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Reformatting a Traditional Image of the Qing Imperial Realm According to Modern Western Cartography: The Map of the “Great Qing Everlastingly Unified” 大清萬年一統 by Li Mingche 李明徹 (1751–1832)

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Abstract

The Göttingen State and University Library in Germany possesses the only surviving copy of a general map of the Qing empire, which until early 2014 was considered to be lost. The map is a middle-format hand-coloured block print. All the place names and other textual elements in the map are given exclusively in Chinese. The map is authored by a known Chinese scholar, Li Mingche 李明徹 (1751–1832), but is undated. Yet the time of its creation can be reliably approximated to the mid-1820s, most likely 1825–1826. The map exhibits a clear stamp of Western mapmaking, primarily that of French cartography of the eighteenth century, yet its fine fusion with the system of traditional Chinese cartographic conventions and aesthetic preferences makes it an interesting hybrid cartographic specimen. This article proposes an initial analysis of the map providing a basis for future more detailed study.

Keywords: traditional Chinese cartography, modern Western cartography, French cartography of the eighteenth century, hybrid maps, Li Mingche, Jean-Baptiste Bourguignon d’Anville

Introduction

The Göttingen State and University Library in Germany possesses a single surviving copy of a general map of the Qing empire (Fig. 1), which until early 2014 was considered to be lost.¹ The map is titled *Da Qing wannian yitong jingwei yutu* 大清萬年一統經緯輿圖 (Terrestrial Map Applying the Longitude-Latitude Graticule of the Great Qing Everlastingly [lit. “for ten thousand years”] Unified) and is a middle-format hand-coloured block print. All the place names and other textual elements in the map are given exclusively in Chinese. The map is authored by a known Chinese scholar, Li Mingche 李明徹 (1751–1832), but is undated. Yet the time of its creation can be reliably approximated to the mid-1820s, most likely 1825–

¹ Full credit for paving the way to the rediscovery of the map (shelf-mark: Cod. Ms. Mapp. 34) should be given to the librarians of the Göttingen State and University Library (Staats- und Universitätsbibliothek [SUB] Göttingen), and in particular to Dr Helmut Rohlfing, who was until November 2014 the director of the Department of Special Collections and Conservation (Spezialsammlungen und Bestandserhaltung), and Bärbel Mund, member of the department staff and head of the Manuscripts and Rare Prints (Handschriften und Seltene Drucke) group. They called my attention to the map in October 2013 and were most helpful in facilitating its initial investigation and digitisation. I am truly grateful also to Catherine Delano-Smith for detailed critical remarks on the first draft of this article, to Katherine Parker, Elke Papelitzky, and two anonymous reviewers solicited by *Crossroads* for important remarks on the final draft, as well as to many colleagues for their help with particular items in relation to this map, whom I thank below accordingly. My special thanks to John Moffett for the English proofreading of this article. Any mistakes found in this article are my own responsibility.

1826, by comparison with other cartographical works of the map's author, as well as other information available about the map.² The map exhibits a clear stamp of Western mapmaking, primarily that of French cartography of the eighteenth century, yet its fine fusion with the system of traditional Chinese cartographic conventions and aesthetic preferences makes it an interesting hybrid cartographic specimen.³ This article proposes an initial analysis of the map providing a basis for future more detailed study. In particular, I advance the hypothesis that the map is an underappreciated attempt to reformat a traditional image of the Qing imperial realm, that of the “Great Qing Everlastingly Unified” 大青年萬年一統 known from the famous “Blue Maps”, which were current in China in the first quarter of the nineteenth century.⁴



Figure 1. *Da Qing wannian yitong jingwei yutu* 大清萬年一統 經緯輿圖 (Terrestrial Map Applying the Longitude-Latitude Graticule of the Great Qing Everlastingly Unified), c. 1825–1826, by Li Mingche 李明徹 (1751–1832), hand-coloured wood-block print. Dimensions of the map sheet including the cloth frame after restoration: approximately 96 x 174 cm; map body: approximately 86 x 148 cm. Source: Göttingen State and University Library (SUB), Department of Manuscripts and Rare Books, <https://gdz.sub.uni-goettingen.de/id/DE-611-HS-3226686>, shelf-mark: Cod. Ms. Mapp. 34. Reproduced courtesy of the SUB.

² Since September 2020, a digital copy of the map has been accessible through the site of the Göttingen State and University Library, as well as the German database of archival manuscript documents, the Kalliope-Verbund: <https://gdz.sub.uni-goettingen.de/id/DE-611-HS-3226686>, <http://resolver.sub.uni-goettingen.de/purl?DE-611-HS-3226686>, <https://images.sub.uni-goettingen.de/iiif/image/gdz:DE-611-HS-3226686:00000001/full/full/0/default.jpg>, <https://kalliope-verbund.info/de/search.html?q=%27-m6%22&lastparam=true>. Regrettably, the map has not yet been entered into the IKAR database of old maps in German libraries.

³ By a “hybrid map” here I mean a map that combines conventions borrowed from at least two cartographical traditions.

⁴ The Blue Maps are the subject of Papelitzky and Pegg (2024); Pegg and Papelitzky (forthcoming).

Material Characteristics

Let us start an examination of the map with its material properties, an aspect that tends to be overlooked in this age of digitisation. The map is printed on a single sheet of paper framed by bands of a pale cerulean textile fabric of plain weave using rather thick threads, most likely silk taffetas. Two small features resembling Chinese buttonholes fixed on the recto of the map, but showing their tips on the verso at the top and the bottom, roughly mark the central vertical axis of the map (see Fig. 2 and Fig. 7). The bands of silk taffetas with “buttonholes” at the top and bottom constitute a framing, known as *hengpi* 橫批, which was often used for Chinese maps in seventeenth and eighteenth centuries China in cases where their breadth was considerably more than their height.⁵

⁵ I am indebted for this information to Camille Schmitt (www.silkandpaper-restoration.com), who kindly inspected the photos and scans of the map.

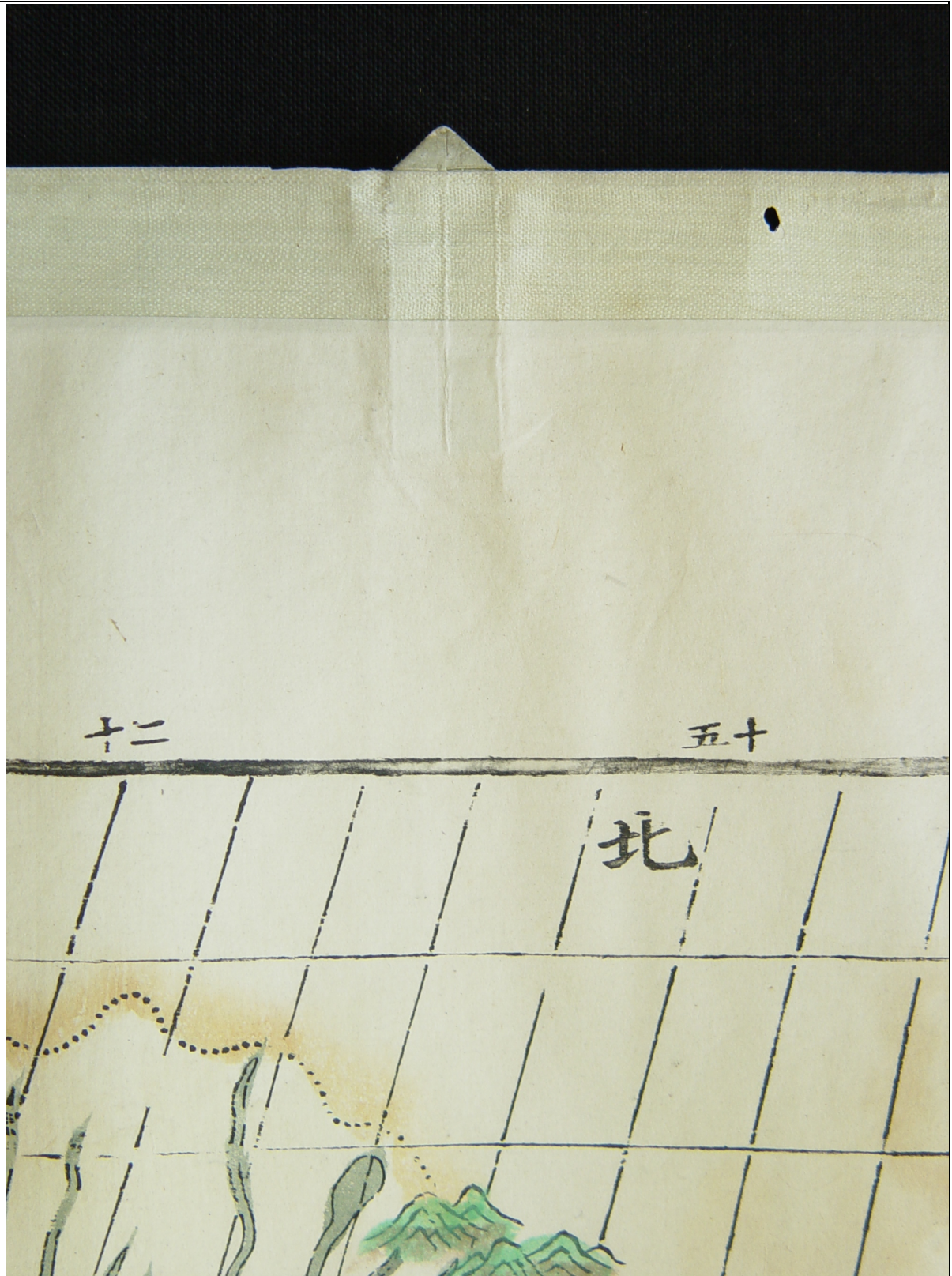


Figure 2. Detail of Li Mingche's map showing the "buttonhole" roughly in the middle at the top (recto), prior to restoration at the SUB. Reproduced courtesy of the SUB.

Prior its restoration at the SUB in 2009, the map was fixed on two wooden sticks to facilitate unrolling – one on the left and one on the right side of the map. In addition, the stick on the right side had straps for fastening the map when rolled (see Fig. 3, Fig. 4, and Fig. 5). The sticks were removed during the restoration. Most of the damage was found on the right side, which was the most exposed when the map was rolled up.

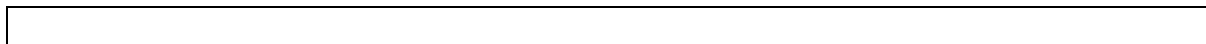




Figure 3. Detail of Li Mingche's map showing left side (recto) before restoration at the SUB. Reproduced courtesy of the SUB.



Figure 4. Detail of Li Mingche's map showing right side (recto) before restoration at the SUB. Reproduced courtesy of the SUB.



Figure 5. Detail of Li Mingche's map showing right side (verso) before restoration at the SUB. Reproduced courtesy of the SUB.

The size of the map sheet including the cloth frame after restoration is about 96 x 174 cm.⁶ The width of the cloth frame after restoration varies between 4.5 and 5 cm on the sides and approximately 1.7 cm at the top and the bottom. The paper map sheet measures approximately 92.5 x 164.5 cm. It was remounted during restoration of the map on a rather dense, but slightly transparent sheet of paper in order to stabilise it. The SUB stamp found on the verso of the right side of the map is clearly visible through the backing sheet (see Fig. 6).



⁶ An approximate size is given because the map edges are not always even.

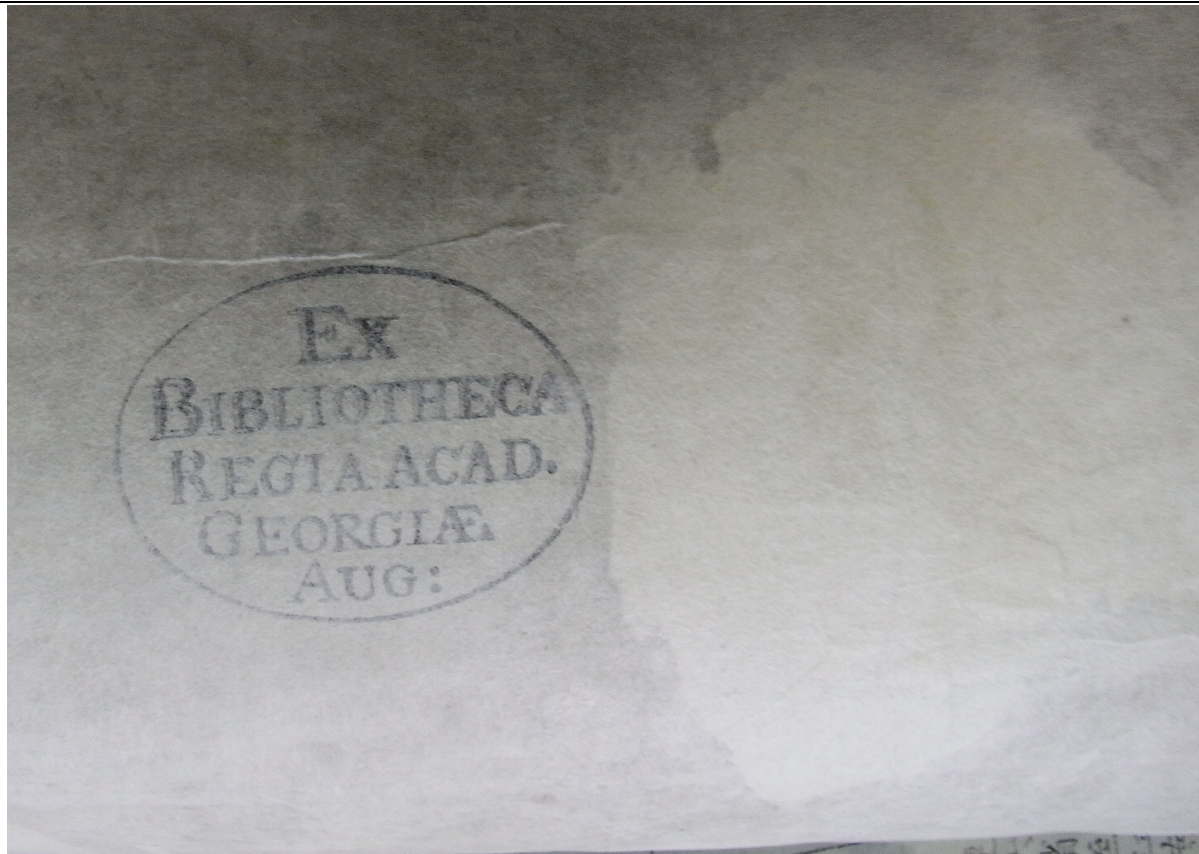


Figure 6. Detail of Li Mingche's map showing the stamp on the verso before (above) and after (below) restoration at the SUB. Reproduced courtesy of the SUB.

