Government Publications Registration Number
11-1550110-000060-01

The Rebirth of the Big Jar-coffin

Records on the Production of the Big Jar-coffin

Naju National Research Institute of Cultural Heritage

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Preface

The Rebirth of the Big Jar-coffin, Records on the Production of the Big Jar-coffin, published in 2018 by the Naju National Research Institute of Cultural Heritage, was republished as this book in English.

Various cultural heritages showing traces of the ancient society have been found along Yeongsangang River situated in the southwestern part of the Korean peninsula. One of the most representative cultural heritages found in the area is the jar-coffin.

The jar-coffin is a type of burial facilities made of jars. In the ancient Yeongsangang River basin, large jar coffins in particular were used for burial in ancient tombs. The jar-coffin was taller than a grown-up man and too heavy to be carried by one person. Two parts combine together and become a huge jar-coffin. Jar coffins resemble eggs. It suggests that ancient people in the Yeongsangang River basin buried a dead person in a huge egg, wishing he or she could be reborn.

The burial custom using the big jar coffins found in the Yeongsangang River basin shows the unique local characters. The Naju National Research Institute of Cultural Heritage is conducting various research projects based on such characteristics. One of our projects is big jar-coffin production technology restoration. Since researchers used to have doubts regarding the large jar-coffin production technology, many people initially paid attention to whether it was possible to make a big jar-coffin. Based on our excavation of jar-coffin kilns from the kiln site in Oryang-dong, Naju and our close observation of the jar coffins found in the ancient tombs, we have started making jar coffins.

We have conducted several experiments to restore various properties of jar-coffin production technology. Our research results were published in 2 books until last year.

This book is intended to publicize our research performance to the public in an easier way. In this book, we are going to introduce briefly the features and production process of jar coffins found in the Yeongsangang River basin. In addition, the book shows a variety of events that happened during the production experiments through the stories of participants in the production technology restoration research project including researchers, master artisans, and ordinary people.

We hope that the Research Institute's research performances are disclosed in an open space and shared by everyone, instead of being stuck in the bookshelves. Lastly, may The Rebirth of the Big Jar-coffin serve as the initial stepping stone for future related studies.

September 2020

Head of the Naju National Research Institute of Cultural Heritage

Im, Seung-gyeong

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Chapter 1

The Rebirth of Big Jar-coffin, Records of Time

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First

Lifetime of the Jar-coffin

1. What are Jar Coffins?

2. Big Jar Coffins of Yeongsangang River Basin

What are Jar Coffins?

In ancient times, there was a funeral custom of putting the body and bones of a dead person in jars. Jars used as coffins are called jar coffins; the tomb where a jar-coffin is buried is called a jar-coffin tomb.

In Korea, jar coffins had been used for funerals since the Neolithic age, and they were mostly used widely and were in the most advanced form during the Three Kingdoms period. After that period, the jar coffins usage declined. Later, they were generally used during funerals for babies.

The jar coffins of the Three Kingdoms period, excavated from the Yeongsan-gang River basin, have very distinct characteristics from other areas. Above all, they are overwhelmingly big, taller than grown-ups. Big jar coffins that cannot be easily made even with the current technology must have been made by an expert group of people with a high level of production technology. In addition, they were only used as coffins.

Neolithic Age

Jar coffins began to be used for burial in the Neolithic age when humans first began to make pottery.

Jar-coffin at the Archaeological Site in Sangchon-ri, Jinju

Bronze Age

Jars were placed in an upright position or buried slantingly. The tops of the jars were covered with a wide stone or pottery. Most jar coffins have a hole on the base.

Jar-coffin at the Archaeological Site in Seokcheon-ri, Iksan

Iron Age

Two jars were turned on their side, and their mouths were put together (connection type), or the mouth of the bigger jar was covered by the smaller jar. Such styles of jar-coffin tombs began to emerge. Jar coffins until the Iron Age were generally made of jars used in everyday life.

Jar-coffin at the Archaeological Site in Sinchang-dong, Gwangju

Three Kingdoms Period

In the Three Kingdoms period, big jar coffins began to be made only as coffins. In addition, accessories such as earrings, necklaces, and glass beads, metal items including knives, axes, and iron plates, small jars/plates, gilt-bronze crowns, gilt-bronze shoes, etc. were buried together in jar coffins.

Jar-coffin at the Ancient Tomb in Ogya-ri, Yeongam

After the Three Kingdoms Period

It is not known whether jar-coffin tombs were continuously used after the Three Kingdoms period. Buddhism is assumed to have had a great effect during the Unified Silla Dynasty and the Goryeo Dynasty. Consequently, tombs for cremated remains appeared.

The cremation custom influenced by Buddhism can be confirmed through burial urns assumed to have been made in the late Baekje Dynasty. Since a lot of burial urns have been excavated with Gyeongju as the center, one can assume that cremation must have been prevalent during the Unified Silla Dynasty. The cremation custom continued until the Goryeo Dynasty.

Small jar coffins made of household onggi, Korean traditional pottery, in the Joseon Dynasty have been found. Such jar coffins seemed to have been used for the burial of children.

Jar-coffin (the onggi jars) at the Archaeological Site in Yeodeok-ri, Hampyeong

Jar Coffins of Ancient China, Japan, and Vietnam

Although the types of jar-coffin tombs vary depending on the areas and time, they are one of the most general tomb styles used all over the world. Jar coffins that originated from household pottery being used as coffins were generally used as coffins for toddlers and children or couple tombs in the form of being buried around the central tomb.

Chinese jar-coffin tombs were prevalent during the mid to late Neolithic age in some areas, especially in the Yangshao culture(仰韶) and the Longshan culture(龍山). Later, jar-coffin tombs were not found until the spring and autumn period, appearing again in some areas during the Qin and Han Dynasties. In Japan, household vessels were used as jar coffins to contain children's bones and cremated remains from the Jōmon period. Large pottery was used for the burial of grown-ups from the late Jōmon period to the early Yayoi period. In Vietnam, jar-coffin tombs were a unique burial style that appeared in the Sa Huỳnh culture, which flourished with central Vietnam as the center. A dead body was put into a big U-shaped jar, and a hat-shaped lid is put on the jar. The jar was buried in an upright position in a jar-coffin tomb. Tombs of this style generally formed a cemetery.

1
2 3

1 Vietnam
Jar-coffin excavated from Go Dua Archaeological Site
Housed in the Museum of Sa Huynh - Champa Culture

2 China
W8 Jar-coffin Tomb in Yanshan(巖上) Archaeological Site
Source: Beijing Research Institute of Cultural Heritage, 2008

3 Japan
K24 Jar-coffin Tomb in Muneishi(宗石) Archaeological Site
Source: Nakagawa Board of Education, 2002

Big Jar Coffins of Yeongsangang River Basin

The big jar coffins of the Yeongsangang River basin are drawing attention from numerous people because of their unique characteristics that cannot be found anywhere else. As jar coffins of the Yeongsangang River basin became bigger, they began to be made only as coffins. Big jar coffins showed a unique construction style called multiple burials wherein multiple jar coffins were buried in a single burial mound. Tombs of this construction style were tall and large just like hills. In addition, splendid artifacts showing higher status such as gilt-bronze crowns and gilt-bronze shoes were buried as well, suggesting the power of the area.

Looking into the significance of the big jar coffins of the Yeongsangang River basin and the aspect of their change makes one think about the ideas of people who lived in the ancient society of the area.

"Why were big jar coffins made of jars for burial purposes developed only in the Yeongsangang River basin?"

"Who were buried in big jar coffins?"

The unique tomb style using the big jar coffins of the Yeongsangang River basin sprouted to such questions.

What are the features of the big jar coffin, which are vital clues to the ancient society of the Yeongsangang River basin?

Jar Coffins Resembling Eggs

Two round jars combine together.
It looks like an “egg.”
“Eggs” carry a wish for the rebirth of life.

Jar-coffin at the Ancient Tomb in Goeup, Muan

It is located in Haeje-myeon, Muan-gun, Jeollanam-do. As a result of the research, a burial mound was not found, but a jar-coffin tomb was discovered. The jar-coffin has a wide mouth and a narrow neck. The upper part of its body expands most widely.

After big jar coffins first appeared in the Yeongsangang River basin, they changed in shape over time. Initially, big jar coffins had wide mouths like a trumpet and narrow bases (3rd century). The mouths got narrower, and the bases got wider (4th century). Finally, the curves gradually disappeared and got simplified, so they became U-shaped (5th century). The shape of the big jar coffin went through such change for convenience and safety for burial.

Jar-coffin at Sunchon Archaeological Site in Worya, Hampyeong
Narrow base and curvy shape (3rd century)

Jar-coffin at Ancient Tombs in Ogya-ri, Yeongam
Round base and slightly curvy body (4th century)

Jar-coffin at Ancient Tombs in Naedong-ri, Yeongam
Barely curvy and close to a U-shape (5th century)

A Variety of Patterns Shown in the Jar Coffins

Various patterns are observed in the necks, bodies, and bases of the big jar coffin.

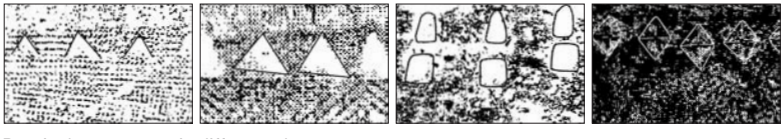
The denticulate pattern on the necks is an element of the sunbeam patterns, symbolizing regeneration and rebirth. Round patterns on the bases are for souls' access. Some believe that the round patterns come from the idea of death and life, which means that it does not consider life and death to be disconnected from each other.

Jar-coffin at Songsan Ancient Tombs in Wolsong-ri, Yeongam

Neck

Generally, the necks of jar coffins have denticulate patterns. The patterns that look like saw teeth or beasts' sharp teeth continue horizontally around the necks. In some jar coffins, various patterns such as triangles, squares, and rhombuses are observed.

Denticulate patterns



Denticulate patterns in different shapes

Body

The bodies of jar coffins are full of square lattice patterns in different sizes. Some jar coffins have bird footprint patterns.

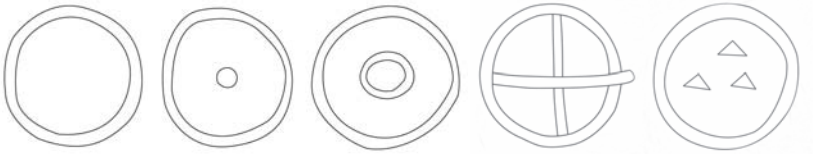
Lattice patterns

Bird footprint patterns

Base

A circle can be observed at the center of the bases, which are called the incised circle pattern. Sometimes, various signs are engraved inside the incised circle patterns.

Incised circle pattern



Different signs inside the incised circle patterns

Signs were engraved on the bases of the big jar coffin on purpose in order to distinguish the makers or producing areas. The signs are also regarded as marks to distinguish the kilns and the quantity of jar coffins produced. Based on this, one can assume that jar coffins were produced in large quantities.

Enlarged Jar Coffins

When big jar coffins were the most prevalent (5th century), they were significantly huge, around 200 meters tall and 200 kilograms each.

