

## Analyzing the early 19th century's geomagnetic declination in Japan from Tadataka Inoh's Santou-Houi-Ki The 11th report.

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The Santou-Houi-Ki is a national treasure of Japan 67 volumes magnetic survey ledger recorded by cartographer Tadataka Inoh in 1800 to 1816, consist of approximately 200,000 magnetic compass land survey azimuth data accuracy of 0 degree 5 min, from the coast of eastern Hokkaido to Yakushima Island in Western Japan. I restarted the analysis stopped after only one analysis in 1917, which done about the magnetic compass survey azimuth data at known position of the retirement home of Tadataka Inoh at Fukagawa in Edo (Tokyo) in 1802-1803, by interdisciplinary simultaneous analysis across geomagnetism, survey science, historical cartography and local history. (1) Interdisciplinary simultaneous analysis. We can increase precise evidence to verify the real azimuth, geomagnetic declination and the reference point where magnetic compass survey was executed, or survey target points recorded in the Santou-Houi-Ki, than traditional way of study separated in each field. (2) Procedure of analysis. Use the recreation software of scenery and digital map of GSI Japan Chiriin Chizu to know the latitude and longitude accuracy sec of particular survey target points, and the outline position of survey reference point to grasp the outline of each real azimuth from the survey reference point to survey target points.  $\text{Geomagnetic declination} = \text{Real azimuth} - \text{Magnetic compass survey azimuth}$  recorded in the Santou-Houi-Ki. Calculate backward the precise position of the survey reference point should be adjusted to the position in accuracy 0.001 sec. in latitude and longitude, where all of geomagnetic declination unit of 0.01 sec. Calculate from the magnetic compass survey azimuth to each different targets at the reference point are approximately equal to each other. Calculate the average value of each declination unit of 0.001 sec. and express it as the geomagnetic declination unit of 1 min. on the day and point Tadataka Inoh's magnetic compass survey was executed. To use the consecutive formula of Excell for speed up and keep accuracy. If it possible to go to the field of the survey reference point, confirm the real scenery and the longitude and latitude by GPS transmitter and recalculate the value of geomagnetic declination. (3) The outline of isogonic line in Japan archipelago and the distribution of the declination in every 15 min in western Japan coast in those days, begun to appear. Compare the isogonic line of declination in those year's Japanese archipelago by analysis of The Santou-Houi-Ki, with the Historical Magnetic Declination map by NOAA (1800, 1805, 1810, 1815) is the NOAA's pace of variation West is almost 5 years later than the analysis of the Santou-Houi-Ki in western Japan. (4) However, from the analysis of Santou-Houi-Ki, we can recognize the magnetic declination supposed as the local geomagnetic declination anomaly in southern coast of eastern Hokkaido, some part of Noto Peninsula, Mt. Asama in Ise, Nobeoka city in Kyushu Island etc., impossible to draw in Historical Magnetic Declination map by NOAA. The analysis is developed from the coast area of Japanese archipelago to the inland area of Honshu island. (5) It is able to restore the precise position of survey reference points where Tadataka Inoh's magnetic compass survey was executed the accuracy of less than sec in latitude and longitude, valuable in local history. It is so accurate as impossible to achieve by other way of study. (6) It is able to change Japan as the concentrated area of data in early 19th century from insufficient area of data and supply data to north east Asia. Total number of analyzed points exceeded 203. (7) We started the discussion to compile those analysis to the data base available to Japan Archeomagnetism Data base, or NOAA's Historical Magnetic Declination Map.

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