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Ming-Qing Border Defence, the Inward Turn of Chinese Cartography, and Qing Expansion in Central Asia in the Eighteenth Century

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Since the Song dynasty, China had sometimes supported a massive navy, which the Mongols expanded to invade Japan in 1274 and again in 1281 and to attack Java. Subsequently, the early Ming navy carried out enormous excursions into Southeast Asia and the Indian Ocean from 1403 to 1434. Ming rulers also declined any political accommodation with the Mongols and their nomadic neighbours, a policy that lasted from 1368 until 1570. They saw in such accommodations, which included possible diplomatic and commercial relations, one of the reasons for the fall of the Song in 1280 to the steppe barbarians. As a result of its more narrow-minded defensive and punitive measures, the Ming dynasty faced continual threats from their Mongol neighbours on the steppe.[1]

During the first century of Ming rule, for example, the "perennial problem of the Mongol menace" became so acute that officials in Beijing feared an imminent reconquest by the Mongols. The infamous Tumu debacle of 1448-49, for instance, began when the Oirats, who had reunified Western Mongol forces on the steppe, had captured the reigning Zhengtong emperor (r. 1436-49) when he led a Ming military campaign against them. In the climactic battle, the Ming army lost half of its 500,000 soldiers. Rather than capitulate to Oirat extortionist demands for ransom or move the capital from Peking back to Nanjing, the Ming court chose to replace the captured emperor with his younger brother, who was then enthroned as the Jingtai emperor (r. 1450-56) and led the successful defence of Beijing. The proposal to retreat to the south reminded Ming officials too much of the disastrous experiences of the Southern Song when it had moved its capital from Kaifeng to Hangzhou.[2]

The crisis continued when the Zhengtong emperor, a worthless hostage by then, was returned by the Oirats in 1450. Several years later he retook the throne in 1457 as the Tianshun emperor (r. 1457-64) during the coup d'êtat of 1457, during which the officials who had sacrificed their emperor

in 1449 were accused of treason and executed. After 1457, the Ming pulled its army back from the Inner Mongolian steppe, and the rebuilt Great Wall became, in the sixteenth century, the only immediate barrier separating the capital from the Mongol tribes.[3]

In the 1460s, the Ming court terminated naval expeditions to Southeast Asia and the Indian Ocean, which had been especially prominent from 1403 to 1434, in favour of a strictly coastal navy. The Tianshun emperor, who had already suppressed the great "Treasure Ships" of the Ming navy before his capture by the Oirats, maintained a military vigil on his northern borders after returning to power. In 1474, only 140 warships of the 400 ships that had comprised the main fleet remained. Thereafter, all seagoing ships of more than two masts were scrapped and used as lumber, while the court attended to military campaigns against the Mongols and rebellious southeastern tribes. A coastal navy thereafter defended the China coast from Japanese pirates in the sixteenth century, albeit in vain. This northern border focus on steppe defences lasted until the mid-sixteenth century, when the Wokou pirate menace loomed in the Yangzi delta and the southeast.[4]

Chinese naval power revived briefly in the late Ming as a result of Ming efforts to aid Korea and to halt Hideyoshi's (1536-98) invasion of that country. Ming loyalists subsequently defeated the Manchu Qing dynasty in major naval and land battles along the Fujian coast. This brief naval efflorescence lasted until the 1680s but, thereafter, new types of sailing vessels continued to be developed (such as the Zhejiang junks first built in 1699). They were used in northern waters for the Ningbo-Nagasaki trade between Japan and China, which lasted into the eighteenth century despite Japan's alleged "closed door" policies.[5]

Pre-Jesuit Cartography and Descriptive Geography

During the late Ming, native attempts at serious cartography and descriptive geography provided Chinese with a foundation that cumulatively helped bridge the gap between the orthodox symbolic geography popular since the Song period and the Jesuit techniques that stimulated the emergence of more precise cartography in the seventeenth century. Chinese achievements in geography climaxed with the production of schematic grid-maps, sailing charts, and relief maps. Although few maps from early dynasties have survived, two other extant maps, which demonstrate the remarkable development of map-making in China, were carved on stone in the twelfth century. Informed by Tang models, the maps were entitled the *Map of China and Foreign Areas* (*Huayi tu*) and *Map of the Tracks of Emperor Yu* (*Yuji tu*). The latter (see Figure 1), carved in 1137 as a grid based on a scale of approximately 1:1.5 million, is described by Needham as "the most remarkable cartographic work of its age in any culture."

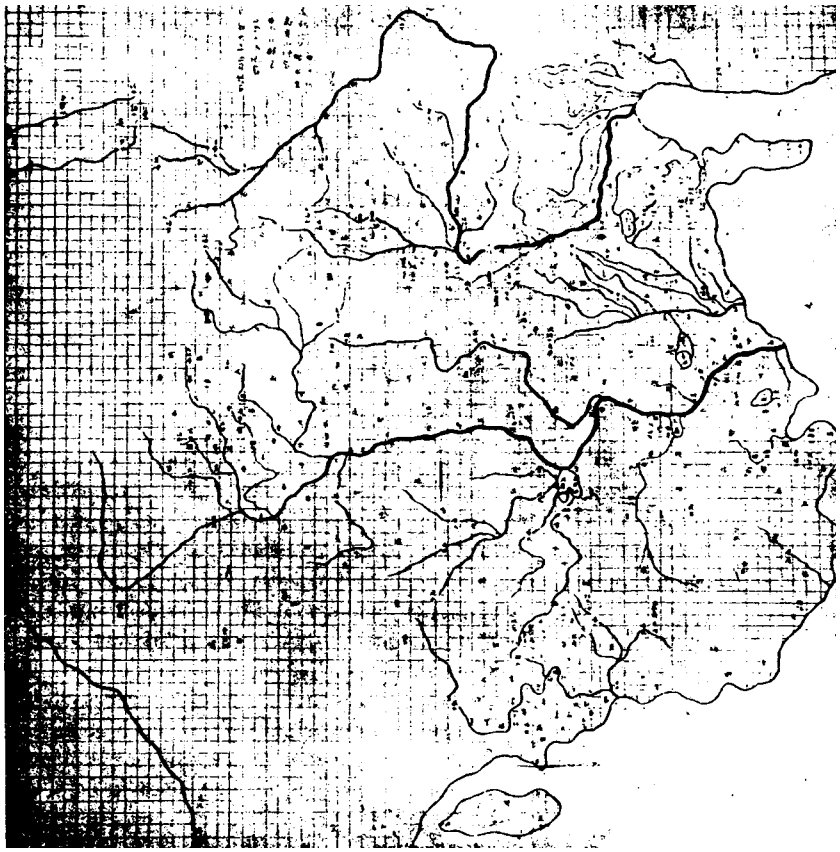

Figure 1 Map of the Tracks of Emperor Yu (Yuji tu).
Source: Reprinted from Joseph Needham, *Science and Civilisation in China,* vol. 3, Cambridge University Press, 1959. Copyright © 1959. Reprinted with the permission of Cambridge University Press.

The medieval cartographer Pei Xiu (224-271) first used the method of indicating distances by a rectangular grid system. Since then, cartography in China was often based on the grid tradition, although many important maps still followed the Map of China and Foreign Areas model and were not rendered using a grid. Jia Dan (730-805), the greatest Tang cartographer, constructed a map of Chinese and foreign regions for the emperor. The map, now lost, was thirty feet long, thirty-three feet high, and used a grid scale of one inch for one hundred Chinese miles (equal to about thirty-three English miles), the same scale used in the Map of the Tracks of Emperor Yu. Jia Dan's map, given its huge scale, likely depicted all of known Asia.[6]

Zhu Siben (1273-1337) inherited this grid format. Perhaps the best known Chinese cartographer until the twentieth century, Zhu used grid-maps to summarize the large body of new geographical information that the Mongol conquests in Asia had added to the earlier fund possessed by Tang and Song geographers. Zhu's map, circa 1320, was known as the "Mongol Atlas of China" (*yutu*). An early Ming map, circa 1390, replicated the imperial pretensions of Mongol maps and charted the empire's sway from Central Asia and Japan to the Atlantic via Southeast Asia and the Indian Ocean world.[7]

In the sixteenth century, Luo Hongxian (1504-64) discovered a manuscript copy of Zhu Siben's map of the known world, which Zhu prepared between 1311 and 1320 but never printed. Luo revised and enlarged Zhu's grid format in 1541. He also added new information, some derived from the early Ming naval explorations led by Admiral Zheng He. Luo's map (*Guang yutu*, lit., "Enlargement of a map of the earth"), printed about 1555, included a clear depiction of the Cape of Good Hope and southern Africa, leading some to speculate that Zheng He was the "Vasco da Gama of China" and had traversed from the Indian to the Atlantic Ocean and back some seventy years before da Gama did it in reverse.[8]

Ming Knowledge of Foreign Countries

Geographers and cartographers in Ming China were fairly knowledgeable about the southern regions (*nanyang*, i.e., what Chinese referred to as Southeast Asia) and foreign countries in the Indian Ocean and Arabian Peninsula (*Xiyang fan'guo*, i.e., "Western tributary states"). Information of this type peaked in China as a result of the early fifteenth-century voyages of the of the Ming fleet. Zheng He, the eunuch commander of seven Ming expeditionary fleets launched between 1405 and 1433, at one time or another reached Sumatra, Java, Ceylon, Hormuz, Aden, and East Africa.