Jar-coffin Tomb No. 1 of Masan Tomb No. 3 in Hwajeong-ri, Naju
The bigger jar-coffin is 209 centimeters, and the smaller one is 118 centimeters. The smaller jar-coffin is inserted into the bigger one.

Jar coffins are much taller than a grown-up man and 6 adult men or more are required to carry a jar-coffin.

8 adult men moving a big jar-coffin made in 2018 into the kiln

A completely shaped big jar-coffin during a big jar-coffin production experiment in 2009

Jar Coffins in Huge Ancient Tombs

As political bodies called ancient nations such as Goguryeo, Baekje, Silla, and Gaya appeared, they began to build huge ancient tombs as if trying to show off their strength.

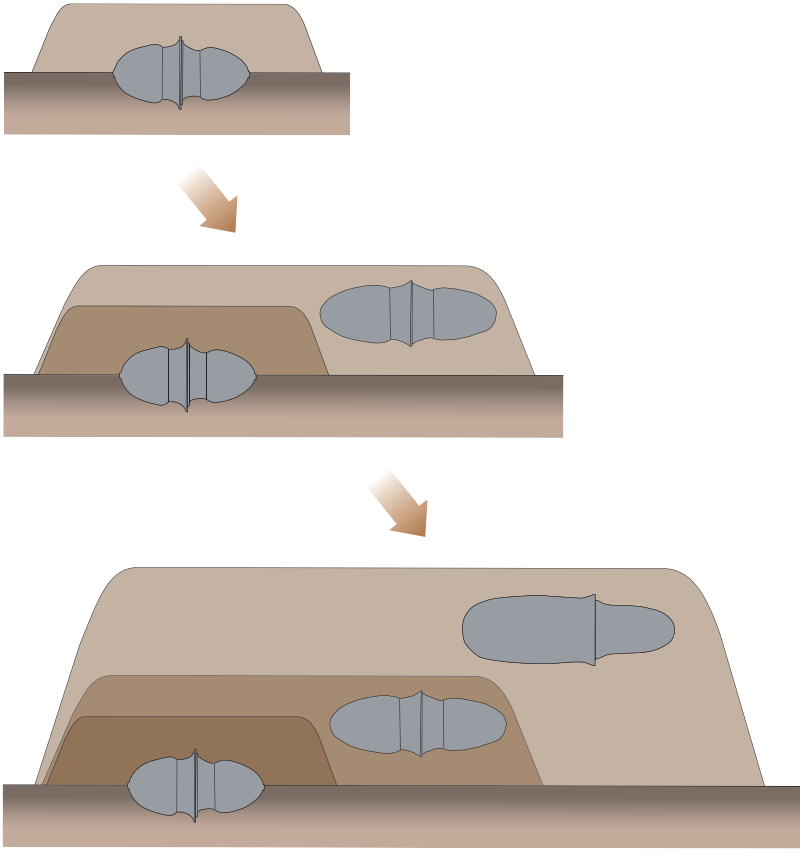
Such huge ancient tombs are found even in the Yeongsangang River basin whose records are gone. In particular, the ancient tombs of the Yeongsangang River basin are very unique in the sense that big jar coffins were used as burial facilities.

The image shows the ancient tombs of the Three Kingdoms period located in Deoksan-ri, Bannam-myeon, Naju-si, Jeollanam-do, designated as Historic Site No. 513. Tombs vary in shape: round type, square type, and rectangular type. They range from 10 meters to 45 meters in diameter. In particular, the burial mound of Tomb No. 3 is huge, reaching 45 meters. Three jar-coffin tombs were found in the burial mound. Various splendid artifacts such as iron arrowheads, silver bells, and glass beads as well as pottery were excavated.

Naju Bannam Ancient Tombs Ancient Tombs in Deoksan-ri, Naju

A Change in the Ancient Jar-coffin Tombs

The ancient tombs of the Yeongsangang River basin feature multiple burials wherein a huge and tall burial mound are piled and then dug multiple times to bury additional jar coffins. This suggests that the succession and bond between blood relations lasted for a long period of time. As jar coffins were getting bigger, ancient jar-coffin tombs were increasing in size accordingly.



A change in ancient jar-coffin tombs in the Yeongsangang River basin

The Dawning Stage: Jar Coffins Appearing Together with the Iron Age Culture

Early-stage jar coffins of the Yeongsangang River basin were added to wooden coffin tombs surrounded by gutters or were used for attached tombs. Handled potteries or potteries with clay strings used in daily lives were used as jar coffins.

Jar-coffin Tomb No. 3 at the Archaeological Site in Unnam-dong, Gwangju

After digging a hole at a constant depth, two jar coffins were placed on their side and combined together. The jar-coffin generally consisted of pottery with bridge shaped-handles designed in a short flaring lip and a small base and pottery with a triangular clay band rim.

The Generation Stage: Emergence of the big jar coffin

Entering the 3rd century, jars only for big jar coffins began to be made at the Yeongsangang River basin, instead of using small household jars. They were buried underground in round or trapezoidal tombs and their gutters. Early-stage jar coffins made of jars exclusive for burial were very curvy, including flaring mouths, narrow necks, and wide bodies.

Ancient Tombs in Yongho, Naju

The tombs of multiple burials found at the Ancient Tombs in Yongho show that wooden coffin tombs surrounded by gutters gradually changed to ancient jar-coffin tombs. Generally, two jar coffins were combined together in a jar-coffin tomb. Three jar coffins were buried only in Jar-coffin Tomb No. 18. The adjoining parts were sealed with clay.

Jar-coffin Tomb No. 18 at Ancient Tombs in Yongho, Naju

Large jar

Medium jar

Small jar

The Development Stage: Big Jar Coffins Began to be Used as a Major Burial Facility

Chobungol Ancient Tombs in Naedong-ri, Yeongam

In the 4th century, jar coffins and wooden coffins became major burial provisions in the Yeongsangang River basin. They were buried in trapezoidal burial mounds. Due to the multiple burial custom of jar coffins, burial mounds expanded horizontally and got bigger.

Jar-coffin Tomb No. 1-2 at Chobungol Ancient Tombs in Naedong-ri, Yeongam

Chobungol Ancient Tombs in Naedong-ri is located in Sijong-myeon, Yeongam-gun, one of the areas where the jar-coffin tombs of the Yeongsangang River basin are concentrated. Jar coffins made of jars exclusive for burial were used in the jar-coffin tomb. The adjoining parts were sealed with off-white clay.

The Peak Stage: Standardized and Enlarged Big Jar Coffins Made of Jars Exclusive for Burial

Ancient jar-coffin tombs had its heyday in the 5th century. In the Yeongsangang River basin, 2-meter tall U-shaped jar coffins with unique local characteristics exclusive for burial were used as a major burial provision. With Bannam in Naju as the center, burial mounds were expanded both horizontally and vertically.

Naju Sinchon-ri Tomb No. 9

The excavation research on Sinchon-ri Tomb No. 9 was conducted twice during the Japanese colonial era, in 1917 and 1918. It is a square mounded tomb with a flat top and a square base. 11 jar coffins were found in the upper part consisting of 2 layers. The U-shaped jar coffins were excavated together with various artifacts such as pottery, ironware, metals, and jade. It is one of the most representative tombs symbolizing the ancient culture of the Yeongsangang River basin.

Bangdu Ancient Tomb in Daean-ri, Naju

Ancient Tomb in Ungok-dong, Naju

The Declining Stage: Big Jar Coffins with Degenerate Shape and Structure

Naju Bogam-ri Tomb No.3

In Bogam-ri Tomb No. 3, various burial facilities were found in a single tomb, providing new research materials regarding the tomb styles of the ancient Yeongsangang River basin.

By the 6th century, jar coffins were no longer a major burial provision of ancient tombs. Stone chambers replaced jar coffins. The typical U-shaped jar coffins consisting of two jars were replaced back to being jar coffins using household jars or sealed with stones.

'96 Stone Chamber of Naju Bogam-ri Tomb No. 3

It is situated at the center of Bogam-ri Tomb No. 3. '96 Stone Chamber is a stone chamber with a corridor. It has a grave corridor, a tomb entrance passage, and an innermost chamber. 4 jar coffins were placed inside the stone chamber, and human bones were found inside the jar coffins. It shows transitional features from jar coffins to stone chambers.

Ancient Tomb in Gusan-ri, Muan

Jar-coffin Tomb No. 5

A U-shaped jar-coffin and a large household jar were combined together. The base of the large jar was broken, and the hole was covered with a stone slab.

Jar-coffin Tomb No. 6

A U-shaped jar exclusive for burial was sealed with piled crushed stones. It imitated a jar-coffin tomb consisting of two jars.

People collected soil from the Yeongsangang River basin and built a huge ancient tomb by piling the soil securely.

In this place, people must have held a burial service for the deceased. They must have placed the body in a jar-coffin and buried grave goods here. We could still feel the family's sadness.

Restoration of the jar-coffin burial service

Various Grave Goods Buried with the Jar Coffins

Various grave goods were found inside and around jar coffins. pottery, metals, and jade were excavated, which show the local characteristics and history 300 years ago, when big jar coffins were popular. During the generation and development stages of the big jar coffin, ironware, which was rare, was buried together. During the peak stage, artifacts such as gilt-bronze crowns and gilt-bronze shoes -- which prove the highest social status -- were buried. Such grave goods show that the persons buried in big jar coffins had a higher status. A smaller number of grave goods were buried in ancient tombs in the Yeongsangang River basin compared to the ancient tombs in Yeongnam. It shows a difference in burial customs between the two areas.

Jar-coffin tomb and grave goods of Deogam Ancient Tombs in Sachang-ri, Muan

Grave Goods of Jar Coffins in the Generation Stage

Pottery is mostly soft, including pots, bowls, short-neck jars, double-rim jars, jars with wide mouth, and jars with two lugs. Ironware includes iron knives, iron arrowheads, and iron axes.

Pot
Manga Village, Yedeok-ri, Hampyeong

Short-neck jar
Geumgye-ri, Yeongam

Double-rim jar
Songsan, Wolsong-ri, Yeongam

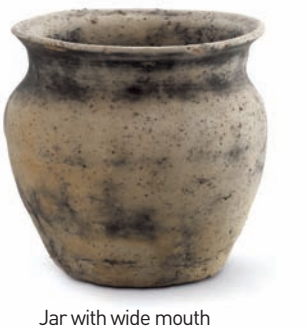
Jar with two lugs
Jangdong, Naju

Jar with wide mouth
Seongnam, Hampyeong

Iron axe
Sunchon, Hampyeong

Grave Goods of Jar Coffins in the Development Stage

Pottery includes jars with wide mouths, long-neck jars, short-neck jars, and jars with two lugs. Blacksmith tools, ironware, and accessories such as jade were excavated.



Jar with wide mouth
Wau-ri, Yeongam

Long-neck jar
Sinyeon-ri, Yeongam

Short-neck jar
Naedong-ri, Yeongam

Jar with two lugs
Naedong-ri, Yeongam

Blacksmith tools
Sachang-ri, Muan

A set of blacksmith tools such as tongs, iron chisels, L-shaped tools, hammers, and whetstones used to grind or sharpen iron tools were excavated in Sachang-ri, Muan. In particular, a set of blacksmith tools were excavated in the Yeongsangang River basin only.

