Examining Coastal Shipping Processes around Shodo Island during the Tokugawa Period

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Abstract

Shodo Island in the Seto inland sea used to be the major entrepôt of wall stones, which were taken to the Osaka castle, gathered from some islets around this island. The processes of constructing Japanese castle walls are composed of three processes, viz. quarrying stones, shipping or transporting them, and heaping them up. While many historians have studied upon quarrying and piling them, no comprehensive research has been done as for shipping or transporting them, mainly because no historical document exits. In order to throw light upon seaborne stone transportation from Shodo Island to Osaka, therefore, underwater surveys around this island were carried out on seabed As a result, many submerged wall stones, as well as a submerged stone called "Kamome Ishi", on which an old stone post was stood, succeeded in being found on the bottom of the sea; this mooring post is said to be built by ship owners who carried wall stones to the Osaka castle, and these waters could serve the most important mooring port of Shodo Island for wall stone transportation. To prove this historic event, a tide simulation on the basis of survey data was analyzed and a reconstructed model for mooring and loading wall stones around the mooring post was hypothesized, which was verified by current fieldworks. Although millions of mariners have been working in the Seto inland sea since the ancient times, a new maritime and navigational technique seems to be emerged from Shodo Island and its surroundings early in the 17th century.

Key words: Shodo Island, Tokugawa Period, Kamome Ishi, Seto inland sea, Yaana

Introduction

This paper will examine the shipping processes of stone used to build Osaka Castle's wall in the Tokugawa period. Shodo Island in the Seto inland sea used to be the major entrepôt of wall stones, which were taken to the Osaka castle, gathered from some islets around this island. This entrepôt has been recognized coastal areas of the Seto inland including Settu Ashiya or Mikage other than Shodo Island. It is discussed from historical and archaeological viewpoints through analysis of castle history about the actual conditions of "job site" as processing stone and the "daimyos" who managed it. It may be said that the east Seto Inland sea where Shodo Island is located is a "field of action", having various cultural landscapes since ancient times. Above all, in this field, cultural behavior mainly on "the stone" has been carried out. For instance, the fabrication methods of chipped stone tools called "Setouchi blade" in antiquity, was the stone used for Osaka castle's wall in the medieval period, and contemporary stones used for modern building. It goes without saying that "the stone" used as tools to support local life continue supporting our culture now. "The stone" is the remarkable keyword if we intend to establish a cultural landscape in the eastern Seto inland sea. Based on the above, in this study, "the stone" that is constructing Osaka castle's wall as the target, we want to reevaluate the technical examination. Thus far, the processes of constructing Japanese castle walls are composed of three processes, viz. quarrying stones, shipping or transporting them, and heaping them up. While many historians has studied upon quarrying and piling them, no comprehensive research has been done as for shipping or transporting them, mainly because no historical documents exit. Therefore, the focus of this study is evaluating and examining the shipping process by carrying out an underwater investigation which has not been done in a conventional study. The research area is the Tenguiwaiso job site located at Iwagatani, on east coast in Shodo Island. We attempt a construction of the data from the basis of an environmental view point by cyclopedically analyzing the whole area between the shore and the sea. There are few similar examples of the practice of using of the underwater archaeology in such a manner. Particularly, the direction through such practices can bring up new questions, and it becomes a methodological approach to propose the clarifying facts between the relations of human and technology on maritime culture. The important point in this study is how to take the sea into account. In a conventional stone wall study, it relies mostly on the political description about each daimyos who managed job site and a technical description about how to break stones or to construct the castle, however, it is necessary to interpret this as "how they shipped the stones" to assume that the people who carried and engaged it. Technical invention can overcome this special environment like a sea is a major premise used to know this environment. We estimate the technique ("the knowledge") from investigation of environment and archaeological structure.

Fig. 1 Research area division of the project. (K. Mogi).