The expeditions overlapped with the Ming maritime tributary system, around which trade and diplomatic relations were organized in Ming China. Moreover, Ma Huan left a descriptive account of Zheng's fleets in 1433, which was based on his service as Muslim translator for three of the seven expeditions (1413-15, 1421-22, and 1431-33). Ma's *Captivating Views of the Ocean's Shores* (*Yingyai shenglan*) described the countries the fleet visited and portrayed the customs, religions, and lifestyle in each place. He also depicted topography, geology, and wildlife.[9]

Subsequently, other members of Zheng He's expeditions described their adventures. For example, Fei Xin's (1388-1436?) *Captivating Views from a Star Guided Vessel* (*Xingcha shenglan*) and Gong Zhen's *Gazetteer of the Western Tributary States* (*Xiyang fan'guo zhi*, 1434) were based on first-hand visits and help fill the gap in Indian Ocean accounts that occur between Marco Polo's *The Travels* and Portuguese reports in the late fifteenth century. References to the expeditions and the exotic gifts brought back to China were

added, for instance, to Cao Zhao's (fl. 1387-99) *Key Issues in the Investigation of Antiquities* (*Gegu yaolun*), which was published in the early Ming and was enlarged several times. The work originally appeared circa 1387-88 with important accounts of ceramics and lacquer as well as of traditional subjects such as calligraphy, painting, zithers, stones, bronzes, and ink-slabs.[10]

Excerpts and extracts were subsequently included in the massive early eighteenth-century *Synthesis of Books and Illustrations Past and Present* (*Gujin tushu jicheng*), the largest encyclopaedia in Chinese history. The Qianlong Imperial Library also included a 1520 annotation of Ma Huan's account by Zhang Sheng (1442-1517). In addition, the Imperial Library summarized the content of Gong Zhen's work and mentioned Huang Shengzeng's 1520 *Records of Western Tributaries* (*Xiyang chaogong dianlu*), although neither was copied into the collection. Huang's work drew on and cited earlier sources.[11]

Within China, Ming dynasty explorers such as Wang Shixing (1547-98), Xie Zhaozhi (1567-1624), and Xu Hongzu (also known as Xu Xiake, 1586-1641) travelled to the most remote borders of the empire. In their travels they collected notebooks outlining in descriptive terms the river systems, topography, and cultural aspects of the places they visited. Xu Hongzu, for example, discovered the main source of the West River in his travels through much of Southwest China and was able to determine that the Mekong River and the Salween River were different river systems.[12]

Cartography and Ming Military Defence

Interest in cartography and geography in China was tied to problems of border or maritime defence. Luo Hongxian became interested in geography because of Japanese pirate raids on the maritime provinces in the Yangzi delta and along the Southeast Coast in the sixteenth century, which were aided by Chinese accomplices. The Ming government urgently needed maps and geographical advisors to cope with the situation. Luo spent three years collecting geographical materials for military defence and, in the process, discovered the manuscript of Zhu Siben's grid-map.

Zheng Ruozeng (1505-80), a native of Suzhou prefecture, was also involved in coastal defence because of the Japanese pirate threat. In the 1540s, Cheng compiled a strategic atlas of China's coastal region, extending north from the Liaodong Peninsula to southern Guangdong, which included maps and strategic information. More important, however, was a work on coastal geography compiled under then Zhejiang governor Hu Zongxian's (1511-65) auspices by Zheng Ruozeng.

First published in 1562, the resulting *A Maritime Survey: Collected Plans* (*Chouhai tubian*) was modelled after Luo Hongxian's work. The *Maritime Survey* was an ambitious survey of geographical minutiae about the China coast, and it contained accurate accounts of China's neighbours, Japan and Korea. Hence, it was not simply an atlas. A major contribution to Chinese

historical geography, the *Maritime Survey* marked a major turning point in Chinese geographic studies. Arguably, its completion provided the impetus for later literati to incorporate Jesuit information into the Chinese tradition of geography and cartography.[13]

Prior to the sixteenth century, threats to China's security had mainly come from the north and northwest (e.g., the Jurchen, the Mongols, and the Manchus). Hence, earlier geographers such as Zhu Siben focused attention on the northern frontier areas. In the sixteenth century, however, the primary military menace came from Japanese pirates and their Chinese collaborators along the South China Sea coastline. Zheng Ruozeng's research on the maritime provinces in the southeast thus stimulated a shift in geographical research. A number of sixteenth-century geographical treatises on maritime defence were either inspired by or followed the pattern of the *Maritime Survey*.[14]

Because of their travels, European Jesuits could claim expertise in world geography when they arrived in Ming China in the late sixteenth century. Their charts of the globe were based on the New World discoveries of the Portuguese and Spanish explorers they often accompanied. The mappa mundi that Matteo Ricci (1552-1610), his collaborators, and others produced for literati in the late sixteenth century caused an uproar because the Ming imperial system was based on a cosmological view of its geographical centrality in the world, which the Jesuit maps seemed at first to challenge. It was difficult, for example, for literati to accept the Jesuit claim that the earth was round because this suggested that the "vaulted heavens" (*gaitian*) were circular as well. Many literati considered the earth to be flat and the sky to be a finite vault overhead.[15]

Matteo Ricci's Mappa Mundi

Jesuits added to the geographical knowledge that Ming literati already had in the late sixteenth century. Produced with the help of Chinese converts, the first edition of Matteo Ricci's mappa mundi, entitled *Complete Map of the Earth's Mountains and Seas* (*Yudi shanhai quantu*), for instance, was printed in 1584. A flattened sphere projection with parallel latitudes and curving longitudes, Ricci's world map went through eight editions between 1584 and 1608. The third edition was entitled *Complete Map of the Myriad Countries on the Earth* (*Kunyu wan'guo quantu*) and was printed in 1602 with the help of Li Zhizao (1565-1630; see Figure 2). Li studied European mathematics and astronomy, in addition to geography, after meeting Ricci in Peking in 1601.[16]

Ricci's description of the form and size of the earth obliged many seventeenth-century Chinese literati to revise their views of the world. For the first time, Chinese became aware of the exact location of Europe in relation

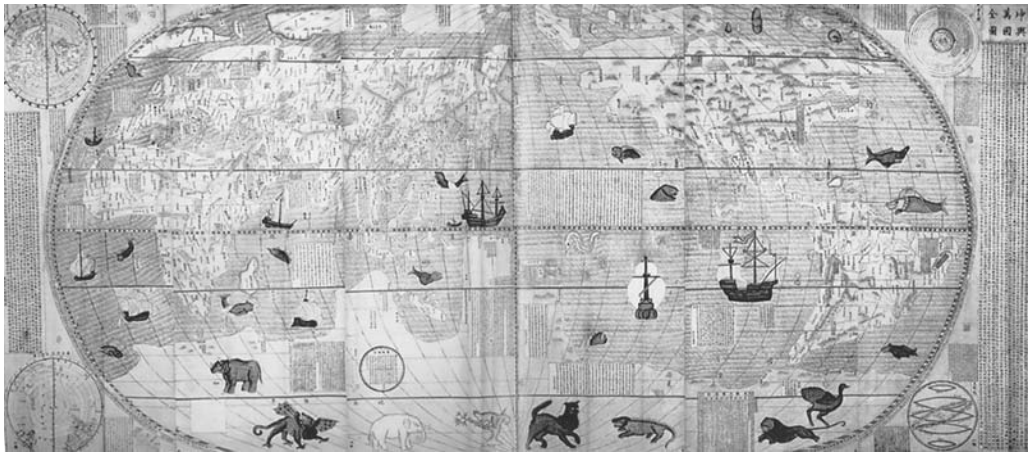

Figure 2 Complete Map of the Myriad Countries on the Earth (Kunyu wan'guo quantu).

Source: http://geog.hkbu.edu.hk/GEOG1150/Chinese/Catalog_main_11.htm.

to their own country. In addition, Ricci's maps contained technical geographical lessons for Chinese geographers: (1) Ricci taught Chinese cartographers to localize places by means of circles of latitude and longitude; (2) he invented many geographical terms and names, including Chinese terms for Europe, Asia, America, and Africa; (3) his maps transmitted to China the most recent discoveries made by European explorers; (4) he described the existence of five terrestrial continents surrounded by large oceans; (5) his maps introduced the sphericity of the earth; and (6) he spoke of five geographical zones and their location on the earth (i.e., the Arctic Circle, the Antarctic Circle, the zone between the Arctic Circle and the Tropic of Cancer, etc.).[17]

An indication of the initial impact of Ricci's maps, especially the 1608 edition printed in Beijing, was its inclusion in geographical works produced by literati scholars in the closing years of the Ming dynasty. For example, Zhang Huang (1527-1608), who had met Ricci in Jiangxi in 1595, added Ricci's Complete Map to his own illustrated collection, which Zhang called *The Compendium of Maps and Materials* (*Tushu bian*, 1613). In addition to Ricci's 1584 map of the world, in his massive collection Zhang also printed European depictions of the northern and southern hemispheres, along with traditional maps of the four seas.[18]

The only known copy of the first Chinese map of the world produced in 1593 was entitled *The Comprehensive Map of Heaven and Earth and the Myriad Countries and Ancient and Modern Persons and Artifacts* (*Qiankun wan'guo quantu gujin renwu shiji*) and included geographical information brought by the

Jesuits. It was based on Ricci's first world map of 1584, which is now lost. The map offered a traditional representation of China, with foreign lands arranged around the periphery. It served chiefly as an administrative map for officials and thus included statistical information such as population (based on families) and locally produced commodities.

