XVIII International Reunion for the History of Nautical Science
12-14 November, 2018
Ponta Delgada (Azores)

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European Art of Navigation in the Edo Period of Japan
-Reverberation of Iberian way and coming Dutch way-

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1. Reverberation of *Genna-koukaiki* ,or *Navigation Book of Genna era*

At the beginnings of sixteenth century, Portugal and Spain had needs to sail across oceans safely and steadily, for the former with the interest of spice trading in east India and the latter for colonization of America. To educate pilots who lead ships and to control navigation, La Casa de Contratación was established in Seville. Many guidebooks of navigation were published and pilots went to the New World and Asia with copies of them.

In the circumstance that Iberian people came to Japan and Japanese also went to abroad such as Taiwan, Philippines, Thailand, etc., one navigator of Nagasaki whose name was Kouun Ikeda sailed between Japan and Philippines with a nanbanjin (note: Iberian people) pilot Manoel Gonçal, who might be Portuguese because he taught Ikeda by Portuguese language for two years starting from the year of 1616 and learned the Iberian way of navigation. Basing on the knowledge which Ikeda got in the navigation with Manoel Gonçal, in the fourth year of Genna era, or the year of 1618 of Gregorian Calendar, he wrote a navigation guidebook which had no name at first but lately got the title of *Genna-koukaiki* (sometimes called as the *Genna-koukaisho*) or *Navigation Book of Genna era,* by reason why it was written in the Genna era. One manuscript of this book is preserved in the Library of Kyoto University.

Even though the *Genna-koukaiki* was the first Japanese book treating European art of navigation, this is not an introductory book, but covers almost all items necessary for astronomical navigation. And astronomical tables based on the Gregorian calendar given by the Pilot Manoel Gonçal were transferred to those of the Japanese contemporary calendar by Ikeda's effort in order to be used directly on board by Japanese mariners. In order to avoid confusion of using solar table based on solar calendar as luni-solar calendar, he began the solar table from February of the solar calendar and use Portuguese names of every month in place of Japanese names. Furthermore, he offered to be examined publicly his ideas of improving celestial watching ways which he learned, and this fact shows internationally his ambition and intelligence. (*1)

Origin of the solar declination table of the *Genna-koukaiki,* which occupies 60 percent of whole pages, was being looked for long time and was found in the version of the year of 1588 of the *Compendio del Arte de Navegar* of Rodrigo Çamorano, Piloto Mayor of la Casa de Contratación.(*2) However the contents of the *Genna-koukaiki,*, except its solar table, were not translation of the *Compendio del Arte de Navegar* of Rodrigo Çamorano and many of origins of tables and numbers appeared in the *Genna-koukaiki* are not yet identified.

After the *Genna-koukaiki* was written, the government of Tokugawa Shougunate began national isolation policy called as "Sakoku" and completed it in 1641 by limiting foreign trade only with Dutch in a small artificial island Dejima. Losing the purpose of using European art of navigation, Japanese who had intention to learn it disappeared. While European art of navigation was disappearing in Japan, how the *Genna-koukaiki* held its reverberation?

Banreki, or *Iberian Calendar*

Another manuscript of the *Genna-koukaiki* once existed in the Library of Shoukoukan of Tokugawa in Mito City until 1945. Unfortunately it had never been published and was burnt by bombing in the last World War. Akira Hirayama (*3) transcribed it personally by hand before its loss and published a few numbers of his transcript in a form of mimeograph in 1963. By this private publication we can know another manuscript of the *Genna-koukaiki* existed in Mito under the title of *Banreki*. Though Hirayama transcribed this *Banreki,* unfortunately he transcribed only some chapters which were not included in the *Genna-koukaiki* and omitted all writing which might correspond to the content of the *Genna-koukaiki*, by reason why it was already published.

Hirayama said in its preface "The *Banreki* consists of two volumes and the second volume is revised so as to be consulted easily, that is to say, months and days from January to December are lined up horizontally and numbers of solar declination from the first year to the fourth year corresponded to every days are written vertically. But the first volume contains only three pages and omits other pages from the middle of March of the first year of the declination table. Though the declination table of the second volume is complete, that of the first volume is simplified."

The declination table of the *Genna-koukaiki* starts from February of the solar calendar in order to correspond to January of the luni-solar calendar and put Portuguese name of every month at its beginning and put Japanese name as secondarily so as to avoid confusion. Thanks to the *Banreki*. we can confirm a manuscript of the book originally written by Kouun Ikeda was handed down to Mito and also we can assume that the solar declination table of the first volume of the *Banreki* was not the table beginning from January published in the *Compendio del Arte de Navegar* of Rodrigo Çamorano (hereinafter called as the "Original Declination Table" in this paper) but was the declination table of the *Genna-koukaiki* beginning from February and not being the Original Declination Table which begins from January as was said "written from Fevereiro to Março of Iberian Calendar". But the complete declination table of the second volume begins from January and this fact gives us to guess this table might be a beginning part of the Original Declination Table. If it is so, both declination tables of the Original and of the *Genna-koukaiki* once remained at the same time in the Shoukoukan. We shall study on this theme afterward.

Hirayama did not make more detailed comparison of these two tables. Hirayama thought that reason of the declination table of the second volume being simpler than the table of the first volume was caused by "simplification" of the latter "in order to consult

and to use the table easily". But this consideration is reverse at its starting point of view, because the Original Declination Table was simple because it was made for the solar calendar, and to the contrary, the table of the *Genna-koukaiki* was modified by Kouun Ikeda to fit the Original Declination Table for the luni-solar calendar used in Japan.

The almost all of the rest of contents of the *Banreki* is a study on relationship of Japanese calendar with the Gregorian calendar and has nothing of navigation art. As we saw in the *Banreki*, though who studied on calendar system took interest in the *Genna-koukaiki* until around the end of Kyouhou era or about 1735, but such interest in the area of the study of calendar also diminished gradually and disappeared at last.

Sokuryou-higen, or *Secret words of Land Survey*

A memorandum which contains a description makes us feel reverberation of the *Genna-koukaiki* long after the *Banreki* was written is *"Sokuryou-higen*" which is a diary like book written by Chishin Hosoi (*4) when he visited Nagasaki at 20' of the eighteenth century for the purposes of collecting information about astronomy, navigation art and surveying technology. We can glance by this book a memory of the early period of Tokugawa Shougunate remained in Nagasaki after one hundred years. Most related sentences are shown as follows:

"When we calculate length of a way, it is said from old time that Dutch one degree corresponds to Japanese forty five ri. However, Kenryuu Shimaya, the Captain of the junk said that it corresponded to forty two ri. Dutch makes one degree correspond to their fifteen ri and Nanban (Iberian) makes one degree correspond to seventeen ri and half. English and French make one degree correspond to twenty ri. (Note: The "ri" is an unit of length in Japan and also in China. Here "ri" is used to mean European "league" of respective country.) As length of the ri of each country differs, it is difficult for us to know exact length."

August 28th: Theory of Pirouto Maneigosaru is that one degree corresponds to seventeen ri and half in Europe. One degree corresponds to Japanese forty five ri and six chou. And theory of Anjin is that one degree corresponds to Japanese fifty two ri, twenty eight chou and six tan. (Note: These "ri", "chou" and "tan" are old Japanese units of length and there are different interpretations of their relation.) Anjin, who was a European people, came to Japan with a man called Yayousu, lived in Edo and was given a name Anjin Miura. Actual name of a town called "Yaesugasi" originates from a fact that Yayousu was given a house in its area."

From a short sentence of the diary of this day we can get valuable information about foreigners who came from Portugal, England and Netherland at that time. "Pirouto Maneigosaru" is a corruption of pronunciation of "Piloto Manoel Gonçal" and we can

know that after one hundred years the name of Manoel Gonçal was not forgotten in Nagasaki. Yayousu was a Dutch whose name was Jan Joosten van Lodensteijn. There remains one lively and busy area called Yaesu in the east side of the Tokyo station, because he was given a house there. Anjin Miura was an English William Adams who gained confidence of Ieyasu Tokugawa, the first Shougun of Tokugawa Shogunate and built one galleon for him. The word “anjin” means pilot. The reason why he was called Anjin Miura was that he was given a feudal territory in the Cape of Miura near to Yokohama. Jan Joosten and William Adams were the survivals of the Dutch pirate fleet to South America which departed Rotterdam in 1598, leading by Jacob Mahu and Simon de Cordes.

2. Books of Dutch art of navigation by Ichizaemon Shimaya

When the national isolation policy was completed, necessity of the astronomical method of navigation decreased much, but was not lost completely. The reign of Tokugawa Shougunate was steadied and possibility of utilization of this navigation method appeared once more. At first, considering transportation of large volume of products, it was noticed that ocean going transportation might have much more advantage than costal voyage transportation. Japan is a country consisting of many islands and its domestic navigation is basically satisfied by a costal voyage, sailing not losing sight of land. However, transportation of bulky product like rice in a long distance from Kagoshima Prefecture (in old time called Satuma) to Tokyo (in old time called Edo) must have a large advantage. Another necessity was navigation to newly discovered Ogasawara Islands located one thousand kilometers distant from Edo.

