

Excavation Methods and Results of the Underwater Cultural Heritage in Korea

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ABSTRACT

The excavations of underwater cultural heritage (UCH) in Korea are conducted mainly after surveying the waters where they are found, which is only conducted by the National Research Institute of Maritime Cultural Heritage (NRIMCH). Excavation of Sinan shipwreck (1976-1984) was the starting point of academic excavation on UCH. At that time there were no professional divers, technology and equipment, so it was entirely dependent on the support of the Navy (SSU), until the first season underwater excavation of Bianndo at Gunsan (2002). However, from the second season excavation of Biando, when support from the navy became difficult, an excavation team was formed within the NRIMCH to acquire underwater investigation techniques and establish a specialized investigation system. Now its expertise in underwater excavation is improving by operating an exclusive ship for underwater excavation, researching an investigation technique according to the sea environment, and establishing an underwater excavation, conservation, and exhibition system at Taean.

Keywords: NRIMCH, underwater excavation, removing mud, Taean site.

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INTRODUCTION

Academic underwater excavation in Korea has been begun with the excavation of Sinan shipwreck (1976-1984). The discovery of six pieces of Chinese pottery caught in a fishing net served as an opportunity for investigation. No professional divers, technology and equipment existed, which made it entirely dependent on the support of the Navy (SSU), until the first season underwater excavation of Biando, Gunsan (2002). After the second season excavation of Biando, when support from the navy became difficult, an excavation team was organized within the NRIMCH in order to acquire underwater investigation techniques and establish a specialized investigation system. Recently, with operation of an exclusive ship for underwater excavations, research of exploration technique by targeted areas, and establishment of system of underwater excavation, conservation and display of Taean, expertise in underwater excavation has improved. In addition, it reveals new information not indicated in the historical records, which triggered great interest on the underwater excavation.

This paper briefly introduces accomplishments of the NRIMCH and how it became the one and only institute specialized in underwater excavations in Korea.

UNDERWATER ENVIRONMENT AND EQUIPMENT IN KOREA

Underwater environment of Korea

The sea of Korean Peninsular has been a place of life and a transportation route to the outside since prehistoric times, in particular, since the Goryeo Dynasty (918-1392), when the shipping system through the sea route was established, and grains and special products gathered in the provinces were transported by sea or river to Gaegyeong or Hanyang, the capital of the time, rather than land transportation. However, considering the sea conditions of the Korean peninsula, which is high in the east and low in the west, the southwest coast has many islands and reefs are scattered. The current is also fast, causing

many difficulties in sailing. As a result, marine accidents of ships likely occurred frequently.

Fortunately, mud flats have developed in the West Sea, which was the gateway to maritime traffic, and has an environment in which the history of our ancestors, the by-products of these marine accidents, can be preserved. However, in the West Sea, where most of the underwater excavations take place, the tidal difference is large, more than 4 meters (m). Underwater visibility is close to zero because the bottom of the seabed is tidal flat, and the current is fast. In addition, the water temperature drops in the winter season from November to April, making diving surveys difficult. Excluding Taean and Jeju, most of the sea areas excavated so far were in adverse sea conditions, where visibility was not secured and currents were fast, requiring investigation only during the platform tide.

Excavation equipment and methods

The governmental organization called the Underwater Archaeology Division was established in 2007, which made the frames of managing cultural heritage led by the government. Since then, for scientific and systematic underwater excavation, the NRIMCH has secured a Multibeam Echo Sounder and developed the vacuum soil removing system. This suits our underwater environment, it safely collect fine millets from underwater. Excavations are carried out using the Nurian Ship or barge.

Table 1 indicates a brief summary of the equipment used for underwater excavation and method for major underwater excavation areas so far.

Table 3. Summary of method of representative underwater excavations

No.	Site	Excavation Methods	Underwater Conditions
1	Sinan	-Iron grid installation: area excavation -Underwater work: Ship Salvage Unit of Navy -Artifact classification: Qurator -Mud discharge method: air lift, etc. -Surrounding survey: Circular	-Field of view: 0 m -Tide: 3.5 knots -Average water depth: 23 m
2	Wando	-Rope grid installation: area excavation -Underwater work: private divers (veterans participating in Sinan excavation) -Artifact classification: qurator -Mud discharge method: air lift, etc. -Surrounding survey: circular	-Field of view: muddiness -Tide: 2-3 knots -Average water depth: 15 m
3	Gunsan Biando	-1st excavation: navy (underwater work) -2nd-5th: first self-excavation by the NRIMCH -Survey by area: recovering exposed artifacts (in abandoned waterways)	-Field of view: muddiness(>1m) -Tide: 2-3 knots -Average water depth: 16 m
4	Gunsan Sibidongpado	-Rope grid installation: area excavation -Underwater work: qurator etc. -Mud discharge method: water jet, air lift -Underwater camera recording, drawing -Lifting a ship using a crane	-Field of view: 1-4 m -Tide: 1-2knots -Average water depth: 15 m

