

Deepwater Archaeology off Tobishima Island of Northern Japan

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Abstract

Tobishima island on the Japan sea, belonging to Yamagata prefecture, lies about 40 kilometres to the northwest of mainland Japan. Although the island itself is relatively small, it has been on seaborne trading routes since ancient times. Trawl fishermen occasionally find earthenware pots of the 8th century by accident around the seabed. From the late 17th to the 19th centuries Tobishima island was an important islet of call for *Kitamaebune*, which were wooden cargo ships trading along the northern coast of Japan. According to local legends, the southeastern waters just in front of the main port is a kind of ships' graveyard hallowed by sacred memories. Contrariwise, no reliable historical record on maritime disasters or shipwrecks exists. In February 2011 Tokyo University of Marine Science & Technology (TUMSAT) and the Asian Research Institute of Underwater Archaeology (ARIUA) conducted the preliminary submerged survey around these waters, utilising a multibeam sonar system and a Remotely Operated Vehicle (ROV). The research team succeeded in recording fine-resolution bathymetries and video images of a few shipwrecks lying between 60 and 85 metres. One looks modern, but one seems to be potentially older. For the next step, an Autonomous Underwater Vehicle (AUV), which has been designed and developed by TUMSAT, is planned to be employed for the visual mappings. The AUV is able to hover for observation by approaching very close to specified objects, and is equipped with high definition cameras.

Two-dimensional and three-dimensional photo mosaics will be obtained, while accurate bathymetry data shall be recorded using sonar and an optical ranging system mounted on the vehicle in order to creat fully-covered and detailed site plans.

Key words: Deepwater archaeology, Multibeam sonar, Remotely operated vehicle (ROV), Autonomous underwater vehicle (AUV), Tobishima island

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Introduction

According to James P. Delgado (1997:126-127), deepwater sites as archaeology's final frontier are the world's last great archaeological resources. Not only in Japan but also in other industrialized countries, deepwater archaeology has just started. There are two main reasons why many underwater academics have lately become interested in this branch of nautical archaeology. First of all, almost all deepwater archaeological sites are still intact and well-preserved, while shallow-water sites have often already been disturbed by natural and human activities such as erosion, commercial fishing, or treasure hunting. Secondly, the incredible innovation of underwater technology makes now deepwater sites more accessible. In particular, Autonomous Underwater Vehicles (AUVs) are the most essential. Once sites are discovered, drawing the precise plan of the sites distribution is the first step in underwater archaeology as well as in land-based archaeology. Even mapping shallow-water sites distribution by hand using divers, however, is not so easy: in the past it has taken up to 10 years to complete a project. By comparison, a newly-developed hovering type of AUV could manage to do the same job in a fraction of the time even in the deep sea.

No unanimous definition of deepwater archaeology exists. Delgado (1997:126) defines deepwater sites as submerged archaeological sites, usually shipwrecks, found at depths greater than 300 metres. On the other hand, John D. Broadwater implies that this field of study encompasses all sites deeper than 30 metres, saying a majority of submerged archaeological sites lie in coastal waters shallower than 100 feet. He stresses the hazards that divers face, including potential fatalities at depths below about 130 feet (Broadwater 2002:642-643). The deepwater archaeological survey around Greece, which was recently conducted by an international team, targeted submerged sites from 40 to 150 metres deep. Here again the team points out the fact that in deeper water conventional diving is impossible (Delaporta et al. 2006: 79-85). When we divide underwater archaeology into two, i.e. shallow-water archaeology and deepwater archaeology on the basis of divers availability, the depth of 50 metres is an appropriate and suitable border line. Along the similar ideas as for deepwater archaeology, Keith Muckelroy (1978:149-150) said,

Roughly speaking, this means depths in excess of about 50 metres. The upper part of this zone, down to about 300 metres at present, constitutes the range of commercial and naval mixed-gas-breathing divers, while the waters below that are at present visited only by submersibles, manned or unmanned.

Historical and Archaeological Background

Tobishima island on the Japan sea, belonging to Yamagata prefecture, lies about 40 kilometres to the northwest of mainland Japan. From the port of Sakata on the mainland it takes approximately one hour to the island by ferry. The island itself is relatively small; it covers an area of only 2.7 square kilometres, being 10 kilometres round in circumference. The census gives the population of the island in 2010 at 265 persons, but in 1949 at 1,621 persons. According to historical records, on the contrary, its population from the 17th to the 19th centuries showed the figure to be around 1,000 islanders, perhaps because of traditional infanticide. Tobishima island consists of three villages: Hoki village, Nakamura village, and Katsuura village. The easternmost Hoki village is said to be the oldest, but the smallest. Nakamura village used to be named Ura village, which is situated between Hoki and Katsuura villages. The southernmost Katsuura village is the largest, having the main port and some religious centres.