Research in Tenguiwaiso Job Site

There are Minamidani, Tenguiwa, Tenguiwaiso, Tofu, Kamesaki, and Hachininishi Job sites in Iwagatani on the east coast of Shodo Island, and scattered wall stones on each sites. These sites were designated as national historical sites in 1972. The study was of a number of stones, classified with processing marks called "Yaana" in Japanese, and arranged with the carved seal of the daimyos was researched as that time. The Tenguiwaiso job site is a curved site comprising of a whole shoreline of white sand (the seaside). The area is lined with ship setting stones faced with the “Yanna” seal on this beach. The Tenguiwa job site is located in the western mountains from the Tenguiwaiso job site; hence it appears that it is the geographical location where a quarry was established. Stone from the area was removed and taken to the Tenguiwaiso job site. A torrential downpour by typhoon No. 8 in 1974 caused a landslide which flowed down onto the shore. Reports that some stones fell down with this landslide has been documented. Therefore, we must take the geographical change of the site into account both before and after the disaster. Grasping the present state of it is the first priority, and the construction of such a site will be an important model to be analyzed later.

Investigation Method

The basic purpose of this investigation is to obtain data that is topographical and understanding the stone distribution in the whole range of the shore area (both above and below water). The number of stones and the drawings has been recorded by the administrative report, yet the information of which stones are left and in which position and environment was not documented. In this investigation, we acquired data that considered the position of stones, their location on the site and in which kind of environment they were found. In addition to all the stone distribution, it is necessary to obtain the topographical and environmental information.

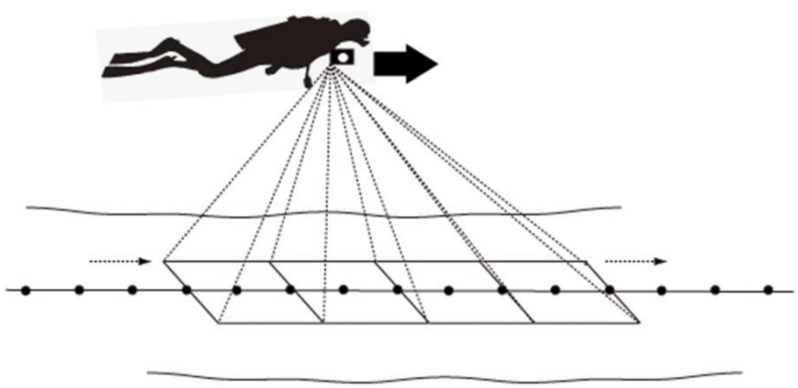
Acquisition Data of Topographical and Distribution of Stones on the Shore

To grasp more objectively the shape and distribution of the stones, we conducted photography from a high elevation of where the stones appeared by using a 5 m, expandable surveying staff with a camera clamp attached to the upper part of the staff. We contrived a system of linking positional information (coordinates) and the photograph, to determine the scale and a direction of the photograph. Photos were taken mainly of wall stones, big stones, and granite blocks. Given the large area and multitude of objects on the site, the methodology that was used would have a more quantitative sample. By using such a scientific example, the site would be easy to reproduce. In getting a topographical data, a total station (TS) is used at every surveying site today. It calculated the distance and the height to collimation point (prism) from the machine point (TS), by collimating at a change point of topography and other points in a random order. Each position and elevation was then derived from calculated coordinate data, which made a basic contour map from the data. In addition, we acquired data which was used for the position, scale, and directional information for the photographical surveying mentioned above. To understand the geographical feature, it could help verify the distribution of stones under each kind of environment, and allowed us to determine where the natural and artificial topographies lied on the site.

Fig. 2 "Kamome Ishi". (K. Mogi)

Acquisition data of topographical and distribution of stones underwater

Based on the results of the investigation in 2012, we determined the rough distribution of stones in all underwater areas by viewing via snorkeling. By this confirmation, we divided the area where stones were distributed conspicuously, and subsequently investigated these areas (Fig. 1). Between each area was a sandy area where stones had not been observed. There is a submerged rock of approximately 3 m in height named "Kamome Ishi" (Fig. 2), on which an old stone post stood at research area II in the open circle of Fig. 1. In local transition, it may be a mooring post that was said to be built by ship owners who carried wall stones to the Osaka castle. "Kamome Ishi" was examined mainly in 2012. It was hypothesized as a mooring post and modeled as such, however, it was not conclusive, thus a reevaluation of the area was deemed necessary. Each section was then divided up via measuring tape into 50×50 m blocks. We then checked the distribution of the stones by scanning the bottom of the sea using animation photography (HERO3 of GoPro). A mark was made at every 1m interval, and at each interval, a photo was taken (Fig. 3). A gap in the image when it was composed was the blurring of the camera position, and the bob weight on the camera was taken in the angle of view. It blurred at the time of photography by setting up an angle to deserve gaps of image, and we compensated for this (Fig. 4). The process provided direction, scale and position of the image by yielding a coordinate on the initial point, middle point, and terminal point on each 1 m measurement line. Based on such a procedure, we acquired consistent underwater data sets to collate with the topographical data gathered from the shoreline.