For the purpose of pursuing to transport annual rice tax from Satuma to Edo by ocean navigation in a shorter period, in 1670 the Government of Tokugawa ordered Heizou Suetugu, the Governor of Nagasaki to build a Chinese style junk in Nagasaki. This junk governed by the Captain Ichizaemon Shimaya, starting Satuma in March of its year and passing through the Pacific Ocean outside of the Shikoku Island arrived Edo after eighteen days of navigation. This speed was magnificent when compared with the time of normal coastal voyage through the Setonaikai. By this achievement Ichizaemon Shimaya was given a bounty and permitted to wear a sword. When he returned to Edo in this autumn after sailing to the northern part of Japan by east coast of the Pacific Ocean in this summer, he had an honor of receiving the Shougun Ietuna at the junk.

There were three Ichizaemon with this same name at the same time in the family of Shimaya and this fact made relation of deeds talked by the name of Ichizaemon complicated. Ichizaemon who took the junk to Edo was distinguished by his pen name,

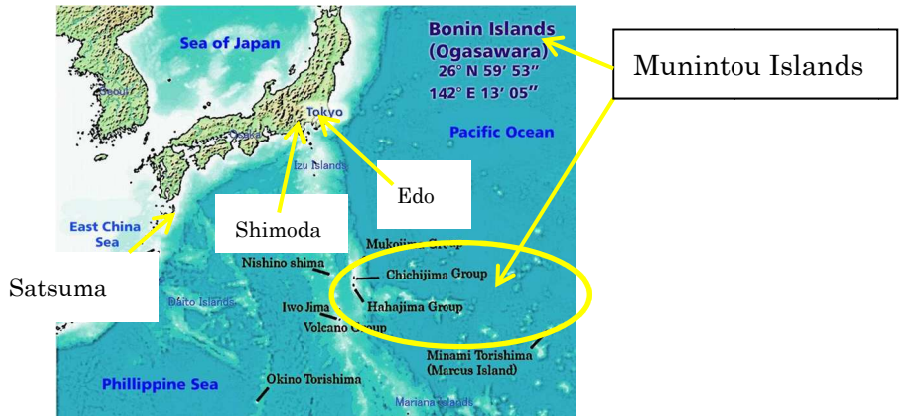
or pseudonym Kenryuu as Ichizaemon Kenryuu.

When Ichizaemon Kenryuu returned to Edo from the northern part of Japan, a captain who gave his name Ichizaemon Hamada was arriving Edo by a junk. The grandson of Ichizaemon Kenryuu Shimaya whose name was Ichizaemon Teijuu Shimaya, interviewed Ichizaemon Hamada about European art of navigation by an order of his superior. At this time his superior must have been Heizou Suetugu. A result of the interview was summarized in a book titled "*Anjin-no-hou,* or *Rule of pilot"* which has a date of November 15, 1670 in the last page.

In the same year of 1670 when the junk arrived in Edo, one cargo ship which loaded mandarin orange blew away by strong northwest wind in the Pacific Ocean and drifted ashore desert islands which were some one thousand kilometers far from the main island of Japan and were named later Ogasawara Islands. Mariners of this wrecked ship made a boat with remained timbers of their broken ship and succeeded to return to the main island of Japan. Though the government came to know existence of these islands by their report, however, at this moment the government only put a name to these islands "Munintou, or Desert Island". The English name is "Bonin Island" which came from the Munintou. After a long time the islands were named "Ogasawara-shotou, or Ogasawara Islands".

In February of 1674 the government ordered Ichizaemon-no-jou Shimaya to explore this desert archipelago. Ichizaemon-no-jou was a son of Ichizaemon Kenryuu. Title "no-jou" is an honorific title and this title was used for him to distinguish from his father. And he is the father of Ichizaemon Teijuu, the writer of *Anjin-no-hou*. Ichizaemon-no-jou, setting sail at Shimoda Port on May 29, 1675 with his son Tarouzaemon, who was a brother of Ichizaemon Teijuu, arrived at the Munintou Islands on June 23 and returned to Edo on August 10 after exploring the islands.

Plate 1: Japan and remoted islands in the Pacific Ocean



When more than fifty years passed after the *Genna-koukaiki* was written, three books

of navigation originated from Ichizaemon Kenryuu Shimaya became known in Japan during about fifteen years from the voyage of the junk to Edo as a starting point. The first book was the *Anjin-no-hou* written by Ichizaemon Teijuu, the grandson of Ichizaemon Kenryuu in 1670. Next ones are *Funanori-pirouto,* or *Mariner-pilot* and *Kanbun-koukaizu*, or *Navigation chart of Kanbun era.* Though we do not know author of the *Funanori-pirouto*, however, in its last page it was said this book was written by the instruction of Ichizaemon Kenryuu in 1685. Even though the *Kanbun-koukaizu* has neither name of author nor date of writing, it is confident that this book belongs to the line of books of Ichizaemon Kenryuu judging from its content. These three books appeared as Dutch style books of navigation art in the circumstance in which nearly no people remembered the *Genna-koukaiki*.

These series of books of the Shimaya Family suggest more or less that they treat Dutch style navigation art. It is understood well that they had to appeal being Dutch style because people of that time could only access to the European culture and technology brought by Dutch. By reading contents of these three books in detail, let us examine whether the art of navigation of Shimaya Family must be positioned in the Iberian style or in the Dutch style.

Anjin-no-hou

One manuscript of the *Anjin-no-hou* is preserved in the National Archives of Japan. In its last page it is signed as "The day of fifteenth of November of the year of tenth of Kanbun era (i.e. 1670), Ichizaemon Shimaya Teijuu" and by this date it is certain that this book is the oldest book of art of navigation of European style next to the *Genna-koukaiki* .

This book begins as "It is said that way of anjin (i.e. pilot) is to know if sea is deep or shallow, to know which direction we are, and to know how far or near, so the freedom of traffic exists in the way of anjin. In the autumn of this year a junk arrived at the port of Edo. This ship has a style of Etsu (note: Etsu is an old country of China) and was built in Nagasaki, studying a ship of Hokuchiu (note: Hokuchiu is a prefecture of China). Boarding on this ship a person who gave his name Ichizaemon Hamada came in. It is said he knows well the way of anjin. Receiving instructions of my master, I asked him about art of navigation. Answering my question Hamada said･･･" and this book consists of a dialog between Ichizaemon Shimaya Teijuu and Ichizaemon Hamada. We can find an answer to a question who is Ichizaemon Hamada in the sentences written as a note in small letters of the beginning of this book. Because at that time there was only one junk built in Nagasaki and there was no one who entered the port of Edo on board this junk other than Ichizaemon Kenryuu Shimaya. So it is beyond question that Ichizaemon Hamada was Ichizaemon Kenryuu Shimaya.

The junk arrived at coast of Shinagawa of the Edo Bay on April 10, 10th of Kanbun era (i.e.1670) and Ichizaemon Kenryuu sailed to the Northern part of Japan in its summer. After returning to Edo, on November 8 he presented the junk to the Shougun Ietuna in his

coming back way from falconry. The *Anjin-no-hou* marked the date of November 15 which was only one week after the visit of the Shougun to the junk. Considering period in which this book was written actually, though the last page indicated the day of November, Kenryuu must have available time to describe the book only two months of May and June in that schedule and it means that it was not enough time to complete an official memorandum ordered by the master of Teijuu, and also the master of Kenryuu. When Kenryuu succeeded to sail the junk to Edo in a short period, his master Heizou Suetsugu must have begun a political movement to show the Shougun the junk and to award Kenryuu and also to call the Shougun's attention to his own remarkable success. Without Suetsugu's political effort, for Kenryuu, a mere master of mariner it would be difficult to present himself to the Shougun and to receive an honor to wear a sword. Upon receiving the remarkable honor for a master of mariner or a pilot, Kenryuu might want to leave his knowledge of Dutch style art of navigation gotten in Chinese ship so as to prove that he was the excellent master of mariner or the best pilot.

Even though there was no inducement to write a book in order to win award, it was natural that Ichizaemon Kenryuu Shimaya, who learned more or less Dutch art of navigation, if it was not so profound, wanted to establish a power of influence of the Shimaya Family as navigator in Nagasaki where the memory of the Iberian art of navigation and of Kouun Ikeda were going away. Why Ichizaemon Kenryuu Shimaya left the *Anjin-no-hou* as a book which might make confusion for us, though it is clear for everyone's eyes that Ichizaemon Hamada was Ichizaemon Kenryuu Shimaya? When we think it obediently, it is thought that it came from a modest virtue of Japanese not claiming one's name directly. Or we can assume that Ichizaemon Teijuu, the apparent writer of this book might be worry that knowledge of Kenryuu could be judged and criticized by the book written by him who was young and immature and created a fictitious character, Ichizaemon Hamada. In this case it was very likely that Kenryuu, who was experienced and knew the world, suggested this false story. Teijuu said "receiving instructions of my master" and he did not mention the name of his master. If the instructions were officially important ones, it was strange. It might be that Suetsugu helped Shimaya Family to make this false story.

(1) Method of latitude by meridian altitude of the sun

-The Original Declination Table of Rodrigo Çamorano remained-

When we look through the *Anjin-no-hou,* immediately we are aware of lack of a solar declination table which occupies most of pages of the *Genna-koukaiki*. Without a solar declination table it was substantially impossible to practice astronomical navigation.