Jade
Sinyeon-ri, Yeongam

Grave Goods of Jar Coffins in the Peak Stage

Hard pottery such as pots, bowls, and jars was excavated. In addition, new grave goods including cups with lid, pedestal dishes, and small wide-mounted jars with perforated body were unearthed. Ironware, metals, and jade were found, too. In particular, artifacts showing higher status such as gilt-bronze crowns, gilt-bronze shoes, and decorated long swords were excavated from Sinchon-ri Tomb No. 9.

Jar with round base
Daean-ri, Naju

Cup with lid
Sinchon-ri, Naju

Small wide-mounted pedestal jar with perforated body
Daean-ri, Naju

Jade

Daean-ri, Naju

According to records, people in Mahan treasured beads even more than gold or silver. A huge quantity of jade was excavated from the jar-coffin tombs in the Yeongsangang River basin. It includes crystal beads, agate beads, amber beads, and gold beads. Jade necklaces are helpful in understanding the accessory culture of the time.

Grave goods excavated from the Eul Coffin of Naju Sinchon-ri Tomb No. 9

The Eul coffin consisting of 2 jars is big, around 250 centimeters long. Jade and pottery as well as metals including gilt-bronze crown, a decorated long sword, and gilt-bronze shoes were excavated. A gilt-bronze crown was placed near the head of the body, and a sword was on the left side. Gilt-bronze shoes as well as a large quantity of beads were placed near the feet. Such artifacts show the higher social status of the person buried.

Gilt-bronze crown
Sinchon-ri, Naju

Gilt-bronze shoes
Sinchon-ri, Naju

Decorated long sword
Sinchon-ri, Naju

Jar Coffins Found along Yeongsangang River

Yeongsangang River is one of South Korea's four rivers together with Hangang River, Nakdonggang River, and Geumgang River. Yeongsangang River features plenty of water, wide plains, and seashore mud flats. Such environmental conditions provided a good environment where people could settle down and make history. In the ancient times, unique cultures with high productivity were formed on the basis of the favorable geographical conditions of the Yeongsangang River basin. One of them is the society of ancient jar-coffin tombs.

Ancient jar-coffin tombs had been a major tomb style of the ancient society of the Yeongsangang River basin before stone chamber tombs were introduced. It is very meaningful since jar-coffin tombs symbolize the unique culture of the local gentry of the Yeongsangang River basin as distinguished from the major tomb style of Baekje. Jar-coffin tombs are densely distributed around Sijong, Yeongam, and Bannam, Naju, which are the lower and middle reaches, respectively, of the Yeongsangang River basin.

Jar-coffin tombs concentrated along Yeongsangang River

Iron Age ~ Three Kingdoms period

The Rebirth of the Big Jar-coffin,

Records on the Production of the Big Jar-coffin

Second

Rebirth of the Jar-coffin

1. Restoration of the Jar-coffin
2. How to Make a Jar-coffin

Restoration of the Jar-coffin

In order to restore the social meaning and production technology of the big jar coffins, which are one of the most representative cultural heritages of the ancient society of the Yeongsangang River basin, the Naju National Research Institute of Cultural Heritage has been conducting research under the theme of "Ancient Big Jar-coffin Production Technology Restoration Project." The Research Institute is making efforts to investigate the big jar-coffin production technology by securing data on jar-coffin kilns through the excavation research on the Kiln Site in Oryang-dong, Naju -- a jar-coffin production site -- and by conducting a production experiment based on research and natural scientific composition analysis.

Big jar-coffin after shaping

The Excavation Research on the Archaeological Sites of Jar-coffin Production

The Kiln Site in Oryang-dong, Naju is a large-scale archaeological site of jar-coffin production where a big jar-coffin production expert group existed. We were able to unveil secrets about the structure and features of big jar-coffin kilns through the excavation research on the Kiln Site in Oryang-dong.

Kiln Site in Oryang-dong, Naju

As a result of the excavation research, around 80 kilns have been found so far at the Kiln Site in Oryang-dong, Naju. Jar coffins were found to have been produced for around 100 years.

Kiln distribution at the Kiln Site in Oryang-dong, Naju

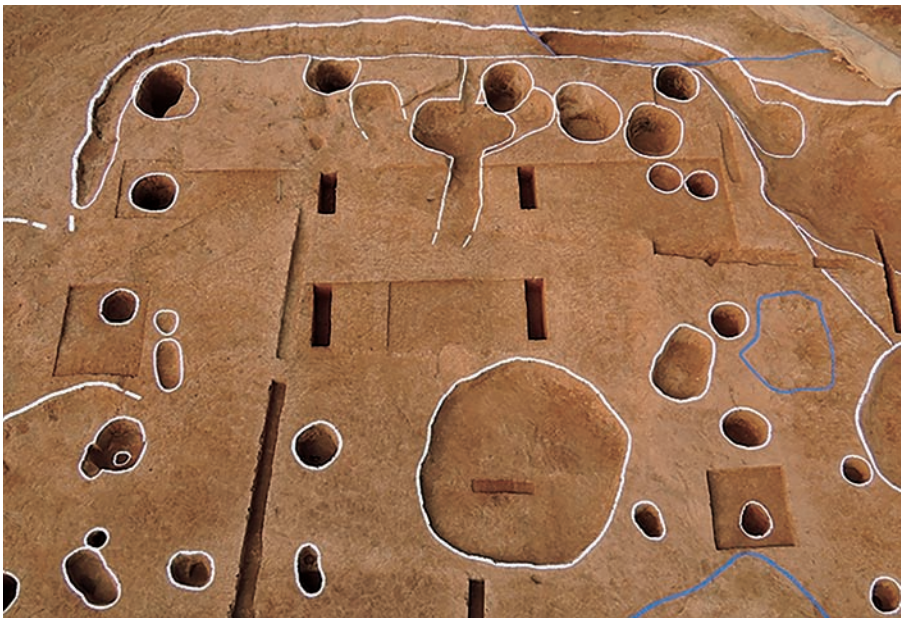
Kilns were situated on the hills where thermal efficiency could increase using natural slopes. Such geographical features enabled people to make the slope of the kiln floor easily and facilitate drainage.

Kiln at the Kiln Site in Oryang-dong, Naju

To bake 200-centimeter tall jar coffins, jar-coffin kilns should be bigger than them. After digging a 100-centimeter deep hole, people installed wood pillars at the walls and the center and made an upper structure by covering an arched frame. Then, they made a ceiling by applying mud made of clay and rice straw on top multiple times. The floor slope should be less than 10 degrees so that jar coffins could be baked securely in the kiln.

Restoration of fire making in the jar-coffin kiln

Making, carrying, and baking jar coffins must have been a complicated, arduous, and hard task. 1,500 years ago, master jar-coffin artisans must have made kilns in Oryang-dong and gone through all the hard work together.



Workshop Site at the Kiln Site in Oryang-dong, Naju

A large number of Huge columns were set up around the site. Work pits were found in the site.

Restoration of jar-coffin workshop

This is a place where artisans made jar coffins. Making jar coffins is too hard and cumbersome to be handled by one person. They must probably have constructed a common workshop and divided work for efficiency.

Kiln Site in Oryang-dong, Naju

(Historic Site No. 456)

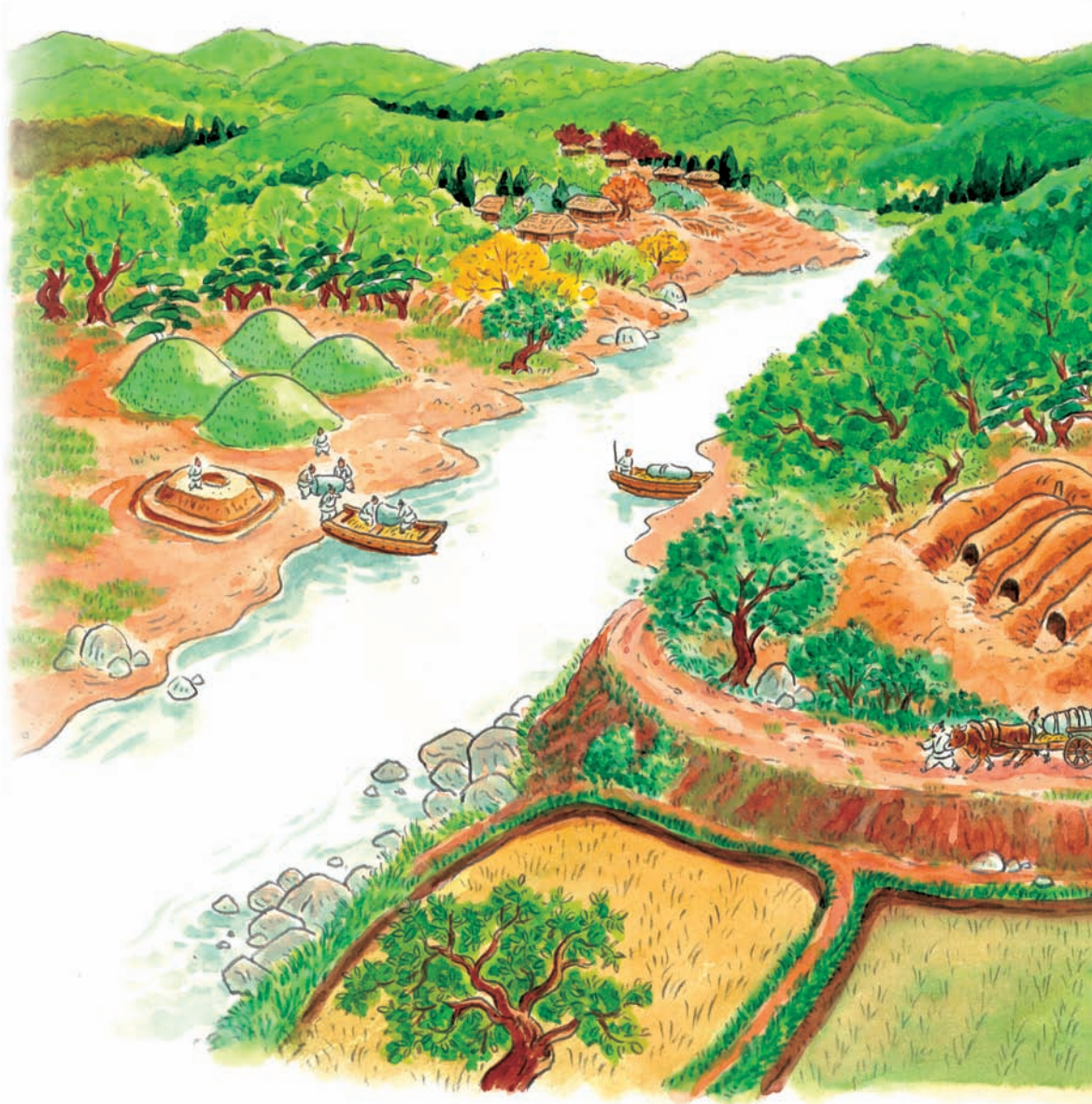
The archaeological site is situated on a gentle hill at an elevation of 20 meters, spanning Oryang-dong to Dongsu-dong. Since the mainstream of Yeongsangang River flows 1 kilometer away from the archaeological site, it is a good location for supplying jar coffins to neighboring ancient tombs.