Katsuura village and its port used to be protected by a fort, which was built on the top of the cape of Ebisumaesaki, just to the southwest of the port. The historical or archaeological origin of the fort is unclear. It is surrounded by stone bulwarks, and it clearly aimed at defending the port. However, neither islanders nor historical documents could give us any reliable information. From the archaeological viewpoint, its construction technique seems to have come from Korea or from northern Asia. Village rumour suggests that at the Middle Ages a pirate group held this fort. According to a historical source, one local chief from the mainland attacked it in 1559. Because he would not have assaulted poor unarmed fishermen, his target was most likely sea bandits at this fort (Kasuya 2010:58-60). Although further historical study will be needed to conclude that pirates really did play an important role in Tobishima island, there is a strong probability of the fort being an ancient lookout or signal fire station. In any event, the vestiges of an old fort prove what a strategic position Tobishima island was on the Japan sea.

Around 6,000 years ago the island had already been inhabited as the archaeological excavations have proved. In the few thousand years following, however, it became uninhabited. The forefathers of contemporary islanders, who settled down in Tobishima island around 1,500 years ago, built some Shinto shrines, and since then the island has been one of the most important sacred and consecrated places, as well as a traffic point, on the Japan sea. Katsuura village has been keeping the Shinto shrine of Ogami Jinjya, which used to be named Oshaku-jima Jinjya. Oshaku-jima is a small uninhabited rocky islet, which lies to the west of Tobishima island. Women are not allowed to land on the islet. Since this islet still acts as the inner shrine or sanctuary of the Shinto shrine of Ogami, islanders even now revere the coastal waters including the islet and other tiny rocks. Partly because of these religious reasons, and partly because of unaffordable island economy, islanders have not permitted strange fishermen to trawl near to shore. This fact has ironically succeeded in helping to preserve the underwater cultural heritage around the island.

The most important industry on Tobishima island is fishing, with little or no agricultural activity on the island. As above mentioned, the island has been a seaborne strategic point on the Japan sea since ancient times. Trawl fishermen, who are not islanders, occasionally find earthenware pots of the 8th century by accident around the seabed between Tobishima island and the port of Sakata. One of them seems to have been manufactured in western Japan. The Shinto shrine of Ogami Jinjya keeps many wooden and stone guardian lion-dogs, which also seem to have come from Hokuriku region or from Korea (Kasuya 2010:54). From the late 17th century Tobishima island on seaborne trading routes grew in importance in naval trade as it became a principal port of call for *Kitamaebune*. *Kitamaebune* were wooden cargo ships, between 20 and 30 metres from stem to stern, which traded along the northern coast of Japan. The staple shipping commodities were oil, spirits, salt, herring, tangleweed, and rice. In particular, rice was the most important for *Kitamaebune* which touched at Tobishima island, because the port of Sakata on the opposite shore in the mainland became the leading rice exporting base of northern Japan, to the city of Osaka or to the capital of Edo.

Kitamaebune, which intended to call at the port of Sakata or to sail out of the port along the main seaborne route, occasionally waited for favourable winds at the port of Katsuura of Tobishima island. The port of Sakata at the

mouth of the River Mogami is not free from danger at all, because it is vulnerable to westerly or northwesterly winds and its depth of water varies from season to season. On the other hand, the port of Katsuura has ample depth of water, being sheltered from westerly or northwesterly winds by the cape of Ebisumaesaki. Historical records tell us that in 1792, for instance, 593 ships called at the port of Katsuura. Before the 19th century approximately 300 ships on average put in at the port per year. Most stopped from March to September (Nagai 1951:164-167). We could still observe some old mooring posts made of stone and some holes for wooden ones at the foot of the cape of Ebisumaesaki. However, the port of Katsuura is absolutely vulnerable to northeasterly or easterly winds. Hundreds of ships are said to have sunk just in front of the port.

Unfortunately, neither detailed historical record nor hard documentary evidence regarding maritime disasters or shipwrecks exists for the area, thereby reinforcing the importance of the underwater archaeological work. According to some fragmentary materials or local stories, maritime accidents around Tobishima island could be divided into two categories: drifting ashore and sinking. The former was by far the commoner of the two. In the cases of drifting ashore, ships sometimes lost their masts or rudders a good distance off Tobishima island, and they were driven ashore suffering significant damage. On the way to Tobishima island, they often threw huge amounts of cargo into the sea for safety reasons. Between 1685 and 1866 roughly 100 ships were recorded as having been wrecked (Nagai 1951:252-264). This figure includes both drifting ashore and sinking. Other than these 100 cases, however, no one knows how many ships really sunk around Tobishima island, in particular, before reaching the island. If islanders had not succeeded in rescuing neither crew nor cargo, they could not have written any records.

