The Introduction of Conservation Treatment of Maritime Artifacts in Korea

Dr Whan-suk Moon[1]

Abstract

Since 1976, the underwater excavation program, which began with the Shinan ship, has yielded some 94,500 relics and eleven shipwrecks (including two foreign ships) from 18 sites in Korea. To conserve each material appropriately the artifacts salvaged from the sea were safely conserved on site and then moved to the laboratory. In particular the hulls of the ships were salvaged by separated pieces. Treatment of PEG 2-step method was applied for several years. The two ship hulls (Shinan and Wando) have been displayed after conservation treatment, and one is being prepared for a new display.

We first tested pre-conservation treatment for safe stabilization and then have applied the best method of pre-study results to the ceramics, wooden tags, metallic objects, bones, crops etc. We excavated many bamboo artifacts after 2009, and are currently studying pre-conservation treatment.

1. Introduction

The dominant maritime relics found in Korea are shipwrecks and their artifacts. They represent specific points in history, which like time capsules, clearly assert the culture of previous eras. The number of declared maritime discoveries in Korea has spanned approximately 242 cases since 1971. Underwater scientific research began in 1976 with the excavation of the Shinan artifacts. To date, there have been 18 excavations of underwater sites which have yielded 94,500 artifacts, 11 vessels, including 9 Korean vessels from the Goryeo dynasty, as well as 2 Chinese vessels. Underwater salvaging was implemented after determining which areas had the greatest spread of artifacts.

The Mokpo Conservation Center was established for the conservation of the Shinan shipwreck site in 1980, and has taken full charge of the relics since then. This paper describes the introduction of conservation treatment of maritime artifacts salvaged in Korea.

[1] Chief of Underwater Excavation & Conservation Division, National Research Institute of Maritime Cultural Heritage (NRIMCH), KOREA, moon118@hanmail.net

2. Conservation treatment and management of maritime artifacts

2.1. Types of underwater artifacts

So far, the salvaged underwater artifacts are predominately the vessels themselves as well as the porcelains contained within the site. In the case of the Shinan shipwreck, interest from several international maritime institutes led to its collaborative excavation in 1970. During that excavation, 20,000 Chinese ceramics, red woods (native plants in India and west Asia), 28 tons of coins, pewter bars, wooden tablets (shipping manifest), and the vessel kitchen utensils were recovered.

At the Taean underwater site over 29,000 Goryeo porcelains, grains, salted foods, and small portable dining tables made of bamboo were salvaged. Scholastically speaking, the ship's manifest in the form of wooden tablets were of the most interesting. These recorded a sailing time, an owner of the cargo ship, the quantity of goods, as well as other important data. Also in the Mado vessel excavation at Taean, more than 62 stone anchors were salvaged, which demonstrates the frequency of marine accidents in the area. Historical documents from that era note a lack of national finance as a direct result of these frequent maritime accidents.

2.2. Conservation treatment of an organic materials

2.2.1. Conservation treatment of old vessels

If it is the case that a salvaged ship is not identified in Korea, then it is named after the region (the sea) where it is excavated. To date, 10 vessels have been salvaged, which includes the Shinan, a 14th century merchant vessel from China.

Salvage operations on Mado vessel number 3 are currently underway. The vessel's hull was normally made of pine, but the nails were made of more durable oak. Because wooden nails were used in the vessel's construction, this made it easier to separate the boards during the salvage operation. The boards were then cut into smaller sections and labeled. Similarly, the Shinan was cut into four sections to facilitate its recovery. The base plate of Mado vessel number 2 was also made of oak. The Jindo ship was constructed with camphor wood.

In the first stage of the preservation process the hulls of the ships were placed in a desalination tank for 2~5 years. A consolidation process was also necessary because of serious deterioration. The ships had been in tidal flats for hundreds of years attacked by marine borer, bacteria, and soft rot. The percentage of water content was up to 500%. The outer surface was substantially deteriorated, but the interior remained consistent to that of green woods.

