

FLOOR EXHIBITION OF INOH'S MAP, THE OLDEST SCIENTIFICALLY SURVEYED MAP IN JAPAN

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INOH Tadataka(1745-1818) was the outstanding surveyor in the latter period of Tokugawa Shogunate Era in the history of Japan. He surveyed all over Japan by traversing survey. Such survey technology had already been applied by some local leaders and they made various local or regional maps for civil works, land boundary problems and so on. However, it is important that INOH Tadataka applied this technology for the whole national land of Japan. His survey started in 1800 and completed in 1816. The trace of his survey reached almost 44,000km around the main four islands and innumerable small islands besides Ryukyu Islands.

Portrait of INOH Tadataka

INOH Tadataka was very rich merchant lived in Sawara village 50km east from Edo (Tokyo). He was very fond of science and studying astronomy continuously while being industrious in his business. He retired from his business at the age of 49 and moved to Edo. He became to the pupil of TAKAHASHI Yoshitoki, the most famous astronomer in the Tokugawa Government.

He studied European astronomy introduced through Dutch from TAKAHASHI Yoshitoki for five years. His study about the earth made him eager to know the size of earth and tried to get the length of one degree of meridian. For this purpose, he measured the distance between his house and TAKAHASHI's office, as both are advantageously almost on north-south line. The data of latitude of both points had been already acquired precisely by their astronomical observation. He got the result by this method and submitted this data to TAKAHASHI. However, TAKAHASHI rejected his trial data because the measured distance was too short. TAKAHASHI said you had better surveyed up to Ezo (Hokkaido, the northernmost part of Japan). This was the motive to start his nationwide survey for seventeen years from then. He ultimately could get the length of one degree of meridian through his survey, which was almost equal to the result by French supreme astronomer Lalande.

Method of INOH's Survey

His survey technology was mix of traversing and astronomical survey. He applied also the method of intersection to reduce accumulated errors. Summits of noticeable mountains, islands, roofs of castles etc. were selected for intersection points. The most distinguished Mt. Fuji was surveyed her azimuth several hundred times from many places where Mt. Fuji could be observed. Other distinguished mountains, islands, capes and so on were also surveyed their azimuth everywhere. These results of survey were compiled as the data book ("Santou Houiki", Data Book of the Azimuth of Mountains and Islands). He also observed the mountains in Korean Peninsula from Tsushima Island, northernmost of Kyushu.

He did astronomical survey every night as far as weather condition was good. He decided latitude by observing stars and tried to get the data of longitude by observing eclipses of sun, moon and planets. However, he did not succeed concerning longitude because of weather problem and insufficiency of his pendulum clock. Longitudinal lines on INOH's Map were drawn based on the distance and the accuracy is low.

His nationwide survey stretched over ten times. The members of his survey party were six persons at first, but increased utmost twenty persons later. The data of surveying was compiled every day and plotted on manuscripts when the survey was impossible for bad weather. The party also drew pictures of landscapes, which were utilized for the description of landscape on map.

After completion of nationwide survey, the formal maps were prepared based on the manuscripts. For plotting the traces of surveyed points from manuscripts to the formal maps, the method of copying by needle penetration was applied. Therefore, the maps drawn by INOH's survey party necessarily have pinholes of survey points.

Unfortunately he died in 1818 before the completion of formal maps. The formal maps were submitted to the Tokugawa Government from the Government Astronomer's Office in 1821.

Various Kinds of INOH's Map

The maps, the results of his survey, which is called "INOH-ZU" (INOH's Map), are classified to the large scale map(1:36,000), the medium scale map(1:216,000) and the small scale map(1:432,000). The large scale map covers whole Japan (from Hokkaido to Kyushu) by 214 sheets. The medium scale map covers by 8 sheets and the small scale map covers by 3 sheets.

