Global influence of the map of Japan produced by Japanese cartographer Sekisui Nagakubo.

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Abstract:
Both epoch-making high accuracy map of Japan named Nihon bunyu zu “ Allocation Map of Japan” (Dr.Kazutaka Unno called it as “Astronomical Map of Japan”) compiled by Japanese Cartographer Sekisui Nagakubo in 1574, and following,改正日本輿地路程全図 “Kaisei Nihon Yochi Rotei Zenzu “Revised General Route Map of Japan” by 長久保赤水 Sekisui Nagakubo in 1779 were created according to the latitude data observed in 14 provinces in Japan recorded in天文瓊統 Tenmon Keitou (book of Astronomy and divination in Japan) written by Japanese astronomer Harumi Shibukawa. And in天文瓊統 Tenmon Keitou (book of Astronomy and divination in Japan) the latitude of 北京 Beijing, 南京 Nanjing and 高麗 Korea recorded in 四海験測 Si hǎi yán tè; Nationwide survey conducted by 郭守敬 Guo Shoujing et al in 1279 in Yuan Dynasty were displayed for revision of calendar to new授時曆 Shoushi-li calendar. 汐川春海 Harumi Shibukawa adopted授時曆 Shoushi-li calendar formulated by郭守敬 Guo Shoujing et al to his 貞享改暦 Joukyou revision of calendar in Japan 1685. This proves that the technology of observation of the latitude in Japan was transmitted from China for revision of calendar and observed latitude datas recorded in Tenmon Keitou were exploited to the cartography of Map of Japan without land survey project. In 1754森幸安 Kouan Mori compiled his 日本分野図, Nihon bunyu zu “ Allocation Map of Japan” by Chinese technology of 方格図 fānggétu grid map east and west equidistant from the distance of latitude 1° by Chinese Cartographer 羅洪先 Luo Hong xian’s 廣輿圖 Guan YuTu, “Vast map of China” in Ming. Kouan Mori improved his map of Japan to realise the particularity in each allocation grid. Kouan Mori learned global atlas from duplicate the Matteo Ricchhi’s 坤舆万国全图 Kunyu Wanguo Quatu; general map of Myriad countries on the earth 1602. In 1779,長久保赤水 Sekisui Nagakubo made many modifications to the Kouan Mori’s maps and improve it to carry in pocket, named改正日本輿地路程全図 “Kaisei Nihon Yochi Rotei Zenzu “Revised General Route Map of Japan” and published it. Since 1809, this Japan’s map has been repeatedly duplicated and translated into the language of each country in Europe and published, in Russia in 1809 and 1810, in France in 1827 by name of famous Surveyor Krusenstern. In 1855-1862 by United Kingdom Admiralty published the map “Japan Nipon(mean Honshu Island)” Kiusiu and Sikok and a part of coast of Korea” based on a replica map by Krusenstern in 1827. However, these were published without knowing the name of the Japanese original author Sekisui Nagakubo.

Keywords: 天文瓊統, Tenmon Keitou 汐川春海 Harumi Shibukawa, 森幸安 Kouan Mori, 日本分野図 Nihon bunyu zu “ Allocation Map of Japan” with grid of latitude line, 長久保赤水 Sekisui Nagakubo,改正日本輿地路程全図 “Kaisei Nihon Yochi Rotei Zenzu “Revised General Route Map of Japan” 郭守敬 Guo Shoujing, 四海験測 Si hǎi yán tè; Nationwide survey, 羅洪先 Luo Hong xian, (1504-1564). 廣輿圖 Guan YuTu, 方格図 fānggétu grid map equidistant from latitude 1°.

Discussion
1. Historical technology of calendar and cartography in China.

In China, observation of latitude was exceeded in nationwide survey 四海験測 Si hǎi yán tè in 1279 for the revision of calendar 宣明暦 Hsuan-min-li from 822 to授時曆 Shoushi-li calendar and objective grasp of nationwide territory simultaneously, conducted by郭守敬 Guo Shoujing (1231-1316) and his colleagues in Yuan dynasty. Chinese technology to confirm latitude from astronomical observation is developed to Chinese cartography of 方格図 fānggétu grid separate east and west equidistant from latitude 1° it was succeeded from 輿地図 Yu Chidu by 朱思本 Zhu Si-ben 1321 to 羅洪先 Luo Hong xian’s (1504-1564). 廣輿圖 Guan YuTu; (Wide map of Ming).