5	Gunsan Yamido	-Rope grid installation: area excavation -Mud discharge method: water jet, air lift, vacuum pump. etc. *Development of vacuum control system for mud Removing (low water depth) -Underwater camera recording, drawing *2006 year: recovering exposed artifacts *2007-09: excavation of re-buried artifacts *Large barge - diving facility, mud removing system, workroom etc. *Survey ship: on-site operation "Seamuse"	-Field of view: 1-4 m -Tide: 1-2 knots -Average water depth: >10 m
6	Taeon shipwreck	-Rope grid installation: area excavation -Mud discharge method: water jet, air lift, -Underwater camera recording, after laboratory drawing *Small barge-diving facility, workroom etc.	-Field of view: 2-3 m -Tide: 1-2 knots -Average water depth: 12 m
7	Taeon Mado no. 1-3 shipwrecks	-Rope or iron installation: area excavation -Vacuum control system for mud removing -Underwater camera recording, after laboratory drawing *Large barge-diving facility, workroom etc.	-Field of view: 2-3 m -Tide: 1-2 knots -Average water depth: 5-19 m
8	Taeon Mado no. 4 shipwreck	-Underwater Excavation ship "Nurian (290ton)" *Diving facility, mud removing system, workroom etc.	-Field of view: 2-3m -Tide: 1-2 knots -Average water depth: 17 m
13	Jeju Shinchangri	-Small boat-mud removing, diving -3D drawing -Nurian ship: resident support	-Field of view: 10 m -Tide: 1-2 knots -Average water depth: 3-5 m

RESULTS OF UNDERWATER EXCAVATIONS

The results of underwater excavation at each site are summarized in Table 2.

[Table 4] Excavation of UCH in Korea (Dec. 31. 2022)

No.	Site	Year	Recovered Artifacts
1	Sinan shipwreck	1976-84	22,000 pieces of porcelain, one Chinese trading shipwreck, 28 tons of coins in the fourteenth century
2	Jeju Shinchangri	1980,1983, 1996, 2019-2021	Metal accessories, 1,294 pieces of Chinese porcelains in the twelfth to thirteenth centuries
3	Taeon Peninsula	1981-87	About 40 pieces of Goryeo celadons, Joseon white porcelain, etc.
4	Wando shipwreck	1983-84	About 30,000 pieces of porcelains, crew supplies in the twelfth century
5	Jindo shipwreck	1991-92	One Chinese Log shipwreck in the thirteenth to fourteenth centuries

6	Muan Doripo	1995-96	638 pieces of Goryeo celadons with gray inlay in the fourteenth century
7	Mokpo Dalido shipwreck	1995	One Goryeo shipwreck in the thirteenth to fourteenth centuries
8	Gunsan Biando	2002-03	2,939 pieces of Goryeo celadons in the twelfth to thirteenth centuries
9	Gunsan Sibidongpado	2003-04	8,122 pieces of Goryeo celadon, one Goryeo shipwreck in the twelfth century
10	Boryeong Wonsando	2004-05	Celadon incense burner, etc. in the thirteenth century
11	Sinan Anjoado shipwreck	2005	Four pieces of Goryeo celadons with gray inlay, one Goryeo shipwreck in the fourteenth century
12	Gunsan Yamido	2006-09	4,547 pieces of Goryeo celadons in the twelfth century
13	Ansan Daebudo shipwreck	2006	Pieces of shipwreck in the twelfth to thirteenth century
14	Taeon Taeon shipwreck	2007-08	25,043 pieces of Goryeo celadons, one shipwreck in the twelfth century
15	Taeon Mado no. 1 shipwreck	2008-10	940 pieces of Goryeo celadons, one shipwreck in the thirteenth century
16	Taeon Mado no. 2 shipwreck	2009-10	974 pieces of Goryeo celadons, one shipwreck in the thirteenth century
17	Taeon Wonan Beach	2010	531 pieces of Goryeo celadons in the twelfth to thirteenth centuries
18	Taeon Mado no. 3 shipwreck	2011	336 pieces of Goryeo celadons in the thirteenth century
19	Taeon Mado	2012 2014	956 pieces of Goryeo celadons, etc.
20	Incheon Yeongdeungdo shipwreck	2010, 2012~13	723 pieces of Goryeo celadons, etc., one shipwreck
21	Jindo Myeongryangdaechep	2012-14 2016-17 2019-21	1101 pieces of Goryeo celadons, etc., in the first to twentieth centuries
22	Taeon Mado no. 4 shipwreck	2015	400 pieces of inlaid porcelains, one shipwreck in the fifteenth century
23	Ansan Daebudo no. 2 shipwreck	2015	76 pieces of Goryeo celadons, one Goryeo shipwreck
24	Taeon Dangampo	2017-18	65 pieces of Goryeo celadons
25	Yeonggwang Nakwoldo	2018	30 pieces of Goryeo celadons
26	Taeon Mado	2018 2019	159 pieces of Goryeo celadons, etc.
27	Gunsan Seonyudo	2022	570 pieces of Goryeo celadons, etc.