The archaeological site was found accidentally while a grave was being formed in 2001. The jar-coffin kiln site first became known through the excavation research conducted by the Mokpo National University Museum and Dongshin University Museum of Culture in 2002.

Later, the Naju National Research Institute of Cultural Heritage conducted the excavation research in order to restore the ancient jar-coffin tomb society of the Yeongsangang River basin by accurately identifying the features of the Kiln Site in Oryang-dong, Naju. The research was conducted a total of 9 times from 2007 to 2017. In the archaeological site, various traces of big jar-coffin production such as kilns, workshop sites, dumpsites, roads, residential areas, and burial features were found.

The Kiln Site in Oryang-dong, Naju was found to be the only archaeological site that produced big jar coffins in large quantities in the Yeongsangang River basin. It is a very important archaeological site with data on the jar-coffin production system at that time.

We restored the Jar-coffin Production Village in Oryang-dong, Naju based on data collected through research. 1,500 years ago, master jar-coffin artisans must have settled down in an area. where they could easily

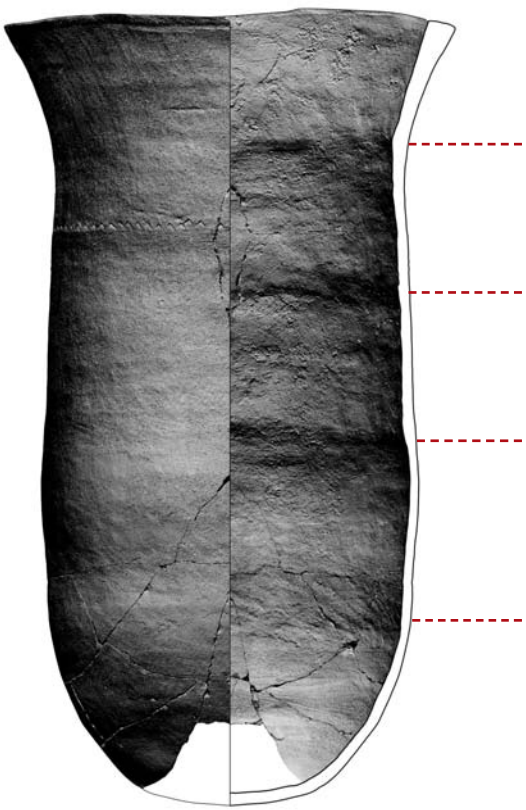


get materials such as soil and firewood. And wouldn't the jar coffins produced here have been supplied to where it was needed by using hand carts and ships?

Restoration of Jar-coffin Production Village in Oryang-dong, Naju

Observation on Various Traces of Jar Coffins

We ran a 3D scan, a CT scan, and an X-ray scan on big jar coffins. Through such observations, we could see the traces and thickness of clay strings and traces of hand press and segment shaping.



3D scanning

(Traces of segment shaping: Large jar of Jar-coffin Tomb No. 8 at the Ancient Tomb in Ungok-dong, Naju)

Segment shaping

Since a jar-coffin is big and heavy, it cannot be shaped at one go. It should be shaped up to a certain height and dried to bear its weight. In other words, 6 to 8 layers of clay strings 5 to 7 centimeters thick should be piled, and the surface should be smoothed out. Then, it should be dried for a certain period of time.

CT Scan (Traces of hand presses)

Hand press on clay strings

Traces of hand press were found on the broken parts of the jar coffins. It seemed artisans pressed the strings while they piled the clay strings. There were fingerprints detected as well.

Analysis on Jar Coffins and Kilns

We conducted an analysis using various natural scientific methods with conservation scientists in order to find out what kind of soil was used for jar coffins, how they were made, and how they changed after baking.

Natural Scientific analysis

After a jar-coffin production experiment, an analysis is conducted on the restored jar coffins and restored kilns.

A broken part of a restored jar-coffin

You can see that clay and coarse stone pieces were mixed together.

As a result of a composition analysis on the ceiling pieces of a jar-coffin kiln at the Kiln Site in Oryang-dong, Naju, the roof was found to be made of mud mixed with herbaceous plants. Thus, we made the ceiling using rice straw and cogon grass when restoring a mud kiln.

Traces of grass found in a ceiling piece of a kiln site in Oryang-dong, Naju

Traces of grass found in a ceiling piece of a restored kiln

Natural Scientific Analysis

Through the preliminary research on the big jar coffins excavated from the Yeongsangang River basin, we selected subjects for the composition analysis, collected samples, and conducted an analysis.

We can see even with the naked eye that jar coffins were made with different types of texture clay and production techniques from pottery made in the same period, and for this reason, a more detailed observation is needed. Thus, we made a list for a natural scientific analysis on jar coffins and checked them with the naked eye. We also ran a 3D scan, a CT scan, and an X-ray scan on some jar coffins. Through such work, we were able to check the traces and thickness of clay strings and the traces of hand press and segment shaping. A natural scientific analysis on the restored jar coffins and restored kilns started with a composition analysis on the restored jar coffins made of texture clay assumed to have been produced near Oryang-dong, Naju. In addition, we conducted a physical, mineralogical, and geochemical property analysis on the restored kilns and jar coffins. We compared the baking experiment result with the analysis result for verification. The verification result has been used as material so far to try various ways of restoring big jar coffins.

Jar-coffin Production Experiment

For a production experiment, we conducted a texture clay formation experiment, a shaping experiment, a kiln making experiment, and a baking experiment stage by stage.

Temporary workshop in 2008

We installed a temporary workshop in front of the Natural Dyeing Culture Center in Bogam-ri, Dasi-myeon, Naju and started our experiments.

Texture clay formation experiment

Shaping experiment

Kiln maknig experiment

Baking experiment

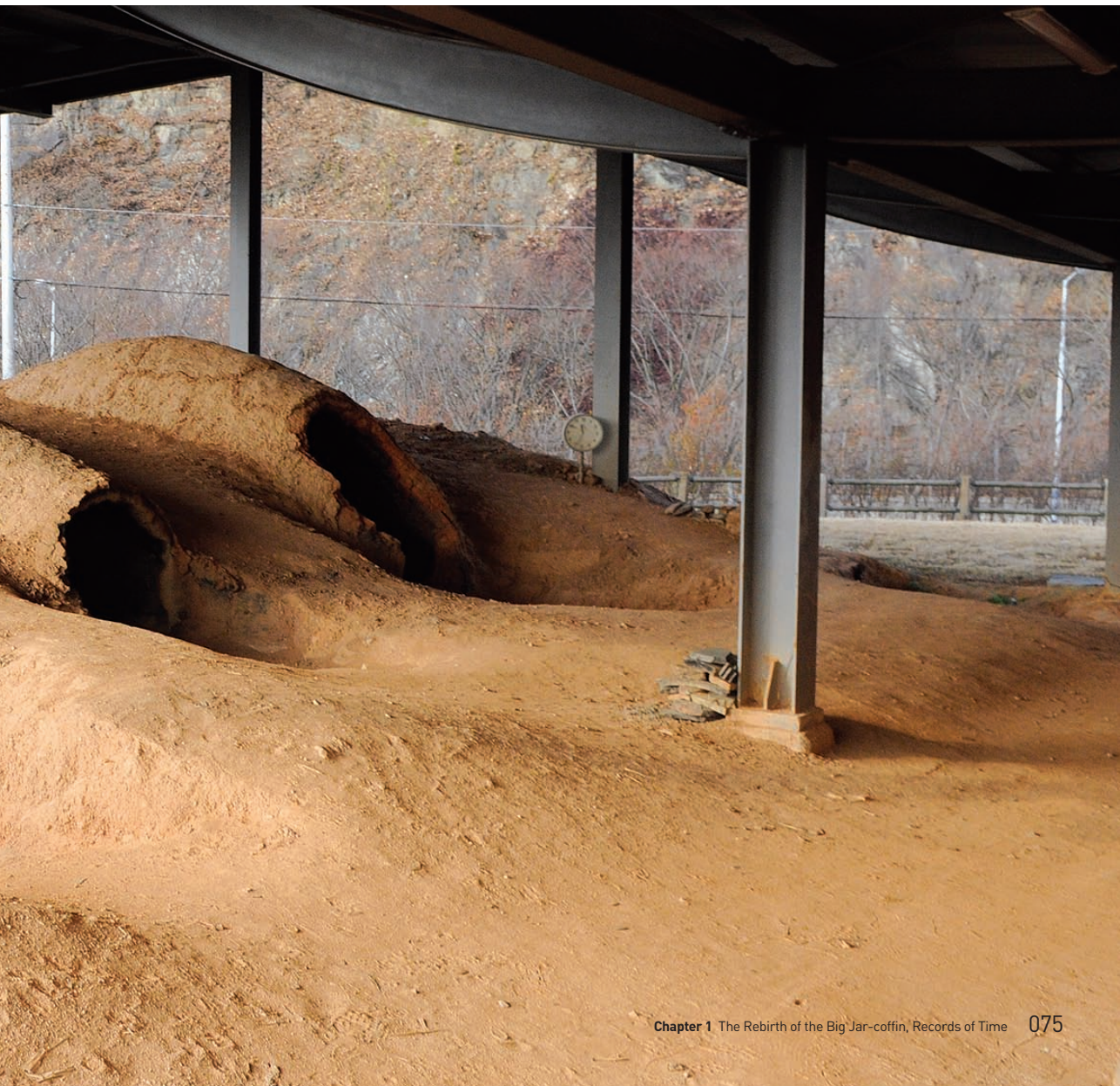
Since 2008, we have conducted a production experiment around 10 times. Through this process, we were able to reproduce the big jar coffins of the ancient Yeongsangang River basin in a comparatively similar way in terms of both appearance and technology. During years of research, we recorded a wide range of information obtained through the experiment process. We are still working on the production experiment.

How to Make a Jar-coffin

To make a jar-coffin, we need a workshop for shaping and a kiln for baking.

The workshop of the Naju National Research Institute of Cultural Heritage has an environment wherein jar-coffin materials can be kept and jar coffins can be made and dried.

We built 3 mud kilns for baking big jar coffins in front of the workshop.



Preparations

Workshop

Constant humidity should be maintained in the workshop. A sudden change in humidity levels may have an adverse effect on jar-coffin shaping, drying, and storage. Thus, we applied loess on the floor and built walls using loess bricks.

Inside the workshop

Pottery Wheel

A pottery wheel is a machine used to make clay into a variety of pottery using a rotational force. We have 3 pottery wheels in the workshop.

A wooden pottery wheel is a kick wheel which works by using a foot pedal. An electric pottery wheel rotates automatically using electricity. Since the height of the upper part of the pottery wheel must be the same as that of the potter's chair, the pottery wheel was installed in a one-meter-deep hole.