Topological rather than topographical, the 1593 Chinese version fit European lands in along its edges without affecting traditional cartography. The New World was shown as a series of small islands surrounding the "Central Kingdom." Methodologically, however, the compiler stressed the "achievements of investigating things and extending knowledge," which by now served as a native trope for the accumulation of knowledge. The linkage of the world map of 1593 to classical studies based on investigating things and extending knowledge heralded the application of such native terminology to European scientia.[19]

The 1602 *Complete Map of the Myriad Countries on the Earth* corresponded to one of the first issues of Ricci's third world map and is the earliest version that survives. This 1602 edition followed the *Typus Orbis Terrarum*, which was produced by the Flemish scholar and geographer Abraham Ortelius (1527-98) and was first published in a 1570 European atlas called the *Theatrum Orbis Terrarum*, itself based on Gerardus Mercator's (1512-94) prominent 1569 world map. The chief alteration for the Chinese version was that Ming China was placed at the centre of the map to appeal to Chinese dynastic sensibilities. The New World was located on the eastern borders. A fourth edition of the map was prepared in 1604.[20]

Ricci's map-making was continued by later Jesuits who, in 1623, produced a lacquered wooden globe, which updated Ricci's map and also stressed the sphericity of the earth. Giulio Aleni (1582-1649) and Yang Tingyun (1562-1627) quickly followed with their *Account of Countries Not Listed in the Records Office* (*Zhifang waiji*), a treatise on world geography that was later included in the 1628 *First Collection of Celestial Studies* compiled by Li Zhizao. Aleni's *Account* grew out of notes on Ricci's 1601 mappa mundi that Pantoja and Ursis had prepared for the Ming court.[21]

Aleni's translation represented the first detailed exposition in Chinese of a world geography that drew on Renaissance traditions of local lore and Ptolemaic cosmography to describe Asia, Europe, Africa, and the Americas. Another section focused on the oceans. In addition to the *First Collection of Celestial Studies*, other Chinese collections reproduced Aleni's treatise in the eighteenth century, thus making it more influential during the Qing dynasty than Ricci's maps, which were quickly forgotten by literati. In the nineteenth century, Aleni's work was reprinted three times in sixty years after Euro-American geography became de rigueur for literati trying to understand the military consequences of the Opium War (1839-42).[22]

A world map composed by the Naples Jesuit Father Francesco Sanbiasi in 1648 was designed as a simplified version of the large maps produced by Ricci. It was drawn as an oval projection, with China at the centre. Later, Michael Piotyr Boym, a Polish Jesuit who had served the embattled Southern Ming in the 1650s, produced the *Map of the Middle Kingdom* (Zhongguo tu), circa 1652, which he brought back to Rome in 1656. The original manuscript was compiled to convey Jesuit knowledge of China to Europe. This version was superseded by Martinus Martini's (1614-61) *Novus Atlas Sinensis*, which was published in an Amsterdam atlas series in 1655.[23]

Although Matteo Ricci introduced the system of longitude and latitude to Ming China, the grid system employed by Luo Hongxian and his predecessors continued to exercise a dominant influence on Chinese cartography throughout the late Ming and Qing periods. For example, an admired genre known as "Complete Maps of All under Heaven" (*tianxia quantu*) was initiated by the Ming loyalist Huang Zongxi (1610-95) in 1673 and was continued by a number of talented literati scholars who were interested in map-making. Cao Junyi's ambitious *Complete Map* of 1644, for instance, mixed inaccurate classical geographical lore with a precise recognition of Europe, Africa, India, and Central Asia (which was provided through the use of longitudes and degrees for estimating their distances from Nanjing, the Southern Ming capital).[24]

In the early Qing, Ferdinand Verbiest (1623-88), with the help of others, produced two works that dealt with world geography. His 1674 world atlas included a comprehensive map in two hemispheres, with gazetteer information about each part of the globe. Later abridged, it was based largely on Aleni's *Account of Countries Not Listed in the Records Office*. Similarly, Verbiest's *Main Records about the West* (*Xifang yaoji*) drew on the topical organization in Aleni's 1637 *Answers about the West* (*Xifang dawen*), which compared China to Europe in light of geographical lore. During the Qianlong reign (1736-95), the compilers of the Imperial Library considered these works important enough to be copied into the collection in the 1780s.[25]

The final stage in the development of traditional Chinese map-making came in the eighteenth century when French Jesuits, on behalf of the Kangxi emperor (r. 1662-1722), conducted systematic surveys of the entire Manchu realm between 1708 and 1718. They drew up a series of maps of the Qing Empire and its border areas, which became known as the 1718 *Kangxi Atlas* (*Huangyu quanlan tu*). Along with succeeding maps in the Yongzheng (r. 1723-1735) and Qianlong periods, the *Kangxi Atlas* surpassed earlier Jesuit surveys completed in the seventeenth century. Although the Manchu court restricted access to and reproduction of these surveys and maps, they remained the chief sources of foreign geographical information concerning China until the twentieth century.[26]

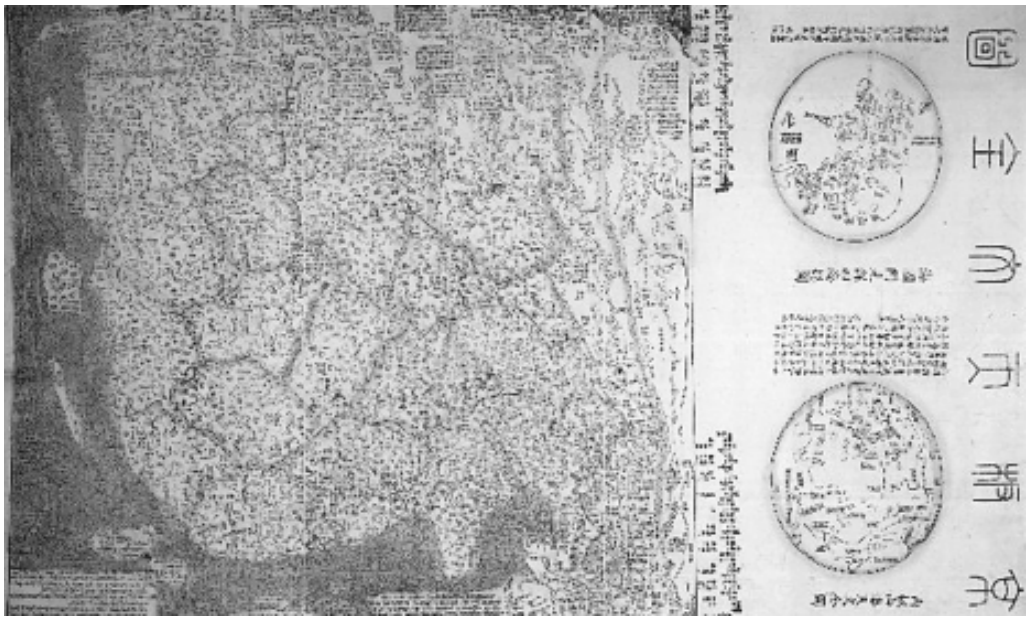

Figure 3 Capital Edition of a Complete Map Based on Astronomy (Jingban tianwen quantu).

Source: The Woodson Research Center of the Fondren Library, Rice University.

Rather than switching to Jesuit cartography, late eighteenth-century literati such as Ma Junliang sometimes presented both a traditional picture of a China-centred world and global maps that loosely duplicated Ricci's mappa mundi. Ma's *Capital Edition of a Complete Map Based on Astronomy* (*Jingban tianwen quantu*; see Figure 3) circulated widely in the 1790s and included two smaller global maps of the Euro-Asian-African and Pacific hemispheres above his detailed map of the Qing Empire, which roughly corresponded to Ricci's *Map of the Myriad Countries on the Earth* rendered in a late Ming encyclopaedia.[27]

Despite displaying substantial variations, a prominent feature of the "Complete Maps" was the mingling of traditional and newer techniques, such as the hybrid overlap between the grid and latitude-longitudinal approach for large-scale land maps. Indeed, Li Zhaoluo's (1769-1841) famous 1832 atlas of the Qing Empire showed both grid and latitude and longitude lines on the same map, indicating, long after the Jesuit mappa mundi were introduced, the reluctance of native geographers to give up the traditional system. This nativist pattern for domesticating European learning was repeated in other new fields of learning, such as mathematical astronomy, during the late eighteenth century.[28]

Mensuration and Cartography in the Eighteenth Century

The late Kangxi and Yongzheng bans on propagating European natural studies did not suffocate literati learning, where a decisive sea change in classical learning was occurring. Eighteenth-century "evidential research" (*kaozheng*) scholars stressed painstaking research, rigorous analysis, and impartial evidence drawn from ancient artifacts and historical documents and texts. They made verification a central concern for the emerging empirical theory of knowledge – namely, "to search truth from facts" (*shishi qiushi*), a Han dynasty expression used, in the eighteenth century, as a slogan for impartial scholarship.[29]

In geography, moreover, evidential scholars during the late seventeenth and eighteenth centuries reacted to the Jesuit contributions in world geography by domesticating such new knowledge in the midst of Qing empire building and the court's use of Jesuit surveying techniques to measure its domains. At the same time that the Manchu dynasty took advantage of international changes in Central Asia, Chinese literati took an internalist turn by focusing on native topics in their new geographic works.[30]

The Seventeenth-Century Turn Inward

Ming naval power revived when the Ming joined forces with the Korean navy to resist the Japanese invasions of the Korean peninsula in 1592 and again in 1597. In particular, hundreds of Ming coastal ships joined the Korean "turtleboats" (i.e., sailing vessels also propelled by oars and also reinforced with iron plates, ringed with spikes, and equipped with cannon) to gain control of the sea war. Their combined forces of some five hundred ships and fifteen thousand men were decisively superior in technology and continually threatened Japan's land-based supply lines. Despite mobilizing a Japanese fleet of twelve thousand men on five hundred ships for the climactic battle at the Noryang Straits in December 1598, Hideyoshi failed in his grandiose plans to use Korea as a stepping stone to conquer China. Some three hundred Japanese ships with ten thousand sailors were lost.[31]

Despite the increased awareness of foreign nations as a result of the Korean wars, contact with Jesuits, and/or the border treaties between the Qing and Russian imperial governments in 1689 and 1727, Han Chinese scholarly interest in such global knowledge waned. Due in part to wide travel in North and South China by many eminent scholars in the seventeenth century, particularly as a response to the Manchu military conquest in the 1660s, research on geography in the early Qing returned to traditional questions of regional military strategy and local, coastal defence. Meanwhile, the Dutch increasingly colonized Taiwan beginning in 1623, when the Dutch East India Company contracted Chinese traders and farmers from Southeast China to settle the island.[32]