An examination of the map viewed with a backing light (using a luminous tablet) allows one to detect that prior to its restoration in 2009 the paper map sheet was first mounted on three sheets of paper with an additional narrow thin band of paper at the verso of its left side, all carefully pasted together. The paper sheet together with its cloth frame was then again mounted on three sheets of paper pasted together.

Although material analysis of the map – the quality and origins of its paper and colorants, as well as comparisons with similar mountings – are still to be carried out, one can already conclude that the use of a single sheet of paper and fine colours, the symbolism of which will be discussed below, make it a rather expensive and refined literati-oriented cartographic product. Another relatively expensive attribute of the map is that it is printed from a well-adjusted set of woodblocks – the seams between the blocks are hardly visible, so that their precise number is still to be determined.⁷

This article is mainly concerned with insights into the map's content and cartometric characteristics, or, in material terms, into the part of the map sheet without blank margins and

⁷ I am truly grateful to an anonymous reviewer, as well as to Cathleen Paethe, for calling my attention to this aspect of the use of several woodblocks for printing the map in question. Qiu Jingjia 丘靖嘉, who inspected the original map on 26 January 2024, suggested that it was printed from four long horizontal woodblocks – of about 41, 17, 10, and 18 cm wide, counting from top to bottom.

the graphic frame, or the map body.⁸ This cartographically functional part occupies an area of approximately 86 x 148 cm.

Encompassed Areas

The map displays a general view of the imperial realm under the Qing dynasty, including its process of expansion to embrace Manchuria, Mongolia, Xinjiang, and Tibet (see Fig. 7). Only territories that constitute the Qing empire are filled out with place names and landmarks, the adjoining lands being left void of landscape features. The only exception is Korea, which occupies an intermediate position in this respect – it contains few landmarks, mostly rivers, and just a couple of place names, thus showing a potential interest of the Qing empire in the Korean territories. The same political principle applies to the adjoining maritime space – the sea is blank with the exception of islands adjacent to the coast *and* belonging to the imperial realm, the largest among them are Hainan, Taiwan, and Sakhalin. Neither Japan nor the Ryūkyū Islands are marked on the map.

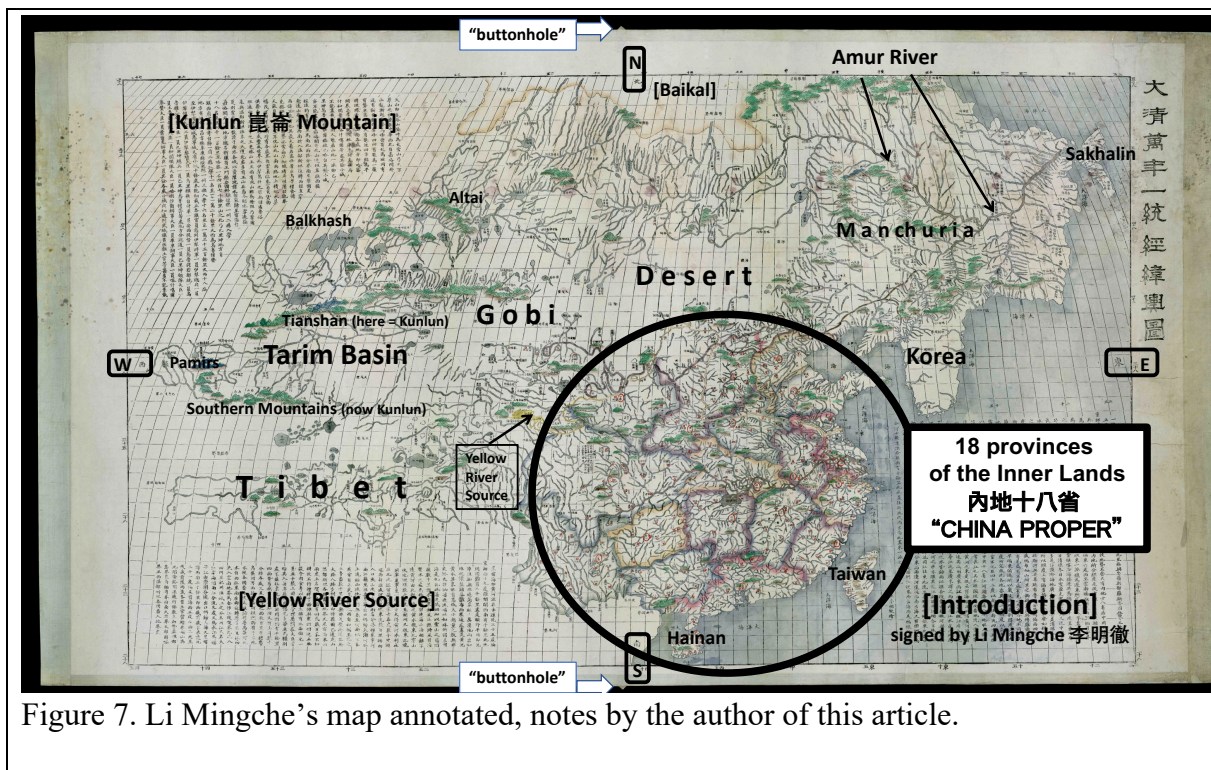


Figure 7. Li Mingche's map annotated, notes by the author of this article.

⁸ The margins on the paper sheet differ in width and are again not always even: the left margin varies from 8.3 to 8.8 cm from top to bottom; the right margin from 7.5 to 7.9 cm from bottom to top; the top margin from 5 to 5.5 cm from right to left. The bottom margin has an even width of 1.5 cm, allowing the conclusion that the map was drawn from its bottom line. It is a matter of regret that catalogue entries for cartographic items, including the map in question, tend to indicate the size of the entire map sheet only, and rarely distinguish the size of the map body.

The northern territories are delimited by a distinct borderline with the Russian empire under the name “Russian Border” (*Eluosi jie* 鄂羅斯界) highlighted in brownish yellow; the south is also delimited by a clear borderline, while the borders in the west are not demarcated, but are named by adjoining areas, for instance, “Badakhshan Border” (*Badakeshan jie* 巴達克山界) to the south-west from the Pamirs. The absence of clear borderlines seems intended to transmit a clear visual message – the west is still not completely appropriated and may be open to further expansion. There are no administrative divisions of the new peripheral territories on the map. These are only applied to the core territories of the imperial realm around the basins of the Yellow and the Yangzi rivers – the “eighteen provinces of the Inner Lands” (*neidi shiba sheng* 內地十八省), which can be referred to as “China Proper”. These are divided by neat borderlines highlighted in different colours, with the exception of the borders of the northern and north-western provinces, which are left open.⁹

Craftsmanship Implications

The eighteen provinces constitute a compact cluster of units densely filled out by place names and are contrasted visually with the sparse new territories. An interesting imperfection can be detected in the delineation of the borders of Shanxi and Shaanxi provinces. These provinces are divided by the Yellow River, but the province border mark between them is missing. In addition, the external borders of these provinces have the same colour, so that visually they look like a single unit of administrative division (see Fig. 8).¹⁰ In comparison, all the other neighbouring provinces on the map have contrasting colours, allowing one to distinguish one from another at a glance.

⁹ The division of the core imperial territories into the eighteen provinces under the Qing dynasty originates from the fifteen provinces, more precisely two capital districts and thirteen provinces, of the Ming empire. During the Qing some of the Ming provinces were subdivided, so that their total number became eighteen.

¹⁰ Both provinces are not delimited in the north.

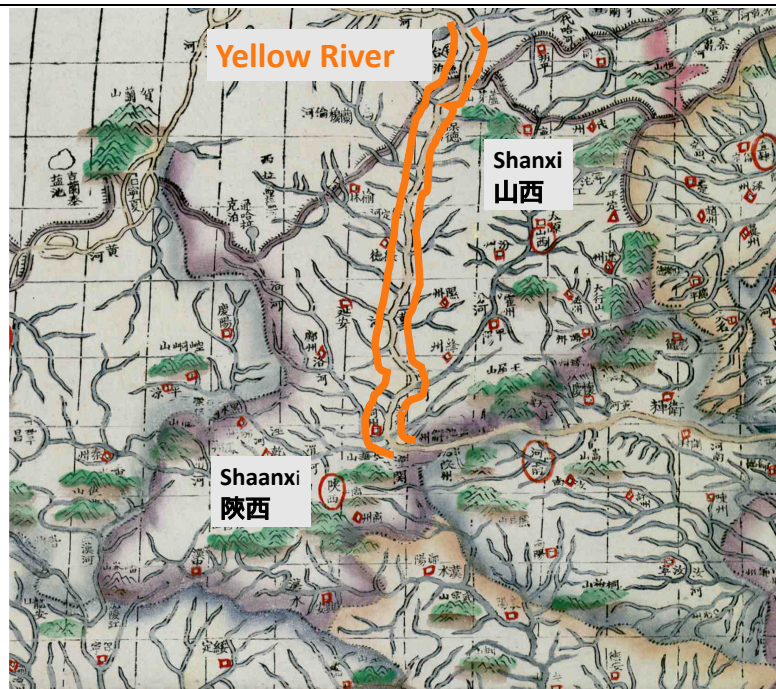
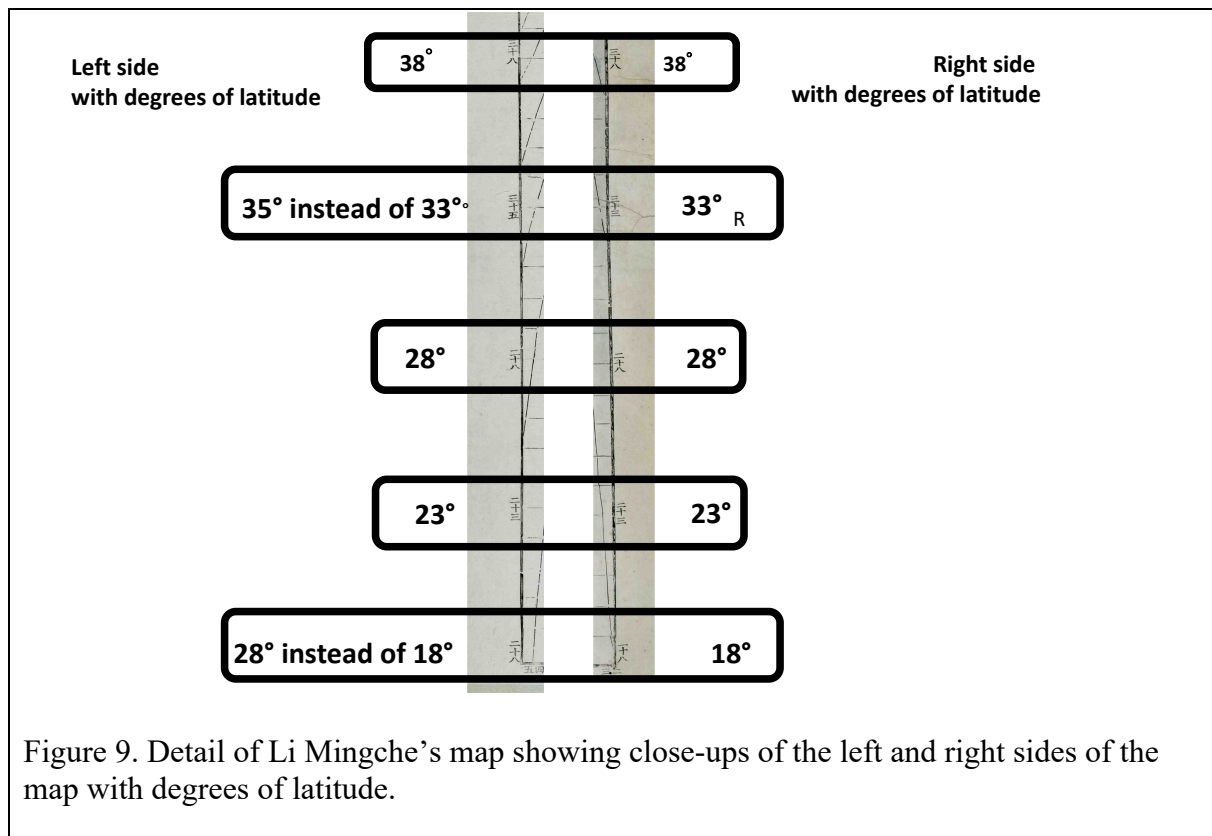


Figure 8. Detail of Li Mingche's map showing a close-up of Shanxi and Shaanxi provinces, erroneously depicted as one administrative unit. The missing bordermark between the two provinces along the Yellow River is highlighted by the author of this article.

The creation of a map starts with its drafting by the author, in this case a recognised cartographer whose identity and cartographical works are discussed in the next paragraph. However, realisation of the draft map involved different craftsmen, who may not have had any specialized geographical knowledge. As a result, they may have inadvertently introduced some errors into the map's content, which the author-cartographer would have been unlikely to have done. In this case, these craftsmen were the woodblock carver and the colourist. Indeed, the carver made an even more significant mistake than omitting the border mark between Shanxi and the Shaanxi provinces, one that provides clear evidence of the carver's ignorance in the principle of numbering cartographic coordinates, that is, in two degrees of latitude given on the left side of the map he carved 28° instead of 18° for the bottom latitude, and then 35° instead of 33° .¹¹ All the other degrees of latitude given on the left side are correct, so there are two outstanding errors in the sequence: 28° (instead of 18°) $\rightarrow 23^{\circ} \rightarrow 28^{\circ} \rightarrow 35^{\circ}$ (instead of 33°) $\rightarrow 38^{\circ}$ (see Fig. 9).

¹¹ Similar mistakes originating from copying cartometric data of a map without understanding this principle are discussed in Dorofeeva-Lichtmann (2020).



Such lapses introduced during the map production raise an interesting question of the limits of the author's role.