The solar table does not exist in the text, but in the text there are descriptions which suggest us this book held the solar table as an annex, not included in the text. Though

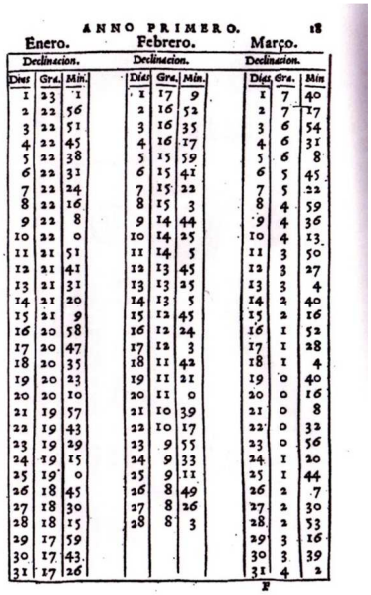
the solar table itself was lost, we can assume the *Anjin-no-hou* annexed the solar declination table for four years as the following Table 1 as same as the *Funanori-pirouto* and the *Kanbun-koukaizu.*

Table 1: First part of the first year of the solar declination table of the *Funanori-pirouto*

Day 1	23	1	
Day 2	22	56	
Day 3	22	51	
Day 4	22	45	
Day 5	22	38	
Day 6	22	31	
Day 7	22	24	
Day 8	22	16	
Day 9	22	8	
Day 10	22	0	
Day 11	21	51	Correction of errors
Day 12	21	41	↓
Day 13	21	31	
Day 14	11	20	21 20
Day 15	11	9	21 9

(The rest of the table is omitted by Yamada.)

Beginning of the 1st year of the solar declination table of Çamorano



ANNO PRIMERO. 18

Enero. Declinacion.			Febrero. Declinacion.			Março. Declinacion.		
Dies	Gra.	Min.	Dies	Gra.	Min.	Dies	Gra.	Min
1	23	1	1	17	9	1	7	40
2	22	56	2	16	52	2	7	17
3	22	51	3	16	35	3	6	54
4	22	45	4	16	17	4	6	31
5	22	38	5	15	59	5	6	8
6	22	31	6	15	41	6	5	45
7	22	24	7	15	22	7	5	22
8	22	16	8	15	3	8	4	59
9	22	8	9	14	44	9	4	36
10	22	0	10	14	25	10	4	13
11	21	51	11	14	5	11	3	50
12	21	41	12	13	45	12	3	27
13	21	31	13	13	25	13	3	4
14	21	20	14	13	5	14	2	40
15	21	9	15	12	45	15	2	16
16	20	58	16	12	24	16	1	52
17	20	47	17	12	3	17	1	28
18	20	35	18	11	42	18	1	4
19	20	23	19	11	21	19	0	40
20	20	10	20	11	0	20	0	16
21	19	57	21	10	39	21	0	8
22	19	43	22	10	17	22	0	32
23	19	29	23	9	55	23	0	56
24	19	15	24	9	33	24	1	20
25	19	0	25	9	11	25	1	44
26	18	45	26	8	49	26	2	7
27	18	30	27	8	26	27	2	30
28	18	15	28	8	3	28	2	53
29	17	59				29	3	16
30	17	43				30	3	39
31	17	26				31	4	2

F

In the solar declination table for four years which begins as shown in the above Table 1, the extreme left column indicates each day of every month, the second column from the left indicates degree and the third column indicates minute of the solar declination of its day respectively. Numbers written outside these three columns are later correction of errored transcription.

The solar declination tables shown in the *Funanori-pirouto* and the *Kanbun-koukaizu* and also must have been shown in the annex of the *Anjin-no-hou* are very simple ones which indicate degrees and minutes of every days and don't have days of week as the *Genna-koukaiki* have them. This simple table had little practicality for Japanese who used luni-solar calendar at that time. That is to say Ichizaemon Shimaya did not make effort to provide Japanese mariners with more useful services for easier astronomical observation on board.

Different from the solar table of the *Genna-koukaiki* which begins from February corresponding to the luni-solar calendar, the solar tables of the the *Funanori-pirouto* and the *Kanbun-koukaizu* of the books of Shimaya begin from January and are same as the Original Declination Table. In other words, not only the indicated numbers are same in Shimaya's solar tables and the Original Declination Table but also in those tables there

are no other description than days, degrees and minutes. By only these differences from the solar table of the *Genna-koukaiki* we cannot decide that Shimaya's solar tables were transcribed from the Original Declination Table which must have existed in Japan. There is a room to think that Shimaya omitted other descriptions than days and numbers of declination even not by intention of simplification.

However there is a decisive evidence to believe that Shimaya's solar tables were not transcribed from the table of the *Genna-koukaiki.* It is that in Shimaya's solar tables there are no errors of numbers of declination which Kouun Ikeda made when he transcribed the Original Declination Table. In the table of the *Genna-koukaiki* there are in total sixty five errors of transcription of declination numbers from the Original Declination Table. The errors of the first year of the solar table of the Original, of the *Genna-koukaiki,* of the *Funanori-pirouto* and of the *Kanbun-koukaizu* are shown in the following Table 2.

Table 2

The first year	The Original Table	*Genna-koukaiki*	*Funanori-pirouto*	*Kanbun-koukaizu*
January 5	-22° 38’	-22° 28’	22° 38’	22° 38’
February 2	-16° 52’	-16° 53’	16° 53’*	16° 52’
March 16	-1° 52’	-2° 52’	1° 52’	1° 50’
April 8	7° 6’	7° 7’	7° 6’	7° 6’
April 20	11° 25’	11° 39’	11° 25’	11° 25’
May 3	15° 35’	15° 25’	15° 35’	15° 35’
May 24	20° 43’	20° 42’	20° 43’	20° 43’
May 25	20° 54’	20° 57’	20° 54’	20° 54’
July 21	20° 33’	20° 23’	20° 33’	20° 33’
July 23	20° 10’	20° 20’	20° 10’	20° 10’
July 27	19° 18’	29° 18’	19° 18’	19° 18’
October 6	-5° 2’	-9° 2’	5° 2’	5° 2’
October 8	-5° 48’	-5° 49’	5° 48’	5° 48’
November 13	-17° 58’	-18° 58’	17° 58’	17° 58’

In the numbers of the *Funanori-pirouto* and the *Kanbun-koukaizu* of the Table 2, the number which is same as the number transcribed mistakenly from the *Genna-koukaiki* is only one number with an asterisk in the *Funanori-pirouto*. Under these circumstances there is no room for doubt that the Original Declination Table existed apart from the solar declination table of the *Genna-koukaiki* in Japan from the time when this book was written. The Shimaya Family copied the solar declination table from the Original Declination Table but not from the *Genna-koukaiki*.

In the *Anjin-no-hou,* after the solar declination table, how to get altitude of sun at its meridian passage by an astrolabe with the solar declination table putting it aside is explained. I am going to mention some points of the books of Shimaya which show difference with the way of Nanban of the *Genna-koukaiki* or which do not exist in that way with regard to the method of measurement of latitude by meridian passage of the sun.

The first point is obliquity of ecliptic, that is to say degree of inclination of the earth axis to the surface of the equator. After development of the astronomical observation of the sun, it became very important to the scholars like Pedro Nunes, Regiomontanus and so on to improve accuracy of this number. For many years the number of 23 degrees and 30 minutes was used, however, the number of 23 degrees and 28 minutes was adopted in Iberian solar declination tables as the newest and Çamorano adopted it in the table of his version of 1588. But in that period and in Netherland the number of 23 degrees and 30 minutes continued to be used. By the way the *Oranda-kaikyousho-wage*, or *Translation of Dutch Zeespiegel*, whose translated version was published in 1643, showed 23 degrees and 32 minutes.

The second point is way of instruction to add or to deduct number gotten by the solar declination table to or from number gotten by observation of the sun. The *Genna-koukaiki* instructs that if color of letters of the table is black the numbers are added and is red the numbers are deducted. In Iberian books if numbers have minus sign "-" the numbers are deducted. On the other hand Shimaya says in the *Anjin-no-hou* "The sun has three stages in its revolution. It shall be known by a circle with parallel lines. In equinox days the sun revolves on a central line. From spring equinox day to summer solstice day the sun goes to north 23 degrees and half, and on autumn equinox day returns to the central line and from autumn equinox day to winter solstice day goes to south 23 degrees and half and returns to the central line on spring equinox day. ・・・ It shall be known where you are by adding or deducting observed numbers to or from degrees and minutes of that day of the calendar (note: The calendar means the declination table.)." Almost the same things are written in *Kanbun-koukaizu.*

The other two books of Shimaya have the same drawings of the round shown below in the Plate 2. A central line is the equator, a line of northern side means the Tropic of Cancer and a line of southern side is the Tropic of Capricorn. Numbers of declination of days from March 21 to September 23, whose names of months are written in the northern belt, shall be added and numbers of declination of days from September 24 to March 20, whose names of months are written in the southern belt, shall be deducted from numbers of degrees astronomically observed. The names of the months of the both belts are written in Japanese letters which imitate Portuguese phonetically. The *Genna-koukaiki* does not have this round and this kind of instruction. These regulations of Shimaya basically have defect of lacking instruction of directions of shade, even method of solar zenith distance latitude was adopted. We shall examine this matter in the section of Astrolabe.