Large wooden pottery wheel

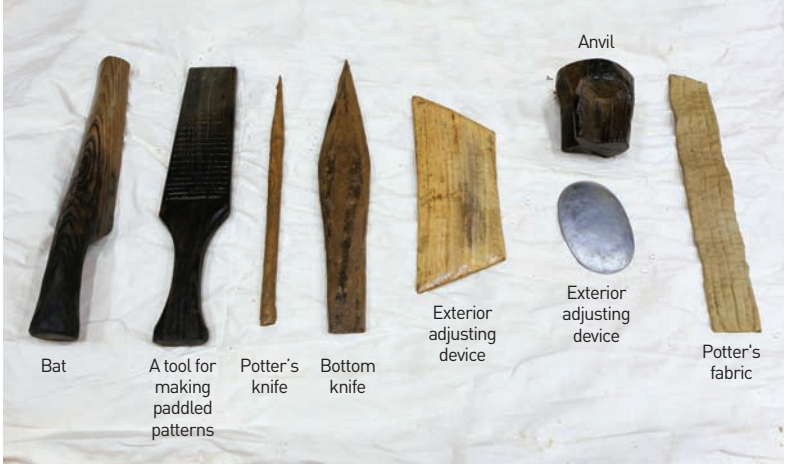
Shaping Tools

We made shaping tools based on artifacts excavated from archaeological sites, data collected through the on-site research, and Korean traditional onggi jar tools.

Shaping tools of pottery village in Tan Van, Vietnam

A tool for making paddled patterns excavated from an Archaeological Site in Suemura(陶邑), Japan

Restored tools (A tool for making paddled patterns, Anvil)



Shaping tools for experiment

Jar-coffin shaping tools include pottery wheels, bats, a tool for making paddled patterns, anvils, potter's knives, bottom knives, exterior adjusting devices, interior adjusting devices, and potter's fabrics.[01]

01
The names of the tools for traditional onggi jars were used.

Preparation for the Texture clay

Prepare clay (texture clay) for shaping a big jar-coffin. To make a texture clay, mix highly viscous clay (base clay) and temper (coarse soil) at a proper ratio and age them for a certain period of time before use.

Mix clay and temper and blend them by adding water.

Remove small stones and foreign substances using a tool.

Shape the mixture into cuboids and pile them neatly. Pound them using a tool to mix clay and temper well.

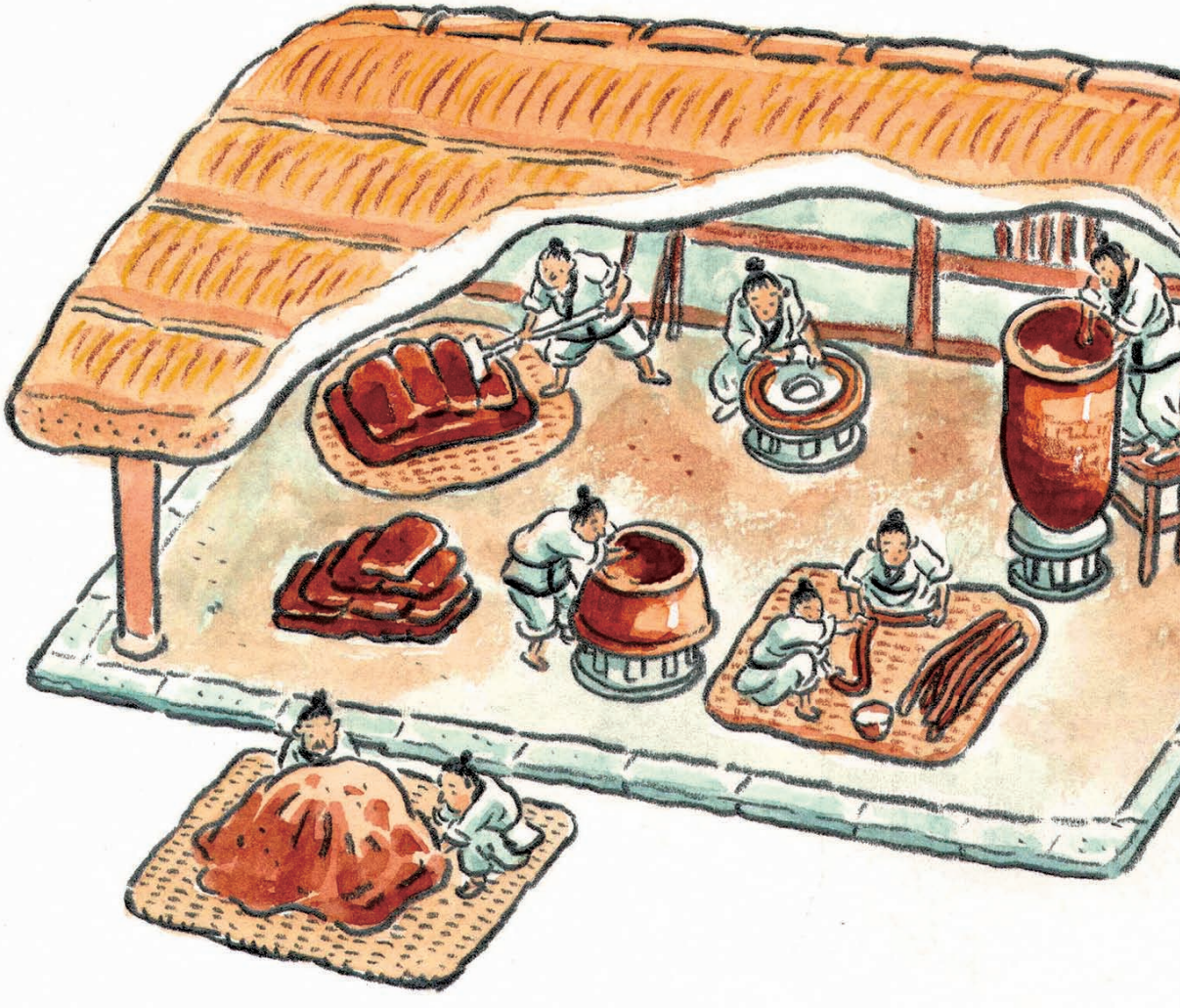
After dividing the widely spread texture clay again, turn over and pound. Repeat this process to remove air from the texture clay.

Shape the texture clay into cuboids and age them for a certain period of time before use. They become more and more viscous over time.

Texture clay

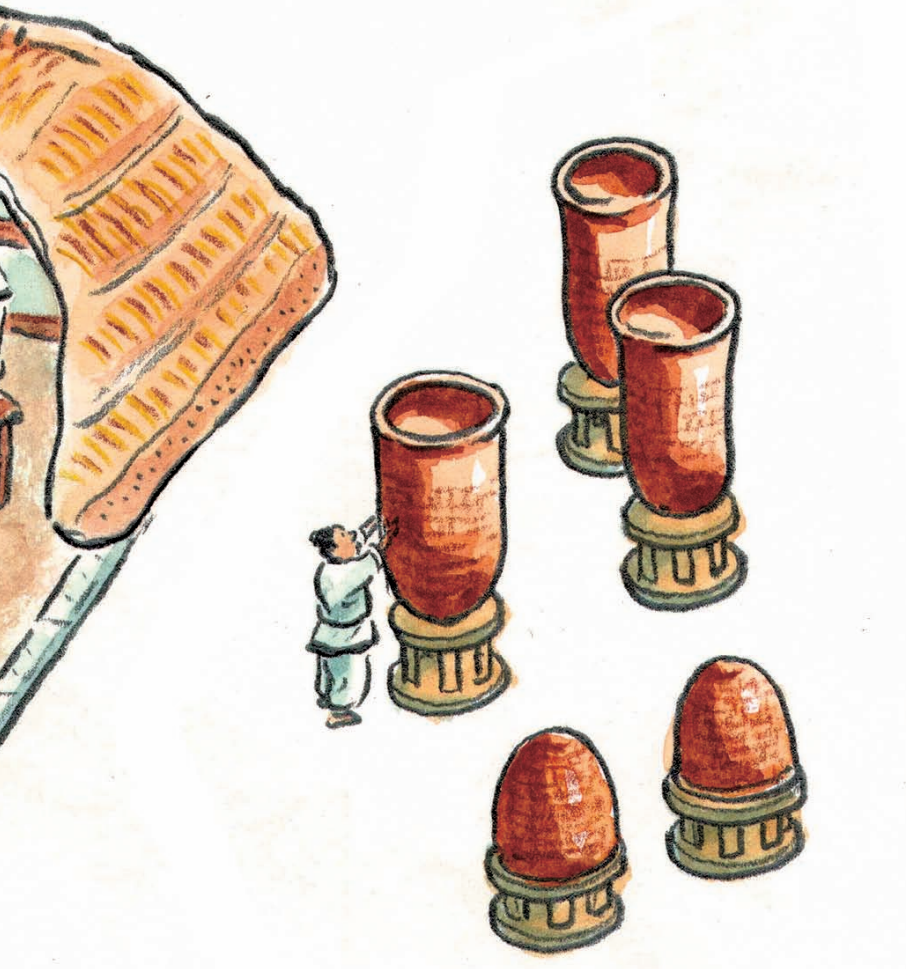
As a result of a natural scientific analysis, jar-coffin texture clay were found to have different properties from small pottery. The clay used for jar-coffin shaping was comparatively highly viscous, containing a lot of stone pieces. This is to maintain the surface of big and heavy jar coffins securely by reducing shrinkage rates during drying and baking. Thus, we mixed highly viscous clay and temper for a production experiment. After several natural scientific analyses and experiments, we set the ratio of clay to temper at 8:2 or 9:1. Making a large quantity of texture clay by mixing two materials took a lot of time and effort since we adopted the traditional method. Thus, we made texture clay whenever needed.

Making a Jar-coffin



Jar coffins are big and heavy unlike other potteries made in the same period. Therefore, they cannot be shaped all at once. A jar-coffin is shaped up to a certain height and then dried, which is called segment shaping.

To make a jar-coffin, shape its lower body upside down and dry the surface. After turning it over, shape the upper body and then make the mouth. More specifically, 'making clay strings → piling them considering the shape of a jar-coffin → smoothing the surface → smoothing patterns using a tool for making paddled patterns'.



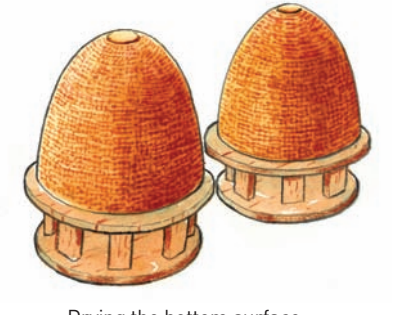
- Making the lower body of the jar coffin

Piling and connecting clay strings

Smoothing the surface

Stamping patterns using a tool for making paddled patterns

Finishing



Drying the bottom surface

- Making the upper body of the jar coffin

Turning it over

Shaping the upper body

Shaping the mouth of the jar coffin

Stamping denticulate patterns

How to Make a Jar-coffin

- First: Making clay strings

First, decide the size of a jar-coffin. Decide the thickness of clay strings considering its size. Then, prepare clay strings shaped like a rice cake bar in advance.

Prepare clay bricks to make the clay strings.

Rub the clay brick several times and roll it to make a longer clay string shaped like a rice cake bar.