Sinan Site

Excavation of Sinan shipwreck took place from 1976 to 1984. This was the beginning of underwater excavation in Korea. The discovery and report of six pieces of Chinese porcelains caught in the fishing net triggered the excavation. At the time, because of the thought that such high-quality celadons could not be recovered from the sea, illegal robbery occurred before the excavation, and in the process of interrogating the robbers who were smuggling, it was recognized that more artifacts were buried, which lead to underwater archaeology excavation.



Figure 1. Underwater excavation by the Navy

The 11 seasons of excavation projects were conducted for nine years with the support of naval divers. As a result excavations uncovered about 20,000 pieces of porcelains from the Song and Yuan Dynasties of China, 28 tons of coins, and about 1,000 pieces of rosewoods (premium wood) including the ship hull. The weight engraved with Gyeongwonro (Ningbo, Zhejiang, China in today) became the critical resource that identified where the ship was departed. Also, a wooden tablet with the reign of the Yuan Dynasty (Jichisamnyeon 1323), Japanese names, and Japanese temple names were discovered, which was helpful to identify the year of sail and destination. Considering the characteristics of artifacts, the Sinan ship was wrecked near the coast of Korea in 1323 CE while sailing from Ningbo, China to the Port of Hakata in Kyushu, Japan. The excavation of Sinan Shipwreck clarified the shipbuilding technology and trading ships of the medieval times which had only been assumed based on historical records and told us the seaborne trades of East Asia.

Taeon site

Major underwater excavation projects were conducted at the Taeon. As a result of the excavations, five shipwrecks and 29,344 pieces of artifacts were discovered. In the waters of Mado, whenever divers went down to the water exposed artifacts are recovered, which helped to set excavation zones for annual excavation projects.

In May 2007, after receiving the news of the discovery of Goryeo celadons by webfoot octopus (*amphioctopus fangsiao*) in Taeon Sea, an urgent survey was conducted immediately. As a result, nine pieces of celadon were collected from underwater at a depth of about 12 m and scattered celadon sherds. In order to prevent robbery and damage from fishing activities, as the targeted area was known to the public, it was selected as a cultural heritage protection zone to prevent public diving. Celadons were excavated in 2007 and the shipwreck and relevant artifacts in 2008. In the excavation, Goryeo celadons, which occupied most of the artifacts, were packed with a wooden containers and buffer straw, and wooden tablets written in black ink were also found. We interpreted the records to find out that celadon were sent by someone who lived in Tamjin (today's Gangjin) and the recipient lived in Gaegyeong. The wooden tablets showed us the production area of celadon, as well as the departure port, the trade relations, the transporter, and the loading units.

In 2009, the excavation of Mado no. 1 shipwreck discovered the cargo tags that recorded the kinds of grains, wooden and bamboo tablets, bamboo products, salted seafood, dried seafood, shipping and departure dates, ports of departure, positions and names of senders and recipients, which indicates the features of the shipwreck and artifacts. The information told us that the Mado no. 1 shipwreck was a transporting ship of the Goryeo Dynasty that collected grains and salted seafood from Haenam, Naju, Jangheung, and Yeongam between the winter of 1207 CE and the beginning of 1208 CE and transported them to the government officials in Gaegyeong.