Cartographical Works by Li Mingche and an Approximation of the Map's Date of Production

One of the main attractions of the map for Chinese historians of cartography and the Chinese scholarly community in general is that it is signed by a known Chinese scholar, Li Mingche (1751–1832), who was born in the sixteenth year of Qianlong 乾隆 (r. 1735–1796) and passed away in the twelfth year of Daoguang 道光 (r. 1820–1850). He was a passionate advocate of modern Western science, and, at the same time, a Daoist master. Links between science and Daoism in China have received considerable attention, but for earlier periods of Chinese history.¹² The case of Li Mingche provides evidence of the continuation of a certain relationship between science and Daoism in China up to the late imperial period.¹³

The name Li Mingche is found at the end of the general introduction on the map, a square-shaped textual passage placed at its lower right corner, the longest of the three textual passages incorporated into the map. The signature constitutes the last six characters of the introduction, which are placed separately (see Fig. 10): “*Qinglai Li Mingche hui*” 青來李明徹繪 (“Drafted by Li Mingche, [bearing style name *hao* 號] Qinglai”). No precise date of the

¹² For a critical survey of studies discussing relationships between science and Daoism in China, in particular studies by Joseph Needham and Nathan Sivin, see the introduction by Alexei Volkov to a special issue of the *Taiwanese Journal for Philosophy and History of Science* devoted to a Daoist master and polymath of the late thirteenth and early fourteenth centuries, Zhao Youqin 趙友欽; Volkov (1996).

¹³ For more on Li Mingche's role as a Daoist master as it relates to his cartographical works, see Zhen (2006).

map's creation is given in the map but is naturally limited by the roughly fifty years of professional activity of its author – from the last two decades of the eighteenth century through the first three decades of the nineteenth century. This rather broad approximation of the map's date may, however, be narrowed down through comparison with other cartographic works by Li Mingche and those by his close contemporaries.

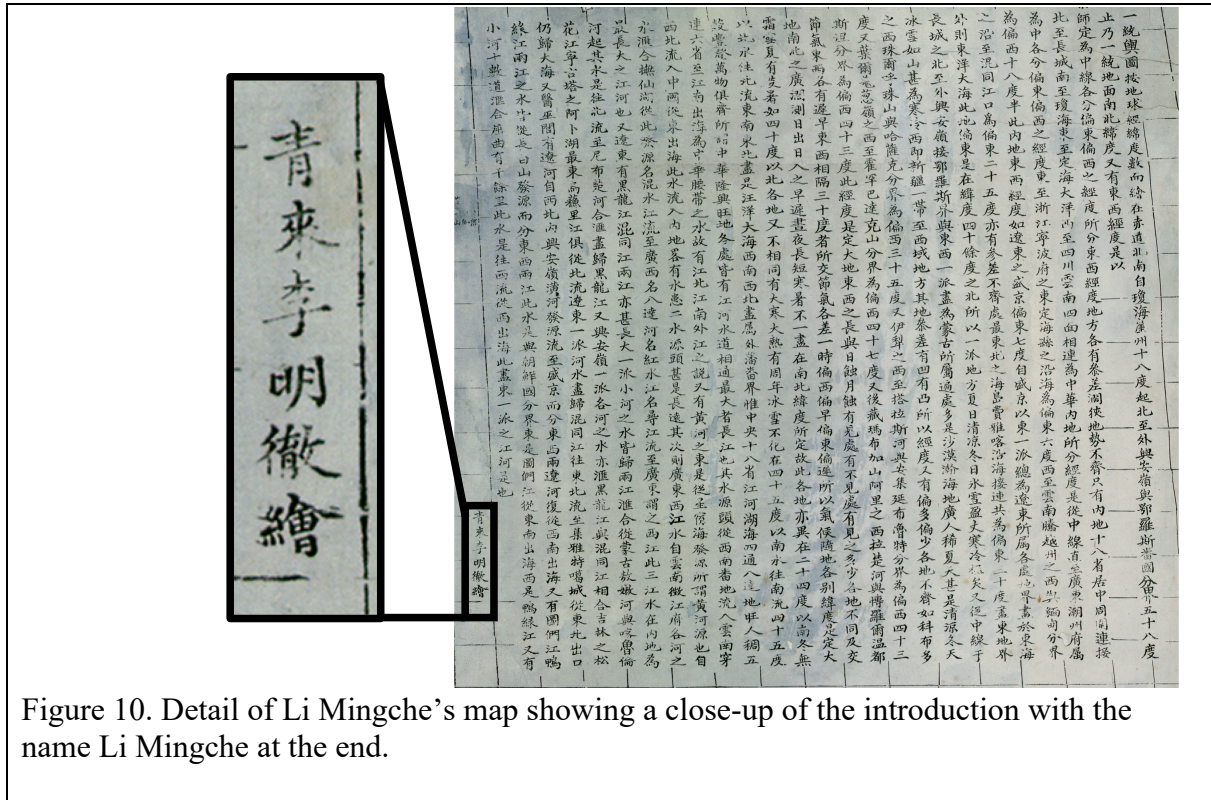


Figure 10. Detail of Li Mingche's map showing a close-up of the introduction with the name Li Mingche at the end.

Li spent all his life in his native Guangdong 廣東 province, having been born in Panyu 番禺 city to the south of its capital, Guangzhou (Canton) 廣州, now one of its districts, and he passed away in Guangzhou. This was a location relatively open to foreign knowledge, and he was primarily concerned with transmitting the achievements of Western astronomy. It was through astronomy that he became interested in Western cartography.¹⁴ It is apparent from his main work, the *Yuantian tushuo* 圓天圖說 (The Round Heavens Illustrated and Explained, 1819–1820). The main text is preceded by a preface by one of the most outstanding Qing dynasty scholars, Ruan Yuan 阮元 (1764–1849), who in 1817–1826 served as the provincial governor of Guangdong, prefaces by two other late Qing scholars, Lu Yuanwei 盧元偉 (1762–?) and Liu Binhua 劉彬華 (1770–1828), as well as a self-preface (*zixu* 自序) by Li Mingche.¹⁵

¹⁴ I am indebted to Lin Tieng-jen 林天人 and Wang Qianjin 汪前进 for calling my attention to the authorship of the map. For a general essay on Li Mingche, see Zhen (2007). For his input into the diffusion of astronomical knowledge, see Needham and Wang (1959), 457; Chu (2018), 351. For an overview of his cartographical works, see Zhen (2006).

¹⁵ The date when the main text was cut is given on the front page of the *Yuantian tushuo* as follows: *Jiading jimaon nian juan* 嘉慶己卯鐫 – “cut in the twenty-fourth [*jimaon*] year of the Jiaqing emperor [1819–1820]”. The prefaces by Ruan Yuan, Liu Binhua, and Li Mingche are dated more precisely (the preface by Lu Yuanwei is undated). The preface by Ruan Yuan is dated to the *chushu* solar term (23 August–7 September) of the twenty-fourth (*jimaon*) year of Jiaqing (己卯處暑 *Jimaon chushu*), and, therefore, refers to 1819. The preface by Li

The third volume of the *Yuantian tushuo* includes a geographical section with a series of maps.¹⁶ It begins with a rather ordinary, for East Asian cartography of the time, map of the world relying on the modern Western cartographic framework. It is drawn according to a globular projection with a 10° graticule and with a prominent ecliptic line. The map consists of two separate hemispheres, each printed on two pages. The delineation of continents and islands in the map is quite approximate. It seems to be copied from a world map dated to 1800 drawn by Zhuang Tingfu 庄廷敷 (fl. eighteenth century).¹⁷ This world map from the *Yuantian tushuo* was translated and extensively commented on by Heinrich Julius Klaproth (1783–1835), a prolific orientalist of broad interests, including cartography.¹⁸

After the world map Li Mingche places a general map of the empire followed by maps of the eighteen provinces of “China Proper”. As with the world map in the *Yuantian tushuo*, the eighteen provincial maps do not contain anything especially innovative. They follow the familiar templates of the first block-printed edition of the Kangxi atlas (1717), the first of the so-called Qing “court atlases”. These atlases were the products of a state project of systematic and comprehensive mapping of the imperial territories, subsequently enlarged to include the territories of close neighbours. It began during the era of the Kangxi 康熙 emperor (r. 1661–1722) and was continued during the reigns of his two successors – the Yongzheng 雍正 (r. 1722–1735) and Qianlong emperors.¹⁹ The Kangxi atlas, which established a long-lasting model for this cartographic genre, is known in the form of the initial block-printed and copper-plate editions, both dating to the same year (1717), and, following the survey of Tibet, the revised copper-plate (1719) and block-printed (1721) editions.²⁰ This cartographic enterprise was the result of interaction between the autochthonous Chinese tradition of cartographic surveying, applying a quantitative square grid,²¹ and modern Western

Mingche is dated to the twelfth month of the twenty-fourth (*jimao*) year of Jiaqing (嘉慶己卯歲嘉平月 *Jiaqing jimao sui jiaping yue*), which corresponds to early 1820 (the twelfth month began on 16 January 1820). The preface by Liu Binhua is dated to the third day of the third month of the twenty-fifth (*gengchen*) year of Jiaqing (嘉慶歲在庚辰三月三日 *Jiaqing sui zai gengchen sanyue sanri*), and, is, therefore, the latest among the dated prefaces and corresponds to 1820. One can conclude that the main text was cut in 1819 shortly before the earliest preface (by Ruan Yuan) and printed in 1820 after the latest preface (by Liu Binhua). The three initial volumes (*zhengbian* 正編) of the *Yuantian tushuo* are supplemented by two follow-up volumes (*xubian* 續編), cut in the first year of the Daoguang emperor (1821).

¹⁶ A copy of this volume can be downloaded from <https://gallica.bnf.fr/ark:/12148/btv1b90062337>.

¹⁷ Dates of life of Zhuang Tingfu are often given as 1728–1800. There is, however, not yet enough evidence for any precise dates. An image of a map by Zhuang Tingfu kept at the Bibliothèque nationale de France (BnF) is available through the following link: <https://catalogue.bnf.fr/ark:/12148/cb40751952p>, shelf-mark: GE C-5354 (RES). A manuscript version of this map is kept at the MacLean Collection (Chicago):

<https://collections.leventhalmap.org/search/commonwealth:v405wp97j>, shelf-mark: 33486. I am grateful to Wang Yao 王耀 and Richard Pegg for these references, respectively. For an overview of Zhuang Tingfu’s maps, see Pegg (2021).

¹⁸ Klaproth (1833).

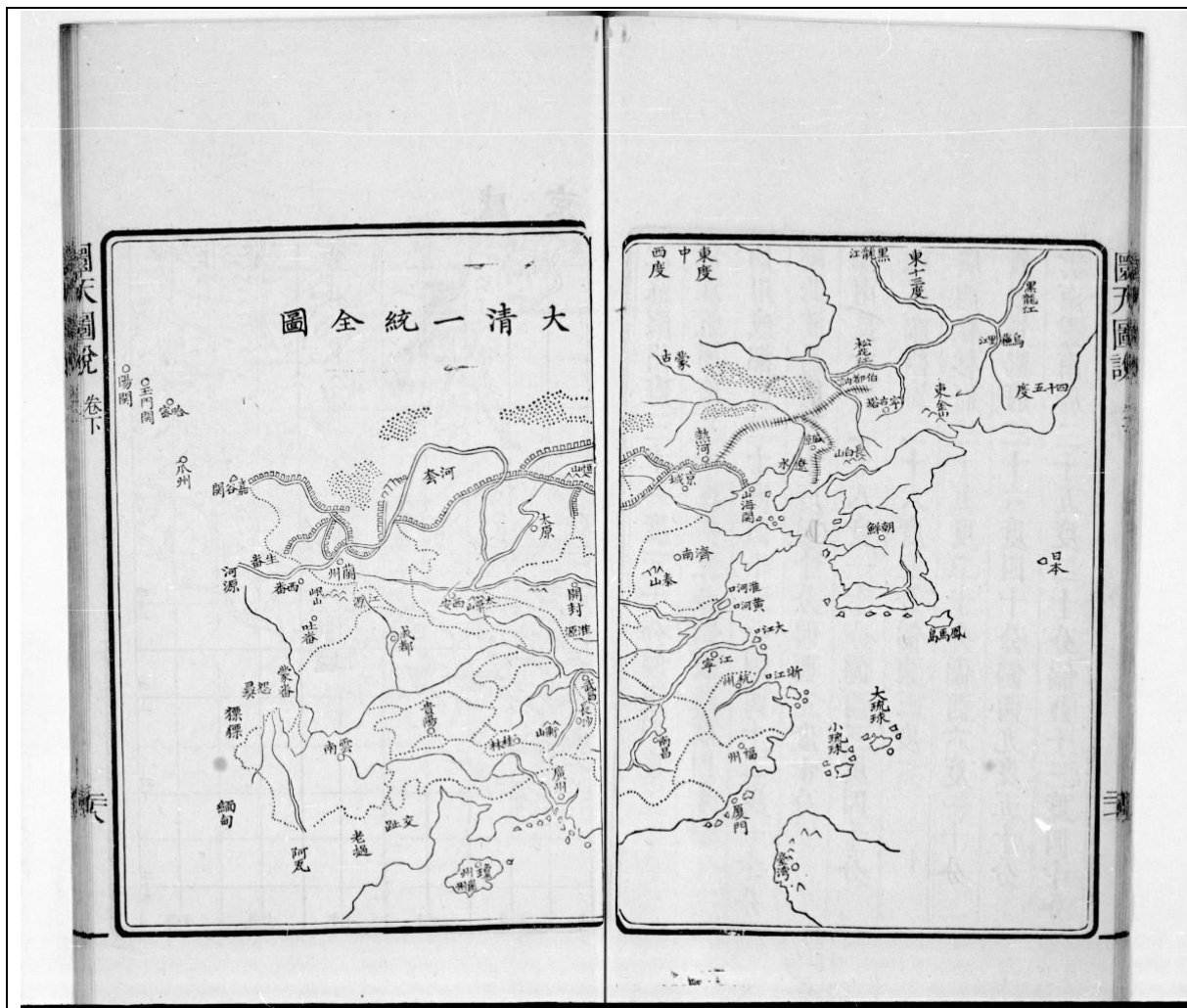
¹⁹ For the seminal study of the Qing “court atlases”, see Cams (2017). For a useful summary of surveying practices during the Kangxi period, see Han (2006). Qing cartography at large is discussed by Hostetler (2001); Hostetler (2009).

²⁰ The development of the Kangxi editions and the genealogy of the printed Qing “court atlases” are discussed in Cams (2017), 177–253, and are conveniently summarized in Cams (2018), esp. Table 2 on p. 256 and Fig. 4 on p. 263, which is reproduced from Cams (2017), Fig. 35 on p. 201. The dates of the Qianlong atlases need to be revised.

²¹ “Quantitative square grid” is a slightly modified more universal definition of the term “quantitative rectangular grid” applied by Needham and Wang (1959), 498. The quantitative square grid is cardinally different

cartography, which relied on more advanced techniques of cartographic surveying and applied a cartographic projection. Various attempts to combine two different cartometric systems – the quantitative square grid and the latitude-longitude graticule – can be traced through the atlases, but this interesting subject is still to be investigated in detail. Thus, the provincial maps of the *Yuantian tushuo* are drawn according to the latitude-longitude graticule, but with an attempt to make the graticule visually similar with the square grid.²² Klaproth also worked on translations of the provincial maps from the *Yuantian tushuo*. These translations were never published, but can be found among his manuscripts in the British Library.²³

The general map of the Chinese imperial realm placed between the world map and the provincial maps is, however, absolutely outside of this cartographic lineage (see Fig. 11).



