenty minutes lower than the capital, there are differences of 2,150 *li* between the East and West. Now, Antoine Thomas used the method to calculate, saying that the solar eclipse is 9 minutes 46 seconds, and it is clear day when the solar eclipse happens. When observed, the solar eclipse lasted for more than 9 minutes 30 seconds, but it was not dark enough to let us see the stars." *Kangxi yuzhi wenji* (*Collected Writings of the Kangxi Emperor*) II, *Juan* 24.
10. Li Guangdi, *Rongcun xu yulu* (榕村续语录), *Juan* 17, Li Qi, ed. Chen Zhuwu, (Beijing: Zhonghua Book Company), 813. *Shengzu shilu*, *Juan* 210, also has a similar record.
11. Li Guangdi, *Lixiang Benyao* (历象本要), woodblock edition of Qianlong reign, 44–45.

12. Antoine Thomas, who was involved in that matter, also talked about that survey event. His record could serve as a cross-reference to the Chinese. See H. Bosmans, "L'Œuvre scientifique d'Antoine Thomas de Namur, S.J. (1644–1709)," *Annales de la Société Scientifique de Bruxelles* 44 (1924): 169–208, and 46 (1926): 154–81. Mme. Yves de Thomaz de Bossierre, *Un Belge mandarin à la cour de Chine aux XVII^e et XVIII^e siècles: Antoine Thomas 1644–1709* (Paris, 1977). The former explains in detail Antoine Thomas's survey work.
13. *Shengzu Ren Huangdi Yuzhi Wenji* (圣祖仁皇帝御制文集), Book III, Juan III.
14. *Shengzu Shilu* (III), Juan 245 (Beijing: Zhonghua Book Company), 431.
15. *Shengzu Shilu* (III), Juan 246 (Beijing: Zhonghua Book Company), 440–41.
16. A. Gaubil, *Correspondance de Pékin, (1722–1759)*, ed. R. Simon, (Geneva, 1970), 301.
17. The Jesuit Pierre Jartoux had taught the lamas some knowledge of mathematics.
18. Qi Han, "The Academy of the Investigations of Things and the Studio for the Cultivation of the Youth—The Scientific Contacts between China and France in the Seventeenth and Eighteenth Centuries," *Faguo hanxue (Sinologie Française)* (IV) (Beijing: Zhonghua Book Company, 1999), 302–24.
19. *Qingshi Gao* (清史稿), Juan 283, Book 70 (Beijing: Zhonghua Book Company, 1994), 10185.
20. *Shengzu Shilu* (III), Juan 261 (Beijing: Zhonghua Book Company), 571.
21. Before Kangxi's *Huangyu Quanlantu* was surveyed and drawn, some places had already conducted surveys on latitude and longitude. The Jesuits François Noël (卫方济, 1651–1729), Antoine Thomas and Jean de Fontaney had done many astronomical observations in many places of China. Some of the findings were published. See E. Souciet, *Observations mathématiques, astronomiques, géographiques, chronologiques & physiques tirées des anciens livres chinois ou faites nouvellement aux Indes et à la Chine, par les PP. de la Compagnie de Jesus, redigées et publiées par le P. Souciet* (Paris, 1729–32).
22. Josef Konvitz, *Cartography in France 1660–1848: Science, Engineering, and Statecraft* (Chicago: University of Chicago Press, 1987), 1–31.
23. J.-B. du Halde, *Description géographique, historique, chronologique, politique et physique de l'Empire de la Chine et de la Tartarie chinoise* (Paris: P. G. Le Mercier, 1735), preface, p. XLV. On Jean-Baptiste Régis, see Shannon McCune, "Jean-Baptiste Régis, S.J., An Extraordinary Cartographer," in *Chine et Europe: Evolution et Particularités des Rapports Est-Ouest du XVI^e au XXI^e Siècle* (Taipei, 1991), 237–48.
24. Du Shiran et others, *Zhongguo Kexue Jishu Shigao* (II) (中国科学技术史稿) (Beijing: Science Press, 1982), 213.
25. *Shengzu Shilu* (III), Juan 283 (Beijing: Zhonghua Book Company, 1985), 765.
26. There was also a lithograph edition. See Qi Han, "Matteo Ripa's Activities at the Imperial Court as seen from Chinese and Western Sources," in *Matteo Ripa e il Collegio dei Cinesi, Atti del Colloquio Internazionale, Napoli, 11–12 febbraio 1997*, ed. Michele Fatica and Francesco D'Arelli (Naples: Istituto Universitario Orientale, 1999), 71–82.