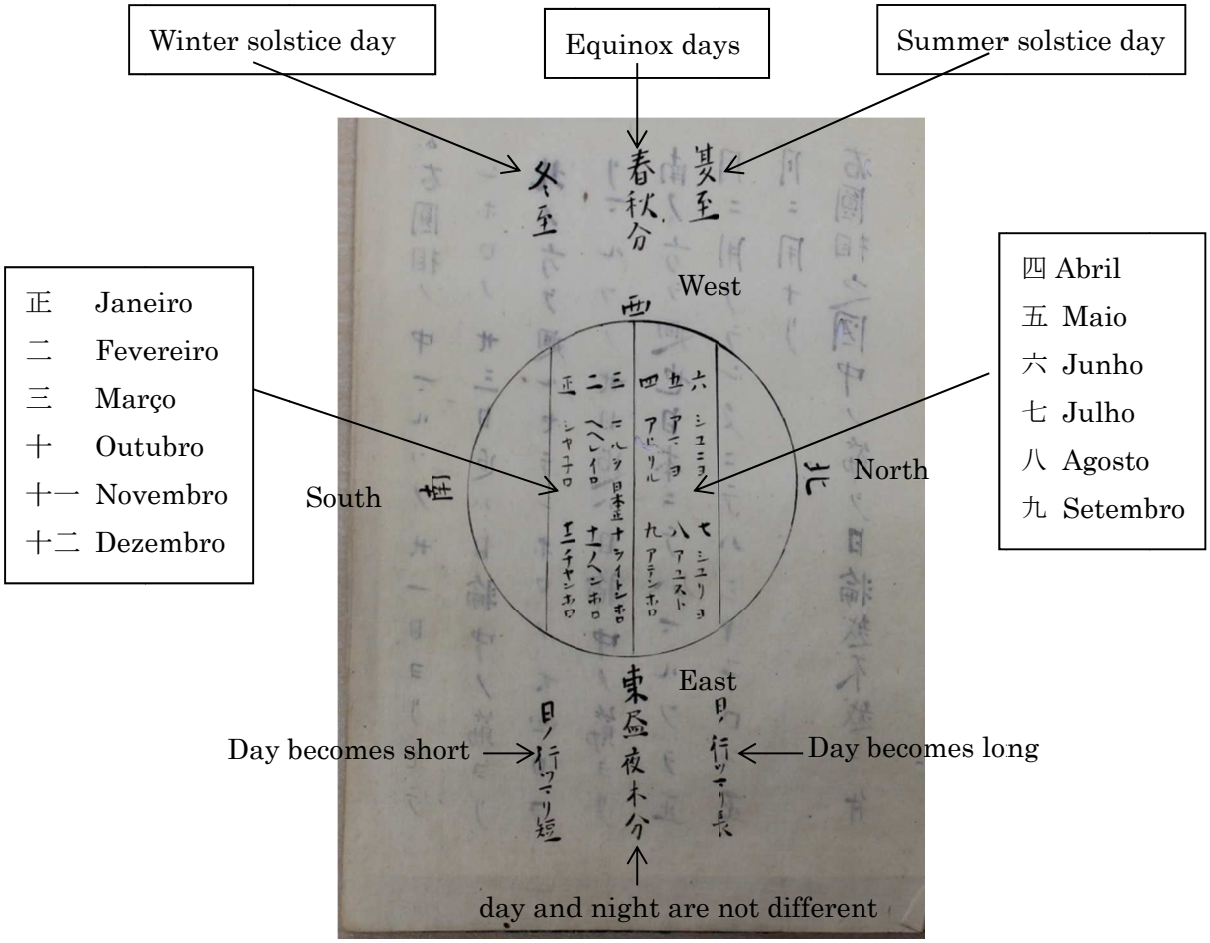


Plate 2: Drawing of "the round" of the *Anjin-no-hou*

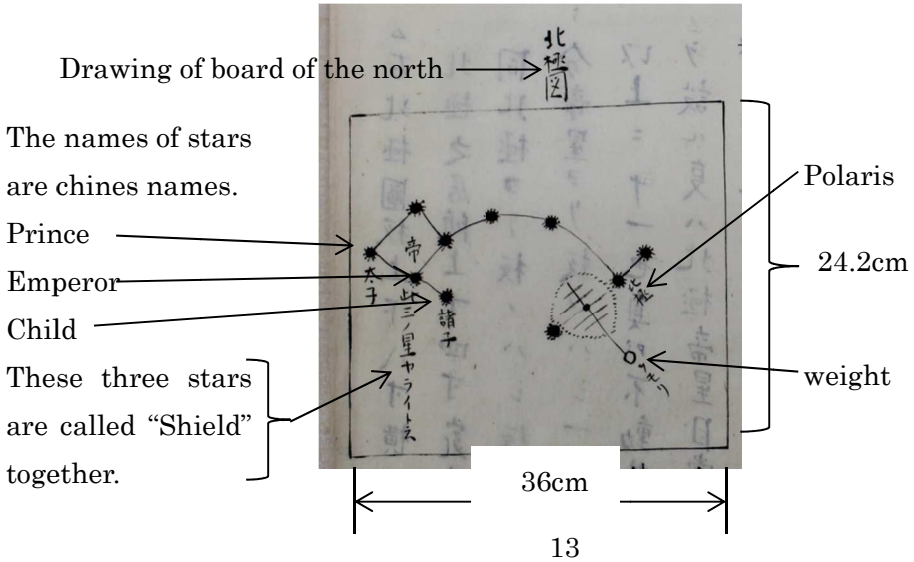
In the declination table of the *Funanori-pirouto* there is nothing of names of months including Japanese ones, on the other hand names of months of the declination table of the *Kanbun-koukaizu* are written in Japanese letters which imitate phonetically pronunciation of both Portuguese and Dutch. The Portuguese names and Dutch names are written alternatively every half year and repeatedly for two years so as to look the declination table in both languages. In the *Funanori-pirouto* and the *Kanbun-koukaizu* there are lists of names of months in Portuguese and in Dutch, of course written in Japanese letters which are pronounced to imitate these languages phonetically. In spite of the books of Shimaya advocating to be Dutch styled, they used Portuguese language because Shimaya intended to use the solar declination tables of Iberian origin as it was, whose names of months were written in Portuguese. Of course the *Compendio del Arte de Navegar* of Rodrigo Çamorano was written in Spanish. But reason why the Original Declination Tables of those of Shimaya were written in Portuguese but not in Spanish was that it was transmitted by Portuguese Manoel Gonçal.

(2) Method of latitude by altitude of the Polaris and the Southern Cross

There is an explanation of the method of latitude by meridian altitude of the sun but there is neither explanation of method of latitude by altitude of the Polaris nor by altitude of the Southern Cross in the *Genna-koukaiki*. But we can know that these methods were premised for astronomical observation in the *Genna-koukaiki* because a drawing of an instrument to know number for correction for the polar distance is given and a drawing to improve this instrument is proposed. On the contrary, the *Anjin-no-hou* begins explanation of the methods of latitude by altitude of the Polaris and the Southern Cross before the method of latitude by meridian altitude of the sun.

When Teijuu asked Hamada how to know position of ship Hamada answered that we should seek the sky and could know degree by stars. In Portugal where the astronomical navigation was developed at first in Europe, method to know latitude was started from the method of latitude by altitude of the Polaris. To practice the method of latitude by meridian altitude of the sun, it needed to accumulate data of declination of the sun of everyday for four years. However, for practice of the method of latitude by altitude of the Polaris it was only necessary to know correction number for the polar distance. Hamada told a way of measurement of latitude by the Polaris using a quadrant. The *Anjin-no-hou* says "The reason why a Kuwatarante (i.e. quadrant) is triangle and also round is clear. A northern board has a shape of quadrangle and round. Why does it? Answering it, the Polaris and the Emperor Star (note: This is the Kochab. i.e. the β of the Ursa Minor.) go around the true star (note: The true star might mean the north pole.) once by one day and one night and go ahead twelve degrees, however, if it starts from its original position once it returns to the original position after three hundred and sixty days. Because of this fact the quadrangle is a ruler to correct an axis equipped from east to west between the Polaris and the Emperor Star. As the round revolves with the Polaris and indicates degree and minute of that time, you must add or deduct number of degree of Kuwatarante depends on length and you can know where you are". This explanation is repeated with more detail showing the following Plate 3 of "board of the north".

Plate 3: Drawing of "board of the north" of the *Anjin-no-hou*



We can assume the correction number may be given by position of the Ploaris. Depends on the position which is above or below or on the central line of the round, we can know correction number which may be added or deducted or not corrected. How we can get correction number by this board? What does the weight with a thread mean? Even there is an explanatory drawing of the Plate 3 in the *Anjin-no-hou,* it is difficult to imagine what this book wants to say.

The drawing of this Plate 3 was modified as the following drawing which had a name "drawing how to look the Polaris" of Plate 4 in the *Funanori-pirouto.* This drawing of the Plate 4 has only a circle, lacking a round with five parallel lines, so we could not read the correction number. Even so, it is said in the drawing "When Polaris is above, 3 degrees shall be deducted when it is below, 3 degrees shall be added" and "When this star (i.e. Polaris) is on a line of east-west, it is not necessary to correct". Actually, separate from the drawing of the Plate 4, the *Kanbun-koukaizu* has another drawing of a round with five lines.

The drawing of the round shown in the following Plate 5 is made of a round shaped paper and one thread for weight and stuck to another page. By applying to the circle this device, which could be revolving in the circle, we can read number of correction as the explanation of the drawing of the Plate 4. Together with the tree drawings I assume how to use this device in the Plate as shown in Plate 7.

Finally for me there remains a question why are there five lines in the round? I imagine that this method of latitude by altitude of the Polaris of Shimaya must have come from Dutch (or Chinese) method and must have lost use of the three lines at a time of its introduction.