In the consolidation process, the wood is first impregnated with 5~20% of PEG 400 (Polyethylene glycol) at 40℃, to begin the consolidation with PEG. In the second stage the wood is saturated with 25~70% of PEG 4000 for 5~10

years. The conservation process of two ships is now complete, and they are currently being exhibited. The third ship is being stored after the second stage of the consolidation treatment. The fourth ship is now being dried after consolidation. The Jindo ship, which is made of camphor wood, requires special care and is being dried using the fixative FRP to prevent deformation and warping. The drying conditions are being closely monitored.

Figure 1. Storage and desalination in pool (NRIMCH)

Figure 2. PEG treatment tanks for salvaged ship (NRIMCH)

Figure 3. Display condition after reconstruction of Shinan ship (NRIMCH)

2.2.2. Conservation treatment of wooden tablets

From the underwater excavation at Daesom, Taean in 2007, bamboo tables and wooden tablets (ship's manifest), which describe the type of cargo, the quantity, the place of shipment, and the receivers were excavated. These tablets and tables were constructed with bamboo, pine, ash, and chestnut wood. Several kinds of small tools were used to remove mud from the surface of the wooden tablets, and the wood was immersed in a 2% solution of EDTA-2Na. Next, a low concentration (5~40%) of PEG#4000 (in t-butanol) was used to

make the inscriptions on the wood more visibly distinct for accurate translation. After that, a vacuum freeze-dry conservation treatment was applied. For sufficient stabilization of the tablet dimensions, the PEG density of the immersed tablets was gradually increased in stages over 15~20 days.

2.2.3. Conservation treatment of crops

At the Taean Mado 1 site many crops such as rice, buckwheat, and millet, were salvaged. Only the husks remained because the crops' main component of starch had dissolved and disappeared after more than 800 years of being underwater.

The safest conservation method for the crops, was chosen among the waterlogged wood conservation treatments, using Sucrose, PEG immersion, PEG (in t-butanol), a vacuum freeze-dry conservation treatment, an high quality alcohol method (cethylalcohol,1 : 1 = cethyl alcohol : stearyl alcohol), which involved distoetion, color change, by visual observation, and surface observation using a stereoscopic microscope. It was determined impossible to keep the logged crops in a consistent dry form without conservation treatment first. Shrinkage was evident at 9.34% in length, and 26.0% in width. In such cases, it is essential to apply conservation treatment prior to the drying process. The formation and color of crops were well preserved in high quality alcohol method (cethylalcohol). Also the impregnation was concluded in 70% grade, since there was no difference between 70% and 100%.

Figure 4. After conservation treatment (NRIMCH)

2.3. Conservation treatment of metals

Most of the salvaged metals at the site were shipboard utensils such as metal pots, copper dishes, and spoons. These were processed for conservation treatment by initial examination, desalination, stabilization, consolidation and restoration. In the case of metal pots, 0.5M NaOH was used to desalinate and eliminate rust on it. Specifically, cast metals might have been severely damaged

because cracking can occur during the drying process if the artifact is not prepared properly. Cracking was prevented and reduced with the addition of adhesive. 0.1M Sodium Sesquicarbonate was used to desalinate and wash the bronze dishes and spoons. It was also noted that a Citric acid wash easily removed debris from coins; especially debris on the many salvaged coins dating back to the Chosun Dynasty. The coins were then treated to prevent corrosion, dried, and consolidated to complete the conservation process.

2.4. Conservation treatment of pottery

As this paper previously mentioned, the staple of underwater excavation is porcelains. The salvaged pottery was mostly intact with defined forms, but when it was damaged, restoration was completed on speculation and through reconstruction as best could be determined. The pottery that had shells fixed to their surfaces were placed in HCl, and the shells were removed using a bamboo knife. They were set in 60℃ immersion for desalination. After that the acid was removed by placing the artifacts in flowing water. Fragments of similar shaped porcelains were recovered in large quantities, thus making the reconstruction process in the laboratory difficult. However, the more technical and high quality fragments, such as inlaid celadon, were restored and colored as well.