Subsequently, southern Ming loyalists led by Zheng Chenggong (Koxinga, 1624-62) resisted the Manchus in major naval and land battles along the Fujian coast in the 1640s and 1650s. Zheng's land and sea forces took heavy losses, however, when they moved up the Yangzi River to Nanjing in 1659, and they were forced to retreat to Xiamen (Amoy). Southern Ming naval forces then challenged the Dutch garrison in northern Taiwan (called "Formosa" by Europeans) at Castle Zeelandia in April 1661 with a force of six hundred ships and twenty-five thousand sailors. The Dutch capitulated after a bitter nine-month siege.[33]

In 1662, for its part, the Qing government ordered coastal inhabitants from Shandong in the north to Guangdong in the south to move inland to cut Zheng's supply lines and to negate the value of the coast as a battleground. In addition, the Manchus developed a naval fleet to defend the coastline. When Shi Lang (1621-96), one of the Southern Ming's most capable admirals, joined the Manchus in 1646 because of a dispute with Zheng, he took command of Qing naval forces along the Fujian coast (during the 1650s and 1660s. In July 1683, Shi Lang commanded the Qing fleet of some three hundred warships and twenty thousand sailors, which first subdued the Pescadores. Taiwan fell to the Qing navy in October, and for the first time the island became part of the "Chinese" Empire.[34]

The Qing navy no longer remained on a war footing after Taiwan was annexed, and the Manchu emperors became increasingly preoccupied with the land-based expansion of the Russians from Siberia into the Manchu homelands and the renewed dangers posed by the Zunghars in Central Asia. In addition, the Qing sought to expand its empire into Tibet and Turkestan. By the end of the eighteenth century, the Qing had doubled its size. When the Opium War broke out in 1839, therefore, the Qing fleet was again mainly a coastal navy used principally for defence against outside pirates and local marauders. For the land-based Qing, the maritime world remained a "center of subversion."[35]

Furthermore, even before the conquest of Taiwan, maritime considerations evoked less interest among Chinese literati. Because the Manchu conquest emanated from the northern steppe, Gu Yanwu (1613-82), a leading voice of the early Qing turn towards precise studies, emphasized China's strategic positions vis-à-vis its traditional foreign neighbours to the north and northwest in his influential geographical treatise entitled *The Strategic Advantages and Weaknesses of Each Province in the Empire* (*Tianxia junguo libing shu*), compiled between 1639 and 1662. Ironically, such "foreigners," particularly the Manchus, Mongols, Tibetans, and Uighurs, would in ensuing years become part of the political-cultural unit that nineteenth-century Europeans referred to as "China."

Gu Yanwu did not even mention Ricci's mappa mundi. He was concerned with the effects of topography on political and economic development within

China. His findings, however, were based on his wide travels, careful first-hand observations, and the study of written materials. Likewise, Gu Zuyu's (1631-92) *Essentials of Geography for Reading History* (*Dushi fangyu jiyao*), written between 1630 and 1660, was a study of native historical, administrative, and natural geography, with an emphasis on the importance of topography for military strategy. Ricci's world map was disregarded, and late Ming interest in the maritime nations waned.[36]

Zuo Zongtang (1812-85) read Gu Yanwu's and Gu Zuyu's geographical treatises in 1829, and they inspired in him a life-long interest in Chinese topography and military strategy. His interest in Chinese Turkestan grew out of his early reading and underscored his later insistence that troops be sent to Northwest China in the 1870s to prevent that area from falling permanently into Russian hands. Zuo's campaigns provoked the opposition of Li Hongzhang (1823-1901) and other Beijing officials who regarded naval power for coastal defence and protection of Korea from Japan as more pressing needs than the recovery of territory in the distant interior.

The compilers of both the official Ming dynastic history and *The Comprehensive Geography of the Great Qing Realm* (*Da-qing yitong zhi*) had access to Ricci's and other Jesuit geographical works, but they dismissed as fictitious many of the Jesuits' claims and the information on their mappa mundi. Nevertheless, Xu Qianxue (1631-94), who chose scholars to work on the Comprehensive Geography project when he was appointed director in 1687, had a high regard for the emerging evidential scholarship of his times, which is highlighted by the fact that he chose leading textual scholars to edit the topographical material for the geography project. Xu's appointment of Gu Zuyu, perhaps the most qualified student of historical geography in his time, indicates the high degree of expertise that went into the Comprehensive Geography project.[37]

Similarly, the late Qianlong compilers of the 1787 edition of the *Comprehensive Analysis of Civil and Military Institutions during the Qing Dynasty* (*Huangchao wenxian tongkao*), which included documents and materials covering the period 1644 to 1785, demoted the mention of Europe to a minor section on Italy within the category "Four Frontiers." Twenty-four chapters in the traditional category of "Geography and Lands" dealt with imperial domains, while only eight covered the borderlands. The compilers of "Four Frontiers" focused on Korea, the Ryukyu Islands, Vietnam, and other neighbouring tributary countries.

The section on Italy mentioned that "what the Italians [i.e., Matteo Ricci] had said about the division of the world into five continents followed from Zou Yan's Warring States theory of the Sacred Ocean [Shenhai], although the Italians dared to add that the land of China was but one of the five continents." Such claims infuriated the compilers, who dismissed the Italians as too grandiose. They could not be taken seriously because they were

simply trying to impress Chinese with European customs, goods, governance, and education. By citing Zou Yan on the question of continents, the *Comprehensive Analysis* was drawing on a long tradition of classical interpretation that held that the ancient "nine regions" (*jiuzhou*) were surrounded by oceans, thus the geographic term for "regions" could also serve as a native term for "continent."[38]

Still, the *Comprehensive Analysis* included detailed geographic discussions of Europe and Russia. Moreover, the dramatic political impact that European surveying methods had in China early in the eighteenth century also piqued the interest of the Qianlong emperor and his court when the Kangxi map of the empire was updated using European surveying methods. European geographical content may have been overlooked, but European methods were still admired and copied in official geography as well as astronomy.[39]

Xue Fengzuo had studied astronomy and mathematics under the Jesuits. Xue then applied the techniques of spherical trigonometry and logarithms to surveying, which was appreciated by the Qianlong Imperial Library editors in their review of Xue's compendium on the Yellow River and Grand Canal. The editors noted that Xue's mathematical expertise was an invaluable aid in analyzing problems related to flood control and canal upkeep. His use of European trigonometry was recognized as a clear improvement over the native forms of trigonometry known as "double application of proportions" (*chongcha*, i.e., properties of right triangles expressed as a function of angles), which dominated traditional Chinese surveying techniques.[40]

Evidential Research and Geography

Literati scholars who compiled imperial gazetteers such as the *Comprehensive Geography* and its Yuan and Ming precursors prioritized geographical knowledge. Qing dynasty geographers increasingly presented the history of geography as the study of topographical change, and, as scholars, they tended to distance themselves from the moral correspondences between heaven and earth that still informed the traditional cosmography popular in unofficial life. The Imperial Library editors writing in the late eighteenth century, for instance, singled out a Ming dynasty study of West Lake in the Hangzhou area by Tian Rucheng (1500-63) to make a methodological point: "Because of the lack of corroborating evidence, no one can evaluate the accuracy of his claims. This [imprecision] is an error that Ming scholars in general all shared." Precision became a new feature informing evidential learning as a result of the overlaps between classicism, geography, and mathematical astronomy.[41]

Within the academic community that promoted evidential research, historical and physical geography took precedence over the application of the idealized geopolitical paradigms popular in Han, Tang, and Song classical

cosmography. Recognition of the physical difficulties in using the ancient mensural order to demarcate existing mountains and rivers indicated that Qing scholars were challenging the traditional approach to the ordering of space. Evidential scholars, for instance, no longer accepted uncritically the portent astrology associated with the field allocation system (*fenye*, lit., "allotted countryside"). Specific celestial fields associated with the twenty-four lunar lodges (*xiu*) constituted the equatorial coordinate system and were used to indicate the positions of celestial objects on the celestial sphere, which corresponded to terrestrial regions presented in the *Documents Classic*, one of the five Confucian classics.[42]

Since the Former Han dynasty, the twenty-eight lunar lodges were associated with twelve ancient feudal states. Analogies were drawn between the celestial realm and the imperial court then based in northwestern capitals of Chang'an and Luoyang. Constellations and stars were considered celestial counterparts to governmental bureaus and their officials. Astrological prediction based on this theory of the continuity between the astronomical and geographical realms remained a common feature in official astronomy through the late Ming and early Qing, even after the Kangxi emperor charged that officials manipulated the major traditions in portent astrology to suit their political purposes.[43]

Although many had questioned the field allocation system, and although astrology itself had not interfered with the accumulation of geographical knowledge, the system was not attacked as an outdated notion until the seventeenth century. Some noted that the southern region, mentioned in the *Documents Classic* as Yangzhou, had comprised a large and important portion of current China. In antiquity, when the capital was in the northwest, Yangzhou was allotted only three of the twenty-eight stations in the heavens. Others pointed out that field allocation was bound to a time when the northwest had been the centre of the empire. Yan Ruoju (1636-1704) discussed the system and noted that it took no notice of "foreign" regions. He asked rhetorically: "How can it be that the sun and stars did not look out over the Man, Yi, Rong, and Di [peoples]?"[44]

Scholars recognized, since medieval times, the gradual impoverishment of the classical centre of ancient culture in the northwest. They also perceived the concomitant enrichment of the southeast, highlighted by the emergence of the Yangzi delta, as the cultural nexus of China since the Song dynasty. Gu Yanwu and Huang Zongxi considered this development the result of historical growth in which circumstance and human effort had helped bring about the geopolitical transformation of the Chinese Empire.