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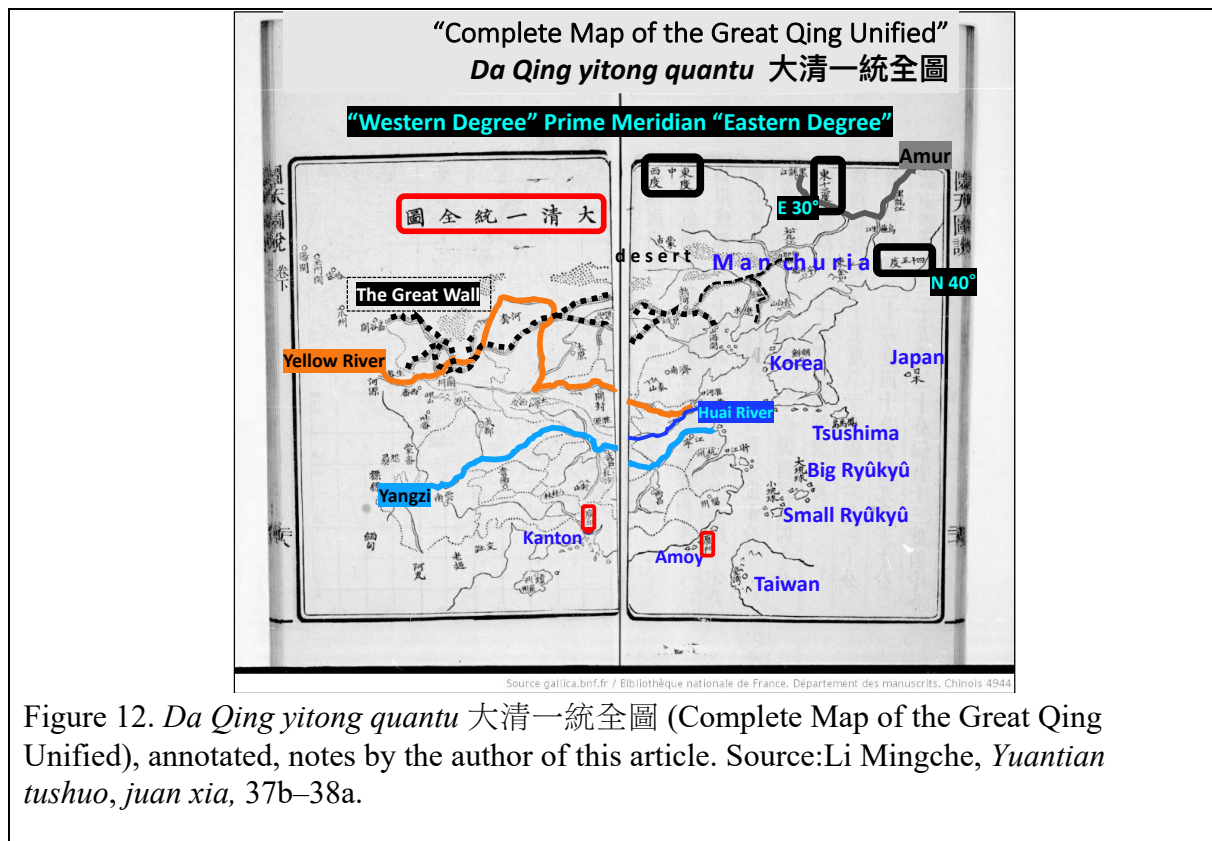
Figure 11. *Da Qing yitong quantu* 大清一統全圖 (Complete Map of the Great Qing Unified). Source: Li Mingche, *Yuantian tushuo*, *juan xia*, 37b–38a.

from the latitude-longitude graticule, in particular, the square grid does not take into consideration the curvature of the earth.

²² The latitude and longitude degrees with respect to the prime meridian at Beijing are given at the margins of the provincial maps; the maps use a 0.5° graticule.

²³ For a description of the Klaproth Manuscripts kept at the British Library, see Dorofeeva-Lichtmann (2021). Translations based on the eighteen provincial maps from the *Yuantian tushuo* constitute File 1 of a total of nine files, into which the Klaproth Manuscripts are subdivided.

In contrast to the world map and the provincial maps that pointedly follow the Western cartographic framework through applying a latitude-longitude graticule, the general map of China is just a rough schematic sketch. It is no wonder that this map never tempted Klaproth to translate it for a Western audience. The map's title – *Da Qing yitong quantu* 大清一統全圖 (Complete Map of the Great Qing Unified) – has a clear affinity with that of the map in question through referring to the territory of the Qing empire as the “Great Qing” (*Da Qing* 大清) and “Unified” (*yitong* 一統). However, it depicts only the core territories of the imperial realm and its north-eastern territories (Manchuria, the ancestral lands of the Qing emperors), while the western peripheries (Xinjiang and Tibet) are out of the picture (see Fig. 12).



The map shows a very rough outline of the main river network; I have marked some of these rivers here (the Yellow, Yangzi, and Amur rivers), as well as a pronounced depiction of the Great Wall with the desert zone to the north (the areas of desert are marked by dotted areas). It also has borderlines between the provinces, though without providing their names, only their capitals and some main cities, for instance, Guangzhou and Xiamen 廈門 (Amoy) on the southern coast of China. The map has some completely outdated topographical features, such as the course of the Yellow River depicted in confluence with the Huai River 淮河, typical of maps of the Ming dynasty (1368–1644). There are also some interesting distortions, in particular in depictions of islands. Thus, Japan is reduced to one small, distant island (as it is found in some Ming dynasty maps), while Taiwan, the Big and Small Ryukyus, and Tsushima

Island are oversized. This rather unusual distortion seems to convey a view from the perspective of the south-eastern coast – the islands closest to it are oversized and those that are the furthest away (Japan) are shrunken. This map is a curious example of the Chinese tradition of diagrammatic or relational maps, which aimed to roughly approximate relative locations of landmarks without much concern for accuracy.²⁴ At the same time, the map bears a mild stamp of modern cartography in the form of a mark at the top of the map of the prime meridian to be delineated through Beijing, as well as those of the E 30° and the N 40° at the north-eastern corner of the map (Manchuria), though the longitude-latitude lines themselves are not delineated.

Now, if we juxtapose the rough sketch map of the imperial realm with the map by the same author discovered in Göttingen, we can see that “something” happened in-between in terms of cartographic quality, even taking into consideration that the maps have very different formats, and that drawing the map discovered in Göttingen on a page of a book is technically impossible. What could cause such a considerable breakthrough in Li Mingche’s cartographic achievements? Li was also engaged in Ruan Yuan’s project of compiling a new, considerably updated edition of a provincial gazetteer – the *Guangdong tongzhi* 廣東通志 (Guangdong Gazetteer). The project started in 1818 and was completed in 1822. The gazetteer was co-edited by one of the most influential geographers and cartographers of the time, a younger contemporary of Li Mingche, Li Zhaoluo 李兆洛 (1769–1841), who in 1820 arrived in Guangdong and must have had an influence on Li’s cartographical competence.²⁵

In the year of Li Mingche’s death – 1832 – Li Zhaoluo published the first edition of his own map of the Chinese empire – *Huangchao yitong yudi quantu* 皇朝一統輿地全圖 (Complete Terrestrial Map of the Imperial Dynasty Unified), created together with Dong Fangli (Youcheng) 董方立 (祐誠) (1791–1823).²⁶ One gets the impression that he could not publish his map earlier out of respect for his elder fellow cartographer. Li Zhaoluo’s map is larger – it is block-printed on eight scrolls, with the map area measuring approximately 243 x 338 cm (8 scrolls 259 x 43 cm each) – and much more elaborate, but has clear affinities with the map by Li Mingche, for instance, in the depiction of the Amur-Sakhalin area and south-eastern Tibet. Yet, Li Zhaoluo’s map shows a much more complete administrative division of the Qing empire. If in Li Mingche’s map the division into provinces applies only to “China Proper”, in Li Zhaoluo’s it already covers the entire imperial realm. There is, however, a principal and interesting difference between the two maps: Li Mingche sticks exclusively to the latitude-longitude graticule, including in his provincial maps included in the *Yuantian tushuo*, manifesting his preference for Western science, while Li Zhaoluo returns to the

²⁴ Map accuracy hereafter is used as a purely technical term – a measure of the location of features on a map compared to their true positions on the face of the Earth. It does not bear any evaluative sense, implying that a map is “good” or “bad”. Little concern for accuracy in the case of Chinese diagrammatic or relational maps simply means that they were drawn with different concerns in mind.

²⁵ For the historical setting of Ruan Yuan’s project and its participants, including Li Mingche and Li Zhaoluo, see Mosca (2013), 202–212; Zhang Xue (2020), 128–132.

²⁶ A copy of this map is in the possession of the Library of Congress: <http://hdl.loc.gov/loc.gmd/g7820.ct003379a>, <http://hdl.loc.gov/loc.gmd/g7820.ct003379b>, shelf-mark: G7820 1832. D5; see also Lin (2013), 90–91.

practice of combining the graticule with the traditional square grid, showing both on one map.²⁷

The map by Li Mingche found in Göttingen is unlikely to have appeared before 1820, and most likely after the completion of the *Guangdong tongzhi* (1822), following a period of collaboration with Li Zhaoluo. This suggestion is confirmed by approximation of the date of the map to 1825–1826 in the detailed description of it by J. R. Morrison in the first volume of the journal *Chinese Repository*, published in Guangzhou in 1832, the year of Li Mingche's passing away and the publication of the *Huangchao yitong yudi quantu*.²⁸ The lengthy description of the map by Morrison has yet to be carefully compared with the discovered version of the map, but the date of the map can be considered to be reliably determined.

Choosing a Cartographic Template and the Ways in Which It Is Adapted

The map by Li Mingche is the result of a complex process of cartographic interaction. A map historian's eye immediately recognises a striking similarity between the general image of the map by Li and one of the most acknowledged cartographic representations of Asia created during the Golden Age of French cartography – *Carte la plus générale et qui comprend la Chine, la Tartarie Chinoise, et le Thibet* by Jean-Baptiste Bourguignon d'Anville (1697–1782). This map was of central importance, providing a model for the mapping of Central and East Asia in Western cartography until the late eighteenth century, as evidenced by the multiple reprints up to 1790 referred to below. The map was completed by d'Anville in 1734, the year given in the cartouche at the lower left corner of the surviving fragment of the first state of the map, and the second and the earliest complete map state.²⁹ The map was first published in 1735, included in the *Description géographique historique, chronologique, politique, et physique de l'Empire de la Chine et de la Tartarie Chinoise* by Jean-Baptist Du Halde (1674–1743).³⁰ Almost immediately – in 1737 – the d'Anville maps, including the *Carte la plus générale*, were pirated at the Hague, having been re-engraved and published as a separate atlas, much to the irritation of the cartographer.³¹ D'Anville criticised the quality of the engraving, in particular the mountain symbols, the typeface, as well as some missing features.³² However, the pirated version had an important advantage: it was cheaper and printed in a larger format, so one did not need to unfold the maps anymore in order to consult them, and for this reason the pirated atlas became more popular than the original edition by Du Halde.³³

²⁷ I briefly touch on the relations between the Chinese square grid and the latitude-longitude graticule in my article on Klaproth, see Dorofeeva-Lichtmann (2021).

²⁸ For the approximation of the map's date, see Morrison (1832), 34.

²⁹ The first and the second states are preserved in one example each, both at the Collection d'Anville of the BnF; for the second state, see <http://gallica.bnf.fr/ark:/12148/btv1b5962717m#>, shelf-mark: GE DD 2987 (7144 B). For an account of its states, the fifth and the latest of which is dated to 1790, see Caboara (2023), 481–486.

³⁰ Du Halde (1735), the map was inserted at the beginning of the book.

³¹ D'Anville (1737). For the pirating of d'Anville's maps, see Cams (2017), 233–239.

³² For the original and the English translation of d'Anville's lamentations, as well as a comparison of a close-up of an original map and its pirated version, see Cams (2017), 237.

³³ For a discussion of this phenomenon, as well as the following reprint of the atlas in The Hague in 1785, and of the printing of the original maps by d'Anville as a separate atlas in the same year in Paris, see Cams (2017), 238–239, esp. the diagram including the original and pirated publications. See also a useful summary in Cams (2023).

The pirated version of d’Anville’s *Carte la plus générale* tends to be dismissed, for understandable reasons, if one regards it from the view of Western cartography.³⁴ However, when considered in the context of its potential for wide circulation for private use, its more general accessibility turns out to be more important than any technical imperfections or minor mistakes.

The pirated map has an interesting difference from the original, not discussed in the studies referred to here.³⁵ The original map includes a textual passage at the top explaining the colour scheme of the borderlines, titled “Avertissement sur l’Enluminure de cette Carte”, which specifies the following: carmine or red (*carmin/rouge*) for borderlines between the fifteen provinces that constitute “China Proper”, blue or the colour of water (*bleu/couleur d’eau*) for borderlines between the six parts of Chinese Tartaria (Tartarie Chinoise), and saffron or yellow (*saffran/jaune*) for delimiting Korea. It also notes that no colours are used for borderlines in Tibet and western Tartaria, as it is difficult to establish their delimitations.³⁶ This passage has been deleted from the pirated version, with good reason, as this version has either no colours at all,³⁷ or applies a slightly different colour scheme, as is the case in the example of the version of the map in the David Rumsey Map Collection (see Fig. 13). Here, different colours are used for delineating the borders of neighbouring provinces, as is also the case in the map by Li Mingche. In order to reduce the blank space left in the pirated version of the map a compass rose has been placed at the top, at the intersection of 55°N and 30°W. In some copies the compass rose is accentuated in colours.

³⁴ See the table of occurrences of the maps by d’Anville, which includes only its original versions, in Caboara (2023), 486.

³⁵ For instance, Mario Cams mentions the pirating of the original map in The Hague edition of 1737, having provided a reproduction of its second state, but does not point out this curious difference; see Cams (2023), 139. The second state is available at <http://gallica.bnf.fr/ark:/12148/btv1b5962717m#>, shelf-mark: GE DD 2987 (7144 B).

³⁶ One can read the passage by zooming into the second state of the map (see note 35).