- Second: Making the lower body

Fix a round wood plate on the pottery wheel.

Make a doughnut-shaped clay plate and mark the size of a jar-coffin at the beginning.

Pile clay strings in several layers and connect them.

Press clay to increase the binding force of clay strings.

Apply more clay on the inside and outside of the lower body to strengthen the surface of the jar-coffin.

After piling clay strings around 20 to 40 centimeters high, beat the inside and outside of the lower body using a tool for kneading the clay to firm the surface. Paddled patterns are engraved on the outside during this process. Make the lower body narrower to the top.

Carve a circle on the bottom using your fingertip. Dry the lower body in the shade for a day.

- Third: Making the upper body

Put a stand on the bottom of the jar-coffin and fix it tightly using a muslin cloth and turn it over. Put the bottom of the jar-coffin on the pottery wheel and level it off.

Smoothen the internal surface of the lower body.

Make a groove on the connecting part of the lower body and stack clay strings to make a body.

Smoothen the surface of the jar-coffin using a tool for trimming the clay pottery

Trim the connected clay strings using a tool for making paddled patterns and a tool for trimming the clay pottery and shape the jar-coffin.

Beat the inside and outside of the jar-coffin using a tool for making paddled patterns to firm up the surface. Paddled patterns are engraved on the outside during this process.

Gradually stack the day strings to raise the body. It is not piled up all at once, but it is partially dried midway to make it firm.

Shape the mouth using water.

Stamp denticulate patterns by pressing the neck with the edge of a tool for making paddled patterns.

- Finish

Dry the finished jar-coffin for at least a month. Dry the jar-coffin slowly in well-ventilated shade.

Shaping

Since 2008, we have made about 30 big jar coffins through around 10 experiments. We restored various types of jar coffins from big jar coffins of the beginning stage to typical big U-shaped jar coffins of the peak stage.

To identify the features of the big jar-coffin production methods, we observed big jar coffins excavated from archaeological sites and ran a 3D scan, a CT scan, and an X-ray scan. As a result of research, we found that the lower and upper parts of the jar-coffin body have different lattice patterns on the surface. Also, clay strings used for piling were 5 to 7 centimeters thick. Traces of segment shaping were found every 20 to 40 centimeters. Based on such traces, we found out that we should shape the lower body upside down and do segment shaping with drying technique after piling clay strings of uniform thickness up to a constant height.

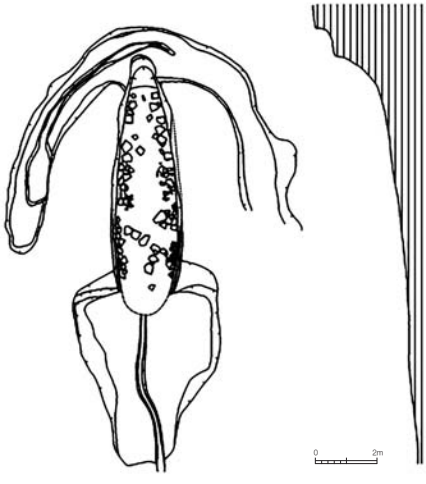
Making a Kiln

Kilns for big jar coffins were found through the excavation research on the Kiln Site in Oryang-dong, Naju. In front of the jar-coffin workshop, three mud kilns were restored for a big jar-coffin baking experiment.

Restored Mud Kiln Nos. 1 and 2 are big jar-coffin kilns restored based on jar-coffin kilns, and Restored Mud Kiln No. 3 is a pottery kiln. We can bake big U-shaped jar coffins in Restored Mud Kiln Nos. 1 and 2 and big jar coffins of the beginning stage in Restored Mud Kiln No. 3.

Selection of a Kiln to Restore

We selected a kiln with clear structural features among various jar-coffin kilns.



Kiln No. 12-7 at the Kiln Site in Oryang-dong, Naju

Segmentation

Flatten out the floor considering the slope of the kiln floor. Based on the drawing of the model jar-coffin kiln, draw the outline of the kiln for segmentation and for excavation.

Based on Kiln No. 12-7 in Oryang-dong, we drew the outline of the kiln on the slope.

Excavation

Loading station
(窯前部)

Firing chamber
(燒成部)

Vent
(煙道部)

After basic excavation

Based on the outline, excavate a loading station, a combustion chamber, a firing chamber, and a vent in turn. It is a semi-underground kiln. Its firing chamber has an underground excavation depth of 140 centimeters, and its floor has a 7-degree slope.

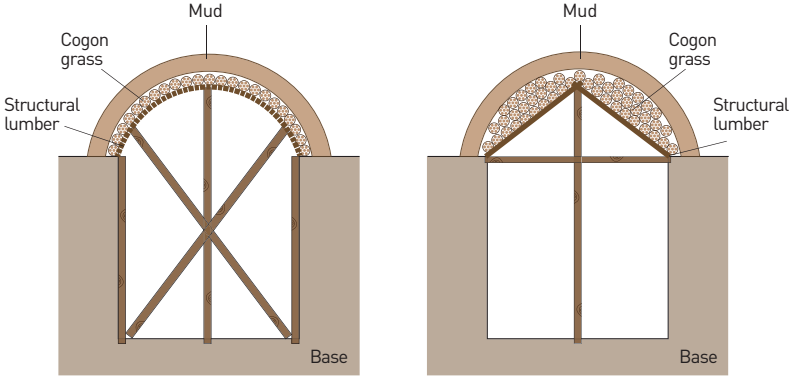
Making the Frame

Making straw ropes to connect the kiln frame

Method 1: Set up wood pillars at the center of the floor and make an arched ceiling by bending bamboos.

Method 2: Set up wood pillars at the center of the floor and fix bamboos horizontally. Then, make a triangular ceiling by connecting the wood pillars and the tips of the bamboos. Cover the triangular frame with stacks of rice straw and cogon grass in an arched shape to finish the ceiling.

Finished arched ceiling



Arched ceiling frame

Triangular ceiling frame

Restoration of ceiling frame

We used two ways to make an arched ceiling. First, we made an arched frame by bending bamboos. Second, we made a ceiling frame by installing bamboos in a triangular roof shape, and then covered it with cogon grass in an arched shape. The latter way allowed us to save a lot of time and effort but was less stable in terms of structure.

Covering with Mud

We mixed clay, chopped rice straw, and water well, and then let it stand for around a day to increase viscosity.

Cover the kiln ceiling frame evenly with mud.

Put mud about 5 centimeters thick on the top of the ceiling and repeat this process 5 to 7 times in order to make the mud layer around 30 centimeters thick. By covering the roof several times with enough time spacing, we can reduce the drying time and maximize the structural strength of the roof by repairing cracks occurring during the drying process.

mud-covered Kiln after it has been completed

Drying Kiln

Natural drying:

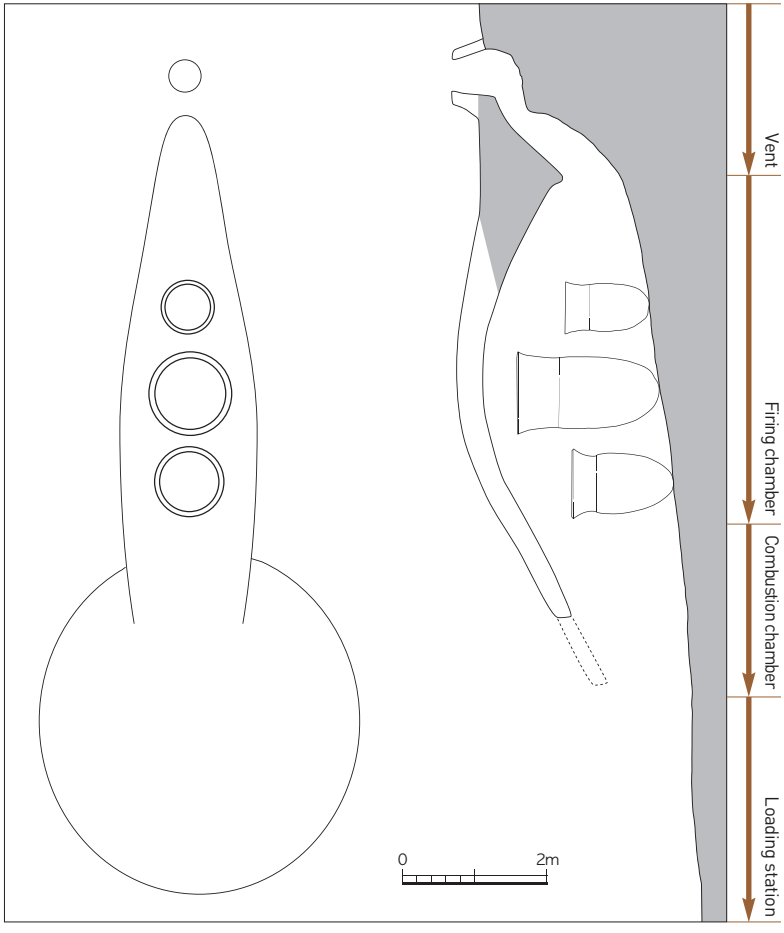
Dry the mud-covered ceiling for around a month naturally.

Kiln being dried slowly

Baking a kiln:

Before baking a jar-coffin in the kiln, burn the internal frame of the kiln consisting of bamboos and cogon grass in order to increase the stability of the kiln walls and secure the internal space. The furnace gets scorched black as the internal frame of the kiln is burnt.

Internal frame being burnt fast



Schematic of a restored kiln and names of parts

Vent	Where the Smoke of the kiln passes through. The chimney is projecting slightly.
Firing chamber	Where the jar-coffin is baked. It can accommodate up to around 3 jar coffins.
Combustion chamber	Where the Firewood is burnt. It is the hottest part in the kiln.
Loading station	Where work tasks place when making a fire; a place for piling up firewood; also function as a wind barrier

Baking a Jar-coffin

Transportation

Before baking a jar-coffin, put it into the kiln. This work requires the largest number of people. To move a big jar-coffin that weighs over 200 kilograms, 6 adult men have to work on it. The first method we tried to move a jar-coffin was rolling it on the sand or rice husks. Note, however, that there was a great danger of breaking. After several attempts, we found that the safest way was to hang muslin cloths on a jar-coffin and move little by little while maintaining balance on both sides.

Attempts at various transportation methods

On sand

On rice husks

Using muslin cloths

Using a straw mat

People moving a big jar-coffin weighing over 200 kilograms using muslin cloths

Putting Jar Coffins into the Kiln

It is optimal to put 3 jar coffins into the kiln. We found out how to put jar coffins into the kiln by observing the black specks on their surface. Tilting placement or transverse placement was applied to jar coffins of the beginning stage, with vertical placement applied to big U-shaped jar coffins. Since jar-coffin pieces were found in the kiln site in Oryang-dong, Naju, we used jar-coffin pieces as the base to make the jar-coffin stand. The jar-coffin kiln has the highest ceiling at the center. Thus, put the largest jar at the center. Small jars are placed in the front and back of the largest jar. In addition, pottery was put in front of the small jar located near the combustion chamber in order to prevent the jar-coffin from coming into direct contact with the flames.

Transverse · Tilting placement: Put a jar-coffin on its side or slantingly.