Hu Wei (1633-1714), writing in the second half of the seventeenth century, confirmed the recent rise of the Yangzi delta and saw in it sufficient cause to show that the ancient correspondence with the "nine regions" mentioned in the *Documents Classic* could no longer be taken literally to

account for historical changes. The historicization of cultural geography meant that the old cosmograms (i.e., charts of symbolic correspondences between the natural world and human affairs) were no longer applicable. The enlargement of geographical horizons led to the discrediting of the idea of the local applicability of portents.

Such pioneering views were more critical than were those of the Jesuit Figurists, who tried to add the Bible to the cosmological correspondences Chinese literati had woven together for centuries. Such correspondences were also reworked by others to favour the priority of Chinese traditions and were included in the new mathematical collections. Evidential learning (based on a community of scholars who were literati) and imperial ideology (propagated in the court) had parted ways. Thereafter, imperial rhetoric based on the five Confucian *Classics* was ever more undercut by scholarly opinion.[45]

Scholars who used empirical methods in their geographical research during the Ming-Qing period rejected the symbolic geography in cosmograms and magic squares. They turned instead to precise fields of descriptive and historical geography. Criticism of the River Chart and Lo Writing was so acute that even champions of orthodox learning felt compelled to dissociate the mysterious charts from the teachings of their Song dynasty masters.

Embarrassed by the inclusion of the charts in Zhu Xi's (1130-1200) commentary on the *Change Classic*, a second of the five Confucian classics, those who remained orthodox scholars played down the importance of the charts. Huang Zongxi (1610-95) denied the cosmological significance of the charts and maintained instead that they were originally primeval geographical maps, charts, and registers, not cosmograms of transcendental significance. Continuing Huang's efforts to historicize the universal charts, Hu Wei demonstrated the Daoist origins and associations of the charts in the Change in his critique of their purported mystical correspondences. Their heterodox origins also placed into doubt the legitimacy of Song literati as rightful transmitters of the classical canon.[46]

These cosmograms were linked by Han and Song literati to the origins of Chinese writing and mathematics, which was affirmed in the mathematical works compiled in the Kangxi court. The Qing literati attack on the authenticity of these charts thus struck at the heart of the traditional cosmological ordering of the heavens and the earth and, unknowingly, at Jesuits who associated these cosmograms with the Biblical narrative.[47]

The leading Qing literati-scholars turned historical geography into a precise field of evidential inquiry. Place-names were now a sign of their time and specific location. They were employed by scholars as the empirical basis for discerning geographical anachronisms in forgeries. On the technical level, geography was an important element of concrete studies (*shixue*) and was always valued for help in land reclamation and hydraulic works – projects

used to order physical space in the eighteenth century. Jesuit surveys of the empire completed in 1718 also encouraged this practical emphasis. Separated since the late Song period, the reunion of classical and technical studies during the Qing produced literati specialists who adopted an active, interventionist approach to problems in river and flood control. The empirical emphasis of evidential studies had implications for imperial statecraft that began to be felt in China a century before the forced introduction of European technology.[48]

More and more, diagrams (*tu*) and tables (*biao*) were used as aids in discussion, explanation, and classification. One of the most prominent features of eighteenth-century historical scholarship, for instance, was the use of tables of persons (*renwu biao*), supplements, and supplemental tables to help make the *Dynastic Histories* more accessible as research tools. Many evidential scholars produced important works in this genre. Interested in the organization of knowledge more than evidential studies, Zhang Xuecheng (1738-1801), for instance, insisted that historical writing should include documentation tables and tables of persons, which would summarize the institutional forms and workings of central and local government.[49]

Gu Donggao's (1679-1759) Table of Major Events in the *Spring and Autumn Annals* (*Chunqiu dashi biao*, 1748) was a model for the collection of chronological, geographical, genealogical, and economic information concerning the late Zhou period from 722 to 481 BC. Gu arranged his work in tabular form under fifty topics, and he placed supplementary notes by other scholars after each topic whenever there was an element of dispute or doubt. Gu also attached maps that included explanations in which the ancient and present forms of place-names were given.

The use of diagrams as the first step in the graphic reconstruction of ancient relics by Dai Zhen (1724-77) and others indicates that leading Qing scholars changed the meaning and use of such diagrams from cosmogram to explanatory model. Geometrical diagrams were so abundant in Mei Wending's (1633-1721) writings because, through them, Mei was depicting the mathematical nature of astronomy. In their attempts to comprehend celestial motions, Chinese astronomers such as Wang Xichan (1628-82) shifted from strictly numerical procedures to geometric models of successive locations in space.

Rather than imago mundi, however, the epistemological status of diagrams became for evidential scholars such as Qian Daxin (1728-1804) simply ingenious calculations. Unlike Mei Wending, Qian Daxin would not accept abstract diagrams as possible keys to understanding natural phenomena. The mathematization of the world, which in Europe was dependant on the unique wedding of Newtonian mechanics and Leibnizian calculus in the latter half of the eighteenth century, was unavailable to evidential scholars in China until the aftermath of the Opium War.[50]

Although the internal turn in Qing evidential research did not produce a cartographic reconceptualization of foreign lands, we should not underestimate Jesuit and European cartographic influence in China. Through systematic gathering of materials that they would then critically scrutinize and in some cases quantify, Qing scholars combined evidential research methods with data collection and organization. As research pushed forward in the eighteenth century, Asian and Chinese continental geography became a key discipline.[51]

Despite the internal turn of this research away from concern with maritime lands far from China, achievements in geographical knowledge during this period were still evident in military defence and historical and descriptive geography, particularly along the Qing borders with Russia, Zungharia, and Kashgaria in Siberia and Central Asia. In addition, the cultural construction of Mukden (Shenyang) and its environs as the exclusive homeland of the Manchus was achieved in part through the mapping of the area under Jesuit direction. The mapping of Manchuria began circa 1690 in the aftermath of negotiations with the Russians to determine the boundaries of the Amur River in Northeast Asia.

Such achievements lent themselves to the accumulation of geographical knowledge. Cumulative progress was possible because evidential scholars, building on the efforts of their predecessors, stressed an empirical epistemology and focused on research topics that allowed for a continuity in geographical research. As a result, geography emerged as a precise discipline during the Ming-Qing transition period. Song-Yuan mathematics also became an important aspect of evidential studies and the revitalization of classical learning.[52]

To be sure, the Americas were still depicted as parts of the Asian land mass north of the Great Wall in a Chinese world map circa 1743, which was based on Liang Zhou's 1593 world map. Moreover, Phillipe Foret's account of the planning for the Manchu summer capital in Chengde and for other imperial sites demonstrates how European cartographic technologies coexisted with earlier Chinese geographic practices such as the geomancy informing cartography, landscape architecture, and urban arrangements. The geography of the Qing Empire was intertwined with Tibetan Buddhism, and this relationship was an essential component of Manchu expansion into Central Asia. That expansion also required a substantial investment in state-of-the-art mapping techniques from Europe to delineate accurately the Russo-Chinese border in the eighteenth century.[53]

Cartography, Sino-Russian Relations, and Qing Imperial Interests

Early Manchu rulers recognized the need for better records for land use and taxation. In 1646 a cadastral survey was undertaken, but its geographic

inadequacies were recognized. When the Russians appeared in force along the northern frontier in the seventeenth century, the Manchu court and Chinese officials required more accurate geopolitical information to deal with the latest threats to the empire. After the Tungusic chief Gantimur defected from the Qing in 1670 to allegedly Russian territory, the Russians quickly took advantage.

A crisis in Sino-Russian relations ensued from the 1670s to 1690s, when the Manchus learned that the Russians had already built a fortress in 1654 along the Amur River at Nerchinsk in Gantimur's native region. The Kangxi emperor refused any further trade or diplomatic relations with Russia until the deadlock was resolved. Meanwhile, the Russians and Zunghar Mongols both expanded their interests in the northwest while the Qing was preoccupied in the south and southwest during the Revolt of Three Feudatories from 1673 to 1681. Much like late Ming calendar reform, Qing recognition of its geographic needs preceded the European contributions to Chinese cartography. The changing borders threatened the Manchu homeland.[54]

During the Rites Controversy, the Manchu court was embroiled simultaneously in military threats from Zunghars and Russians along the borders of the empire in Central Asia, which introduced new elements into the storm over the Jesuits and their loyalty to the Qing dynasty. For example, when the Russian mission was allowed into Beijing in 1676 to negotiate trading agreements and population movements, Ferdinand Verbiest was involved. The lack of a clear boundary in the Amur River area and the ambiguous claims to sovereignty in the area later led to the Treaty of Nerchinsk in 1689, negotiated by the French Jesuit Gerbillon, which demarcated the frontiers between the Qing and Russia.[55]

Jesuits and Mapping the Qing Empire

The Jesuits and others were commissioned to provide the necessary data that would enable Qing leaders to stem the tide of Russian infiltration into Manchu and Mongolian homelands. The geographical knowledge that accrued during this time was an important addition to earlier information on foreign lands. In the process, the Kangxi court's awareness of the actual geographical divisions of the Sino-Russian frontier slowly came apace of their long-standing knowledge of and interest in Southeast Asia.