Unfortunately, these maps were burnt out caused by the fire of Imperial Palace (Edo Castle) in 1873. However, the duplicates of these maps, which were kept in INOH's family, had been submitted to the government. Although these duplicates were also burnt out at the Kanto Earthquake of 1923, Army, Navy and Ministry of Home Affairs copied these duplicates of large scale maps before then. Despite that whereabouts of these copies had been unknown for a long time, a lot of these copies were discovered recently one after another.

In 1995, 69 sheets of the large scale INOH's Map copied by Ministry of Home Affairs were discovered in the Meteorological Agency. These maps were held by the National Diet Library at present so that these copies are called "Kokkai Daizu" (Kokkai means Diet and Daizu means large scale map in Japanese).

In 2001, the 207 sheets copied by Army were discovered in the Library of Congress of the United States. These are called "America Daizu". It is not clear why these copies were transferred to the United States.

On the other hand, Navy copied these maps for preparing nautical charts. These copies were slightly modified and the scale was reduced. These are held by the Coast Guard, which are called "Kaiho Daizu" (Kaiho means the Coast Guard).

Among these copies, "Kokkai Daizu" was most faithfully copied. The color and contents of map must be nearest to the original formal map which had already burnt out. Concerning "America Daizu", it is not colorful except for Hokkaido and several other maps. But its surveyed lines are drawn with red ink and place names are faithfully copied. Therefore, "America Daizu" is very effective historical document.

Tokyo National Museum holds three kinds of precious INOH's Map, namely three sheets of small scale map, eight sheets of medium scale map and 21 sheets of large scale map of Kyushu Island, each of which were submitted to Shoheiko (the university of government) and Minister of Tokugawa government. All of these have pinhole of surveyed points and were prepared by INOH's survey party. These are designated as the Important Cultural Properties by the government.

INOH Tadataka Memorial Museum in Sawara holds a lot of INOH's historical materials which were donated from the INOH's family. It includes his survey diaries, survey data books, letters, survey instruments and various maps drawn by his party on the way of nationwide survey. These huge materials were designated as the National Treasure last year. This is the third designation in the field of historical materials.

It is necessary to mention about the INOH's map discovered in France. This map is a set of eight sheets which covers all Japan by the medium scale. Although it is not clear why this map was discovered in France, it might be related to that Tokugawa government was intimate to French government at the time of Meiji revolution. This map has the pinholes and drawing is magnificent. This map has been restored and held by Nissha Printing Co., Ltd in Kyoto.

In Britain, a set of three sheets of small scale map is held in Greenwich Maritime Museum. These maps were handed from Tokugawa government to British Navy in 1864. British Navy intended to survey around Japan. However, British Navy amazed the accuracy of these maps, so that they canceled the survey in detail around Japan and took out these maps.

Besides, INOH's Map of various levels exists in some museums and universities. Also, there exists INOH's Map of medium scale written by Kata-kana (Japanese alphabets) in Italy.

The Contents of INOH's Map

Although the original INOH's Map submitted to the government was burnt out, we can suppose the contents of original map from the various duplicates and copies. The items as follows are the contents of INOH's Map. The most important item is red surveyed line, which is namely the trace of traversing survey. A lot of place names of villages and towns were written along surveyed lines. The red circle mark on the top of place name means relay stations where inns were located and luggage were relayed. The red star mark is put on the places where astronomical observation was carried out. The red ship marks of harbors and red shrine marks are also drawn. The castles of Daimyos (Feudal lords) are drawn picturesque. Mountains, rivers, lakes and fields are drawn much picturesque and like bird's

eye view. The place names include mura (village), machi (town,city), kuni (prefecture), gun (county) and natural place names such as mountains, rivers, lakes.

The names of temples, shrines and lords are written and such symbol buildings are drawn larger than ordinary houses in villages. Sometimes the surveyed line reaches to the front of temples, shrines or lord's house. It seems that temples and shrines are very important as not only the symbols of religion but also the organizations of administration.

On the medium and small scale maps, longitude and latitude lines and azimuth lines to surveyed mountains by the method of intersection are drawn. Because the Accuracy of longitude lines is low as mentioned above, Hokkaido is biased to more eastern than real position on INOH's Map.