Vertical placement: Put a jar-coffin vertically.

Jar-coffin fragments are put in front of a jar-coffin to block the flames.

Remaking the Ceiling of the Combustion Chamber

After putting jar coffins into the kiln, remake the ceiling of the combustion chamber, which was removed to secure access space.

Making a combustion chamber ceiling frame:

Set up wood pillars at the center of the combustion chamber and make an arched frame using bamboos.

Bamboo frame on the combustion chamber ceiling

Making the combustion chamber ceiling:

Remake the arched ceiling structure by utilizing the mud and ceiling pieces baked during the earlier experiment.

Covering the combustion chamber ceiling using kiln ceiling pieces and mud

Recording the Change in Kiln Temperature

Monitor the change in temperatures inside and outside the kiln using infrared thermal imaging camera and multi-channel thermometers.

Installing multi-channel thermometers

Sensors should be installed in the combustion chamber, firing chamber, and vent. Monitor the change in temperature at different points inside the kiln and temperature differences at the same points.

Location of multi-channel thermometer sensors and measuring the results

Taking images using an infrared thermal imaging camera

A thermal imaging camera is used to identify heat flow inside the kiln.

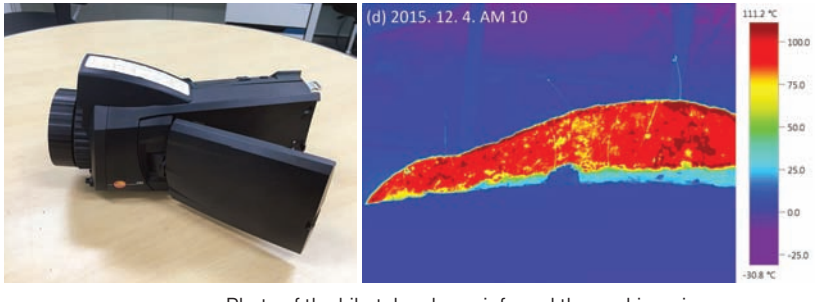


Photo of the kiln taken by an infrared thermal imaging camera

Making a Fire in the Kiln

Jar-coffin baking goes through starting fire, small fire, medium fire, and large fire in sequence. The kiln is lit for around 4 or 5 days on average. After cooling down the kiln for around one week, open the furnace and take the jar coffins out.

Starting fire:

Remove moisture from the kiln and jar coffins and preheat by making a low heat with rice husks and firewood. The temperature should be maintained below 200°C

Make the first fire and burn rice husks.

Burn firewood at the entrance to the kiln to preheat.

Small fire (1st raised fire):

Make a fire in earnest using firewood. 3 or 4 pieces of firewood are needed per hour. The temperature should be maintained below 500°C.

Making the fire bigger and bigger by putting firewood into the kiln

Medium fire (2nd raised fire):

Flames tend to gather at the center inside the kiln. Therefore, put firewood evenly at the center and on both sides of the furnace in order to minimize the temperature differences. 12 to 15 pieces of firewood are needed per hour. The temperature should be maintained below 800°C.

Soot inside the kiln is disappearing almost completely.

Large fire:

30 to 40 pieces of firewood are needed per hour. Keep adding firewood at intervals of 5 minutes. Flames should be maintained consistently. The temperature exceeds 800°C and approaches 1,100°C.

The inside of the kiln is getting brighter.

Fill the furnace with firewood right before intercepting the fire.

When the kiln reaches the highest temperature, flames burst out of the chimney.

Once the temperature inside the kiln exeeds 1,000°C, jar coffins turn red and soon change to yellow. becoming extremely hot.

Adding More Mud on the Firing Chamber Ceiling

In order to prevent cracks on the kiln and keep the heat inside, apply mud on the newly made firing chamber ceiling several times during firing.

Adding mud on parts where the heat leaks

Sealing Kiln

Sealing the furnace

Sealing the chimney

Applying Muddy Water on the Kiln

After sealing the kiln, apply muddy water on the entire ceiling to keep the heat inside.

Applying muddy water on the entire kiln surface

Baking

We divided the baking steps of the jar-coffin baking process into starting fire, small fire, medium fire, and large fire and observed changing aspect in the jar coffins depending on the temperatures inside the kiln. Multi-channel thermometers were installed in the kiln to measure baking temperatures. During the starting fire, the temperature should be maintained below 200℃. The baking temperatures of small fire, medium fire, and large fire were divided every 300℃. A starting fire is made with rice husks. The starting fire removes moisture from the inside of the kiln and preheats the kiln slowly. A starting fire takes more than a day. Firewood is used from small fire. The flames can be controlled through the quantity of firewood used. When we increased the highest temperature inside the kiln up to 1,200℃, the jar coffins were deformed, and the surface got glossy, unlike the actual jar coffins. Thus, we kept the highest temperature between 1,000℃ and 1,100℃. Seal the furnace and chimney when the highest temperature inside the kiln reaches the target temperature. We sealed the furnace and chimney by creating a variety of baking environments such as oxidation and reduction based on actual jar coffins. The kiln is lit for around 4 or 5 days on average. After cooling down the kiln for around one week, open the furnace and take the jar coffins out.

In the autumn of 2018, all the employees of the Research Institute participated in making a fire in the jar-coffin kiln together.

On the last day of the five-day firing process, they were smiling in front of the kiln after completing all the hard work.

Opening Kiln

Breaking open the furnace and chimney:

The chimney and the entrance to the furnace, which are sealed in the last step of the baking process, are broke open.

Furnace opened

Chimney opened

Breaking off the combustion chamber ceiling:

Once the kiln cools down, put the jar coffins into the kiln and break off the combustion chamber ceiling again to secure space for moving the jar coffins.

Breaking off the combustion chamber ceiling

Taking Jar Coffins out of the Kiln

Take the jar coffins out of the kiln. At least 6 grown-ups are required to lay a large jar down and carry. 3 grown-ups are needed to move a small jar.

Taking a large jar out

Taking a small jar out

The inside of the kiln was sintered after baking. We could find traces of the rice straw and cogon grass used to make the ceiling.

Inside the kiln

Kiln ceiling

Kiln wall

Finished Jar Coffins: Oxidation Firing

Oxidation firing

At the last step of firing, we opened the chimney and the entrance to the furnace so that oxygen could flow in. Jar coffins were generally reddish-brown, dark brown, or yellowish-brown.

We used oxidation firing for baking, and the baking temperature was 1,000°C. Vertical placement baking was applied, and rice husks were spread on the ground as a support. As a result of baking, the jar coffins turned reddish brown, and a round black mark was found at the bottom.

Finished Jar Coffins: Reduction Firing

Reduction firing

At the last step of firing, we blocked the chimney and the entrance to prevent oxygen from flowing in. The highest temperature did not exceed 900°C to 1,100°C. Jar coffins were generally gray, gray-black, or black.

We used reduction firing for baking, and the baking temperature was 1,000°C. We dug holes on the kiln floor and put jar coffins into the kiln vertically on the holes. As a result of baking, the jar coffins turned gray-black, and a round yellowish-brown mark was found at the bottom.

Finished Jar Coffins: High-Temperature Firing

High-temperature firing

At the last step of firing, we increased the temperature inside the kiln to 1,200°C. Jar coffins cracked and collapsed due to the high temperature.

We used oxidation firing for baking, and the baking temperature was 1,200°C. Vertical placement baking was applied, and rice husks were used as the base. In the baking process, flames touched the jar coffins, which cracked and broke at the bottom. Jar coffins were dark brown, and a natural glaze was found in some parts.

Jar coffins created for an experiment were made in the same shape as the big jar coffins excavated from archaeological sites. For various experiments, we tried to change their sizes and colors by applying different experimental conditions. The phenomena shown in the restored jar coffins were similar to those found in actual jar coffins. Therefore, they are very useful data in restoring production technology. We will continue our experiments by conducting a comparative study on our experiment results and actual jar coffins.

Chapter 2

Big Jar Coffins' Rebirth and the People Behind

Third, Those Who Made Jar Coffins

Fourth, With Reborn Jar Coffins

The Rebirth of the Big Jar-coffin,

Records on the Production of the Big Jar-coffin

Third

Those Who Made Jar Coffins

Jar Coffins Made in Oryang-dong 1,500 Years Ago

Although Oryang-dong is now farmland, it was a huge village producing jar coffins 1,500 years ago.

Discovery of Kiln Site for Big Jar Coffins

Although a lot of the big jar coffin had been excavated from the Yeongsangang River basin, no jar-coffin kiln had been found at all until the late 20th century. All those who were interested in big jar coffins wondered where the jar-coffin kilns were. Park, Cheol-won, who worked for the Dongshin University Museum of Culture at the time, was one of them.

In the spring of 2001, Mr. Park visited Oryang-dong to irrigate his father-in-law's paddy as he did every year. He suddenly looked at the hill across from the paddy as if possessed by something.

He found something revealed on the hill where trees were cut down and the ground was dug for a tomb. He ran to the place and checked the site based on his extensive experience in excavation. He saw a huge pile of jar-coffin pieces. He had a hunch. "Is it a jar-coffin kiln site?" The thought crossed his mind. He took photos first. He contacted Dongshin University Professor Lee, Jeong-ho with whom he shared his academic interest. Professor Lee said it was very likely that the place was a jar-coffin kiln. There was a high probability that jar-coffin kilns existed there.

A big jar-coffin kiln site finally revealed itself. Someone said an important archaeological site is found by accident. He could see that the saying was true.

It rained. A few days later, he visited the place again. He saw the traces of kiln walls. Distorted jar-coffin pieces were scattered. Some jar-coffin pieces got scorched and stuck to each other. He checked the neighboring hills as well as the site. Part of the kiln walls were found on a reclaimed hill (current District A) adjacent to the Yeongsangang Riverside. Part of the kiln walls were also found on the opposite hill (current District C). Finally, he was able to find out the current range of the Kiln Site in Oryang-dong.

A huge quantity of jar-coffin pieces were everywhere on the ground of the archaeological site in Oryang-dong.

The first excavation research was conducted to excavate the inside of the jar-coffin kiln in 2002.

> Another story 1. Professor Choi, Sung-rak said that the role of Professor Lee, Jeong-ho in the excavation research on the Jar-coffin Kiln Site in Oryang-dong is as important as that of Park, Cheol-won who first found the site. While Lee, Jeong-ho was working for the Mokpo National University Museum after studying in Japan, he was appointed as a professor at Dongshin University. Professor Choi said that academic research, investigation, and excavation on the Jar-coffin Kiln Site in Oryang-dong accelerated when Professor Lee joined the excavation as a local expert.

Trial Excavation/Excavation Research on Kiln Site and Designation as Historic Site

After a jar-coffin kiln site had been found in Oryang-dong, a proper excavation research was desperately needed. Nonetheless, we could not start an excavation right away due to various circumstances. The Mokpo National University Museum and Dongshin University Museum of Culture secured a budget together. In August 2001, the first research was finally conducted. Nonetheless, we were still short of money. We only had basic excavation tools such as shovels, homis(One of traditional korean weeding tool), and handcarts, and there was even an incident where all such tools suddenly disappeared.