Plate 4: Drawing of "how to look the Polaris" of the *Funanori-pirouto*

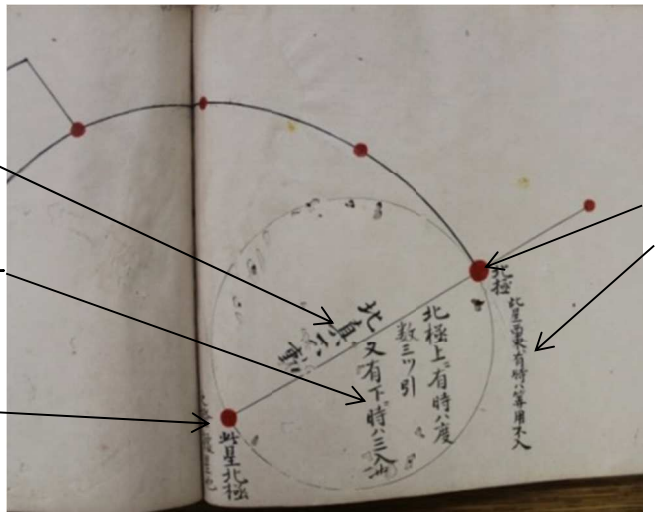
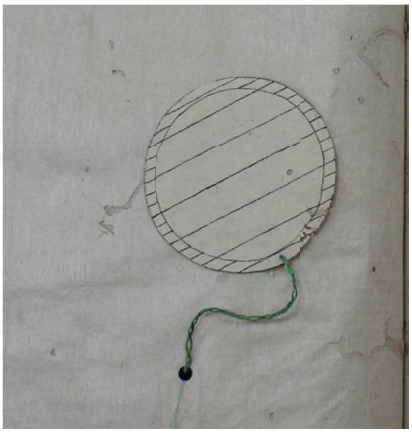


Plate 5: Drawing of a movable round of the *Kanbun-koukaizu*



I have not yet seen this kind of method in Iberian books. In the *Genna-koukaiki* one drawing of instrument to intend to improve the Iberian method whose drawing is called in the book "Koden-no-zu, or a drawing comes from old time" (Plate 6a), however any drawing of Iberian origin was not shown in the book. My understanding is that Iberian method normally used angle which is made by a line connected between the star α and β of the Ursa Minor makes with line of horizon, something like that of Spanish Martín Cortés Albácar shown in the following Plate 6b. The method of the latitude by altitude of the Polaris of Shimaya likes the method of "Chapter 29: How to know altitude of zenith by star" of the *Oranda-kaikyousho-wage*, or *Translation of Dutch Zeespiegel*". A star which was called "Opposite star of Polaris" in the drawing of the Plate 4 is not identified which name it has in present day, but it seems a star located between face and neck of the Camelopardalis (giraffe) which was recognized as a constellation by Dutch astronomer Petro Plancius at that time.

I think that in original Dutch idea the five lines must have indicated three different numbers of degree from -3 to +3 including zero.

Plate 6a:Koden-no-zu

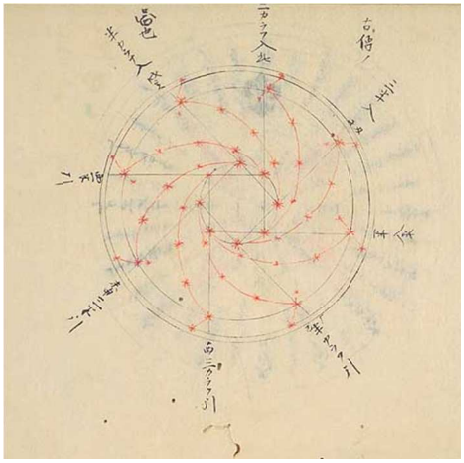


Plate 6b:from Breve Compendio de la Esfera y del Arte de Navegar, Martín Cortés Albácar (1551)(*5)

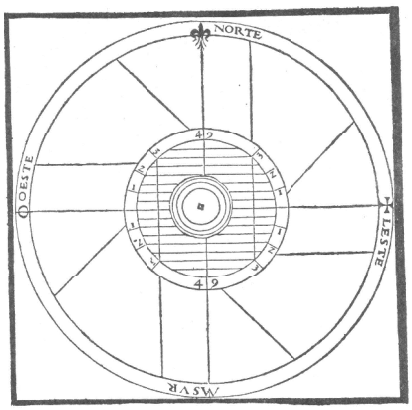
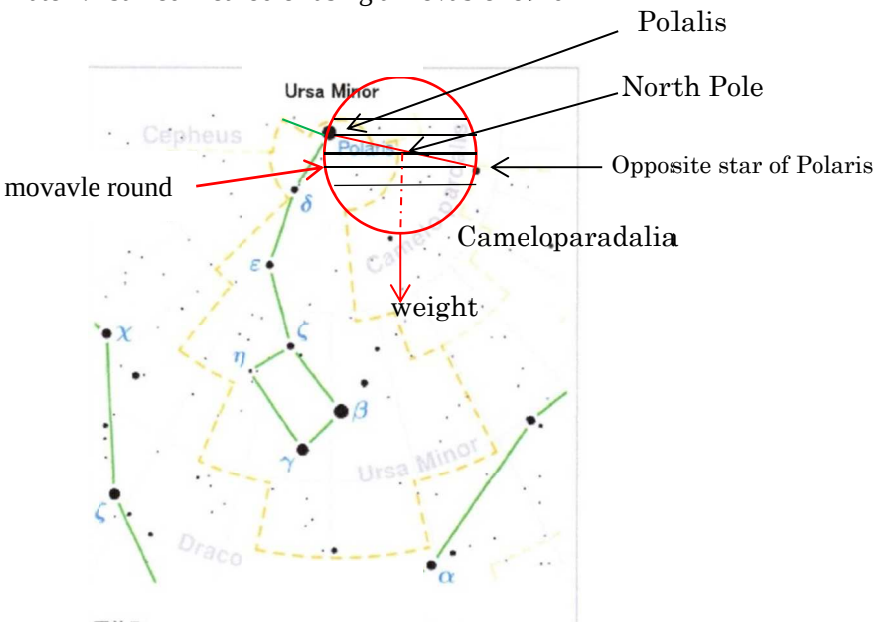


Plate 7:Asumed method of using a movable round



The three books of Shimaya call the constellation of the Southern Cross as “Southern pole” and apply the same method of latitude by altitude using the Southern Cross and say that it is not necessary to correct observed numbers in the case of the Southern Cross, because this constellation is just on the South Pole and observed number itself shows the latitude of the place where you are. But this is an error of the method of latitude by altitude of the Southern Cross explained by Shimaya. Of course a correction of numbers was necessary because the star α of the Southern Cross had a polar distance of thirty degrees at that time. On the contrary Kouun Ikeda made a question if we could know latitude when a line between the star α and the star γ is not vertical but is declining and he proposed an instrument which has a shape of half round with scale to solve this question. In the period of the *Genna-koukaiki*, that is to say before the national isolation of Japan, Japanese sailed to area where they saw the Southern Cross, but after that policy was enforced none of Japanese saw that constellation and was not interested in observation of it.

It should be noted that the method of latitude by altitude of the Southern Cross is not mentioned in the *Oranda-kaikyousho-wage.*

If a pilot wants to know difference of distances between altitudes of two places after finding altitudes of the places by astronomical observation, either by altitude of the sun or by altitude of polar constellations, it is necessary to multiplying the difference of the altitude and length of one degree measured on the surface of the earth. Then what was such length of one degree in the *Genna-koukaiki* and in the books of Shimaya? The *Genna-koukaiki* says “One degree of Garabu (note: This is a phonetical imitation of Portuguese “grau”. In the books of Shimaya it is “Karato”.) makes seventeen ri and half in the Nanban.” (*6) If we admit it correct, Iberian ri must be equivalent to Dutch ri. As already quoted in the *Sokuryou-higen*, Hosoi noted that one

degree made fifteen ri in Netherland and this “fifteen ri” was correct number of Dutch league. The *Oranda-kaikyousho-wage* also said that one degree of altitude makes fifteen ri under the same meridian.” The books of Shimaya made mistake of applying Iberian league to Dutch league for one degree.

The books of Shimaya, which intended to be Dutch style, made a list of the names of months in Dutch and a list of nomenclature of mariners naming it “Players on board” written in Japanese letters imitating phonetically Dutch and also Chinese. Was this learned from Chinese? Then, how is used Portuguese language? Only the names of months mentioned in Portuguese in Shimaya’s three books as the Plate 2 of the *Anjin-no-hou* and in the *Funanori-pirouto* and in the *Kanbun-koukaizu* of the three, after listing the name of month in Dutch, Portuguese names are listed.

(3)Prediction of gale

What we have looked into the books of Shimaya makes us realize that the astronomical navigation described in them was not influenced by the *Genna-koukaiki*. In spite of this fact, in the Shimaya’s books there are sentences which were copied almost word for word what were described in the *Genna-koukaiki*. These sentences are not appeared in the *Anjin-no-hou*, but we can look them in other books under a title of “Prediction of gale”. Their contents have a style similar to some contents of *Capítulo I: De la Astlorogía rústica* of the *Libro Tercero* of the *Instrcción Náutica* by Diego García de Palacio (*7). As there are so many itemized sentences, only beginning items of the *Genna-koukaiki* and the *Kanbun-koukaizu* are given as follows:

＊“How to know gale looking the sun”

＊“If many clouds gather in the direction of sunrise before the sun rises, thunder and gale must come.”

＊“If a blue sun rises, gale and rain must come.”

＊“If the sun looks vaguely, gale must come.”

Of course even not all items of the *Genna-koukaiki* and the books of Shimaya are same, but almost all of them continue in same language as this. It is very interesting that with regard to the astronomical navigation, few influence of the *Genna-koukaiki* is observed in the books of Shimaya, however, the almost same descriptions of the traditional advices on weather appear in both of them. I have not yet found good explanation on this phenomenon.

