RUINS ON THE OCEAN FLOOR (SALVAGING THE KAIYO MARU)

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Surrounded by a shoreline exceeding 30,000 kilometers in length, and abounding with lakes of various sizes, Japan has countless fossils buried underwater.

Reputed to be the largest in Asia at the time, the Kaiyo Maru, a 2590-ton warrior ship, was constructed in Holland by order of the Tokugawa Shogunate in 1866. Just 2 years later, in 1868, it was submerged in 10 meters of water at Esashi, Hokkaido, after striking a rock during a storm.

This paper describes the research methods and results of excavation of the Kaiyo Maru remains, which provide invaluable insight into Japan's adoption of Western culture and modernization during that period.

As if symbolizing the disruption of the Tokugawa Shogunate, the Kaiyo Maru, Japan's largest shogunate battleship, was stranded off the coast of Esashi, Hokkaido, on December 28, 1868.

As the Meiji government was keenly interested in the modern equipment which was aboard the Kaiyo Maru, they tried to salvage it. However, after several unsuccessful attempts, the Kaiyo Maru was forgotten.

In 1968, the year of Hokkaido's 100th anniversary, the salvage of the Kaiyo Maru was planned as part of some memorial projects. Research was conducted by the submarine "Yomiurigo" on August 14 of the same year, and remains of chains and ship chandlery were confirmed. At the same time, it was stated in documents being used for the compilation of "The History of Esashi-cho" that vast remains of the Kaiyo Maru probably existed, but finances would not permit further execution of previously formulated salvage plans as one of the memorial projects.

Further research was planned for the following year by Hakodate Development Construction Office prior to the construction by the Hokkaido Development Agency of a new port at Esashi where the Kaiyo Maru is believed to have submerged. Research activities were ceased and a report submitted after copper board, chain, bullets and 20 other items were salvaged.

However, the Esashi-cho Education Committee was far from satisfied with the content of the report. After discussions with Hokkaido's
government and the Agency for Cultural Affairs, the wreckage of the Kaiyo Maru was reaffirmed as an important cultural property deserving of thorough investigation. Investigation into the current condition of the wreckage was subsequently planned under the guidance of the agency for cultural affairs.

As the result of the preparatory research conducted by myself and two other divers in August 1974 in which many more remains than expected were found on the ocean floor, we were convinced that full-scale excavation would unearth better results. However, construction of the new port had been completed and a breakwater which divided the estimated area of the Kaiyo Maru wreckage into inland and open seas had been built.

In June, 1975, the first full-scale excavation on the sea floor in Japan was finally commenced, with open sea research conducted mainly by the Esashi-cho Education Committee with support from the Agency for Cultural Affairs and Hokkaido Educational Agency, and inland sea research conducted by the Hokkaido Development Agency.

Peculiarities of Research on the Ocean Floor.

As no excavation of the ocean floor had been conducted in Japan prior to the full-scale Kaiyo Maru research in 1975, the only reference materials available were from American and European research.

After studying some of these references, I realized that there was little difference between land and sea excavations with the exception of the natural environment of the ruins. That is, different excavation equipment is necessary for underwater excavations, and excavators must dive rather than walk to the site. Obviously, ocean floor excavators must have sufficient experience in general excavation, adequate judgement to adapt to the situation, and basic knowledge of the characteristics of ruins -- sunken ships -- and the sea.
Should more advanced or complicated problems occur, it is possible to receive advice from research collaborators with relevant specialist knowledge. It is believed that a person capable of research on land is also capable of research on the ocean floor, the only problem being his/her diving skill. Recently, safe, easy to use diving apparatus has become available in Japan, thereby reducing diving skill requirements: the archaeological accomplishment of the excavator is the most important factor.

From Preparatory Research to Salvage.

Looking from the surface of the sea, we could clearly see the bottom more than 10m below; however, visibility was unexpectedly limited at the bottom. Due to poor light conditions and the presence of microscopic plankton, the deeper we dove, the less clearly we could see, making us aware that the efficiency of excavation & research work is greatly influenced by visibility.

Certification of Remains.

In order to certify the area where the remains are believed to be scattered, we adopted the simplest swim-research method for Kaiyo Maru preparatory research. Inside the bounds of the breakwater, we decided to dive within 2m of each other due to poor visibility, but unfortunately were unable to confirm the presence/absence of remains, and had difficulty seeing each other, even at depths of 4 - 6m.

As the open sea water was particularly clear, we had sufficient visibility to dive within 5m of each other at depths of 6 - 15m, and were able to confirm numerous remains of the wreckage on the ocean floor.