One of the typical drifting cases is as follows: a *Kitamaebune* left the city of Osaka on 1st March in 1820 carrying mainly cotton and salt, and then arrived at Tobishima island on 26th March. On 28th she tried to clear the port, but owing to strong easterly winds she was obliged to return to the port. Again on 30th she tried to do so, but by the winds she was drifted ashore (Nagai 1951:193, 256). Infrequently, only lifeboats whose mother ships had sunk a good distance off Tobishima island managed to arrive at Tobishima island. In 1804 a *Kitamaebune* leaving the port of Hakodate on 25th August was damaged by strong winds and lost the mast and much of its cargo just off

Tobishima island. The crews abandoned the ship and landed on the island by lifeboat on 4th September. Around 11th September, however, they rediscovered the deserted ship, and then towed her into the port (Nagai 1951:192-193, 255).

According to the Japanese maritime customary laws during the premodern era titled *Kaisen Shikimoku*, by the way, the coastal community which first found flotsam and jetsam could claim an ownership to them in order to appropriate them for the renovation of local religious buildings, only when all crews died or disappeared. As long as the very last one survived, on the other hand, they did belong to the cargo ship or the ship's owner. Usually, however, the captain or owner had to pay a generous remuneration in reward to the community's services. In 1832 the following local rules were issued: islanders at Tobishima island were invariably granted a right to receive 5 percent of cargos whose ship had drifted ashore and to receive 10 percent of jettisoned and sunken cargos (Nagai 1951:190). In addition, islanders who tugged half-wrecked ships on to the port normally succeeded in receiving a substantial amount of cash from captains by secret. Once one *Kitamaebune* was drifted ashore, Tobishima island fairly enriched. However, that was not always the case. When official or governmental cargo ships wrecked, islanders often received no remuneration at all. Sometimes they had to dry soak cargos for nothing.

Even after the era of steamers, the area of Tobishima remained a kind of ships' graveyard. In 1868 during the civil war of Boshin, two battleships belonging to the ruling Tokugawa shogunate came to Tobishima island. One was a wooden schooner, and the other was a steel steamer built in Glasgow. On 23rd October, the strong easterly wind blew against those battleships. The schooner succeeded in leaving the port of Katsuura, but the steamer named *Nagasaki-maru No. 2* was driven ashore by the wind. Fortunately all crews managed to land on Tobishima island, and later on to unload almost all weapons, navigation requisites, and personal belongings from the ship. On 23rd December a rescue ship arrived at Tobishima island, accommodated all crews and weapons, and left the island. When she sailed, some requisites and belongings such as a barometer, a binocular telescope, banners, and kitchen utensils were gifted to some islanders in gratitude for their kindness. More than for 100 years these heritages were kept in Tobishima island, but they were recently transferred to a museum at the city of Sakata. As the wreckage was

scrapped, however, there is no trace of *Nagasaki-maru No. 2* herself in the island at present (Kasuya 2010:158-159; Nagai 1951:214-219).

Preliminary Survey

In February 2011 TUMSAT and the ARIUA conducted the preliminary submerged survey around these waters, utilising a multibeam sonar system and a ROV. Typically side scan sonars and magnetometers are used for shipwreck survey, but old wooden shipwrecks may not have iron parts, and they may be submerged in sands or silts and covered. Thus a multibeam sonar, which can obtain a detailed profile of the seabed, is sufficient for these targets instead of side scan sonars. The along track resolution of the multibeam sonar which is used for the survey is 1 degree and across track resolution is 0.5 degree. Supposing that the depth is about 70 metres the footprint of one beam is 1.2 x 0.6 metres. The multibeam sonar provides 256 points of depth ranges within a 130 degree swath. These measurement data are stored together with GPS and Inertial Measurement Unit (IMU) data, which are roll and pitch angle of the sonar, in a computer on board of a survey boat, and a bathymetry is obtained by post processing. Multibeam sonar also provides backscatter data so the operator can see side scan like image in real time while doing survey.

The purposes of this multibeam sonar survey were as follows: 1) Explore shipwrecks and locate suitable sites of interest because the research team have no detailed information about shipwreck positions. 2) Obtain detailed bathymetry for AUV survey mission planning because a hovering AUV will cruise very close to the seabed at an altitude of 2 metres to take high-resolution images. 3) The bathymetry will be used for three-dimensional mapping with high-resolution mosaic image draped on. No one sensor is sufficient in itself but combinations of different sensors provide a very powerful mechanism for addressing the needs of the archaeologist working underwater (Singh, *et al.* 2000:319-328).