³⁷ See, for instance, The Hague edition of the *Nouvelle atlas* by d’Anville of 1737, available through the Gallica digital library at <https://gallica.bnf.fr/ark:/12148/btv1b53096745m/f1> (first map inserted after p. 12 and p. 20).



Figure 13. *Carte la plus générale et qui comprend la Chine, la Tartarie Chinoise, et le Thibet* by Jean-Baptiste Bourguignon d'Anville (1697–1782), drawn in 1734, printed (pirated) in 1737, hand-coloured copper print. Dimensions of map body: approximately 47 x 69 cm. David Rumsey Collection, shelf-mark: 13322.010. Source: d'Anville (1737, first map inserted after page 12).

In this article I use d'Anville's *Carte la plus générale* in the sense of a generic map, one that provides the general outlines of the mapped territory, so that using one example at this stage is sufficient for determining its general similarities and differences when compared with the map by Li Mingche. Taking into consideration the greater accessibility of the pirated version for private use, that Li Mingche's project to draw a general map of the Chinese empire was on his own private initiative, and the common principle of coloured highlighting of the borderlines between the provinces of "China Proper" in the pirated version of d'Anville's map and the map by Li Mingche, I shall use the pirated version for comparison.

It is, however, important to note that the d'Anville map is, in turn, based on Chinese sources – namely, the Kangxi atlas – and, like the role of the Kangxi atlas in Qing "court" cartography, it introduced a model for representing the Qing imperial realm in Western cartography until at least the end of the eighteenth century.³⁸ It would seem more likely that a

³⁸ For the complex process of d'Anville's appropriation of cartographic information from the Kangxi atlas, see Cams (2014); see also Hostetler (2009), 107–115. An interesting discussion of d'Anville's map and related

Chinese cartographer would prefer to rely on the Chinese source map – the Kangxi atlas. However, it, as well as the other “court” atlases, does not include any key map. They are composed of separate sheets, each showing a part of the imperial realm, and, therefore, could not serve as a template for a general map of China. It was d’Anville who first derived a synthetic view of the entire Qing imperial realm from the separate sheets of the Kangxi atlas, having drawn a general map on a single medium-size map sheet.³⁹ It provided a standard outline of the Central and East Asia, which became current in Western cartography during at least five decades, that is during the period of time when Li Mingche started his scholarly career.

Digitisation considerably facilitates comparisons of maps of different dimensions, as it enables one to juxtapose them in a visually comparable size and thus immediately grasp the common features of their configuration. In the case of the assembled sheets of the revised copper-plate edition of the Kangxi atlas, we are dealing with a huge source map. One sheet measures approximately 40 x 66.5 cm, and the mosaic of forty-one sheets with cartographic content extends up to 320 x 470 cm.⁴⁰ Its two successive descendants – the general maps by d’Anville and Li Mingche – are much smaller, but also considerably different to each other: d’Anville’s map is about 3.4 times smaller than the map by Li. A simple viewing of digital copies of these maps placed side-by-side shows that from the perspective of its configuration, Li’s map is generally closer to d’Anville’s than to the assembled sheets of the Kangxi atlas, as I will lay out below.

(1) The layout of d’Anville’s map provides a classic example of a skilful intertwining of a cartographic body with concomitant elements of a map, including decorative ones, so that the sheet is filled out in a visually balanced way. Large spaces not occupied by the cartographic body in his map – the lower left and the lower right corners – are filled out by richly ornamented cartouches. The largest and most artistic cartouche to the left frames the title of the map with some details concerning the map’s sources. The smaller cartouche to the right contains a sequence of distance scales. On closer inspection, Li Mingche follows this layout, but replaces the cartouches with textual passages (see Fig. 7), thus adapting his map for a Chinese audience, as cartouches are not used at all in traditional Chinese cartography, whereas textual interpolations are quite common.⁴¹ The distance scales, a necessary asset of Western maps of the time, are then completely dropped by Li. Legends are also nowhere in evidence. There is also one important difference of the cartographic area encompassed in the map by Li from that by d’Anville – the former does not include the Caspian Sea and the

issues took place in May 2014 on ISHMap-List – the discussion list of the International Society for the History of the Map – with active input from Joel Kovarsky and Alexei Postnikov.

³⁹ Only recently were the forty-one sheets of the revised copper-plate edition of the Kangxi atlas (1719) used in most scholarship assembled together into a convenient, online, searchable, digital general map as part of the QingMaps project. See <https://qingmaps.org/maps/Kangxi-1721> (here the revised copper-print edition is erroneously dated to 1721 instead of 1719).

⁴⁰ See Cams (2017), 186, Fig. 31 on p. 189; see also Cams (2018), 252.

⁴¹ In terms of composition, “non-cartographic” spaces on modern Western maps were, as a rule, part of decorative framing, sometimes with large blank areas, whereas in traditional Chinese maps decorative framing did not play an important role. Here “non-cartographic” spaces were rather used for accommodating textual passages, or just left blank. I thank one of the anonymous reviewers for calling my attention to this aspect of composition. For cartouches in early modern Western maps, see van Duzer (2023).

territories to the east of it up to the Pamirs, which together constitute a visually distinctive unit in the upper-left (north-western) corner of the d'Anville map. In the map by Li this unit of the cartographic body is “cut out” and replaced by another textual passage, thus avoiding any major change of the layout in general. The reason for this is that these territories had never been part of the Qing empire, and, therefore, were simply beyond the scope of Li's concerns. For the same reason, the Caspian Sea and adjoining territories are not included in the Kangxi atlas.

(2) All three maps are distinguished by the prominent place given to the Amur-Sakhalin area (the north-eastern or the upper right corner of the maps) with the characteristic so-called Delisles's shape of Sakhalin Island, already out-dated in Western cartography by the middle of the eighteenth century.⁴² In the maps by d'Anville and Li Mingche the imperial territories in the north are delimited by a clear borderline, while in the Kangxi atlas they are cut off by the northern edge of the map, continuing beyond the mapped area.

(3) Neither the map by Li Mingche, nor that by d'Anville depicts Lake Baikal, not because there is no space, as its place in both maps, above the northern border of the imperial realm, is just left blank. In the Kangxi atlas, on the other hand, Baikal is prominently depicted at roughly the middle of the northern edge of the map and is the most eye-catching lake in the atlas.

(4) In the maps by Li Mingche and d'Anville, Taiwan is depicted completely, not just by a thin band of its western coast, as is the case in the Kangxi atlas and also the later court atlases.⁴³

(5) The visual focus of the map by Li Mingche is the dense cluster of the eighteen provinces of “China Proper”, highlighted by the use of different colours for the borderlines between them. This highlighting of the borderlines is one of the formal distinguishing features of European cartography of the eighteenth century, and is applied in some pirated copies of the map by d'Anville, for instance the one kept at the David Rumsey Collection mentioned above (see Fig. 13). In comparison, the borderlines between the units of administrative and territorial divisions in the black-and-white print of the Kangxi atlas are barely visible. In the maps by d'Anville and Li Mingche the western territories are not delimited. There is, however, an interesting difference: the absence in Li's map of delimitations between the units of what d'Anville referred to as the “Tartarie Chinoise” (Manchuria and Mongolia).

⁴² I thank Robert Batchelor for this observation, who also called my attention to the step back to the early eighteenth century in representations of the Amur and Sakhalin area also present in Japanese mapping of the North Pacific in the 1780s and 1790s. In the case of the map by Li Mingche and the Japanese maps just mentioned we are dealing with East Asian maps aiming to follow the standards of late-modern Western cartography. They should, therefore, be evaluated with respect to the development of Western cartography, and such backwards movements with respect to the mainstream of the Western cartography are rather curious. The reason for this requires a special study.

⁴³ See, for instance, the block-printed Yongzheng atlas (1729) and the copper-plate Qianlong atlas on 104 sheets (1760s), together with the revised copper-plate edition of the Kangxi atlas (1719), available via the QingMaps project at <https://qingmaps.org/maps/yongzheng-1728> and <https://qingmaps.org/maps/qianlong-1766>, respectively; the Yongzheng atlas is dated here to 1728, the Qianlong atlas to 1766. The Qianlong atlas is also based on a pseudo-cylindrical projection, whereas the Yongzheng atlas is based on a square grid, with the zero point of the coordinate grid at Beijing – the zero vertical line corresponding to the prime meridian is delineated through Beijing, while the zero horizontal line is delineated slightly to the north from Beijing (corresponding to 40°N). For more on the Yongzheng atlas, see Cams (2021).

(6) Li Mingche represents the desert zone (Goby-Tarim) as a blank area. The same image of a blank desert space is found in the Qing “court” atlases. Using blank spaces in maps is commonly attributed to d’Anville as a means to depict poorly investigated regions, but it seems that this cartographic practice was already in use earlier.⁴⁴ Whatever its precise origins, in the d’Anville map the desert zone is blank. This idea seems to have been introduced to China from Europe, the influence on the “court” atlases included, as traditional Chinese maps of the Ming and Qing dynasties depict the desert area in a markedly different way, using an eye-catching cartographic symbol – a broad band often coloured in black. A good example of this is the first printed edition (c. 1556) of the atlas of the Ming empire, the *Guangyutu* 廣輿圖 (Enlarged Terrestrial Atlas) by Luo Hongxian 羅洪先 (1504–1564).⁴⁵ In other examples, the desert area is filled out by dots imitating sand, as is the case in the Blue Maps and their polychrome congeners, which will be briefly discussed below.⁴⁶

(7) I mentioned above that the pirated version contains an added element not found in the original d’Anville map – a compass rose placed at the top, at the intersection of 55°N and 30°W. In the map by Li Mingche the orientation to the four cardinal direction is also explicitly indicated, but in the way used in traditional Chinese cartography – by placing the designation of the cardinal direction at about the middle of each side of the map (see Fig. 7). This designation of the cardinal directions was, however, rarely used in Chinese maps of the late eighteenth and early nineteenth centuries. For instance, they are no longer in evidence in the Blue Maps and their polychrome congeners. A possible explanation for this is that making the orientation to the cardinal direction explicit again may have been inspired by the compass rose, and may be seen as an additional argument that Li used the pirated version of the d’Anville map as a template.

There is, however, one substantial difference in cartometric characteristics between the map by Li Mingche and the map by d’Anville – they are based on cardinally different projections. Li applies a pseudo-cylindrical projection, meaning that the projection used in the first place belongs to a big family of projections. It is characterised by latitude lines drawn parallel to each other; the only longitude line or meridian delineated as a straight line perpendicular to the latitude lines is the prime meridian, which serves as a symmetry axis, all the other meridians being delineated as curves symmetrical with respect to the prime meridian. A pseudo-cylindrical projection had been introduced into China from the beginning of the diffusion of Western cartography, in particular through the oval world maps known as the “Ricci Maps”.⁴⁷ The special attraction of a pseudo-cylindrical projection for the Chinese audience was its partial visual resemblance to the quantitative square grid attained through maintaining straight lines of latitude. A pseudo-cylindrical projection looks very similar to a

⁴⁴ For a discussion of the origins of using blank spaces in maps, commonly attributed to d’Anville, see Haguet, who argues that blank spaces started to be used before d’Anville, their accreditation to him becoming established only in the nineteenth century; Haguet (2016). I thank Elke Papelitzky for calling my attention to this study.

⁴⁵ For the two most important studies on this atlas, see Fuchs (1946); Unno (2010).

⁴⁶ Unno Kazutaka in his pioneering study suggested that the Chinese depiction of the desert by tiny points was eventually transmitted to Western cartography, see Unno (1981). For the latest survey of representations of the desert zone in Chinese cartography, see Papelitzky (2021).

⁴⁷ The maps are attributed to Matteo Ricci (1552–1610), but were co-created by different authors. I am grateful to Elke Papelitzky for this remark. For the recent studies of the Ricci Maps, see Cams and Papelitzky (2024); Hostetler (2024).

square grid in the area around the crossing of the equator and the prime meridian, which is delineated through Beijing in all three of the maps under discussion. The revised copper-plate edition of the Kangxi atlas also makes use of a pseudo-cylindrical projection, the sinusoidal Mercator-Sanson/Sanson-Flamsteed or simply Sanson projection, but rather surprisingly this was determined only about thirty years ago by one of the leading specialists of the history of Chinese cartography, Wang Qianjin.⁴⁸ There is, however, an interesting difference between the projection applied in the Kangxi atlas and the classic form of the sinusoidal projection. In the classic sinusoidal projection, the lines of longitude are delineated with a smooth curvature. In the Kangxi atlas the curvature of the lines of longitude is attained through a not-insignificant solution from the point of view of Western cartography: within each map sheet all the lines of longitude are drawn as parallel straight lines declined with respect to the horizontal lines of latitude; thus, the curvature in the assembled sheets of the Kangxi atlas is obtained through progressive diminishing of the declination angles. The lines of longitude, therefore, form a sequence of segments (see Fig. 14), such that I would refer to it as a *modified* Sanson projection.

⁴⁸ Wang (1991a), Wang (1991b). For the controversy over the use of projection in the Kangxi atlas in scholarly literature, see Jupp (2017), esp. 216.

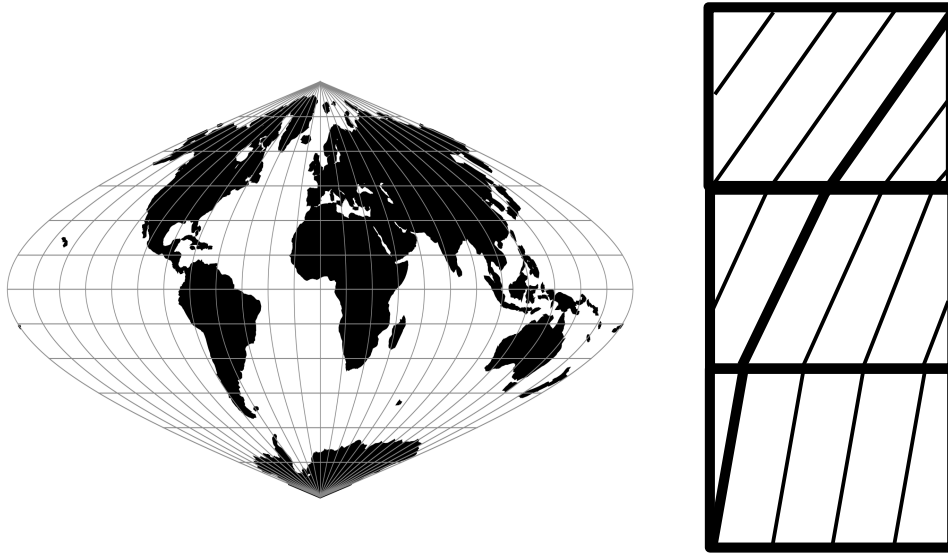


Figure 14. Left: a sinusoidal projection with the lines of longitude delineated with a smooth curvature. Right: a model of a sequence of map sheets, where within each map sheet all the longitudes are drawn as parallel straight lines declined with respect to the horizontal lines of latitude. The curvature of the lines of longitude is attained through progressive diminishing of their declination angles. In this case the lines of longitude form a sequence of segments.