The central line of the upper illustration is measurment tape, and colored ball on the line is a mark taking every 1m. Camera makes fixing to some extent beneath the surface of the water, and photographing this line making central to scan bottom of the sea. Established the initial point in each phtography area, being sure to photograph in same direction.

Fig. 3 Underwater Photographing Method. (K. Mogi)

The acquisition method of the underwater topographical data was used as well as the surveying method at the shore area stated earlier. We measured the topography at random to the spot about 300 m ahead from the shore. Collimation (prism) attached top of the measurement staff, calculated distance and height of the collimation point from the machine point (TS). We stabilized the collimation and the staff by two scuba divers and one snorkeler manning each at bottom of the sea position, middle position, and surface of the water position. The diver at the sea bed selected a change point of the topography at approximately 5-10 m and at random, and the diver at the surface determined the direction of movement. In addition, a research member on the ship acted as contact to the operator on the shore. Each position and elevation of collimation are derived from calculated coordinate data, it matched data of the shore area, and made a basic contour model. The measurements between the ship using sonar or multi-beam is common for an ocean study and the method of making a counter map at the bottom of the sea, is necessary completion with the land since this area is the full coastal zone in this study. For that reason, we think that bringing a land method into practice underwater brings yields valuable information, since we are able to obtain data with a more detailed approach using such a method.

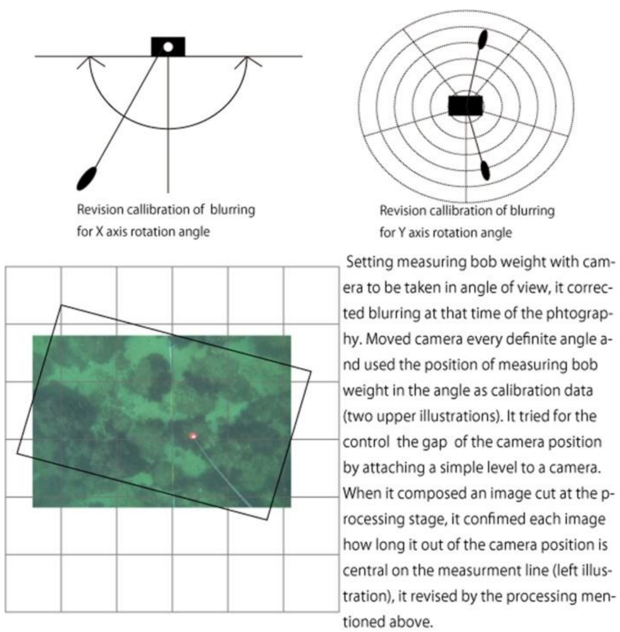


Fig. 4 Method of Control and Revision of the Camera Position. (K. Mogi)

Reduction and Analysis of Acquisition Data

Topographical Data in the Shore and the Underwater

To coordinate topographical data at the shore and the underwater area using the practice mentioned above and extract latitude and longitude, we made a topographical map (contour) of the whole research area by Kriging method used in geology (Fig. 5). Reproduction of the shore and the seafloor topography was compiled to match and supplement both data sets of these environments. In consideration of Fig. 5, the shore topography makes curves like a bow and in perspective we know that it formed a gentle topography to measure points at the off side at approximately 300 m. In addition, the shore area represents a beach with a sandwiched concavity in both the north and the south of the site. The port and the breakwater have shore protection at present. From a narrower perspective, it is confirmed that the large shallow area in the north coastal zone, and the irregular sequences on the contour line which in the center of coastal zone are consistent with the location of "Kamome Ishi". Please note that the two dales in the northeast side (the shore side) from its area. This has been confirmed on site; the erosion traces by the wave could be seen on the lower part it. These two dales formed a geographical placement that suggests relation with the Tenguiwa job site as a quarry located in the mountains place of the northeast side.