In addition, the new mapping technique known as "trigonometric surveying," which both the Kangxi and Qianlong emperor mastered, became part of the political repertoire used by the dynasty in the eighteenth century to take stock of its dominions. Careful measurement of a base line, with one known location, was linked to determining latitudes using celestial observations. Precise longitudes were then calculated by the actual measurement of distances using a calibrated chain. When the exact location of

the second end of the base line was known, the third point could be reckoned by triangulation. A series of triangles could then be extended trigonometrically for any distance. Additional positions could be determined in this manner (i.e., an entire area or region could be successfully "surveyed").[56]

The geographical ambitions of the empires of the Qing dynasty, Imperial Russia, and the Mongol Zunghars in Central Asia led to the redrawing of the frontier boundaries between Russia and the Qing as well as to the crushing of the autonomous state of Zungharia in 1760 by Qing armies. Peter Perdue has noted how eighteenth-century Central Asian borders were constructed in three stages: (1) military confrontation, (2) negotiated treaties, and (3) symbolic representation on maps and instantiation in imperial documents. Joanna Waley-Cohen adds stelae inscriptions, military pageants, and commemorative paintings to the repertoire of empire-building. The Qing dynasty, Zungharia, and Russia each produced important new maps of unprecedented scale and accuracy as political and ideological weapons in their struggle for control of Central Asia. In fact, however, these maps were the products of preliminary surveys that had preceded warfare and, moreover, often made it possible.[57]

Because Russian expansion in Siberia challenged Qing power, the Jesuits limited access to the most sensitive frontier areas of the Qing Empire when the survey for the *Kangxi Atlas* was carried out. Territorial claims and dynastic security compelled the Qing court to hire only those Jesuits who did not intend to return to their native lands. The dynasty avoided circulating such information too widely inside and outside China. Seeking to open an overland route from Rome to China via Russia, Verbiest, however, may have secretly provided Russian missions with maps and descriptions of the border region with Siberia, which included the locations of Manchu forces obtained from Russian deserters. By 1727, Qing knowledge of the region of Amuria was seen in light of the realities of Russian penetration into Siberia.[58]

When Russia and China defined their mutual borders in the Treaty of Nerchinsk in 1689 and the Treaty of Kiakhta in 1727, they both applied new cartographic surveying techniques to the newly defined borders. In addition, new classification systems and ethnographic atlases to control the movements of refugees, nomads, tribes, traders, soldiers, and other mobile groups across the borders were compiled. Both sides used tax and land registers, censuses, border patrols, passports, and visas to keep people from moving freely across the borders. Each also applied seventeenth-century European technical knowledge (transmitted through the Jesuits) to survey their new territories.[59]

The Kangxi emperor, like Louis XIV, mapped his entire empire out of strategic concern. The Jesuits produced their first survey of Beijing in 1700, which the emperor checked. Later, he asked for a survey of portions of the Great Wall in 1707. In 1710 further surveys along the Amur River helped

mark the strategic bases on the border with Russia. The *Kangxi Atlas* attempted to systematize the Qing dynasty's knowledge of its imperial territories and rationalize its claims vis-à-vis the Zunghars and Russians. The Manchu homelands were surveyed between 1709 and 1712, and a complete map of greater Mukden (i.e., "Manchuria") was produced.

The text and maps that were included in the 1733 edition of the *Collected Statutes and Precedents of the Great Qing* (*Da-qing huidian*) were concerned with military deployments and garrison towns. They were compiled under the auspices of the Ministry of Military Personnel. The maps that the Jesuits prepared for the Manchu homelands became the starting point for later Japanese and European maps of the region in the eighteenth and nineteenth centuries.[60]

The atlas and its subsequent Qianlong-era revisions shared features that were consistent with contemporary European maps. They left out pictorial elements and drew on astronomical observations to calculate longitude and latitude based on a precise scale. Hostetler interprets such developments in light of Qing evidential studies and the change in research epistemologies that affected scholarly views of geography in the late seventeenth century, a time when government interests increasingly focused on internal military defence and historical and descriptive geography. In the original maps, however, "China" and the "Qing Empire" were not coterminous. "China" was presented as one distinct part of the Qing Empire, and the Manchus homelands were another. Two other versions of the map from the same surveys, however, were entirely in Chinese with no Manchu script, perhaps to avoid offending Han Chinese cultural sensibilities. These Chinese language maps elided the Manchu view that the maps included distinct administrative and cultural spheres, to which Zungharia and Tibet would later be added.[61]

French and Russian Imperial Cartography

France was a leader in cartographic activity under Louis XIV after he appointed Colbert as minister for home affairs. Colbert made France a centre for science and solidified that role in Europe by founding the Academy of Sciences in 1666. Louis XIV also promulgated topographical surveys for territories based on astronomical observations that were initiated under his chief of astronomy, the Italian Jean Dominique Cassini. While in the employ of Pope Clement IX, Cassini published a series of tables in 1668 based on the eclipses of Jupiter's moons. Colbert invited Cassini to France in 1669 in order to make astronomical observations that were crucial to improved navigation and mapping. Because Cassini communicated with the Jesuits in China, he sought such observations globally.[62]

Enlarged in 1676, Cassini's Ephemerides permitted astronomers to determine the latitude and longitude of the point from which they made their observations. In 1679, France began a national survey relying on Cassini's

tables for accurate measurements. The French Academy required observations from around the globe, which, in part, led to Louis XIV sponsoring the French Jesuits in China under the Missions Etrangères in 1663. Once map-making became a vital component of imperial expansion, the cartographic technology to carry out accurate geodetic surveys spread quickly. France, Russia, and the Qing employed experts regardless of their origins. Colbert had recruited the Italian Cassini, Kangxi employed the French Jesuits, and Russia engaged the Swedish officer Strahlenberg, who was taken prisoner by Russians in 1711, to collect information about Siberia, Mongolia, and neighbouring regions.

Peter the Great (r. 1682-1725), like the Kangxi emperor, used maps to measure the growth of the Russian Empire and to legitimate its claims. In 1698, Peter had already commissioned a survey of his new territories, and new maps for an atlas were completed in 1701, although full surveys of the empire were not formally initiated until 1727. For France, the Qing, and Russia, the requirement of better maps was tied to imperial expansion. New surveying and map-making techniques were essential. In the midst of Russian expansion into Siberia the Qing Empire more than doubled in size between 1660 and 1760 within a global context of population growth and colonial exploration and expansion.[63]

The Kangxi surveys were completed by 1717, while French surveys took until 1744 to accomplish. The Qianlong revisions of the 1717 survey were finished in 1755, while the second edition of the French survey appeared in 1788. Similarly, the Russian imperial atlas, which followed the French national survey, appeared in 1745. Peter the Great used cartography and his European experts, who were also hired to explore the North Pacific, to put Russia on the map of eighteenth-century Europe. The *Kangxi Atlas*, for instance, had decisively changed European map-making when the Jesuit maps first arrived in France in 1725 and the new information was digested in Paris, London, and elsewhere.

Similarly, the latest mapping technology was effective for the Qing in legitimating and consolidating the empire, and it became the basis for China's modern territorial claims in the twentieth century. The Kangxi emperor's gift of his survey to Peter in 1721 indicated a desire to apprise Russia of Qing sovereignty and cartographic sophistication. It did not record all the strategic information the Qing had about the northern border areas, however.[64]

More important, the Kangxi emperor sought peace with the Russians to free his hand in wars with the Zunghar Mongols in Central Asia. By neutralizing Russia, the Qing court prevented a possible Russo-Zunghar alliance against them. Hence, when the Russians demanded the principle of equality at the Nerchinsk peace negotiations, the Manchus did not allow ceremonial difficulties to interfere with their primary diplomatic task. The

emperor relented on the usual Qing ceremonial claim of imperial superiority when dealing with bordering states. The Treaty of Nerchinsk represented a compromise in which the marking out of the frontier was more favourable to the Manchus, while the Russians kept Nerchinsk. In addition, the Manchus conceded that trade could be initiated by either side, and each could cross the border with passports. Furthermore, the problem of the repatriation of fugitives was settled.

As instruments of diplomacy, the Qing government's economic concessions in the 1689 treaty proved their political worth when the leader of Zungharia, Galdan, proposed an alliance with the Russians in 1690. Joint military action against the Manchus was now impossible, however, because the Russians were bound by treaty with the Qing. The Kangxi emperor was left free to eliminate the Zunghar threat, arguably the "last nomadic empire," which he did in 1696. Galdan's death in 1697 reduced the Mongols as a potentially divisive third force in Central Asia.[65]

In 1718, the Russians contemplated full normalization of Sino-Russian relations during the Rites Controversy, which was damaging Jesuit and Roman Catholic interests in China. Peter the Great, for example, expelled the Jesuits from Russia in 1719 and tried to install a Russian "bishop" in Beijing in 1722. Russian authorities were not successful in keeping this effort secret from the Manchus and the Jesuit enemies of the Greek Orthodox Church in Beijing, but Qing suspicions prevented the appointment. Subsequently, in 1728, the Zunghar threat against the Manchus in Turkestan and Tibet revived. Again, the Manchus eliminated the threat through the Zunghar wars in the 1750s, which were facilitated by the Treaty of Kiakhta, which ended Russian interference.

Since 1727, the Treaty of Kiakhta had established officially supervised trade in Amuria, which stabilized the Russian-Qing frontier until the nineteenth century. The Qianlong reign brought a complete victory over the Zunghars, and the Qing incorporated Ili (in the far northwest) in 1755. Manchu military victories led to Qing overconfidence vis-à-vis the Russians, and this generated a ban on trade caravans to Beijing from Russia after 1755.