Li Mingche uses curved lines of longitude, but invents a modification of a pseudo-cylindrical projection in which the sharpest curves of the lines of longitude are found at the upper-left corner of the map occupied by text, while its bottom part and in the area around the prime meridian, which covers “China Proper”, the latitude-longitude graticule visually almost forms a square grid. Generally, Li tried to shape his latitude-longitude graticule as squarely as possible. D’Anville applies a conical (Delisle’s) projection, based on a different principle: lines of latitude are curved and lines of longitude are delineated as straight lines converging at the pole. The advantage of this projection in comparison with the pseudo-cylindrical one is that it allows for much less distortion when applied to parts of the terrestrial surface. Taking the configurational differences imposed by projections, the general configurational similarity between the maps by Li and d’Anville is even closer.

In the Kangxi atlas and the map by Li the latitude-longitude graticule has 1° spacing with no further graduation, whereas d’Anville’s map uses a sparser 5° spacing, but with

further graduation scales given at the map's frame. This difference is of a technical nature, but it is worthy of note that in Chinese maps a denser graticule was adopted.

It should be noted that Li Mingche drafted his map during a period of growing concern for the mathematical underpinning of maps, which was formulated by Johann Heinrich Lambert in 1772.⁴⁹ However, establishing equations for every projection was effectuated only over the course of the nineteenth century, so that these equations were little used until the twentieth century.⁵⁰ The Li Mingche map still followed early-modern conventions in designing projections, that is, their being defined in the first place by their methods of construction, especially since Li, as pointed out repeatedly in this article, largely relied on outdated models of the early eighteenth century.

I compared the coordinates of some locations between the maps by d'Anville and Li, as well as the revised copper-plate edition of the Kangxi atlas, the block-printed Yongzheng atlas (1729), and the copper-plate edition of the Qianlong atlas on 104 sheets together with its block-printed edition on ten rolls, both from the 1760s.⁵¹ The results of this comparison are provided in Table 1.

⁴⁹ See Lambert (2022 [1772]).

⁵⁰ For a useful summary of the analytical development of map projections Edney (2019), 122–123. I also thank Alexei Postnikov for advice concerning the projection problematic in relation to the map by Li Mingche.

⁵¹ A block-printed Qianlong atlas on ten scrolls of different scales dated to c. 1760 is in the possession of the British Library (India Office Records, X/3265/1-10 + 11 (Index) & microfilm IOR Neg 1338). A reconstruction of the area covered by the map to a unified scale has been proposed by Göran Bäärnhielm in relation to his study of the Johan Gustaf Renat maps of Dzungaria; see Barthelme (2017); and for a general view of the reconstruction, Bäärnhielm (2017), image 14. The advantage of this reconstruction is that waterways are coloured in bright blue, so that their shape, especially that of the lakes, is clearly visible. This version of the Qianlong atlas, similar to the Yongzheng atlas (1729), is based on a square grid, in which vertical lines conform to lines of longitude lines; latitudes are approximated by by Göran Bäärnhielm.

Table 1. Comparisons of several locations

	Kangxi 1719 copper plate	Yongzheng 1729 block print	D’Anville 1734/1737 copper plate	Qianlong 1760s copper plate on 104 sheets Qianlong 1760s block print on ten rolls (British Library version, below marked as BL)	Li Mingche c. 1825– 1826 block print
Colour	Black and white	Black and white	Hand-coloured black-and-white print*	Black and white	Hand-coloured black- and-white print*
Prime meridian	Beijing	Beijing	Beijing	Beijing	Beijing
Graticule spacing	1° with no further graduation	1° with no further graduation	5° with 1° graduation scale	1° with no further graduation	1° with no further graduation
Extreme south, Qing imperial realm and mapped territories (latitude below Hainan)	18°N**	<i>33°S from Beijing</i>	18°N**	18°N**	18°N**
Hainan, latitude through the top	20°N**	<i>30°S from Beijing</i>	20°N**	20°N**	20°N**
Extreme north, Qing imperial realm (latitude)	55°N	Open	56°N	Open	58°N* (Hinggan mountain range)

Extreme west (1), Qing imperial realm (longitude line at the western end of Tibet, between the vertical river-course and mountain range)	44°W	45–46°W	40°W*	45°N	44°W (no mountain range, similar to Delisle's sketch)
Extreme west (2), Qing imperial realm (longitude through the middle of the Pamirs)	40°W** (western end of the mapped territories)	40°W** (middle of two distinct units of the Pamirs)	40°W** (west of “Kashgar”)	48°W* (west of Xinjiang borderline)	48°W*
Extreme east longitude through the upper eastern side of Sakhalin	30°E**	26°E* (longitude delineated to the east from the upper eastern end of Sakhalin)	30°E**	31°E	30°E**
Sakhalin, latitude through the southern end (slightly above its end)	50°E**	9°N from Beijing	50°N**	50°N**	50°N**
Mouth of the Amur River, longitude	25°E**	22°E*	25°E**	26°E	25°E**

Taiwan, the most eastern longitude at the top	5°E**	8°E*	5°E**	6°E BL: 8°E*	5°E** (Taiwan ends shortly before 6°)
Taiwan, depicted shape	Western coast**	Western coast**	Entire island*	Western coast BL: Western coast**	Entire island*
Longitude through Liaodong's end – Shandong's middle	5°E**	5°E** (a bit shifted to the west, shift due to projection)	5°E**	5°E**	5°E**
Lake Balshakh (latitudes below and above; longitude to the west, longitude through the eastern end of the lake)	-	-	-	46**-48°N** 37**-41°W** BL: 46**-48°N** (31pprox.. GB)† 37**-41°W**	46**-48°N** 36-40°W
Lakes cluster in central Tibet (latitudes below and above, longitude to the west, longitude through the eastern end of the right lake)	-	33**-37°W** 5°-7°S from <i>Beijing</i>	-	34-38°W 33-35°N** BL: 33-37°W 35-37°N (31pprox.. GB)	33**-37°W** 33**-35°N** (mistake in degrees of latitudes at the left side: 35°N instead of 33, 28 instead of 18°N)
Lake Namtso with an adjoining lake in the west	Crossed by 32°N** 25**-28°W**	29-32°W 10-11°S from <i>Beijing</i>	31-32°N** Crossed by 25°W	Crossed by 32°N** 26-29°W	Crossed by 32°N** 25**-28°W**

Lake Yamdroktso (the ring lake)	Crossed by 30°N** 25**-26°W**	30**-31°W <i>13-14°S from Beijing</i>	28-29°N 25**-26°W**	Crossed by 30°N** 26-27°W	Crossed by 30°N** 25**-26°W**
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Notes: Outstanding characteristics are marked with a single asterisk, similarities are marked with a double asterisk. †: approximated by Göran Bäärnhielm, see Bäärnhielm (2017), image 14.

There is no question of any advanced geo-referencing here, like, for instance, the partial geo-referencing of the revised block-printed edition of the Kangxi atlas by David Jupp.⁵² A geo-referencing of the map by Li Mingche applying basically the same strategy was undertaken by a GIS developer Lin Nung-Yao 林農堯 in cooperation with historian of Chinese and Korean late-imperial cartography Yang Yulei 楊雨蕾.⁵³ In general, the results obtained were predictable – “China Proper” and the core parts of Manchuria are the most accurate, while the greatest errors occurred in the mapping of peripheral lands in the West and the Amur area (see Fig. 15). In addition, substantial distortions are found in the configuration of lakes (see Fig. 16), an interesting phenomenon for further study.

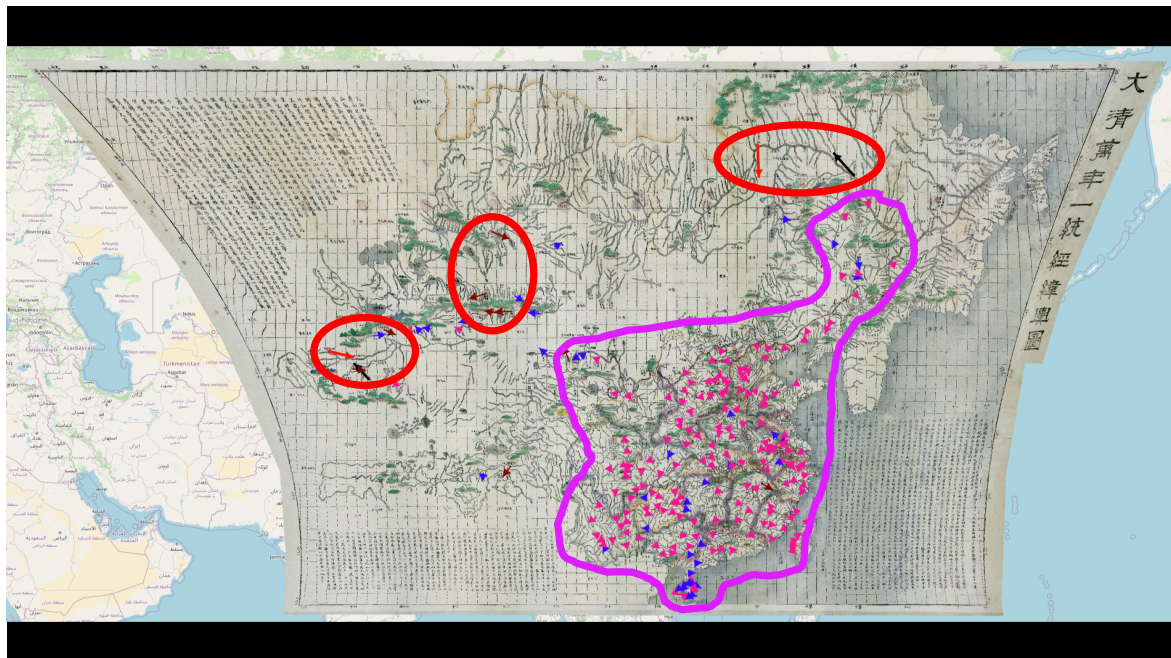


Figure 15. Li Mingche’s map re-projected and geo-referenced (author: Lin Nung-Yao); arrows show the degrees of shifts of geographical coordinates on the map in question with respect to accurate coordinates, see appendix by Lin Nung-Yao. The area with high accuracy is circumscribed in magenta, areas with the highest distortions in red.

⁵² Jupp (2017). See also his site https://qinshuroads.org/Kangxi_Jesuit_Maps/Kangxi_Jesuit_Maps.htm.

⁵³ The geo-referencing of the map by Li Mingche was part of the “Translation Terroirs” project and have not yet been published. For the main premises and principles of geo-referencing the map in question, see the appendix of this article authored by Lin Nung-Yao.