2. The observed data of latitude in Japan by Harumi Shibukawa revision of calendar in Joukyou era.

In 1685 Japanese astronomer 汐川春海 Harumi Shibukawa studied授時曆 Shoushi-li transmitted from China for revision of calendar from old 宣明暦 Hsuan-min-li calendar 862 in Japan to授時曆 Shoushi-li calendar. The technology to grasp the nationwide area including surrounding area Matsumae southwest of Hokkaido by observation of latitude for revision of calendar and operated the observation of the latitude in 14 provinces from northern part of Tsugaru in Honshu Island to Kagoshima city in Kyushu Island covering mainland of Japan in 1659, and add the latitude data of Ryou-Kyu (Okinawa Island). Harumi Shibukawa reored those data in his天文瓊統, Tenmon Keitou (book of Astronomy and divination in Japan) Harumi Shibukawa compiled 大和暦 Yamato calendar and Shogunate Government enforce the revision of
calendar in 2nd year of Joukyou 1685 in Japan called it as 貞享改暦 revision of calendar in Joukyo era.

**Keywords:** 郭守敬 Guo Shoujing(1231-1316), 改暦 revision of calendar,授時暦 Shoushi-li calendar, 四海験測 Si hài yán sè nationwide survey in 1279, 契地圖 Yu Chidu by 朱思本 Zhu Si-ben 1321, 貞享改暦 the revision of calendar in Joukyou era.

3. Application of observed latitude data in cartography to produce accurate general map of Japan, by citizen without national survey project.

In 1779 長尾赤水 Sekisui Nagakubo made many modifications to the Kouan Mori’s 日本分野図 Nihon bunya zu “Allocation Map of Japan” map add description and picture of high way, river, sea way, sea stream and sea tide, stood on domestic user’s viewpoint and improve it to carry in pocket useful map, named 改正日本輿地路程全図 "Kaisei Nihon Yochi Rotei Zenzu "Revised General Route Map of Japan” and published it. We can recognise Sekisui Nagakubo’s study of Chinese cartography and Matteo Ricci’s Atlas, from Fig6, Fig5.

In Japan there are many mountains and islands and complex terrain, citizen and domestic navigator needed accurate and detailed maps of Japan. In those years, published map of Japan was a simple and inaccurate picture map, such map as Ryuusenzu compiled by Tomonobu Ishikawa. Fig.9

General map of Japan (pictorial map) was compiled from submitted region map across the country more than 5 times from 1591to 1871 by Shogunate Government. And General coastal Map of great Japan (so called Inoh map 伊能図) was compiled in 1821by national project. But all of these general maps of Japan were classified as national secrets.

Both Kouan Mori or Sekisui Nagakubo tried to use the observation data of latitude recorded in the astrology book “Tenmon Keitou 天文統図”written by astronomer Harumi Shibukawa in 1698 when the calendar was revised. Fig.1

Each of them estimated the position of the line every 1degree of latitude from the latitude observation data by astronomer Harumi Shibukawa and expressed it on a map, and drew the grid line of longitude estimated with equidistant 1degree of latitude. They divided line of longitude to the west and east at the former capital Kyoto.

(example: Imperial Palace 御所 Gosho in Kyoto, DMS Lat 35° 01′ 27″ N, Long135° 45′ 44″ E. Comparing the distance of longitude 1° with the distance of latitude 1° in Kyoto, is approximately 17.7% less than 1° latitude distance(91,274m :110,949m).

(But Kouan Mori imagine the length of 1° latitude as 40 里 ri=3927m ×40=157080m)

成都 Chengdu is at 30° 04′ N.

Comparing the distance of latitude 1° with the distance of longitude 1° in 成都 Chengdu, the distance of longitude 1° is approximately 13.0% less than the distance of latitude 1°.