Significance of INOH's Survey and Map

The significance of INOH's survey and map is compiled as follows:

(1) INOH's survey was the first scientific and systematic survey for all over Japan. Before INOH's survey, scientific surveys were only applied locally for making village maps. On the other hand, INOH was very eager to reduce the cumulative error and astronomical survey. INOH applied such scientific survey nationwide.

(2) INOH decided the position of Japan on the earth and geodetically connect Japanese Archipelago to Asian Continent. By his astronomical observation, longitude and latitude were decided. INOH's Map is the first map with the grid of longitude and latitude which was scientifically decided. The reference of position between Japan and Asian Continent was developed first time by observing mountains in Korean Peninsula.

(3) INOH's Map had been utilized for one hundred years. After Meiji Revolution (1868) INOH's Map was copied and utilized for making modern topographic maps of Japan. Until the network of triangular stations was completed, INOH's Map had been effective for preparing the State Map.

The Change of National Land Known by INOH's Map

INOH's Map expresses the shape of national land of Japan two hundred years ago. Therefore, by comparing INOH's Map with the modern topographic map, we can recognize the change of national land since then. The several examples should like to be shown.

Consumption of Lake by Earthquake

Kisakata Lake was very scenic spot along Japan Sea at the foot of Choukaisan Volcano in the Northeastern District in Japan. Choukaisan Volcano erupted in 1800 and Kisakata Earthquake happened in 1804. By the Kisakata Earthquake, the crustal movement occurred so that Kisakata Lake had disappeared.

INOH surveyed this area in 1802. He surveyed the coast line of Kisakata Lake and drew the lake in detail and smoking volcano on INOH's Map.

Disappearance of Large Sand Spits by Reclamation

Two large sand spits are drawn on INOH's Map in Mikawa Bay, Central Japan near Nagoya city. INOH did not survey these sand spits because the impossibility of walking. But he drew nothing without survey or investigation. So, there must be sand spits shown on INOH's Map then. At present this area has been reclaimed and has become big factories of car industry.

Change of Biwako Lake

Biwako Lake near Kyoto city is the largest lake in Japan. In the southern coast area, Oumi-Hachiman city is located. In Oumi-Hachiman area, there developed much swampy land and many small lakes and ponds. On the INOH's Map, dark green colored dots are drawn along the lake coast and many dark blue lines of canals are also drawn. This drawing means that this area was swampy and drainage channel tried to be made. Modern topographic maps show this area has already been dried up to rice fields and many canals run on all directions. However, the small swampy area has still been left. This area has become sightseeing spot now.

Superimposition of INOH's Map to Topographic Map

INOHARA, one of the authors, has tried to plot the INOH's surveyed lines on 1/25000 topographic maps by using the GIS software "Chizu-Taro" developed by his company. Fig. shows the present coastal line and the coastal line of two hundred years ago. From this figure it is clarified that the coastal line has advanced and the area of national land has much increased by reclamation for these two hundred years.

Floor Exhibition of INOH's Map

After the “America Daizu” was discovered in the Library of Congress of the United States, Geospatial Information Authority of Japan digitized these maps cooperating with the Library of Congress. Afterwards, the corpus of INOH’s large scale maps was compiled, which was composed of the best copies of INOH’s large scale maps which have been discovered till then.

Taking this opportunity, the floor exhibition of INOH’s Map was planned out. For this exhibition, the new panels of replicas of INOH’s large scale Map were made by Nissha Printing Co. Ltd in Kyoto by using these digital data. These replicas of INOH’s Map are spread on the floor of gymnasium which size should be ideally 60m by 30m.

INOH’s Map is so large that it is very difficult to see in detail on wall display. However, by walking and seeing on maps spread on floor, it is easy to see the surveyed line and place names and so on in detail. We can see the Japan of two hundred years ago.

The floor exhibition has held more than ten times since 2009 in many place of Japan. And more several exhibitions are now on going everywhere. These exhibitions will encourage the promotion and understanding of map and survey.