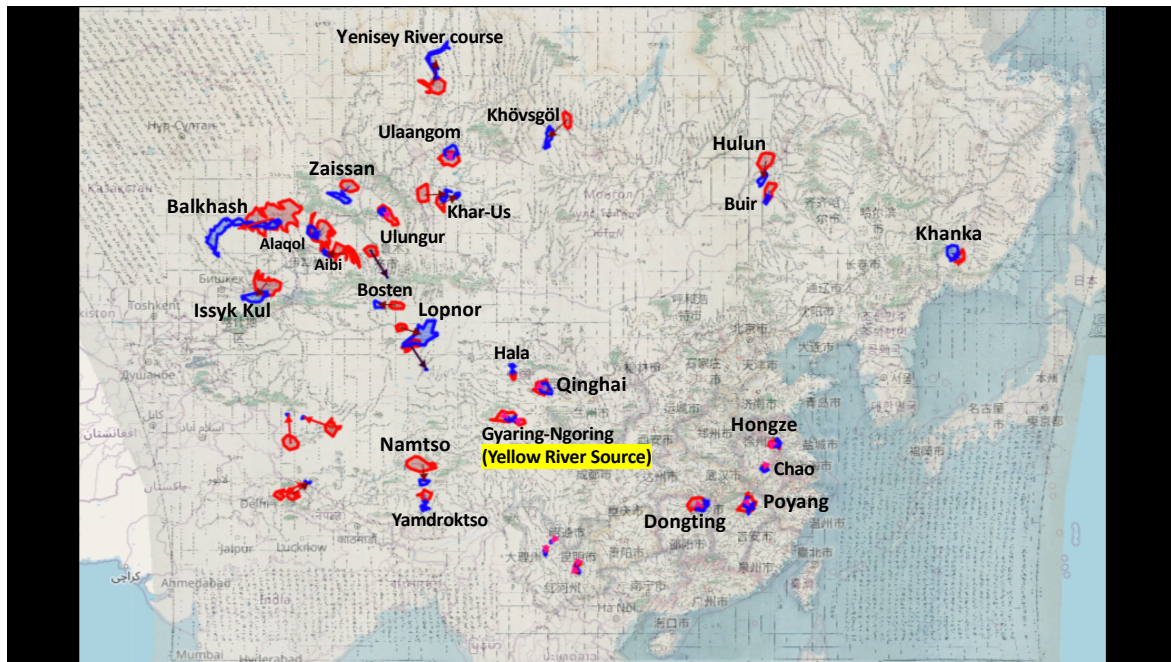


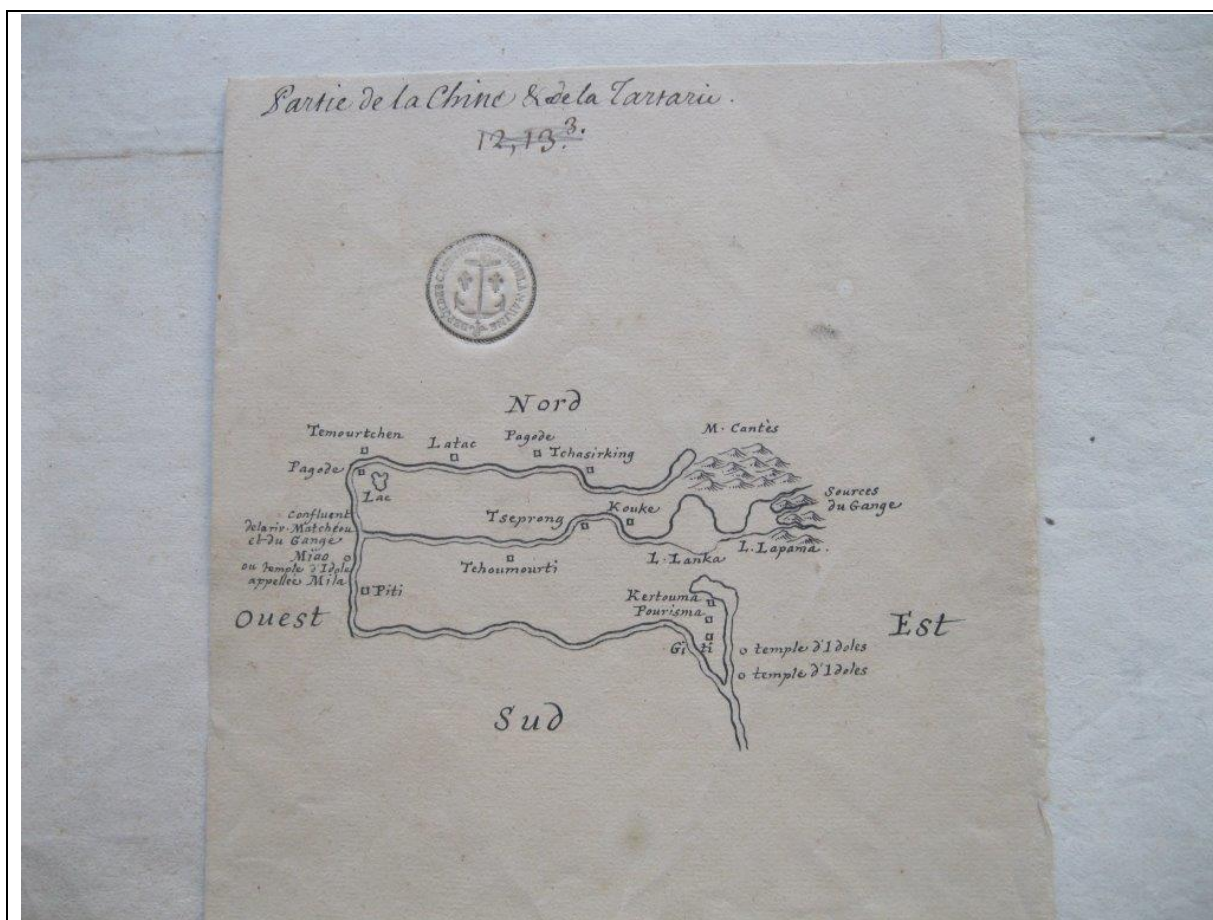
Figure 16. Analysis of lakes in the re-projected and geo-referenced Li Mingche map; real configurations of lakes are marked in blue, and their configuration in the map in question in red (author: Lin Nung-Yao).

Table 1 shows comparisons of some test locations between the maps through naked-eye observation for eventual further elaboration via geo-referencing. Here we apply such rough coordinates as, for instance, “latitude below Hainan” or “longitude line at the western end of Tibet”, or give the lines of latitude and longitude framing or crossing a landmark. This simple method identifies considerable differences between these five congener maps. It reveals, for instance, continuous cartographic expansion to the north, areas of ongoing recalibrations in the east and the west, and, in particular, allows one to pinpoint general similarities and differences in the map by Li Mingche with respect to the map by d’Anville and the “court” atlases. For instance, one can see that in mapping the east and the west Li followed the model of d’Anville (test areas and points: Sakhalin, the mouth of the Amur River, Taiwan), while the “court” atlases followed a slightly different model. Thus only the western coast of Taiwan continued to be mapped in the court atlases; the representation of Sakhalin-Amur changed slightly when compared to the Kangxi atlas. In mapping the north, Li took into consideration the expansion of the court atlases in this direction – the northern limits of his map are considerably higher when compared to the Kangxi atlas and d’Anville’s map, and his representation of the western areas relies considerably on the later court atlases.

In the Kangxi atlas, as well as in the map by d’Anville, the central area of Tibet is still blank, though in the latter the blank area is considerably smaller, not least due to the

application of a different projection. In the Yongzheng atlas (1729) one landmark appears in this area, but of quite a characteristic shape and relatively large size, which is then reproduced in the copper-plate edition of the Qianlong atlas on 104 sheets and its block-printed edition on ten rolls (1760s). This landmark looks like two large lakes linked by a river flanked by a dense cluster of smaller lakes. The map by Li Mingche carefully reproduces this new topographical element. In the Qianlong atlases there is a prominent depiction of Lake Balkhash. Its characteristic tripartite shape is included in Li's map, where it is the largest of the lakes. One can see that if the latitudes of these landmarks are stable, the longitudes vary slightly.

Beginning from the Kangxi atlas, the court atlases and the maps by d'Anville and Li Mingche include a distinctive fork-shaped group of connecting rivers and lakes, which represents south-western Tibet, the south-western end of the imperial realm. A separate manuscript sketch of this region was drawn by Joseph-Nicolas Delisle (1688–1768) (see Fig. 17).⁵⁴ In contrast to the court atlases and d'Anville's map, the sketch does not depict mountain ranges framing the rivers, just a few mountains. The depiction of western Tibet in the map by Li has a striking similarity with Delisle's sketch (see Fig. 18). The likeness cannot be accidental and provides additional proof that Li relied on French cartographic sources.



⁵⁴ Archives nationales de France, Paris, France: Cartes et Plans, 6JJ74A.

Figure 17. A manuscript sketch map of western Tibet by Joseph-Nicolas Delisle (1688–1768), Archives nationales de France, shelf-mark: Cartes et Plans, 6JJ74A.

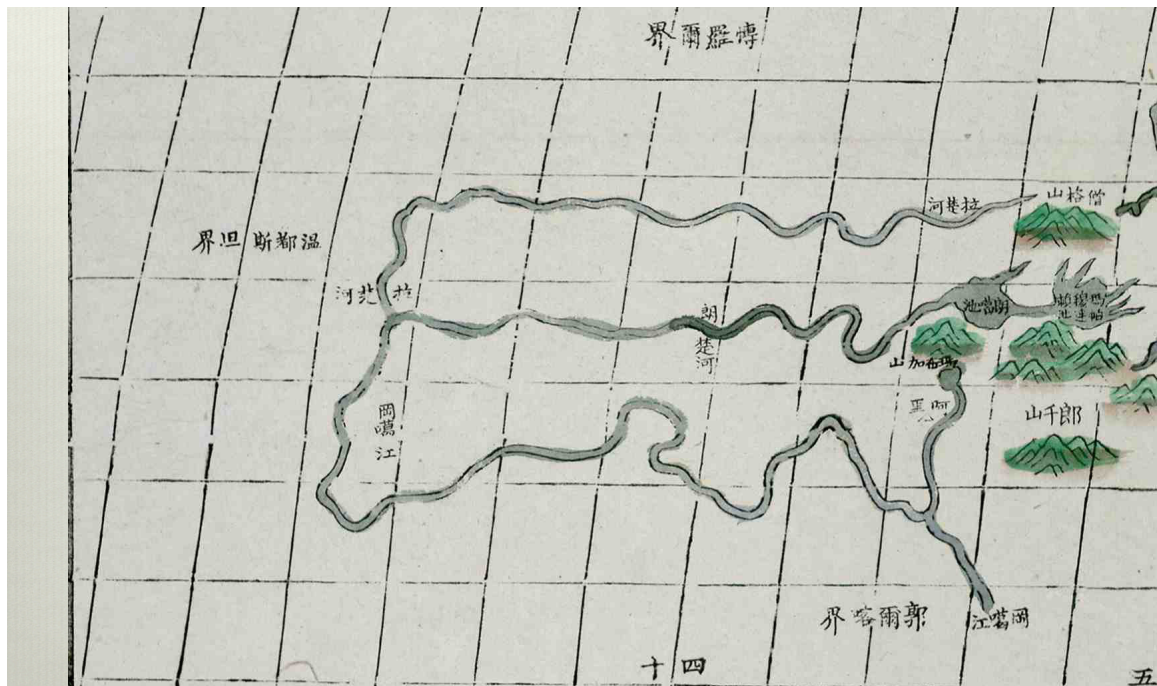


Figure 18. Detail of Li Mingche's map showing a close-up of western Tibet.

My working hypothesis, still to be developed, is that Li used the map by d'Anville as an outline map – or a map showing the general configuration of a territory with its key landmarks and its geographical coordinates, having enlarged it, reconfigured it from a conical projection to the more common in China pseudo-cylindrical projection, and filled it out using topographical data according to Chinese cartographic conventions and aesthetic preferences, having relied in this respect on Chinese sources, primarily the series of the court atlases.

Accentuated Landscape Features and Elements of Administrative Divisions

The map by Li Mingche keeps to a tradition in Chinese cartography of a rather pictorial representation of landscape features, especially waterways and mountains. Thus, rivers and lakes in the map in question appear wider and larger than in Western maps of the eighteenth and nineteenth centuries. In addition, three main rivers are highlighted by special colours, in contrast to the grey used for smaller rivers. The three rivers are the Yellow River, coloured in brownish yellow, also seen in some other Chinese maps beginning from the Ming dynasty,⁵⁵

⁵⁵ An especially bright depiction of the Yellow River in yellow is found, for instance, in the *Gujin xingsheng zhi tu* 古今形勝之圖 (Map of Advantageous Terrain Past and Present) (coloured wood-block reprint, 1555; map sheet approx. 113.8 x 100.8 cm) in the possession of the Archivo General de Indias, Seville, Spain, shelf-mark: FILIPINAS 5, R.2, N.21. See Knauth (1968); Lee and Caño Ortigosa (2017).

Figure 19. Detail of Li Mingche's map showing a close-up of the Yellow River Source region: Zhalinghai 札凌海 and Elinghai 鄂凌海 lakes with the "starry area" (Eduntala ji Xingxiuhai 鄂敦他臘即星宿海 [Eduntala = Star Lodges Lake]) highlighted in bright yellow; Big and Small Jishi Mountain Ranges (Dajishi shan 大積石山, Xiao Jishi shan 小積石山) to the right from the lakes, placed in the crooks of the Yellow River course coloured in brownish yellow.

The map is distinguished by elaborate depictions of mountains, which are its most eye-catching and beautiful cartographical feature, giving it an artistic touch. The mountain symbol is a depiction of the profile view of its southern slope, in evidence at least from the earliest extant specimens of general maps of China, which date to the early twelfth century. This easily comprehensible convention for a mountain is used in many cartographic traditions, and is, for instance, used in d'Anville's map, with the difference that the mountain symbols are smaller and more uniform, being all of the same size, standing for a generic mountain. No colour is used here for accentuating mountains. In the map by Li Mingche, in contrast, mountain symbols vary slightly in size and are coloured in vivid green and dark blue. This not only makes the mountains immediately stand out, but also allows one to distinguish especially high mountains, which are marked in dark blue. These include the Pamirs (Congling 蔥嶺 = Onion Ridge), Tianshan (= Heavenly) Mountain Range, and Hinggan Ridge (Xinganling 興安嶺) (see Fig. 20). This style of depiction of mountains is attested in Chinese cartography beginning from the Ming dynasty, and shares the same colour and configuration code of representing mountains with Chinese landscape paintings, the earliest samples of which are known from the Tang dynasty.

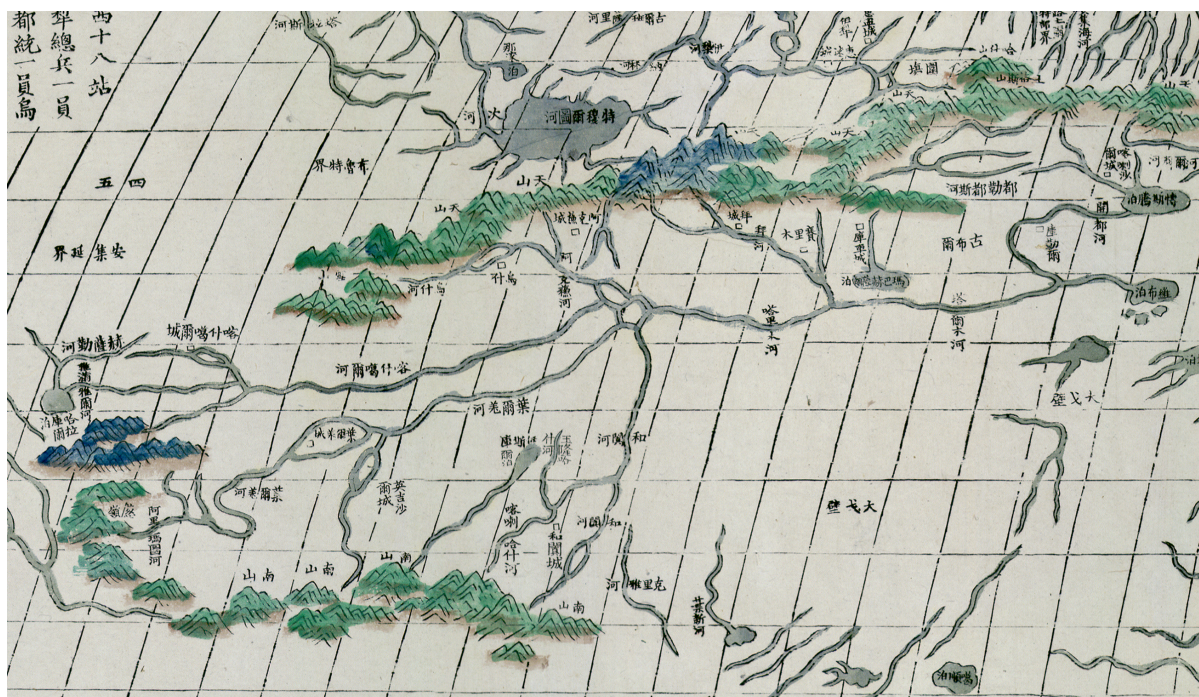


Figure 20. Details of Li Mingche's map showing a close-up the Western Region, with the entire Pamirs (Congling 蔥嶺) and the highest mountains of Tianshan Mountain Range

(Tianshan 天山) coloured in blue (upper fragment), and a close-up of Hinggan Ridge (Xinganling 興安嶺) with its highest mountains coloured in blue (lower fragment).

The map is also distinguished by an emphasised depiction of the border with the Russian empire. As is the case in d’Anville’s map, the border mostly relies on the Treaty of Nerchinsk (Nibuchu tiaoyue 尼布楚條約) (1689), but is longer and coloured in an eye-catching brownish yellow.

Finally, the map follows the general convention on colouring the entire maritime space and leaving the background of the terrestrial space uncoloured, characteristic of late-modern East Asian maps.⁵⁹ In this map the sea is coloured in monotone bluish grey.