London is at 51° 31′ N latitude.

Comparing the 1° latitude distance with the 1° longitude distance in London, 1° longitude distance is approximately 37.6% less than 1° latitude distance.

In the case of Japan or China, it is not a big difference like in London or in northern European.

The latitude described in Harumi Shibukawa’s 天文統図 Tenmon Keitou Astronomy book is based on 365degree, and it same to nationwide survey 四海験測 in 元 Yuan.

These values are based on 365°, 1.4% more than modern values based on 360°, and there are also differences due to non-numerical expressions.

4. Realize national prosperity in national isolation.

Sekisui Nagakubo folded the small map which became accurate and detailed, and made it portable. This Sekisui Nagakubo’s map has made a strong contribution to Japan’s domestic prosperity in not only in national economy but in people’s culture, even though national isolation at that time, and has become long-term sales for over a century in Japan.

5. Realize international reliability as sea map

Numerical latitude and the lines in this map, and lines temporary representing the longitude are also very useful for foreign navigator. It translated into the language of each country in Russia and Europe, repeatedly duplicated and published. In Europe, the name of the Japanese original author was not written on those maps, but was published under the name of famous explorer Krusenstern, or published under the name of the cartographic office of the admiralty (United Kingdom).

**Conclusions**

This high-precision map “Revised General Route Map of Japan” created by Sekisui Nagakubo was used around the world because he took in, fused, and accurately made Chinese technology, European technology of cartography and Japanese geographical knowledge, and returned it to not only domestic but also for the World.

This Nagakubo’s “Revised General Route Map of Japan” triggered the creation of the Inoh’s complete survey map of the mainland of Japan. With the map by Inoh, Japan was able to defend national land, and diplomatic scramble with United Kingdom not colonized by imperial Russia or so, and realized the industrial revolution.

Unknown Japanese original author of “Revised General Route Map of Japan” cartographer Sekisui Nagakubo 長尾赤水 and tentative map’s cartographer 森幸安Kouan Morin’s name should be specified in the cartographer’s history of the world from now on with name of cartographer 伊能忠敬 Tadataka Inoh and Rinzou Mamiya 間宮林蔵 who found Channel of
1. Chronology in China

Key word in Chronology

1. calendar and cartography 2. latitude 3. the concept of globe. 4. other chart

1279 元 Yuan 郭守敬 Guo Shoujing 四海验测 Si hai yyan tse observation of latitude for objective grasp of nationwide territory, and revision of calendar to 授時曆 Shoushi-li calendar

1321 元 Yuan 朱思本 Zhu Si-Ben 格子地图 grid map of China based on the distance of Latitude

1555 明 Ming 罗洪先 Luo Hong Xian (1504-1564) 廣輿圖 Expanded General Map of (Ming)

1595 Abraham Ortelius (Brabantian) published “Japoniae Insulae Descriptive” Map of Japan partly including middle East Coast of China with scale of latitude North 30°, 35°, 40° and longitude east 145° - 150° -145° by lunar distance, not Greenwich (mid atlantic ocean)

1602 明 Ming 利玛窦 Matteo Ricci (1552-1610) from Italy to Macau (1582) the concept of globe 契地海全圖 Yudi Shanhai Quantu General Map of the Mountain and Sea (geographic), the first edition of Matteo Ricci’s World Atlas

1584 坤舆万国全图 Kunyu Wanguo Quantu General Map of Myriad Countries on the Earth. 1602

2. Chronology in Japan

1685 Harumi Shibukawa 渋川春海 (1639-1715) Japanese astronomer adopted Yuan’s technology to revise calendar transmitted to Japan by his study, and he operated 貞享改革 Shoushi-li calendar revision of calendar in Joukyou era in Edo era from 宣明暦 Hsuan-Ming-ri to 授時曆 Shoushi-li, and nationwide observation of latitude in Japan to confirm the distance of geographical position 里差 between China and Japan for revision of new calendar 大和曆 Yamato calendar was operated. (Cf. Abraham Ortelius’s Map of Japan in 1595)

1685 Harumi Shibukawa 渋川春海 wrote 文天瓊統 Tenmon Keitou (book of Astronomy and divination in Japan), with observation data of 14 province in Japan.