Though some fifty years passed after the *Genna-koukaiki* was written, we cannot believe if Ichizaemon Shimaya did not know about the name of Kouun Ikeda who had lived in the same city of Nagasaki and his occupation was the same pilot. In Nagasaki even after more than one century reverberation of Ikeda and Manoel Gonçal was felt as we know it by the *Sokuryou-higen*. By these circumstances we can consider that Ichizaemon Kenryuu got the Original Declination Table of Çamorano and must have not studied the *Genna-koukaiki*, but must

have gotten hearsay about this book, Kenryuu was taught something Dutch style of astronomical navigation by Chinese when he was on board Chinese ship. We cannot deny possibility that he learned it from Dutch mariner, but it seems such possibility was very few. Anyway it must be noted that the Tokugawa government recognized his ability of the astronomical navigation and appointed him the captain of the junk to take it to Edo and to explore the Munintou Islands. At the beginning of the seventeenth century, the theories of the astronomical navigation of Iberian countries and of Netherland were basically same, it can be said that only some numbers and instrument of these countries were different. Even so, the books of Shimaya fell far short of practical usefulness comparing with the *Genna-koukaiki*, which was written for practical use of pilot on board, and remained no better than for conceptual understanding of the astronomical navigation.

In the last part of the *Anjinno-hou*, for taking his feelings Ichizaemon Shimaya (officially named Hamada) said “At last I have completed a disposition of the world with degree. I name it *Anjinno-hou* and pass it down to future generations. However I was not handed down any textbook guiding me to use for teaching it by words or by practice. Now I am intending to teach it by words, however, I am afraid of shortage of my knowledge. And I worry about that I shall not be able to maintain way of teaching for long time. By this reason I have collected words handed down from past and I shall look for a mirror in future in order to reflect anxiety of doubt in the mirror.” If Hamada, whom Teijuu met him occasionally for a while, said these words, they did not suit that situation and sound very strange for us. This is also a reason why we think Ichizaemon Hamada was Ichizaemon Shimaya himself. It should be noted that Shimaya said “I was not handed down any textbook guiding me for teaching it by words or by practice.”, and by this expression we must think that Shimaya did not know the *Genna-koukaiki* or he ignored its existence. Though there are two choices, I don’t think that he ignored intentionally existence of this book for pretending that his knowledge had no relation with Iberian style. I consider that he wrote his books based on his knowledge of Dutch navigation gotten on board Chinese ship.

Though the *Anjinno-hou*, which declared intention of the author to hand down the European art of navigation to the future generations, was written by Teijuu based on what was taught by Kenryuu, why Kenryuu newly remade other books as the *Funanori-pirouto* and the *Kanbun-koukaizu*? As its reasons at first I think that Kenryuu wanted to make a book to be told by his own name, because the *Anjinno-hou* used the name of Hamada. In occasion of writing a new book, he intended the book to have a style of guidebook having contents itemized instead of a style of memorandum.

One manuscript of the *Funanori-pirouto* is preserved in the Library of the Touhoku University and a space of the last page adequate for signing one name was filled by black ink so that we could not read what had been there. We can imagine that there must have been a name of author. A comment of the Library says “We could not read it by photograph of X-ray and Infrared-ray.” and unfortunately

we cannot know what was there. Though we cannot know author, the date of instruction by Kenryuu Shimaya was written as the second year of Joukyou era (i.e. 1685). As this date was fifteen years after the *Anjinno-hou* was written and five years before Ichizaemon Kenryuu died, it is assumed that someone of the Shimaya Family, for example Teijuu made this book.

The *Anjinno-hou* starts from a table of contents and draws a picture of compass-rose with sixteen directions in Japanese language. Then a description of route of navigation of a round trip between Japan and Thailand continues under the title of "Route of navigation to Siam (i.e. Thailand) The way of Oranda (i.e. Holland)." and a description of the route of navigation of round trip between Japan and Luzon Island of Philippines continues. At the end of these descriptions of the two routes it is said "These descriptions are the routes of Oranda." It is emphasized that these routes are originated in Netherland mentioning repeatedly the way of Oranda and the routes of Oranda.

(4)Degrees of some places

The *Funanori-pirouto* mentions altitudes of some places related to navigation from Nagasaki to Asian countries in a form of list under the title of "Shojo-dosuu-no-koto, or Degrees of some places". In the list of Degrees of some places, after mentioning Nagasaki, Meshima Island which is located near Nagasaki, places of Asian countries including Sunhou, Takasako, Tagen, Ukuu, the places where Shimaya's junk stopped at in the middle of navigation from Satuma to Edo under a subtitle of "Satuma-no-kata, or Places of Satuma" are listed as follows:

Shojo-dosuu-no-koto, or On Degrees of some places

・Nagasaki, Meshima,

・Degrees of foreign countries: Sunhou, Takasako, Tagen, Ukuu, Nanmou, Suwatea, Amakawa, Guwarou, Sebiro and Chanhan-saki.

Satuma-no-kata, or Places of Satuma

・Koshiki (a), Uchikusakaki (b), Kuroshima (c), Sata-no-misaki (d), Hyuuga-Hososhima (e), Tosa-Ashisuri-no-misaki (f), Kishuu-Ooshima (g).

・Edo.

・Nanbu-Miyako-no-ura.

After the list of Satuma-no-kata, list of altitudes of Munintou Islands where Ichizaemon-no-jou Shimaya and Tarouzaemon Shimaya explored comes under a subtitle of "Memorandum of Munintou" as follows:

Memorandum of Munintou

・One island of surroundings of 10 ri (note: today called Hahajima), One island of surroundings of 15 ri (note: today called Chichijima), One island of surroundings of 7 ri, One island of surroundings of 5 ri, And there are four or five islands of surroundings of 1, 2, or 3 ri. Also there are about fifty islands of surroundings of 1, 2, or3 chou, and these are located in the direction of south east from Izu-Shimoda and 350 ri away from Shimoda on sea.

・Izu-Shimoda, Hachijou-Jima, ・Kita-no-Munintou (note: repeat of the above Chichijima),

・Minami-no-Munintou (note: repeat of the above Hahajima)

Plate8: Map of Satuma

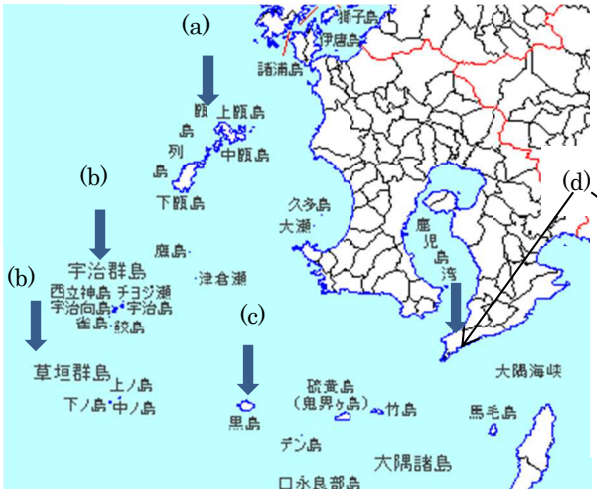
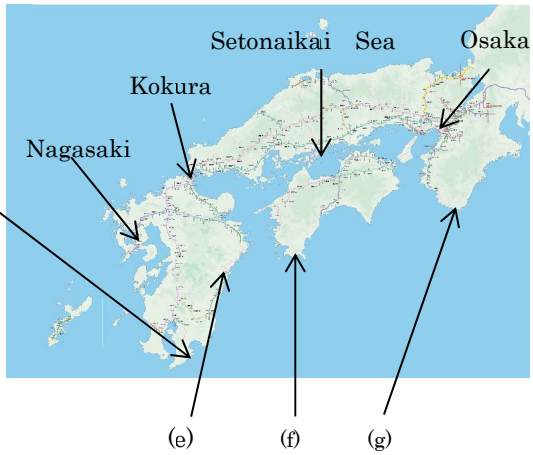


Plate9: Map of Western Japan



After the list of these altitudes, distances between places located in the route of navigation were given and summed up in order to know total distance from Shimoda to Munintou.

In the *Anjin-no-hou* there is no list of Munintou islands because the exploration of these islands was not yet realized at that time. In spite of the fact that the sailing of the junk by Kenryuu was done, the subtitle of Satuma-no-kata was not given and the altitudes of the places visited by the junk were mentioned mixed with those of the foreign places. However, the fact that the altitudes of Nagasaki and Edo were written with Dutch numbers as notes as follows:

・Nagasaki 33 degrees Oranda says 32 degrees

・Edo 35 degrees and half This is different from what Oranda says 37 degrees.

Then how is the Shojo-dosuu-no-koto of the *Kanbun-koukaizu*? This book has neither title of the Shojo-dosuu-no-koto nor subtitles of the Satuma-no-kata and Memorandum of Munintou and mentioned the numbers of altitude of the visited places by the junk, that is, Kusakaki, Uchikusakaki, Kuroshima, Koshiki, Mejima, Nagasaki, Edo and Nanbu-Miyako mixed with those of the foreign places. And Izu-Shimoda, Hachijou-Jima, Munintou and Minami-no-Munintou continue.