Additionally, the dale topography is around a 10 m deep on the southeast side. This may be a part of the site influenced by the disaster in 1974; it could show which area was affected my observing mudflow sediment. Depending upon the size of the disaster, the landslide sediments left traces we can observe. Yet the sediment is not present. It is possible that the landslide sediment disappeared via the erosion of water from the disaster. Undoubtedly, an area along the shore that is predominantly affected by waves, tidal flow, and topography, it is obvious that the natural and physical phenomenon such as the erosion forms chaotic natural molding for the beach topography and the landscape. However, it does not lead to the generalization of the natural phenomenon in the shore area when compared with a study of hydrology or engineering science in the region these days, so it is suggested that a "Critical transition" occurred (Marten Scheffer, 2009) which represents dramatic chaos on the site which change some parameters. To consider such a background, while taking a wave and a flow of the sea into account, it must push forward by discussing this as an interpretation of the shipping process based on the analysis of the data.

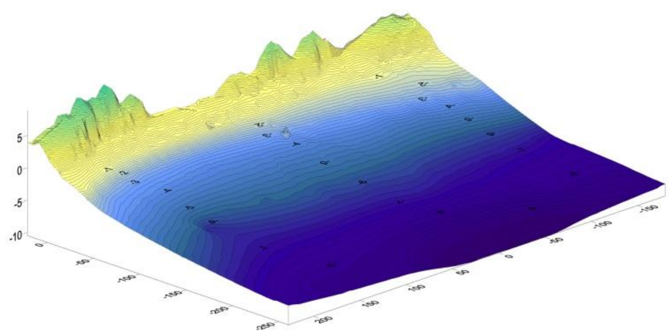


Fig. 5 Topographical Map in Shore and under Water. (K. Mogi)

Distribution of Stones in the Shore and Underwater Area

To coordinate the distribution of stones from both on the shore and underwater, we digitized the shape of each stone via enforced geometry correction, stored in a GIS (Geographic Information System). It distinguished the stones from the sand, and other objects (e.g. noise) by checking color tone and image, and subsequently made a distribution map of the stones (Fig. 6). We are analyzing it now, making a distribution map of stones in the whole investigation area.

Stones left on the job site without being carried to Osaka castle were labelled as "Unfortunate Stones". Nevertheless, it is strange that many of the stones were recorded underwater. It has our assumption that the stones underwater were stones which fell into the sea, and were left without being recovered. This practice could have propelled the myth of "the fall of the castle" used in local folklore. To understand it better, see Fig.

5, where stones are concentrated, appearing that they have a consistent arrangement. As mentioned before, the sandy area is devoid of stones. The distribution of stones would be scattered everywhere in a more random pattern if they were not picked up because it would mean "the fall of the castle". Therefore, in this study, we doubt the claim of these stones being called" Unfortunate Stones", and put forward the theory that the distribution of stones underwater as "intentional".

Suggestion of the Shipping Process

First, as the examination of "Kamome Ishi" (Fig. 2) mentioned above, authors have tried modeling the shipping process completely dependent on high and low tides. In particular, because it made a hole in the top surface of "Kamome Ishi" and a stone pillar was embedded in it, it was assumed as a mooring post. The "Moyai" in the Sea of Japan is a similar example, and it could be said that the “Kamome Ishi” has a similar structure to the mooring post. However, including an example of the Sea of Japan, the mooring post for ships docking at old ports was typically made in most of the sea cliffs or the wave cut bench which have an enclosed cape or a cliff facing the sea. In contrast, the "Kamome Ishi" is located in the sea at approximately 2 m depth on the average. It is unique that the post is placed directly ahead of the shore. Authors have measured and investigated the "Kamome Ishi" from 2012, and examined and evaluated its function. Assuming the "Kamome Ishi" serves the function of mooring a ship, it becomes necessary that the post is always higher than the height of the water surface. Tidal analysis was conducted on the region between the years 1619 CE (the year the Osaka castle began construction) to 1630 CE (the year the Osaka castle was completed). The data allowed us to deduce that waves never surpassed more than upper parts on "Kamome Ishi" of approximately 320 cm height**.** Therefore the stone pillar was always higher than water surface. From this, it could be said to some degree of certainty that the "Kamome Ishi" did indeed function as a mooring post. One interpretation in this is, viz. A ship, such as a flatboat arrived between the land and the "Kamome Ishi" at high tide. It then it moored the ship using its anchor and the stone pillar of "Kamome Ishi". The ship ran aground at low tide and used a board as a gangplank between the land and the ship. After loading the stones it waited until high tide (when the ship refloated), and started sailing. This process is an assumed hypothesis. Since historical documents and records are poor pertaining to shipping or transporting this material, we can only hypothesize a scenario such as this one.