1691 Tomonobu Ishikawa 日本海山瀨陸図 Nihon Kaizan chou riku zu Map of sea and mountain, sea current and land of Japan (tentative by Tsujimoto) (picture map of Japan)

1701-D year (unknown) Kouan Mori 森幸安

1751 大地圆球天合 三大界五大洲萬國圖 cf. a, b, c, d

Atlas of great circle globe consisted by 3 Worlds and 5 continents and myriad countries. Duplicated from 利玛窦 Matteo Ricci’s 坤舆万国全图 Kunyu Wanguo Quantu General Map of Myriad Countries on the Earth

1754 日本志舆地部 日本分野図 Field allocation map of Japan (Allocation Map of Japan)

1717-1801 Sekisui Nagakubo’s 長崎赤水 Shoushi-li calendar cf. a, b, c, d

1768 Sekisui Nagakubo 改製扶桑分里図 Reproduced allocate by li distnce ) Map of Japan.

1775 Sekisui Nagakubo 新刻日本輿地路程全図 Revised print General road map of Japan.

1780 改正日本輿地路程全図 Revised General Road map of Japan became a century long seller.

1783 大清輿圖 Dai Shin Kouyouzu General map of Great Qin duplicate and revised by Nagakubo.

1785 地球萬國山海輿地全圖 around 1788 duplicated and revised by Sekisui Nagakubo.

3. Chronology in Russia and Europe duplicated and translated without original Japanese author’s name

(1784 Issac Titsu ing send Sekisui Nagakubo’s “Revised General road map of Japan” to Holland)

1809 Irkutsk

“General Map of showing Japanese Islands and Neighoring Countries” File in Irkutsk by Baron Frederiks N.P. Rezanov due to the second mission to Japan in Nadezhda in 1805.

(Allexei V Postnikov wrote)

Shigeru Kobayashi wrote Khvostov or Davidov subordinate of N.P. Rezanov gained it in Sakhalin.

1810 St. Petersburg “ General Map of the Japanese Sixty-Six Provinces”in 1810 by Lieutenant Colonel A.I. Khato (by Postnikov.)

The representation of direction by Khato was corrupted. (Tsujimoto)

1827 Krusenstern (from Paris) CARTE de l’empire du “JAPON” 1827

1835 Frantz Von Siebold NIPPON I Third and Fourth distribution from Holland (By Miyazaki)

1855 United Kingdom Admiralty

“JAPAN NIPON KYUSIU and SKIKOK and a part of coast of Korea” According to Krusenstern’s chart of 1827. Cartographic office of the Admiralty
Fig1. 副千政日本輿地路程全図 Revised Route Map of Japan by Sekisui Nagakubo in 1780 (Takahagi city)

Fig2. General Naya Karta Japonskago 1809 The General map, Showing Japanese Islands and Neighboring Countries Copied from the Japanese File by Baron Frederiks. RGVIA Russia State Military History Archive.

Fig3. CARTE de l’empire du JAPON 1827 By Krusenstern published in France (Kinki University library)

Fig4. JAPAN NIPON KYUSIU and SKIKOK and a part of coast of Korea
Cartographic office of the Admiralty1855 According to Krusenstern’s chart of 1827. (United Kingdom Hydro office). (the bended landform of Tsushima Island in both Krusenstern1827 and United Kingdom 1855 was caused by the fold).

Fig5. 地球萬國山海輿地全圖説 around 1788 Chikyuu Bankoku Sankai Yochi Zenzu Setsu) By Sekisui Nagakubo 長保赤水 “General Map of the Myriad Countries, and Mountains and Seas on the earth”
(Tentative translation by Motohiro Tsujimoto) Kyoto University Library Muroga Collection

Fig6. 大清広輿圖 Dai Shin Kouyozu around 1783 “General map of Great Qing” by Sekisui Nagakubo 長保赤水 Ibaraki Prefectural Library. Speculated as edited with reference to multiple Chinese maps applied observation data of latitude and grid. 羅洪先 Luo Hong
Xian 廣輿總図 Guanyu zongtu General Map of the expanded Territory of China.