In subsequent research, we used underwater TV cameras, whose effectiveness varied according to the clarity of the water. Some could be suspended and controlled from a boat, thereby reducing divers' labor. Physiochemical detection equipment such as sonobuoys, magnetic detectors and metal locators were also used.
Due to inherent inadequacies in all types of single detection equipment, we decided to combine a variety of investigation methods. Detection equipment is being improved rapidly, and effective methods are likely to be developed in the near future.

Establishment of the Excavation Area & Estimation of the Necessary Research Period.

Although the actual area for excavation and the time requirements were determined at the preparatory research stage, it was difficult to plan accurately prior to commencement of actual excavation. Unlike on-land excavation, natural phenomena including ocean current, tides and depth of water, and factors such as whether or not a large boat can be used exert a major influence on the degree of difficulty. The lack of reference materials further hampered accurate assessment.

The area of Kaiyo Maru remains in the open sea is estimated to be approximately 16,000m², and 13,000m² in the inland sea. Remains are estimated to be concentrated in a 600m² area in the open sea, and in a 2,300m² area in the inland sea. These area were accordingly designated for excavation. Salvage operations were planned to be conducted over a 5 year period, with 60 actual working days per year and an annual budget of 30 million yen including expenses for desalination and preservation of remains.

Investigation and salvaging operations in the open sea were completed in seven years, but little progress was made in inland sea research during the same period. Thirty thousand remains were salvaged during excavation -- many of them heavy pieces, including a screw shaft weighing more than six ton.

Completion of inland sea research is likely to take a further five years due to the difficulties imposed by unclear water, and the high level of skill required for retrieving a huge hull still submerged there. Expenses to date have totalled three hundred million yen.
Mechanical Equipment for Research and Excavation Methods.

When the site can be confirmed by written records or transmissions, or by remains on the sea floor, determination of the research area presents no major problems. However, when no such information is available, it is necessary to excavate certain areas. Prior to trial excavation, a sonobuoy was used to accurately assess the depth of water, type of deposit (sludge, sand, pebbles or base rock) and the order and thickness of layers to 4 - 5m below the ocean floor. The appropriate depth for excavation and necessary tools may be determined in accordance with sonobuoy results.

It may be noted that the only tools used commonly for both land and ocean floor excavations are pencils and measuring tapes. There are only three methods of excavating the ocean floor -- scooping, suction, and sweeping. Scooping is used for salvaging remains from dense layers. Deposit is scooped into a bucket, emptied into a transporter boat, and disposed off-shore. Depending on the size, a bucket can usually scoop approximately 1m³. We found suction the most appropriate method for the bulk of our excavations, and therefore used the air lift frequently. To use the sweeping method efficiently, it is necessary only to create enough current to remove unwanted deposits. In broad, shallow regions, a screw manipulated from an anchored boat with a deep shaft was used to create sufficient current. The three abovementioned methods were combined in accordance with prevailing conditions.

Recording Methods.

Recording methods do not vary greatly from those of on-land excavations. However, water must be very clear to obtain good results from transit work or plane table measurements. It is best to set up ropes & scaffolding pipes sectionally and directly on the ocean floor for use as datum lines. Absolute positions can be measured on the ground by checking buoys located at the intersecting points of pipes. Although minor errors occurred, we had expected to gain relative rather than absolute positions of remains. Both methods required major time and labor expenses. Although diving time may be effectively reduced by photography, we were unable to use it due to the uncleanness of the water.

During the excavation of ruins in the shallow part of Lake Biwa where Jomon and Yayoi wares are scattered, the area of the site (20m²) was surrounded with vinyl sheets, as was an additional 5m² area within the site area. For this experiment, the sedimentation chemical PAC which is used for the purification of city water was successfully used to submerge floating particles, and to clarify the water.
Salvaged remains must be desalinated immediately after recording. Prior to commencement of the Kaiyo Maru excavation operations, there had been no research on desalination of antiquities. With cooperation from both Tokyo and Nara National Research Institute of Cultural Properties, the establishment of appropriate methods is underway.

The remains of Kaiyo Maru are made up of six types of metal, six types of organic substances, three types of ceramics and other complex substances including those forming objects ranging from an iron cannon and cannonball to Japanese paper.

As due caution must be taken to avoid deterioration of remains according to their composition, it is wise to keep them safely on the ocean floor until preparation is fully completed.
Research conducted even at 100m above sea level is not difficult if there are roads to facilitate transportation of equipment. Contrarily, the entire procedure, from preparing research to preserving and processing remains, is extremely expensive even if conducted at only 10m below the ocean floor.

In spite of this, there are still many valuable objects belonging to our cultural heritage, which cannot be found in on-land archaeology, still lying at the bottom of the sea. In this country, although the study of underwater archaeology has only just begun, and the number of researchers is limited, I believe that it will become an important archaeological field in future, and plan to continue my endeavours zealously.
LITERATURE CITED


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