Qing success in Central Asia in the eighteenth century thus occurred within the context of Russian expansion into Amuria. Through compromise and accommodation, Russian interests in trade and Manchu interests in Central Asia were negotiated. Diplomacy, warfare, and timely mapping of strategic frontiers enabled the Qing dynasty to incorporate major portions of Amuria, Zungharia, and Kashgaria at the expense of the Mongols, Uighurs, Kazaks, Tajiks, and Russians.[66]

Before the arrival of the Macartney mission in 1793, the inward turn among Qing scholars to native traditions of classical learning remained in place despite Jesuit influence in the arts and crafts. Moreover, during the Newtonian

century in Europe, Chinese scholars simultaneously focused on restoring native medicine, mathematics, and astronomy to admired fields of classical learning worthy of the attention of literati. When Chinese had their first intellectual contacts with modern science as it appeared in Benjamin Hobson's *Treatise of Natural Philosophy* (*Bowu xinbian*, lit., "Broad learning of things newly compiled," 1851), they quickly realized how far beyond the Jesuits natural studies in Europe had gone. Their eighteenth-century predecessors in China, however, never knew what had transpired in Europe after the demise of the Jesuit order in the middle of the eighteenth century. They were content to domesticate the Western learning and geography that the Jesuits had introduced and to note its similarity to ancient astronomy, historical geography, and Song-Yuan mathematical innovations. Native geographical studies, however, grew apace with the eighteenth-century expansion of the Qing Empire in Central Asia and rarely addressed the maritime world again until the Opium War (1839-42).[67]

Notes

1 Henry Serruys, *Sino-Mongol Relations during the Ming*, in *Melanges Chinois et Bouddhiques*, vol. 1: *The Mongols in China during the Hung-wu Period, 1368-1398;* vol. 2: *The Tribute System and the Diplomatic Missions* (1967) (Brussels: Institut Belge des hautes études Chinoises, 1959), 8.

2 See Philip de Heer, *The Care-Taker Emperor: Aspects of the Imperial Institution in Fifteenth-Century China as Reflected in the Political History of the Reign of Chu Ch'i-yü* (Leiden: E.J. Brill, 1986); and Frederick W. Mote, "The T'u-mu Incident of 1449," in *Chinese Ways in Warfare, Chinese Ways in Warfare Chinese Ways in Warfare*, edited by Frank Kierman, Jr. and John Fairbank, 243-72 (Cambridge: Harvard University Press, 1974).

3 Arthur Waldron, *The Great Wall of China: From History to Myth* (Cambridge: Cambridge University Press, 1990), 79-86. Waldron notes how Ming forces withdrew from steppe garrisons as early as 1403-10. See also Alastair Johnston, *Cultural Realism: Strategic Culture and Grand Strategy in Chinese History* (Princeton: Princeton University Press, 1995), 195-97.

4 On the Ming fleets and their forays into the Indian Ocean, see Joseph Needham, *Science and Civilisation in China,* vol. 4, pt. 3 (Cambridge: Cambridge University Press, 1954-), 477-553. On Ming relations with Southeast Asia, see Wang Gungwu, *Community and Nation: China, Southeast Asia and Australia* (St. Leonards, Australia: Allen and Unwin, 1992), 77-146.

5 See Jung-pang Lo, "The Decline of the Early Ming Navy," *Oriens Extremus* 5, 2 (1958): 147-68.

6 See Richard Smith, "Mapping China's World: Cultural Cartography in Late Imperial Times," in *Landscape, Culture and Power in Chinese Society*, edited by Yeh Wen-hsin, 62-68 (Berkeley: University of California, Center for East Asian Studies, 1998). See also Alexander Wylie, *Notes on Chinese Literature* (Taibei: Book Shop Limited, 1970 [Shanghai: American Presbyterian Press, 1867]), 43-67, for premodern works on geography.

7 Smith, "Mapping China's World," 67-68.

8 *Science and Civilisation in China*, vol. 3, 533-51 and vol. 4, pt. 3, 500-2; and L.C. Goodrich Chaoying Fang, eds., *Dictionary of Ming Biography,* 2 vols. (New York: Columbia University Press, 1976), 982. Compare such speculations with the claims presented as facts to unsuspecting audiences in Gavin Menzies, *1421: The Year China Discovered America* (New York: HarperCollins, 2002), passim.

9 See Jan Julius Lodewijk Duyvendak, *Ma Huan Re-examined* (Amsterdam: Noord-Hollandsche uitgeversmaatschappij, 1933), 8-9.

10 See *Hsing-ch'a-sheng-lan: The Overall Survey of the Star Raft by Fei Hsin*, translated by J.V.G. Mills, revised, annotated, and edited by Roderich Ptak (Amsterdam: Noord-Hollandsche uitgeversmaatschappij, 1933). See also Sir David Percival, trans., *Chinese Connoisseurship, the Ko Ku Yao Lun: The Essential Criteria of Antiquity* (London: Faber, 1971).
11 *Siku quanshu zongmu* [General catalog for the complete collection of the four treasuries] (Taipei: Commercial Press, 1983-86 [reprint]), 78.14b-19a.
12 *Siku quanshu zongmu*, 71.3b-4b, 78.14b-15a; *Science and Civilisation in China*, vol. 3, 511, 557-58. See also Ting Wen-chiang, "On Hsu Hsia-k'o (1586-1641): Explorer and Geographer," *New China Review* 3, 5 (1921): 325-37. Detailed discussion of Hsu Hsia-k'o's travels can be found in Li Chi, *The Travel Diaries of Hsu Hsia-k'o* (Hong Kong: Chinese University, 1974).
13 Originally completed in 1562, the *Maritime Survey* was reedited by Hu Zongxian's descendants and reissued in 1624. The editors of the later editions dropped Zheng Ruozeng's name as the author and replaced it with Hu Zongxian, their revered ancestor. Compare the account in *Siku quanshu zongmu*, 69.31a-32b.
14 *Science and Civilisation in China*, vol. 3, 514-17.
15 Cordell Yee, "Traditional Chinese Cartography and the Myth of Westernization," in *The History of Cartography,* vol. 2, book 2: *Cartography in the Traditional East and Southeast Asian Societies*, edited by J.B. Harley and David Woodward, 170-202 (Chicago: University of Chicago Press, 1994).
16 Ricci's world map is reproduced in *Science and Civilisation in China*, vol. 3, 582-83 (Plates XC and XCI). A 1608 colour version is included in *Symbols of Power: Masterpieces from the Nanjing Museum* (Anaheim, CA: Bowers Museum, 2002).
17 Helen Wallis, "The Influence of Father Ricci on Far Eastern Cartography," *Imago Mundi* 19 (1965): 35-45; and Kenneth Ch'en, "Matteo Ricci's Contribution to, and Influence on, Geographical Knowledge in China," *Journal of the American Oriental Society* 59, 3 (1939): 325-59. Compare Theodore Foss, "A Western Interpretation of China Jesuit Cartography," in *East Meets West: The Jesuits in China, 1582-1773*, edited by Charles Ronan S.J. and Bonnie Oh, 209-51 (Chicago: Loyola University Press, 1988).
18 Zhang Huang, *Tushu bian* [The compendium of maps and materials] (Taibei: Chengwen chuban she, 1971 [reprint]), 19.33a-40a. See also Ch'en, "Matteo Ricci's Contribution," 343-47. For the initial reaction of Chinese literati, see Pasquale M. d'Elia, "Recent Discoveries and New Studies (1938-60) on the World Map in Chinese of Father Matteo Ricci S.J.," *Monumenta Serica* 20 (1961): 82-164.
19 *The Library of Philip Robinson*, pt. 2 (London: Sotheby's Auction Catalogue, 1988), 77-95, especially 76-77, 78-79. The 1593 world map was engraved by Liang Zhou, an education official in Wuxi, and printed in Nanjing. See also John Day, "The Search for the Origins of the Chinese Manuscript Copies of Matteo Ricci's Maps," *Imago Mundi* 47 (1995): 94-117.
20 *The Library of Philip Robinson*, pt. 2, 79-80. See also Lionel Giles, "Translations from the World Map of Father Ricci," *Geographical Journal* 52, 6 (1918): 367-85; and ibid., 53, 1 (1919): 19-30.
21 Wylie, *Notes on Chinese Literature*, 58.
22 See Bernard Hung-kay Luk, "A Study of Giulio Aleni's *Chih-fang wai-chi*," *Bulletin of Oriental and African Studies* 40 (1977): 58-84; and Eugenio Menegon, *Un solo Cielo: Giulio Aleni S.J. (1582-1649)* (Rome: Grafo, 1994), 141-46. See also Richard Smith, *Chinese Maps: Images of All under Heaven* (Oxford: Oxford University Press, 1996), 49-54.
23 *The Library of Philip Robinson*, pt. 2, 83, 85-86, 89, 95. Martini had been in China from 1643 to 1646. See also Boleslaw Szczesniak, "The Seventeenth-Century Maps of China: An Inquiry into the Compilations of European Cartographers," *Imago Mundi* 13 (1956): 116-36.
24 Smith, "Mapping China's World," 71-83, usefully introduces the "Complete Maps" genre.
25 See Luk, "A Study of Giulio Aleni's *Chih-fang wai-chi*," 76-77. See also Chen Minsun, "Ferdinand Verbiest and the Geographical Works by Jesuits in Chinese 1584-1674," 123-64, and Lin Tongyang, "Ferdinand Verbiest's Contribution to Chinese Geography and Cartography," 135-164, both in *Ferdinand Verbiest, S.J. (1623-1688): Jesuit Missionary, Scientist, Engineer, and Diplomat*, edited by S.J. John Witek (Nettetal: Steyler Verlag, 1994).