Fig. 7 日本分野図 1754 Nihon Bunyazu by Kouan Mori
“Astronomical division Map of Japan”.
(named in English by Dr.Kazumasa Unno)
“Allocation Map of Japan”
(Tentative name in English by Motohiro Tsujimoto)
(with Latitude grid for explanation including Astronomer Haruumi Shibukawa’s 天文分野之圖 Tenmon Bunya no Zu 1677 ) National Archives of Japan

Fig. 8 森幸安大地圓球天合 三大界五大洲萬國圖 1748
“Dai chi enkyuu tengou sandaikai godaishuu bankoku zu”
Kouan Mori Atlas of great circle globe consisted by 3 Worlds and 5 continents and myriad countries.
Duplicated from 利瑪竇 Matteo Ricchi’s 坤輿萬國全図 Kunyu Wanguo Quantu ; General Map of Myriad Countries on the Earth National Archives of Japan

Fig. 9 石川流宣 Moronobu Ishikawa
Map of Japan 日本海山潮陸図 1691
National Museum of Japanese History
Sekisui Nagakubo produced “Revised General Route Map of Japan” along to the latitude recorded in *天文瓊統* (Tenmon Keitou, book of Astronomy and divination in Japan) recorded by Japanese astronomer Harumi Shibukawa. The latitude data of 東萊 (Dongnei) in Busan city’s latitude on Sekisui map is 36°30′N, almost same to 大田 (Daejong city), 200km north west from Pusan. 東萊 Dongnei is the ward in Busan where government office of Imperial Korea was located and pair to Embassy office of Japanese Tsushima clan 草梁倭館 Choryang Waegwan. 東萊府 Dongnei Fu and 草梁倭館 Choryang Waegwan was symbol of friendship between Korea and Japan. This mistake of latitude of Tsushima called several sea survey by European countries around Tsushima. An island written 槙 Maki in front of 東萊 Dongnei is 影島 Yeon do.

北京 Beijing ② 29° is the old capital of 元 Yuan Dynasty, 内蒙古自治区寧城県 Nei Menggu Ning county, and that of 北京 Beijing later in the year is 大都 Daydu.

Incidentally, the latitude of 北京 Beijing, 南京 Nanjing and 高麗 Korea were described in the Japanese astronomical book *天文瓊統* Tenmon Keitou (book of Astronomy and divination in Japan) by Harumi Shibukawa is same to the latitude observation data of 四海験測 Si hǎi yān tsē Nationwide survey conducted by 郭守敬 Guo Shoujing in 1279.

However, 北京 Beijing in the nationwide survey in Yuan China 四海験測 Si hǎi yān tsē was the old capital of 元 Yuan Dynasty is 内蒙古自治区寧城県 Nei Menggu Ning county, and that of 北京 Beijing later in the year was 大都 Daydu in 四海験測 Si hǎi yān tsē nationwide survey in Yuan China. This is the evidence of traditional technology of latitude from 郭守敬 Guo Shoujing in 1279 to Harumi Shibukawa, Kouan Mori or Sekisui Nagakubo.


*Table1.中國測繪史 1.2 卷 The History of Chinese Surveying and Mapping Vol.1 Last Volume 2002 編撰委員会 compiling committee of P206 元朝四海測験結果及与現代観測結果之対比 Compare the result of four sea measurement Si hǎi yān tsē nationwide survey in Yuan dynasty and result of today’s observation. Translated in Japanese by Dr. Ryohei Imamura and castigation by Japan Cartographers Association. 今村遼平訳 日本地図学会校訂 中国地図測量史 2014*
Appendix Necessity of review

It is impossible to complete the research of historical general map of Japan after 18 century, only by verification of vocabulary or picture as traditional study in literature, without numeric science of cartography. Open science to interdisciplinary research and, open the door to the research by citizen.

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Supplement

Another purpose of Kouan Mori to produce 日本分野図 Nihon-Bunya-Zu, Allocation Map of Japan was able to describe the particularity in each grid region.