Comparing the the Shojo-dosuu-no-koto, or the Degrees of some places of the three books of Shimaya, the most important difference between them is that the *Funanori-pirouto* has the two subtitles of Satuma-no-kata and Memorandum of Munintou and in the first subtitle of Satuma-no-kata the places visited by the junk were arranged in an order of visiting places from Koshiki to Nanbu-Miyako-no-ura against that the other two books put these places mixed disorderly with the foreign places. In the latter subtitle of Memorandum of Munintou, the altitudes of every island of the Munintou Islands was mentioned and also the distances between the places where passed Ichizaemon-no-jou were given. The description of the Shojo-dosuu-no-koto of the

Funanori-pirouto gives us a vivid impression that we feel as if the two deeds of sailing of the Shimaya Family were realized recently.

The *Funanori-pirouto* offers a drawing of a compass-rose of twenty four directions with Chinese names once more, I say “once more”, because a compass-rose of sixteen directions with Japanese names was given at the beginning of the book, and next to this Chinese compass-rose offers a navigation rutter (i.e. navigation guide book) between Nagasaki and Thailand written in Chinese language under an explanation of “we do sailing with the directions shown”. It can be summarized that The *Funanori-pirouto* begins with the Japanese compass-rose accompanying the Dutch style rutter and ends with the Chinese compass-rose accompanying the Chinese style rutter and also can be mentioned that experience of navigation on board Chinese ship appears in this book.

(5) Sketches of astrolabe

A sketch of astrolabe of the *Funanori-pirouto* is the most polite and realistic in various drawings and sketches shown in the books of Shimaya. The sketches of astrolabe of these books, including the *Genna-koukaiki* are shown below in the Plate 10,11,12 and 13.

Plate10: Astrolabe of the *Gennna-koukaiki*

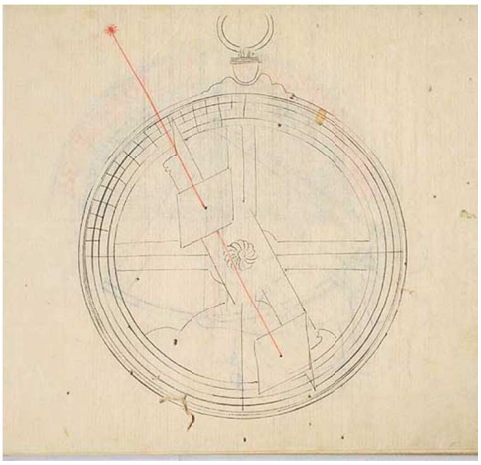


Plate 11: Astrolabe of the *Anjin-no-hou*

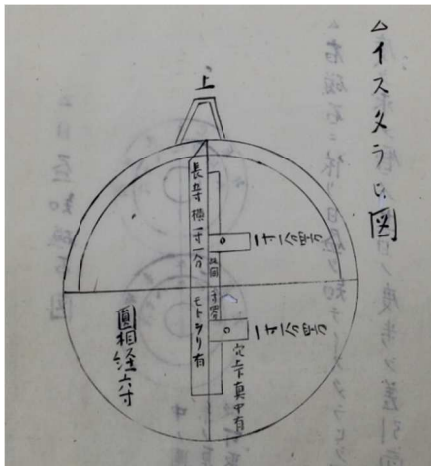


Plate 12: Astrolabe of the *Kanbun-koukaizu*

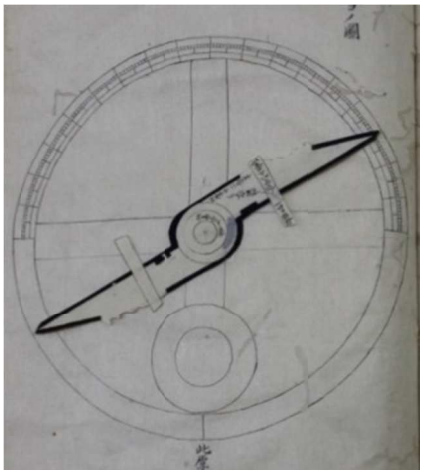
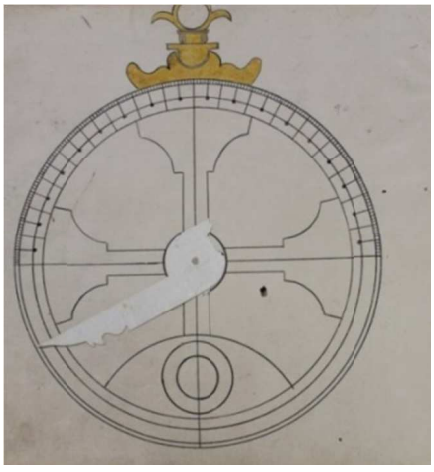


Plate 13: Astrolabe of the *Funanori-pirouto*



An alidade of the astrolabe of the *Kanbun-koukaizu*, which was separately made of a piece of paper, is attached to the center of the instrument so as to be revolved and the Plate 12 has a screw drawn on a piece of paper in the back page. Also an alidade separately made of white paper of the astrolabe of the *Funanori-pirouto* lost it half part and we cannot know if this half lost alidade was original or was added later. It is interesting that a decoration pattern of tip of the alidade of the Plate 12 and Plate 13 are similar and also the astrolabes of these Plates have a circle with two small parallel round lines in an inferior part of a cross. The sketch of the astrolabe of the *Funanori-pirouto* looks very realistic and it is probable that this sketch imitated Portuguese astrolabe of the first half of the seventeenth century, for example, Banda II, Atocha II, Atocha IV or Spanish Ríncon (*8).

Plate 14: Atocha II with date of 1616

(6)The existing only one early modern astrolabe in Japan

There is only one early modern astrolabe in Japan, which was preserved in Tenri University (Plate 15).

Plate15: Astrolabe recovered from Portuguese nau Nossa Senhora da Graça which sank on January 6, 1610 in Nagasaki Bay.

This astrolabe is a type for zenith distance observation whose scale of altitude zero begins at the top of the equipment.

This astrolabe was equipped in Portuguese nau Nossa Senhora da Graça which was attacked by Daimyo Harunobu Arima and sank by self-explosion in Nagasaki Bay on January 6, 1610. This astrolabe has a special characteristic of zenith distance observation type. That is to say it has a scale of the altitude beginning 0 degree from the top of the equipment increasing degree to 90 degrees at the both ends of the diameter. This is a very important factor for understanding that *Genna-koukaiki* and the books of Shimaya use regulation (o regimento) of zenith distance observation. If we do not know the use of this method, their explanations on the regulations have so many errors and insufficiencies. Luis de Albuquerque mentioned that this method was an originality of the Portuguese astronomical navigation in order to make mariners easy for operation. (* 10)

Plate 16: astrolabes of the normal type (Fig.1) and of the zenith distance observation type (Fig.2)

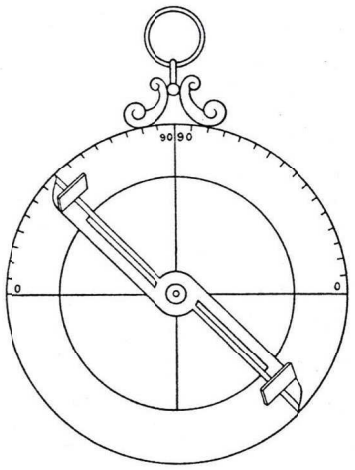


FIG. 1

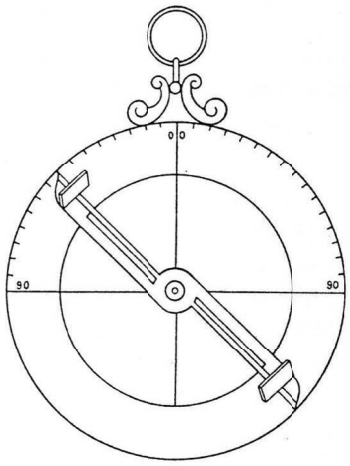


FIG. 2

3. Transcription of the books of Shimaya followed

1) *Sanpou-nichigetu-kou*, or *Calculation way of sun and moon*,

2) *Hiden-chiiki-zuhou-daizensho*, or *Secret complete work of drawing regions*, and

3) *Nanbanryuu-tenmon-no-sho*, or *Book of Iberian way of astronomy*

1) *Sanpou-nichigetu-kou*, or *Calculation way of sun and moon*

One manuscript titled "*Sanpou-nichigetu-kou*, or *Calculation way of sun and moon*", which transcribed the *Kanbun-koukaizu* or the *Funanori-pirouto*, is preserved in the Library of Touhoku University. Period of transcription of this book can be assumed by the newest year of the years appeared in the book, the ninth year of the Genroku era (i.e.1696) written in a calendar contained in the book.

The contents of this book look like those of the *Kanbun-koukaizu* than those of the *Funanori-pirouto.* Characteristics which differ from these two books are mentioned in the following.

It begins with the same solar declination table as that of Shimaya without Japanese era. At the side of each month of the first year Dutch name of respective month is written. Regarding to the Shojo-dosuu-no-koto, there is neither title of the Shojo-dosuu-no-koto nor the subtitles of Satuma-no-kata and Memorandum of Munintou and names of places and their latitudes are written directly. There is nothing about the Munintou. After the list of latitudes, the same rutter as that of Shimaya continues under a title of "Navigation route of Chinese ship, Dutch Way", however a description of the sailing route from Osaka to Kokura, which is a city of Nothern Kyuushuu, through the sea of Setonaikai is added (see Plate 8). The navigation route through the sea of Setonaikai is a typical coastal voyage route.