26 Walter Fuchs, "Der Jesuiten-Atlas der Kanghsi-Zeit," *Monumenta Serica*, Monograph Series 4 (1943): 60-75. See also James A. Millward, *Beyond the Pass: Economy, Ethnicity, and Empire in Qing Central Asia, 1759-1864* (Stanford: Stanford University Press, 1998), 70-72.
27 Smith, "Mapping China's World," 77-81.
28 *Science and Civilisation in China*, vol. 3, 551-86. Maps based on latitudinal and longitudinal degrees were essential for ocean-going vessels (which the Chinese did not prioritize for their coastal fleet).
29 For the locus classicus, see Benjamin Elman, *From Philosophy to Philology: Social and Intellectual Aspects of Change in Late Imperial China,* 2nd ed. (Los Angeles: UCLA Asia Institute Monograph Series, 2001), 72-122.
30 Compare Frank Swetz, trans., *The Sea Island Mathematical Manual: Surveying and Mathematics in Ancient China* (University Park: Pennsylvania State University Press, 1992), 7-16.
31 See Kenneth Swope, "Crouching Tigers, Secret Weapons: Military Technology Employed in the Japanese Invasion of Korea, 1592-1598," *Journal of Military History*, 69, 1 (2005): 11-41.
32 Cordell Yee, "A Cartography of Introspection: Chinese Maps as Other than European," *Asian Art* 5 (1992): 29-45. See also Tonio Andrade, "Commerce, Culture and Conflict: Taiwan under European Rule, 1623-1662" (PhD diss., Yale University, 2001).
33 Cheng K'o-ch'eng, "Cheng Ch'eng-kung's Maritime Expansion and Early Ch'ing Coastal Prohibition," in *Development and Decline of Fukien Province in the 17th and 18th Centuries*, edited by E.B. Vermeer, 228-44 (Leiden and New York: E.J. Brill, 1990).
34 John Wills, Jr., "Maritime China from Wang Chih to Shih Lang [Shi Lang]," in *From Ming to Ch'ing: Conquest, Region, and Continuity in Seventeenth-Century China*, edited by Jonathan Spence and John Wills, 228-34 (New Haven: Yale University Press, 1979).
35 Wills, Jr., "Maritime China," 233; and Peter Perdue, "Boundaries, Maps, and Movement: Chinese, Russian, and Mongolian Empires in Early Modern Central Eurasia," *International History Review* 20, 2 (1998): 263-86.
36 Ch'en, "Matteo Ricci's Contribution," 347-59.
37 Arthur Hummel, *Eminent Chinese of the Ch'ing Period* (Washington: US Printing Office, 1943), 522, 909.
38 *Huangchao wenxian tongkao* [Comprehensive analysis of civil and military institutions during the Qing dynasty], in *Shitong,* vol. 2 (Shanghai: Commercial Press, 1935-37), 298.7469-70.
39 *Huangchao wenxian tongkao*, vol. 2, 298.7469-7474, 298.7481-89.
40 *Siku quanshu zongmu*, 69.22a-23a. See also *Science and Civilisation in China*, vol. 3, 569-79.
41 *Siku quanshu zongmu*, 70.4b. See also Minghui Hu, "Measuring the Cosmos: The Rise of Precision Narratives in Qing China," paper presented at the Colloquium sponsored by the Center for the Cultural Studies of Science, Medicine, and Technology, UCLA History Department, 6 May 2002.
42 On the *fenye* system, see Edward Schafer, *Pacing the Void: T'ang Approaches to the Star* (Berkeley: University of California Press, 1977), 75-84. In unofficial life and popular culture, however, literati efforts to distance such correspondences and the mantic arts were unsuccessful. See Richard Smith, *Fortune-Tellers and Philosophers: Divination in Traditional Chinese Society* (Boulder, CO: Westview Press, 1991); and Elman, *A Cultural History*, 295-370
43 See Schafer, *Pacing the Void*, 75-84; and John Major, "A Note on the Translation of Two Technical Terms in Chinese Science: *Wu-hsing* and *Hsiu*," *Early China* 2 (1976): 1-3.
44 See Yan Ruoju, *Qianqiu zhaji* [Assorted notes by Yan Ruoju] (Taibei: Commercial Press, 1973), 3.2a. See also *Science and Civilisation in China*, vol. 3, 231-52.
45 John Henderson, *The Development and Decline of Chinese Cosmology* (New York: Columbia University Press, 1984), 82-87, 219-25.
46 See Schuyler Cammann, "The Evolution of Magic Squares in China," *Journal of the American Oriental Society* 80 (1960): 116-24.
47 Michael Saso, "What Is the *Ho-t'u?" History of Religions* 17, 3 and 4 (1978): 399-416. See also *Science and Civilisation in China*, vol. 3, 55-59.
48 See Rong Zhaozu, "Yan Ruoju de kaozheng xue" [Yan Ruoju's evidential studies], *Lingnan xuebao* 1, 4 (1930): 90-91.

49 Du Weiyun, *Qing Qianjia shidai zhi shixue yu shijia* [Historians and historical studies during the Qing Qianlong and Jiaqing eras] (Taibei: Wenshi zongkan, 1962), 11-12, gives a comprehensive list of such supplements. See also David Nivison, *The Life and Thought of Chang Hsueh-ch'eng* (Stanford: Stanford University Press, 1966), 195, 216.

50 See Henderson, *The Development and Decline of Chinese Cosmology*, 231-53; and Nathan Sivin, "Wang Hsi-shan," in *Dictionary of Scientific Biography*, editor in chief, Charles Gillispie, 159-62 (New York: Scribner's Sons, 1970-78).

51 Smith, "Mapping China's World," 71-77, stresses Chinese disdain of "barbarians." For problems with this perspective, see Lydia Liu, "Legislating the Universal: The Circulation of International Law in the Nineteenth Century," in *Tokens of Exchange: The Problem of Translation in Global Circulations*, edited by Lydia Liu, 127-64 (Durham, NC: Duke University Press, 1999). Though frequently anti-foreign, Qing rhetoric about "barbarians" is a later European construction.

52 See Mark Elliot, "The Limits of Tartary: Manchuria in Imperial and National Geographies," *Journal of Asian Studies* 59, 3 (2000): 603-46.

53 See *The Library of Philip Robinson*, pt. 2, 95; and Smith, *Chinese Maps*, 54-59. Compare Phillipe Foret, *Mapping Chengde: The Qing Landscape Enterprise* (Honolulu: University of Hawai'i Press, 2000), chap. 6.

54 Peter Perdue, "Boundaries, Maps, and Movement: Chinese, Russian, and Mongolian Empires in Early Modern Central Eurasia," *International History Review* 20, 2 (1998): 263-86; and Laura Hostetler, "Qing Connections to the Early Modern World: Ethnography and Cartography in Eighteenth-Century China," *Modern Asian Studies* 34, 3 (2000): 623-62. Compare Elliot, "The Limits of Tartary," 619-20.

55 Vladimir Miasnikov, "Ferdinand Verbiest and His Role in the Formation of Sino-Russian Diplomatic Relations," in Witek, *Ferdinand Verbiest (1623-1688)*, 274-75.

56 See Sun Jiji, *Kang-Yong-Qian shiqi yutu cehui yu jiangyu xingcheng yanjiu* [Research on cartographic surveys and boundary formations during the Kangxi, Yungzheng, and Qianlong eras] (Beijing: Zhongguo renmin daxue chuban she, 2003).

57 Perdue, "Boundaries, Maps, and Movement," 263-86; and Perdue, "Military Mobilization in Seventeenth and Eighteenth-Century China, Russia and Mongolia," *Modern Asian Studies*, 30, 4 (1996): 782-90. Compare Joanna Waley-Cohen, "Commemorating War in Eighteenth-Century China," *Modern Asian Studies* 30, 4 (1996): 869-99.

58 Peter the Great later expelled the Jesuits from Russia because he thought they had betrayed Russian interests in the Treaty of Nerchinsk. See Miasnikov, "Ferdinand Verbiest," 273-79; and Hao Zhenhua, "Ferdinand Verbiest and Sino-Russian Relations," in Witek, *Ferdinand Verbiest (1623-1688)*, 282-96. Compare Mark Mancall, *Russia and China: Their Diplomatic Relations to 1728* (Cambridge: Harvard University Press, 1971), 98-109. See also Perdue, "Boundaries, Maps, and Movement," 269-71.

59 See Perdue, "Boundaries, Maps, and Movement," 263-86; and Laura Hostetler, "Qing Connections to the Early Modern World: Ethnography and Cartography in Eighteenth-Century China," *Modern Asian Studies* 34, 3 (2000): 623-62.

60 See Walter Fuchs, "Materialen zur Kartographie der Mandju-Zeit, part 1," *Monumenta Serica* 1 (1935-36): 395-96; and Fuchs, "Materialen zur Kartographie der Mandju-Zeit, part 2," *Monumenta Serica* 3 (1938): 189-231. Compare Elliot, "The Limits of Tartary," 621-32.

61 Perdue, "Boundaries, Maps, and Movement," 274-75; and Laura Hostetler, *Qing Colonial Enterprise: Ethnography and Cartography in Early Modern China* (Chicago: University of Chicago Press, 2001), 17-18, 76. Compare David Turnbull, "Cartography and Science in Early Modern Europe: Mapping and the Construction of Knowledge Spaces," *Imago Mundi* 48 (1996): 5-24.

62 See Roger Hahn, *The Anatomy of a Scientific Institution: The Paris Academy of Sciences, 1666-1803* (Berkeley: University of California Press, 1971), 66-67, 90, 96-97.

63 Hostetler, *Qing Colonial Enterprise*, 71-75. See also Perdue, "Military Mobilization," 757-93; and James Millward, "'Coming Onto the Map': Western Regions' Geography and Cartographic Nomenclature in the Making of the Chinese Empire in Xinjiang," *Late Imperial China* 20, 2 (1999): 61-98.

64 Hostetler, *Qing Colonial Enterprise*, 74-79; and Elliot, "The Limits of Tartary," 626.
65 Thomas Barfield, *The Perilous Frontier: Nomadic Empires and China* (Cambridge, MA: B. Blackwell, 1989), 277-94.
66 Mancall, *Russia and China*, 149-59, 209-10. The translation of the treaty is on 280-83. See also Eric Widmer, *The Russian Ecclesiastical Mission in Peking during the Eighteenth Century* (Cambridge: Harvard University East Asian Research Center, 1976), 45-58, 174-78.
67 See Benjamin Elman, *On Their Own Terms: Science in China, 1550-1900* (Cambridge: Harvard University Press, 2005), chaps. 9 and 10.