2.5. Management and subsequent change research after conservation

There are two methods for managing finished conservation artifacts in Korea; one method is to exhibit the artifacts, and the other method is to keep the artifacts in storage. The latter method keeps the relics stabilized at a constant temperature and humidity. The Shinan and Wando vessels are currently on exhibition after completion of the conservation treatment. However soon after the exhibition of the Shinan vessel, corrosion began to occur for two reasons. First, the metal nails the shipbuilders used to connect the parts of the vessel began to corrode. Secondly the PEG used as consolidant appeared to increase the metal corrosion. This type of phenomena was observed in the *Vasa*, *Mary Rose* timber, *Batavia* and other vessels. Experts are now conducting investigative research to help prevent this sort of event from occurring. Likewise, we have also been monitoring the state of change regularly since September 2010.

The two ships in exhibition are currently being monitored. This involves measuring temperature and humidity, time-lapsed photographic comparison to check the state of change, and illumination photometry. Oxidization of the Shinan ship became apparent about a year after it was first exhibited in 1995. PEG was leeching out of both the Wando and Shinan vessels. But until currently the amount of the PEG has been small enough to be removed. Based on the monitoring research results, our Institute is assured of the budget to improve the constant temperature and humidity of exhibition spaces.

3. Conclusion

To sum up, this paper has dealt with the introduction of conservation treatment of underwater excavated artifacts in Korea. Conservation of underwater relics began with the Shinan vessel excavation. At first, our Institute was in charge of vessel conservation treatment only, but has treated all types of other artifacts as well. The primary step in conservation of salvaged artifacts is on-site preliminary processing, and the treatment of the artifacts prior to laboratory applications. In Korea, underwater archaeologists and laboratory conservators must work together to ensure complete treatment and conservation of the Korean maritime heritage. For this purpose, a new conservation facility in Taean near the excavation site, now processes everything immediately in conjunction and cooperation with the conservation treatment centered at our division.

However, even with the addition of this new facility at Taean, the diverse variety and large amount of materials makes it difficult to deal with conservation of all artifacts perfectly. For this reason a collaborative research project has been instituted through an exchange program of personnel with other foreign maritime conservation organizations; Western Australia Museum being one. Both institutions are working on research projects set up together. We are specifically trying to solve the corrosion problem in the Shinan vessel. This will improve not only our capacity to better treat maritime artifacts, but also their overall safer conservation treatment in general through global cooperation and exchange of knowledge.

Bibliography

Bowens, A., (ed) 2009	Underwater Archaeology - The NAS Guide to Principles and Practice..
Cultural Heritage Administration. 1984	The Wando Wreck Underwater Excavation.
Cha, M. Y., in press	Conservation of shipwrecks in Korea, International Meeting on Protection Presentation and Valorisation of Underwater Cultural Heritage, UNESCO and Chinese Academy of Cultural heritage, Chongqing, November 2010.
Cha, M. Y. and Yonn, Y. H., 2011	Conservation of Waterlogged Archaeological Rice Seeds. The 33rd National Conference of the Korean Society of Conservation Science of Cultural Heritage, Korea: 123-124.
Cultural Heritage Administration. 1988	The Shinan Wreck Underwater Excavation

Mokpo Conservation Institute for Maritime Archaeological finds. 1993	Report on The Excavation of Jindo Log Boat.
Moon, W. S., B. K. Kim, I. J. and S. S. Yang., 2004	On-Site Conservation of the Underwater Objects Excavated, Conservation Studies 25, National Research Institute of Cultural Heritage.
National Maritime Museum. 1999	Report on The Excavation of Talido Shipwreck.
National Maritime Museum. 2004	The Conservation and Restoration Report of Ship.
National Maritime Museum. 2005	The Underwater Excavation of the sea off Sibidongpa Island, Gunsan.
National Maritime Museum.Sinan-gun. 2006	The Excavation of Anjwa ship.
National Maritime Museum. 2008	Ansan Daebudo Ship Sea Site Submarine Excavation.
Nation Research Institute of Maritime Cultural Heritage. 2009	Taean Treasure ship I,II - Submarine Excavation.
Pearson, C., 1987	Conservation of Marine Archaeological Objects.