An Anti-template: The Blue Maps and Their Congeners

The question to be answered is what was the main point of the final general map of the Chinese empire by Li Mingche? The answer seems to be implied in the title that he chose for his map. The map titles that refer to the Qing empire as “The Great Qing Everlastingly Unified” were used intensively during a rather limited period of time – from the beginning of the nineteenth century through the early 1820s – although the odd copy may appear much later. This title distinguishes a cluster of maps that belong to the most beautiful large-format wall-maps of the Qing imperial realm – the famous Blue Maps and their polychrome congeners.⁶⁰ Since the Blue Maps are explored in detail in a forthcoming book by Richard Pegg and Elke Papelitzky, I shall not go into detail here.⁶¹ The Bibliothèque nationale de France, the Library of Congress, and the MacLean Collection provide links to the specimens of the Blue Maps in their possession,⁶² as well as to the polychrome versions.⁶³ Both groups share many common features in their configuration and content. This allows one to refer to them as to a distinctive cartographic type.⁶⁴ The maps encompass the same territory as the

⁵⁹ See Lange and Hahn (2023).

⁶⁰ The Blue Maps received their conventional name because they are distinguished by the deep blue colour of the terrestrial surface. This colour was applied by printing using the so-called “Prussian blue” pigment, see Lange and Hahn (2023), Papelitzky and Pegg (2024). The sea has a light turquoise colour, and the borders of these two contrasting colours overlap. The Blue Maps may therefore be referred to as duochrome prints, though the light turquoise colour is derived from the same pigment – Prussian blue.

⁶¹ Pegg and Papelitzky (forthcoming). For useful insights into the Blue Maps in the general context of mapping of the Qing empire, see Hostetler (2009).

⁶² BnF: <http://gallica.bnf.fr/ark:/12148/btv1b550095891?rk=836914;0>, shelf-mark: GE A-1096 (RES); Library of Congress: <http://hdl.loc.gov/loc.gmd/g7820.ct002256>, shelf-mark: G7820 1816 .D3; MacLean Collection: <https://www.leventhalmap.org/digital-exhibitions/heaven-and-earth/catalogue/3/>, see also <https://www.leventhalmap.org/digital-exhibitions/heaven-and-earth/>, Digital exhibition organised by Richard Pegg, Director and Curator of Asian Art at the MacLean Collection. Pegg (2014), 18–21, 23–24, Fig. 6 on pp. 20–21. See also a monochrome (black print) version of the map in the MacLean Collection, Pegg (2014), 18, Fig. 7 on p. 22.

⁶³ BnF: <http://gallica.bnf.fr/ark:/12148/btv1b7200281h?rk=643780;0>, shelf-mark: GE C-5353 (1-3 RES); Library of Congress: <http://hdl.loc.gov/loc.gmd/g3200.ct003403>, shelf-mark: G3200 1811 .D3. For a polychrome map in the MacLean Collection, see Pegg (2014), Fig. 8 on pp. 26–27, dated to 1883 – an example of a rare late remake.

⁶⁴ See Hostetler (2009), 94–95. For illustration she provides the BnF copy of the “Blue” Map [GE A-1096 (RES)], see Hostetler (2009), Fig. 3.2 on pp. 96–97, which she mistakenly dates to 1767, the date of creation of Huang Qianren’s 黃千人 (1694–1771) prototype map.

map by Li Mingche, and according to Richard Pegg, the term “unified” (*yitong* 一統) in their titles highlights the Qianlong emperor’s unification of the four regions outside “China proper” – Manchuria, Mongolia, Tibet, and Chinese Turkestan (Xinjiang), which were finally brought under Qing rule after 1759. One can add to this valuable observation that this term was borrowed from late Ming cartography.⁶⁵ Pegg also points out political reasons for the multiple reprints and re-editions of these maps.⁶⁶

All of the extant polychrome versions bear the following title: *Da Qing wannian yitong tianxia quantu* 大清萬年一統天下全圖 (The Complete Under-Heavens Map of the Great Qing Everlasting Unified). The Blue Maps, with one late exception, are titled in a slightly different manner: *Da Qing wannian yitong dili quantu* 大清萬年一統地理全圖 (The Complete Terrestrial Organisation Map of the Great Qing Everlasting Unified).⁶⁷ The difference between the titles is only in the chosen definition of the entire terrestrial space – the “Under-Heaven” (*Tianxia* 天下) in polychrome versions and the “Terrestrial Organisation” (*Dili* 地理) in the Blue Maps.⁶⁸ The title of the map by Li Mingche stands out from these: *Da Qing wannian yitong jingwei yutu* 大清萬年一統經緯輿圖 (Terrestrial Map Applying the Longitude-Latitude Graticule of the Great Qing Everlastingly Unified). The difference in defining the general character of the map as “complete” (*quan* 全) for the Blue and polychrome maps and “terrestrial” (*yu* 輿) in the map by Li Mingche can be considered a minor difference, as *yu* implies the entire terrestrial space.⁶⁹ The main emphasis in the title of the map by Li is laid on applying the longitude-latitude graticule. It can, then, be translated as a “Western-style map of the Great Qing Everlastingly Unified”. The Blue Maps and their polychrome congeners are focussed on the same territory as Li’s map – the territory of the Qing empire, but also include lands of close neighbours and some more distant lands compressed at the margins, and do not use a cartographic projection. They might use an implicit quantitative square grid, but this is questionable. Therefore, we suggest that the Blue Maps served as an “anti-template” for Li, which he aimed to reformat into a modern “Western-style” version of the “Great Qing Everlastingly Unified”.

Acquisition history

⁶⁵ For example, “Huang Ming da yitong ditu 皇明大一統地圖” (Map of the Illustrious Ming Great Unity) in *Huang Ming zhifang ditu, juan shang*, 5a–71.

⁶⁶ See Pegg (2014), 18–26. Since Pegg’s book is a catalogue of the MacLean collection of maps, his primary concern is the maps of the “Great Qing Everlastingly Unified” acquired for this collection.

⁶⁷ The exceptional copy once belonged to the Floyd Sully collection. It bears the title common for the coloured versions – *Da Qing wannian yitong Tianxia quantu* 大清萬年一統 天下全圖 (The Complete Under-Heavens Map of the Great Qing Everlasting Unified). In addition, its date seems to be excessively detailed – the first day of the first decade of the third month of the third year of Daoguang (道光三年歲在癸未桃月上浣吉旦 *Daoguang san nian sui zai gengwei taoyue shangwan jidan*), which corresponds to 1823, see Davis (2015), 24–27.

⁶⁸ I discuss the term *dili* and its various translations in Dorofeeva-Lichtmann (2005); see also Behr (2007), 114.

⁶⁹ Regarding the character *yu* 輿, literally “chariot carriage” symbolising the square Earth, and its earliest occurrences in references to maps, see my contribution to Nürnberger (2016), 191–192n136. The usage of this character in map titles requires a special study, which is beyond the scope of this article. At this point one can say that *yu* in map titles is used as a synonym of *di* 地 (Earth). *Yu* and *di* are often used together, so one can translate the binom *yutu* 輿圖 as a “terrestrial map”, synonymic to *ditu* 地圖.

The very interesting question that requires clarification is how a map drawn in Guangzhou landed in Göttingen, and why it was considered missing for about a century and a half. The last information about the map before its rediscovery can be found in an article by William Huttman published in 1844, where he describes a copy of the map, relying on the *Chinese Repository*, as to be presented to the Royal Geographical Society in Great Britain.⁷⁰ However, Huttman discusses a map *and* an atlas by Li Mingche. Assuming that the general map of the Chinese empire by Li Mingche referred to by Huttman is the one that is now in Göttingen, it should have arrived there shortly after this publication, as the map bears on the verso an acquisition stamp of the library that was in use from about 1765 through 1850 (see Fig. 6).⁷¹ It is not especially strange that the map was sent to Göttingen, as the Georg-August-Universität Göttingen was founded in 1734 by George II (r. 1727–1760), King of Great Britain and Elector of Hannover, and at least till the mid-nineteenth century maintained very close relations with Great Britain.⁷² What is much more surprising is that no copy of the printed map has survived in China. Thus, in the *Panyu xian xuzhi* 番禺縣續志 (Continued Gazetteer of Panyu County), the gazetteer of Li Mingche's place of birth, composed during the reign of Emperor Xuantong 宣統 (Puyi 溥儀, r. 1908–1912), the map is reported as “not in evidence, missing” (*wei jian* 未見).⁷³

It should be noted that until recently it may have been that the map had been a wrongly catalogued item from among the Asch Collection, a donation to Göttingen University by Baron Georg Thomas von Asch (1729–1807), a member of a German family in the service of the Russian Tsars, which contains several East Asian maps and Russian maps of Siberia and the Far East.⁷⁴ Yet, having meticulously checked all the documents related to the items sent by Baron von Asch, including the lists composed by his own hand, I could find no trace of the map.

Conclusion

The period of the recurrent printing of the Blue Maps and their polychrome congeners (1800–1820s) coincided with the period of the professional maturity of Li Mingche. Taking into consideration his passionate interest in Western science, he should have thought that these maps did not correspond at all to the new standards of cartography, which started to be diffused in China with the production of the “court” atlases based on the application of new survey methods. For some reason the Qing “court” atlases do not include any general map of the Chinese empire, so a “modern” general map of China was still missing. Wishing to keep up with the turn in Chinese cartographic surveying, he made an attempt to create such a map. Being an enthusiastic adept of Western science, he used the *Carte la plus générale* by d’Anville as an outline, enlarging it, reconfiguring it from a conical projection to a pseudo-cylindrical projection more common in China, and filling it out with topographical data

⁷⁰ Huttman (1844). See also a study of this article by Eben von Racknitz (2019).

⁷¹ This stamp is distinguished by a colon at the end.

⁷² For an attempt to trace the map's journey from Guangzhou to Göttingen, see Zhu (2023).

⁷³ (*Xuantong*) *Panyu xian xuzhi* 宣統番禺縣續志, 29.4a. I am grateful to Cathleen Paethe for calling my attention to this reference to the missing map.

⁷⁴ For Japanese cartographic sources in the Asch Collection, see, for instance, Dorofeeva-Lichtmann and Simonova-Gudzenko (2024).

according to Chinese cartographic conventions and relying on Chinese sources. However, having changed the projection, he took a step backward from the perspective of modern Western cartography, introducing into his map more distortions. He also completely overlooked the importance of distance scales, neglecting to provide any in his map. Yet, despite all his efforts to make the map accessible to the educated Chinese public, it does not seem to have elicited much response in his homeland, in contrast to his much more traditional magnum opus – the *Yuantian tushuo* – and the only copy of it that has survived to date found its home in the Göttingen State and University Library.

Appendix

Technical notes to geo-referencing of the *Da Qing wannian yitong jingwei yutu* 大清萬年一統經緯輿圖 (c. 1825–1826) by Li Mingche 李明徹 (1751–1832)

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A comprehensive description of the geo-referencing of the map in question is beyond the scope of this article. Below are the main premises and principles of this process.

Cartometric Properties of the Map by Li Mingche in Relation to Geo-referencing

The geo-referencing of the map in question is facilitated by application in it of the latitude-longitude graticule in a pseudo-cylindrical projection with 1° spacing. The prime meridian is delineated through Beijing. The graticule was used as a reference frame for localising of the mapped area.

Re-projecting the Map to Web Mercator – Epsg:3857

Once the localisation was determined, the map was re-projected to a cylindrical projection: the widely used coordinate system Web Mercator – EPSG:3857, which is adopted by Google Maps, OpenStreetMap, Microsoft Bing Maps, and other web-based online map services.⁷⁵ This method has two advantages: it can use rich program resources of the GIS technology and then further compare the obtained results with more maps. It should, however, be taken into consideration that due to the characteristics of the EPSG:3857 coordinate system, the distortion increases as we approach the poles, which in the case of the map by Li Mingche are the northern territories of the Qing empire. The program applied for geo-referencing the map by Li Mingche takes into consideration the distortion factor and is not affected by it.

Alignment of the Map by Li Mingche with OpenStreetMap

We aligned the re-projected map by Li Mingche with OpenStreetMap. This allows us to compare the discrepancies between the two maps in the localisations of cities, towns, and any other locations explicitly marked on the map by Li Mingche as “points”,⁷⁶ or which can be

⁷⁵ See <https://nsgreg.nga.mil/doc/view?i=4478>.

⁷⁶ Different types of settlements in the map are designated by different legend symbols – small squares, diamond symbols, circles. Their common feature is that they are all accentuated by framing in red. The geographical coordinates of the “point” is determined at the centre of these legend symbols.

considered as “points” (e.g., mountaintops). Specifically, the applied method enables us to estimate the discrepancies between the geographical coordinates of the “points” on Li Mingche’s map and their precise coordinates based on EPSG:3857, and thus estimate the accuracy of the map in question. For the time being the geo-referencing was done with respect to 231 “points” (see Fig. 15 in the main article).

Some long and large landscape features, such as rivers, mountain ranges and lakes, as well as units of administrative divisions cannot be geo-referenced only by “points”, so we also compared their configurations represented by lines or polygons in the map by Li Mingche with their configurations in OpenStreetMap. We analysed configurations of thirty mountain ranges and thirty-eight lakes. In addition, the system of waterways was extracted from the map. Configurations of the lakes are shown in Figure 16 of the main article.

Evaluation of Accuracy: Degrees of Discrepancy in Geographical Coordinates

For representing shifts between geographical coordinates of “points” on the map by Li Mingche and OpenStreetMap we use directional arrows. An arrow indicates the direction from a “point” found on the map by Li Mingche to its accurate localisation on OpenStreetMap. For representing the degrees of discrepancy between geographical coordinates of “points” in the map by Li Mingche and OpenStreetMap, we use five different colours for arrows. The colour depends on the length of the shift or distance between the location of “points” on the map by Li Mingche and its accurate geographical coordinates. We have chosen five levels of shifts corresponding to colours, as indicated in Table A1.

Table A1. Discrepancy Between Locations on the Map by Li Mingche and OpenStreetMap

Colour of arrows	Shift length (or distance) between locations of “points” on the map by Li Mingche and accurate geographical coordinates
Pink	0~50 km
Blue	50~100 km
Maroon	100~150 km
Black	150~200 km
Red	200~250 km

For determining the shifts of lakes, shown in Figure 16, we use the centroids of polygons, representing the lakes. We also took into consideration calculations of the areas of lakes.

Fragmentation of a Geo-teferenced Map into Smaller Sections

Marking the discrepancies between the map by Li Mingche and OpenStreetMap using methods described above, one can divide the former into smaller sections based on the degree of its discrepancies. These smaller units can then be further geo-references in a more refined way.

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