Secondary, the authors paid close attention to the near shore current system in the area. The shore topography forms the curves like a large bow over the area. Generally, the near shore current system forms a circulatory system where the shore is nearer than the sea area as has the relatively same flow as the shore ward currents flowing onto shore, Long shore currents flow along the shore, while Rip currents flow seaward from the shoreline. Rip currents have a particularly strong flow in the near shore current system and forms a regular circulating flow style. Depending on this system, the cusp topography which formed the arch-formed shoreline was affected rhythmically occur and has been confirmed in the Tenguiwaiso job site where the team investigated. It was often chosen as a place ("current") to begin rowing unconsciously, so that a big wave is hard to flow at the place that Rip currents are being produced. Therefore, we can consider that a ship laden with the Osaka castle wall stones starting to sail through the mechanism of the Rip currents. . The conditions that Rip current occur and concentrates are a sandy coast, a shoreline bended into an arc form, a surface wave flow on top of sandy coast, and a near structure such as breakwaters which stuck out from shore. Based on the above information and the checked topography in Tenguiwaiso (Fig. 5), these are very present in this environment.

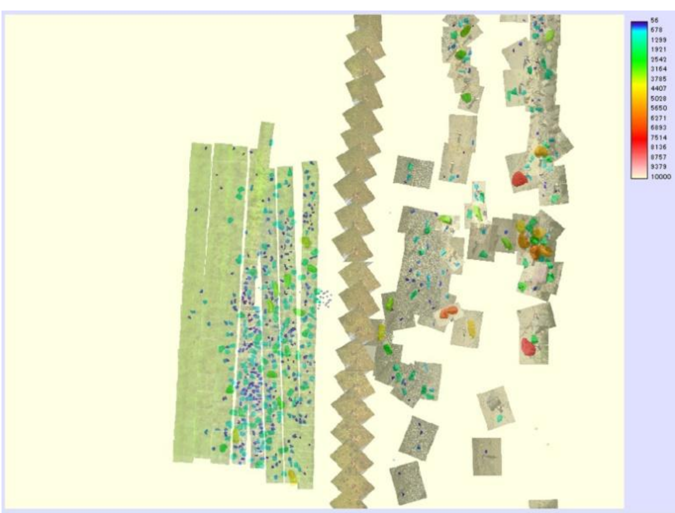


Fig. 6 Distribution Map of Stones. (K. Mogi)

There are two dales on the northeast side of the shore area. These two dales play a big role in the Rip currents' formation. Looking at the topography data, the sandy coast topography formed a fold, not a straight line. On the other hand, while the wave characteristically diffracts to the shallow direction, it is concentrated on a pointed part topographically. Hence, we can understand this two dales have topographical characteristics to form Rip current. Where the "Kamome Ishi" is located, it forms a line at right angles to the shore. An Irregular sequence is observed near this rock and "Kamome Ishi" by topographical data (Fig. 5). In particular, Rip currents are particularly faster near the structure, so it is our opinion that a ship moored at the "Kamome Ishi" can benefit from these extra rapid Rip currents. In light of these Rip currents and topography data, it was suggested that the ships landing here exploit this process when sailing from I and II in Fig. 1 in particular.

Conclusion

This paper examined coastal shipping process of wall stones by evaluating environment around the area and investigating underwater structure and stones. And we gave a new suggestion against it was inarticulate manner. Although it may not wish that is over a level of "the interpretation", it is necessary more procedural analysis that mainly investigation or field work and method to the interpretation in case of treating such several ways and estimations are accomplished. There are still a lot of challenges for the future; however we think that can give a new suggestion for the wall stones study mainly political and technical. It is necessary to let method of investigation and environmental evaluation more deepen hereafter.

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Biography

Kotaro Mogi *is perusing his Masters in the Graduate School of Culture and Information Science at Doshisha University in Japan. He is interested in Spatiotemporal Informatics, Cultural Anthropology, Maritime Archaeology, and Information Science. Especially, study is that interaction water environment including sea and human in principal objective, and human behavior in the space. It is intended to evaluate the human behavior from the information to be provided the investigation in underwater cultural heritage and analysis environment around it. Main research areas are the Seto inland Sea, Egypt, Motosu Lake, and Maldives.*

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