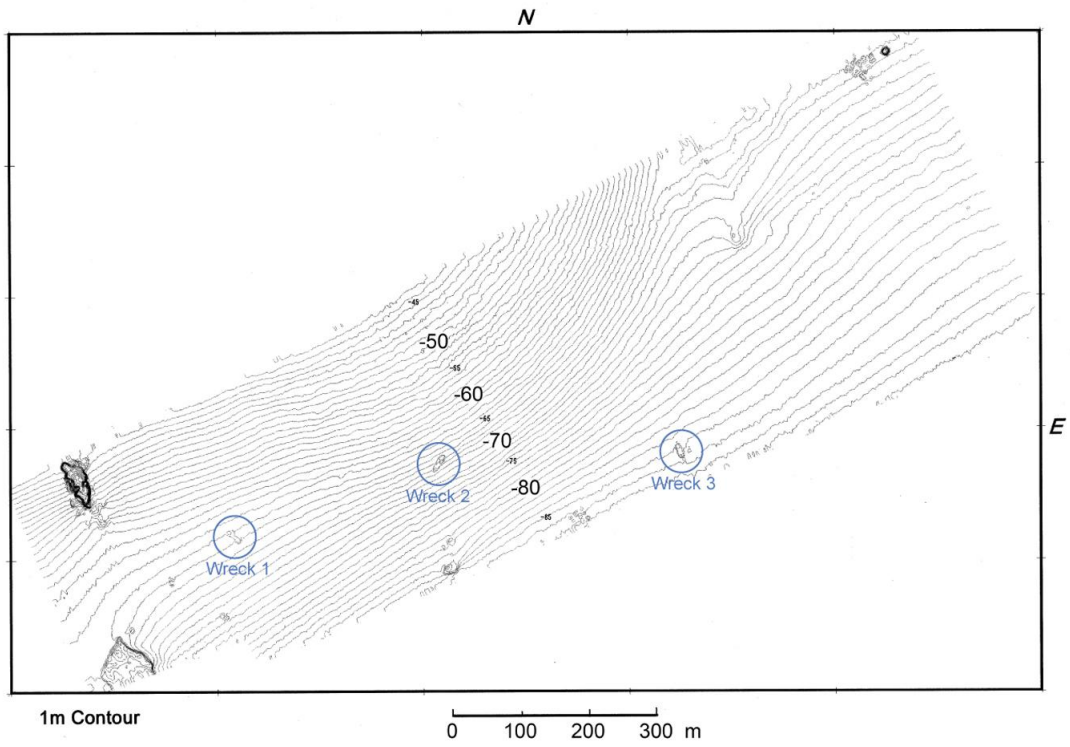


Figure 1. Bathymetry of the Survey Site near the Port of Katsuura (© TUMSAT)



Figure 2. A Shipwreck Found in the Survey Site (© TUMSAT)



Figure 3. AUV “BA-1” (© TUMSAT)

The team set the survey site just south-east off of the port of Katsuura. The size is about 400 x 1,500 metres and depths vary from 45 to 90 metres. The bathymetry contour map obtained by the survey is shown in Figure 1. The research team succeeded in detecting a few shipwrecks lying between 60 and 85 metres in depth on the seabed. One looks modern, but one seems to be potentially older. A small ROV was deployed from the boat to visually prove whether the objects are shipwrecks or not. Figure 2 shows a picture of the Wreck 2 in the Figure 1, which was taken by the ROV. The water current and wind was too strong for the small boat and the small ROV to reach from reaching the Wreck 1 and 3.

For the next step, an AUV (Figure 3), which has been designed and developed by TUMSAT, is planned to be employed for the visual mappings. The AUV is able to hover for observation by approaching very close to specified objects, and is equipped with high definition cameras. Two-dimensional and three-dimensional photo mosaics will be obtained, while the accurate bathymetry data shall be recorded using sonar and an optical ranging system mounted on the vehicle in order to create fully-covered and detailed site plans.

Acknowledgements

This research project is supported by the Canon Foundation Research Grant Program. The authors would like to thank Windy Network Corporation, Toyo Corporation and laboratory students for helping the multibeam sonar survey. We also would like to express our thanks to Q.I Corporation for kindly letting us use their ROV "DELTA-150" for visual survey of the shipwreck. An author would like to acknowledge Dr. Hanumant Singh at Woods Hole Oceanographic Institution for providing me an opportunity to stay at his laboratory to do research and giving me precious advises.

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