27. Feng Baolin, "Research on the *Huangyu quanlantu* during the Kangxi Reign," (*Gugong buwuyuan yuankan*, 1985), No.1, pp. 23–31, 35.
28. Walter Fuchs, *Der Jesuiten Atlas der Kanghi's Zeit: China und die Aussenlaender* (Peking, 1943). This map adopted the projection of French cartographer Nicolas Sanson (1600–67). See Wang Qianjin, "New research on the type

- of projection in the copperplate edition of *Huangyu Quanlantu*," *Ziran Kexueshi yanjiu (Study in the History of Natural Sciences)* 10/2 (1991): 186–94.
29. *Neifu yuditu*, kept in the Bibliothèque Nationale de Paris (Res. Ge. FF. 14550, a copy in a box with 9 volumes, the first volume missing), with covers in yellow silk, including a universal map, maps of Zhili (with Rehe), Shengjing, Ningguta, Wusuli Jiang, Wula (vol. 2), Jiangnan (vol. 3), Jiangxi, Huguang (vol. 4), Fujian, Shandong, Shanxi, Henan (vol. 5), Shaanxi (vol. 6), Sichuan (vol. 7), Guangdong, Guangxi (vol. 8), Yunnan, Guizhou (vol. 9), with the seal of Bibliothèque du Roy, probably sent back to France by the Jesuits.
 30. J.-B. du Halde, *Description géographique, historique, chronologique, politique, et physique de l'Empire de la chine et de la Tartarie chinoise, enrichie des cartes generales et particulieres de ces pays, de la carte générale & des cartes particulieres du Thibet, & de la Corée, & ornée d'un grand nombre de Figures & de Vignettes gravées en Taille-douce*, 4 vols. (Paris: P.G. Le Mercier, 1735). See T. N. Foss, *A Jesuit Encyclopedia for China: A Guide to Jean-Baptiste du Halde's Description [. . .] de la Chine (1735)* (Ph.D. diss., University of Chicago, 1979), as well as his "Reflections on a Jesuit Encyclopedia: Du Halde's Description of China (1735)," in *Appréciation par l'Europe de la tradition chinoise* (Paris: Belles Lettres, 1983), 67–77. Qi Han, *Zhongguo Kexue jishu de xichuan jiqi yingxian (中国科学技术的西传及其影响)* (Shijiazhuang: Hebei People's Publishing House, 1999). Isabelle Landry-Deron, *La preuve par la Chine: la "Description" de J.-B. Du Halde, jésuite, 1735* (Paris: Editions de l'École des Hautes Études en Sciences Sociales, 2002).
 31. In 1736, a pirate copy was printed in The Hague, the Netherlands, and was quickly translated into English, German and Russian. J.-B. du Halde, *A Description of the Empire of China and Chinese-Tartary . . .*, 2 vols. (London: Printed by T. Gardner in Bartholomez-Close, for Edward Cave, at St. John's Gate, 1738–41). The preface described the map as the great treasure of geography. J.-B. du Halde, *The General History of China. Containing a geographical, Historical Chronological, political and physical description of the Empire of China, Chinese Tartary, Corea and Thibet. Including an Exact and Particular account of their customs, manners, ceremonies, religion, arts and sciences. The whole adorn'd with curious Maps, and variety of copper-plates*, 4 vols. (London: Printed by and for John Watts at the Printing-Office in Wild-Court near Lincolns-Inn Field, 1736).
 32. Jean-Baptiste Bourguignon d'Anville, *Nouvel atlas de la Chine* (The Hague, 1737). His other writings included *Mémoire de M. d'Anville, Premier Géographe du Roi, Des Académies Royale des Belles-Lettres, & des sciences. Sur la Chine* (Pékin, 1776) and *Traité des mesures itinéraires anciennes et modernes* (Paris: De l'Imprimerie Royale, 1769).
 33. In du Halde's *Description géographique, historique, chronologique, politique, et physique de l'Empire de la Chine*, the *Carte générale de la Chine* in the first volume was completed in 1730. However in the *Nouvel atlas de la Chine* (1737), there was no year of production. The *Nouvel atlas de la Chine's* maps of countries neighboring China had some differences with the maps in du Halde's book (vol. 4). Other maps in du Halde's book (vol.1, including all provincial maps) were same as those in the *Nouvel atlas de la Chine*.