Figure 2. Exposure status after removing mud

In the excavation of Mado no. 2 shipwreck in 2010, various types of artifacts were found, including a transporting ship from the Goryeo Dynasty, a celadon prunus vase, grains, wooden products, and bamboo tags that recorded the type and recipient of the cargo. The neck of the vase had a bamboo tag that stated ‘Jung Bang Do Jang Gyo Oh Mun Bu / Taek Sang Jeong Mil Seong Jun Bong-重房都將校吳文富/宅上精蜜盛樽封’, which means filled with honey and sealed for Oh Mun Bu, Dojanggyo (low-class government officer) of Jungbang. This told us that prunus vases were called Jun and used to store and transport valuable ingredients such as honey and sesame oil.

As a result of excavating the Mado no. 3 shipwreck in 2011, the NRIMCH discovered various artifacts including 32 wooden tags, 28 pieces of porcelains, grains, deer antlers, Korean chess stones, salted seafood, dried seafood, and textiles. This is also a transport ship from Yeosu in the southern part of the Korean Peninsula to Ganghwadoseong (provisional capital during the war with Mongolia). The Mado no. 3 shipwreck is 12 m in length, 8 m in width, and 2.5 m in depth. It is the most well-preserved shipwreck hull including the bow and stern, the sail pole, and the structure that fixes the sail, which provides details of ship structure and the shipbuilding technology of Goryeo Dynasty.

In 2015, we excavated another shipwreck at Mado, Taean. All four ships excavated at Taean belong to the Goryeo Dynasty, but 111 pieces of white porcelain of the eighteenth century were discovered right next to them and they were highly likely to belong to the Joseon Dynasty. As a result of excavating the Mado no. 4 shipwreck, it was found that the celadon with gray inlay and the wooden tags indicate the ship was wrecked in the fifteenth century (1417-1421 CE). This is 300 years earlier than white porcelain. We concluded the Mado no. 4 shipwreck was wrecked first and another ship transporting the white porcelain was wrecked later. The wooden cargo tags indicate the port of departure was Yeongsanchang, Naju and the ship transported grains to Gwangheungchang, Hanyang. All excavated shipwrecks of the Goryeo Dynasty had one mast at the center of the hull. The exception is the Mado no. 4 shipwreck, which had mast holes at the bow and center for two sails.

Also, the ships of the Goryeo Dynasty had one level of *Dangabbul* (used to fix the sail), but the Mado no. 4 shipwreck had five levels of *Dangabbul* on each *Garyong* (reinforcement material for the outer plank). This shows the robust development of shipbuilding techniques to fix the mast.

As a results of broad survey to Mado site, various artifacts such as pottery, anchor stones, and metals

from different eras and countries such as Goryeo, Joseon, Song, Yuan, and Qing dynasties were recovered. What is noticeable is the anchor stones. We have excavated 153 pieces of anchor stones used to anchor the ships. Most stones were natural stones, but three pieces were artificially dressed stones. Dressed stones were anchor stones mostly used in China. Also, we found a large number of porcelains marked Jeong (鄭), Ju (朱), or Gang (綱), indicating the international merchants of the Song and Yuan Dynasties, to show that Goryeo traded with the Song and Yuan Dynasties and prove the historical fact that this sea route was critical for international trade.

CONCLUSIONS

It has been 46 years since the start of scientific underwater excavation in Korea. With the researcher's active challenging spirits and the full state-led excavation system, it produces great results. In the research, UCH is described as a time capsule that represents specific time and region and provides information not recorded in historical records.

NRIMCH is the one and only UCH institute mandated to investigate the waters of the Korean Peninsula, doubling the size of or country, it is still insufficient to meet the demand for research. Deep-sea surveys are still inaccessible, but through training and securing rebreather diving equipment, a foundation is being laid to expand the research area from the coastal waters to the deep seabed. In order to accomplish the goals, it is seeking to acquire deep-sea survey technology through international exchange. In addition, as a four-year project from 2022, the design and field operation of unmanned ASV (Autonomous Surface Vehicles) that detects UCH is being promoted. All of these are expected to serve as a foundation for expanding UCH research efforts, such as the relationship with maritime culture and the investigation of the maritime silk road, beyond discovering the potential UCH of the sea.

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