2) *Hiden-chiiki-zuhou-daizensho*, or *Secret complete work of drawing regions"*

This book was edited by Chishin Hosoi who is the author of the *Sokuryou-higen*, intending to be a summary of surveying technology in the second year of the Kyouhou era (i.e.1717). After the Content, many sketches of instruments of surveying are shown with explanation and the all contents of the *Kanbun-koukaizu,* with the date of the 13th year of the Kanbun era (i.e. 1673) including the solar declination table and the sketches of the astrolabe and so on are transcribed completely. This book is preserved in the National Diet Library.

3) *Nanbanryuu-tenmon-no-sho*, or *Book of Iberian way of astronomy"*

One manuscript titled *"Nanbanryuu-tenmon-no-sho* is kept in the Miyazaki Prefectural Library. The contents of this book are same to those of the *Kanbun-koukaizu* or it is better to say they are perfectly same as those of the *Nanbanryuu-tenmon-no-sho* including the sketches. In the last page the date of October of the first year of Kaei era (i.e.1848) and the name of Shigeaki Hidaka were shown. Shigeaki Hidaka was a samurai of Hyuuga-Sadohara-han of Kyuushuu and learned art of survey in Edo. This was one of the books which he transcribed in the occasion of travelling to Edo.

4. A hundred years blank – Translation of a Dutch navigation book *Oranda-kaikyousho-wage*, or *Translation of Dutch Zeespiegel*

In the time of the Sakoku, European knowledge and information were brought to Japan through the Dejima Island. As all of them were written in Dutch, Japanese people who directly contacted them were Dutch-Japanese translators. Yoshinaga Motoki who had the title of the "Daituuji, or Grand Translator" translated a Dutch navigation book in 1774 by an order of the government. The title of this book translated from Dutch language is "*Oranda-kaikyousho-wage"* and his original manuscript is

preserved in Tokyo Metropolitan Central Library. The *Oranda-kaikyousho-wage* is not a book composed of what was heard from a pilot, but is an accurate translation of whole of one Dutch book. From its title we can assume that original Dutch book must have been "*Zeespiegel*" of Joan Willem Blaeu. This was not a book of the era of the translation, that is 1774, and the first edition was published in 1623 and the last one was published in 1652 in Amsterdam. This means that the book published more than one hundred years ago was used for the translation of Motoki. Takejirou Akioka(*9), asking his friend who visited Het Scheepvaartmuseum in Amsterdum to investigate which version was used by Motoki, confirmed that the version of *Zeespiegel* translated by Motoki was the version published in1643. Why did Motoki use so old book for his translation, even though there were Dutch books which contained more advanced navigation art? If the government had wanted a newest book, it could be supplied by Dutch traders. After all, the government did not necessitate new navigation art under the policy of the Sakoku. The government was gathering only general information. Other than *Oranda-kaikyousho-wage*, Yoshinaga Motoki translated twelve Dutch books of different categories.

Japanese sailed newly to the Ogasawara Islands, which were called the Munintou Islands in old time, ninety years after the translation of *Oranda-kaikyousho-wage*, using the newest navigation method which they learned in transpacific sailing to U.S.A. with Americans.

5. Conclusion

At the beginning of the seventeenth century when Japanese went out abroad, the Iberian art of navigation was introduced to Japan intensively, and Kouun Ikeda wrote the *Genna-koukaki* basing on what he learned on board from a Portuguese in 1618. Ikeda not only put a lot of thought into apply European navigation art to Japanese mariners, but also proposed his own ideas to improve it. Even though the necessity of Iberian navigation art to go Asian countries crossing the high seas was lost after Japan closed the door of the country in 1642 and the *Genna-koukaki* went to be forgotten, all of necessity did not go away. Because new need to improve transportation of rice of imposition to Edo by sailing Pacific Ocean from distant land arose and Ichizaemon Kenryuu Shimaya met the need. And secondly a necessity to sail to the desert islands newly discovered far from the main land came and his son and grandson realized this voyage to these islands which were given a new name Munintou Islands by the order of the government. Ichizaemon Kenryuu Shimaya must have known the *Genna-koukaki,* but perhaps was not familiar with it. After he succeeded sailing to transport rice of imposition from Kyushu to Edo, his grandson Teijuu interviewed Ichizaemon Hamada,

who came to Edo in a junk, regarding Dutch navigation art and he prepared a memorandum giving a titled of the *Anjin-no-hou* in 1670 so as to report what he learned from Hamada to Heizou Suetugu, his superior and the Governor of Nagasaki. This memorandum has some reverberation of Iberian art of navigation using some Portuguese words. We can know unquestionably that Ichizaemon Hamada is Ichizaemon Kenryuu Shimaya himself. Two navigation books, one of which has the title of the *Kanbun-koukaizu* and another called as the *Funanori-pirouto*, both of them being based on the *Anjin-no-hou*, adding a solar declination table and drawings of astronomical observation instrument. The solar declination tables of these two books were same as the Original Table of the 1588 version of *Compendio del arte de navegar* of Çamorano, being different from that of the *Genna-koukaki.* Why this old Iberian solar table was used in place of Dutch table fifty five years after the *Genna-koukaki* was written? To this question, any answer is not yet given. There are some books transcribed from the *Kanbun-koukaizu*, and the *Funanori-pirouto.*

Though the Shimaya Family pretended that their art of astronomical navigation had origin in Dutch style art and it cannot be denied, it is also true that their books have a characteristic of hybrid of Iberian origin and Dutch origin. Ichizaemon Kenryuu Shimaya established the fame for his family by two excellent deeds of navigation and wanted further to reinforce it by remaining the books, however these books did not make any development from the *Genna-koukaki.* .

The astronomical navigation lost its demand and remained only in a few books of study of calendar and land survey, as the *Banreki*, the *Hiden-chiikizuhou-daizensho,* etc.

Approximately one hundred years later, Yoshinaga Motoki translated the Dutch book *Zeespiegel* to Japanese language and gave it a title the *Oranda-kaikyousho-wage*. This *Zeespiegel* was old enough at that time and the *Oranda-kaikyousho-wage* was never used actually, because the motive of translation was a simple curiosity of the government. The second visit to Ogasawara Islands by Japanese was made in 1863 ninety years after the translation of the *Oranda-kaikyousho-wage,* by using the newest navigation technology gotten from American.

The end

Note:

(*1) Yoshihiro Yamada, "*Japanese Book of the Art of Navigation -Gennakoukaiki- (1618) by Kouun Ikeda*", paper for XVI International Reunion of the History of nautical science in Bremerhaven, October, 2012.

(*2)Yoshihiro Yamada,"*The original version of the table of the Sun's declination appeared in Genna-koukaiki",* KAIJI SHI KENKYU, no.62, December 2005 and no.63, November 2006, The Japan Society for Nautical Research, Tokyo. The solar declination table of the first version published in 1581 of the *Compendio del Arte de Navegar* of Rodorigo Çamorano was different from the table of the 1588 version of the same book. Though there are two other versions of this book published in 1582 and 1586 respectively, I have not yet looked them.

(*3)Akira Hirayama (1904 b-1998 d), Researcher of history of Japanese mathematics

(*4)Chishin Hosoi (1658b-1736d), Confucian scholar

(*5)Martín Cortés Albácar,"Breve Compendio de la Esfera y del Arte de avegar" (1551), Edición de Editorial Naval, Museo Naval Madrid, 1991,258p.

(*6)Yoshihiro Yamada, *"Genna-koukai-sho and the Iberian art of navigation, Portuguese grau and legua".* KAIJI SHI KENKYU, no.60, September 2003, The Japan Society for Nautical Research, Tokyo.

(*7)Diego Garcia de Palacio, "*Instrucción Náutica para Navegar*", Ediciones Cultura Hispánica, Madrid,1944.65p.

(*8)Alan Stimson, "*The Mariner's Astrolabe*", HES Publisher, Utrecht, 1988.

(*9)Takejiro Akioka (b1895-d1975), scholar of the history of geography of Japan.
He published "*The Fundamental Documents concerning the Discovery of the Bonin Islands*", KAIJI SHI KENKYU, no.1, December 1963, no.3&4, April 1965, The Japan Society for Nautical Research, Tokyo.

(*10)Luis de Albuquerque, "O Livro de Marinharia de André Pires", Junta de Investigações do Ultramar, Lisboa, 1963, 84-86pp.

Annex:

Main Japanese books of navigation of European way between 17th and 19th century

Period	name of book	author or translator	owner
1618	*Genna-koukaiki,*	Kouun Ikeda,	Kyouto University
(1670 Sailing of Junk from Satuma to Edo by Ichizaemon Kenryuu Shimaya)			
1670	*Anjin-no-hou*,	Ichizaemon Teijuu Shimaya,	National Archives of Japan
(1675 Sailing of Ichizaemon-no-jou and Tarouzaemon to Munintou Islands)			
1680-84 ?	*Kanbun-koukaizu*,	anonym	National Museum of Japanese History
1685	*Funanori-pirouto,*	Ichizaemon Kenryuu Shimaya	Touhoku University
1700-15?	*Ihou-funanori,*	Sakuzaemon Yamazaki,	Yokohama City University
1717	*Hiden-chiikizuhou- daizensho,*	Chishin Hosoi	National Diet Library
1718	*Banreki,*	Yuuken Koike,	burnt (Shoukoukan)
1726	*Sokuryou-higen*	Chishin Hosoi	Touhoku University
1774	*Oranda-kaikyousho-wage*	Yoshinaga Motoki	Metropolitan Library of Tokyo
1848	*Nanbanryuu-tenmon-no-sho*	Shigeaki Hidaka	Miyazaki Prefecture Library