After going through such hardship, we finally started the full-scale excavation research in 2002. We found out the features of jar coffins. Jar-coffin kilns had a gentle slope and a wide span, although they were similar to pottery kilns in terms of shape. In addition, a large number of jar-coffin pieces were excavated as well on the floor inside the kiln. The pieces were assumed to have been used as a base for jar coffins. It convinced us that a jar-coffin kiln existed there. The

performance of the excavation research on the Jar-coffin Kiln Site in Oryang-dong hit the headlines in both academic circles and media at that time. Although all excavations of ruins are important, the discovery of archaeological production sites carries more significance and far-reaching power.

After the significance of the Jar-coffin Kiln Site in Oryang-dong had been widely known all over the country, Mokpo National University Professor Choi, Sung-rak visited the Kiln Site in Oryang-dong with Lee, Man-yeong who was the Head of the Cultural Heritage Administration Historic Site Committee at the time. Professor Choi, Sung-rak said that the Jar-coffin Kiln Site in Oryang-dong was designated immediately thanks to this event. After the investigation group and numerous people's hard work, the Jar-coffin Kiln Site in Oryang-dong was designated as a historic site in 2004. Around 270,000 square meters were designated as a historic site. It is the largest archaeological site in the area considered as a single historic site.

Take-off for a New Stage: In-depth Research of Naju National Research Institute of Cultural Heritage

After the Jar-coffin Kiln Site in Oryang-dong had been designated as a historic site, it went into a resting phase. Not only did we need an overall understanding of the historic site; we also had to make and implement a systematic excavation and management plan. It was not an easy task. Nonetheless, we finally had a breakthrough. In 2005, the Naju National Research Institute of Cultural Heritage opened its doors.

The Naju National Research Institute of Cultural Heritage, founded with the goal of "Systematic Academic Investigations and Research on Cultural

Heritage Scattered Around Honam," made a plan for various in-depth research studies considering the Archaeological Site in Bogam-ri, Naju and Jar-coffin Kiln Site in Oryang-dong, Naju as major archaeological sites. Jar coffins used as burial facilities of the ancient tombs in the Yeongsangang River basin are huge and cannot be found in other areas. The jar coffins have their own unique shape, to be used only as coffins. Thus, there was a growing emphasis on big jar coffins research. In particular, the discovery of the Kiln Site in Oryang-dong, Naju, which is the archaeological site of jar-coffin production, drew interest in ancient big jar-coffin technology. In 2007, the Research Institute resumed the excavation research on the Jar-coffin Kiln Site in Oryang-dong, Naju.

The excavation research was conducted from 2007 to 2012. The researches were carried out from 2015 to 2017 varying the period of each research from 2 to 7 months every year.

The excavation research on the Jar-coffin Kiln Site in Oryang-dong continued, drawing many people's attention.

Once soil was scraped from the ground, the trace of red-colored kiln due to the firing wall was revealed.

Excavating the kiln wall revealed under a deep layer of sediment
(Assistant Researcher Gang, Myeong-seok)

Excavation Research to Restore Ancient Technical Knowledge

Since 2008, the Research Institute has devoted itself to the Ancient Big Jar-coffin Production Technology Restoration Project. We wondered how such big jar coffins were made in the past. Our goal was to restore big jar-coffin production technology based on our excavation research on the Kiln Site in Oryang-dong. It was largely divided into two. One was finding out how jar coffins were baked by understanding the jar-coffin kiln structure. The other was reproducing a jar-coffin in person using ancient technical knowledge based on our excavation research.

First, we worked on figuring out the structural features of the kilns. The traces of 77 kilns have been found so far at the archaeological site in Oryang-dong. It was a great place to try various investigation methods since kilns were concentrated in the site. In some spots, we found kilns buried under the soil through geophysical exploration using magnetism. The result of the geophysical exploration using magnetism was more than 90% consistent with that of the excavation research. We found out that a geophysical exploration was suitable for kiln discovery.

Conducting a geophysical exploration (Researcher Oh, Hyun-dok)

Recording the strata of a kiln (Assistant Researcher Sim, Jin-su)

To identify the strata inside the kiln, we reviewed the structural features using a variety of methods. We investigated the strata after installing a cross-shaped dike at the center; set up a central line and investigated both sides based on the central line; and left the entire strata of a wall and investigated the sedimentation features at once. Even it was a difficult method to apply in the situation when we had to conduct the overall investigation on the strata of the kiln, researcher Jeong, Seong-mok attempted such a difficult method by thinking outside the box. After investigating the sedimentation features, researcher Lee, Jae-seong, who was in charge of conservation treatment, moved the strata intact to the Research Institute. Now on display in the first Floor Exhibition Hall of the Naju National Research Institute of Cultural Heritage, it is receiving a lot of attention from visitors to the Research Institute.

Taking off the strata to see the sedimentation features inside the kiln
(Researcher Lee, Jae-seong and Assistant Researcher Song, Jeong-il)

Drawing a variety of phenomena that occurred inside the kiln on the floor plan.
(Assistant Researcher Jeong, You-jin)

Jar-coffin Kilns or Pottery Kilns?

What are the differences between jar-coffin kilns and pottery kilns? They have structural differences. Jar-coffin kilns were first discovered in 2001, and their shapes and jar-coffin pieces were found through the excavation research in 2002. Note, however, that researchers disagreed on whether they were jar-coffin kilns or pottery kilns. The clay pottery pieces were excavated with the jar-coffin. Some researchers thought it would not be possible to bake a jar-coffin in such a narrow kiln. They said that the kilns in Oryang-dong must have been pottery kilns, and that the jar-coffin pieces excavated from the kilns must have been used as a base for pottery baking. They thought that it would be better to bake a jar-coffin outside after covering it with clay because of its huge size, instead of baking it inside the kiln. A huge quantity of jar-coffin pieces was excavated inside the entrance to the kiln in 2009. The jar-coffin pieces were assumed to have been discarded when the jar coffins were taken out. Thus, it became relatively clear that the kilns were jar-coffin kilns. Nonetheless, some researchers said they had to find a jar-coffin that had collapsed inside the kiln in order to be sure.

We could identify the structural features of jar-coffin kilns clearly based on the 25 kilns excavated in Oryang-dong. Pottery kilns and jar-coffin kilns are very different in terms of their structures. The shape and length of some jar-coffin kilns are similar to pottery kilns. Note, however, that the kiln floor has a gentle slope of less than 10°, so a huge jar-coffin can be put inside safely. The ceiling is 2 meters or higher, so a jar-coffin can be put inside. These features of jar-coffin kilns are distinct from pottery kilns.

In addition, jar-coffin pieces supporting jar coffins were leaning against the wall at the edge of the kiln floor when they were excavated. When we took the jar coffins out of the kiln after baking for a jar-coffin production experiment, the jar-coffin pieces used as a base were pushed to the edge just like the excavated pieces. Jar-coffin pieces stuck on the floor of some jar coffins when they were excavated.

Organizing a large quantity of jar-coffin pieces discarded in the kiln

Discovery of Workshop Site

Where in Oryang-dong would the jar coffins be made? (Where would be the workshop?) We kept wondering about it after the jar-coffin kilns were discovered through the excavation research. Although we had found a great number of jar-coffin kilns through the research on the hill in Oryang-dong since 2007, we did not discover any jar-coffin workshop facility at all. It must have been somewhere!

When land compensation for the southern area of the Kiln Site in Oryang-dong was completed in 2015, a new stage finally began. As people prefer south-facing houses now, signs of life of people in the past were concentrated in the south of the archaeological site. Researchers thought that they could find signs of a workshop through an excavation on the wide southern area. Their expectation was growing. First, we cut down all pear trees and pine trees forming a dense forest in the southern area to see the ground. When the trees were cut down, we felt sorry for them. Fortunately, Naju City Government used the pine trees to restore Najueupseong Walled Town.

Once the trees were cut down, the ground of the southern area was revealed. An overall trial excavation research was conducted immediately on a wide range. The excavation research was conducted on points where traces of structures are deemed concentrated. Overlapped jar-coffin kilns were unquestionably found at the point connected to the place where Dongshin University conducted an excavation. Finally, we found a site that was assumed to have been a workshop. The site was huge, and the walls were around 10 meters long. Column holes were found along the edges of the walls. Multiple oval pits were concentrated in one part. Nonetheless, we could not find traces of clay and jar-coffin production tools. Researcher Lee, Ji-yeong, who was in charge of the research at the time, said we might be able to find new facilities if we expand our investigation range.

In the middle of the excavation, we sometimes imagined the kiln village in Oryang-dong. Master jar-coffin artisans and their families would live here. Jar-coffin workshops and kilns would be located over there. How many people would live here? How many jar coffins would they make? Could they have known that their descendants like us would imagine about them and talk about their jar coffins in the future?

Drawing the signs of inconsistent shapes and numerous column holes found in the workshop site
(Assistant Researcher Lee, Hye-won and Assistant Researcher Kim, So-ra)

> “Another story 2. One day, a local worker of the excavation research who attended a local public hearing told us that roads would be constructed near the Kiln Site in Oryang-dong, and that a transmission tower would be installed in the historic site. Road construction had already been decided before the Kiln Site in Oryang-dong was found. Construction work proceeded without any measure. Luckily, a transmission tower was not installed. Nonetheless, roads were constructed between Oryang-dong District A/B and District C, which divided the historic site into two. But if we try to look at the bright side, in the past, it was hard to find the Kiln Site in Oryang-dong, which was located in an undeveloped area, but now, one can easily access important historic sites such as the Kiln Site in Oryang-dong and Ancient Tombs in Bogam-ri, thanks to the roads. This is how the detour was installed in front of Bogam-ri and Oryang-dong.”

Ancient Technology is Restored through Jar-coffin Kilns in Oryang-dong

Those who made big jar coffins taller than 2 meters must have been proud of their technology. Since the Kiln Site in Oryang-dong is adjacent to Yeongsangang River, the water is deemed to have flowed right in front of the Kiln Site in Oryang-dong. It is highly likely that the jar coffins made in the kiln site were moved through the waterway of Yeongsangang River. A mark is engraved on the bottoms of some jar coffins, showing that they were made in the Oryang-dong kiln. The same mark was found in neighboring ancient tombs.

At the beginning of the resumed excavation, the Naju National Research Institute of Cultural Heritage focused on restoring the jar-coffin kiln production technology. First of all, we took lots of advice from Park Cheol-won from the Dongshin University Museum of Culture, who first conducted the excavation research, in order to identify the overall shape of kilns. We attempted various methods based on his advice. In addition, we have observed the shape of the kilns found through our excavation research, which led us to the in-depth research. Professor Lee, Jeong-ho of Dongshin University, who conducted the research on kiln ceiling types, speculated the shape of jar-coffin kilns based on the shapes and sizes of jar coffins. Based on such research data, the Research Institute tried to find at the site kiln ceilings and chimneys that were different from pottery kilns in terms of shape. In 2010, the Conservation Science Team of the Research Institute tried to move the strata of a kiln in Oryang-dong intact. We got a kick out of seeing the process wherein the cross section of the strata of the kiln was moved intact by thin cloths and panels. Once the cross section of the strata was moved, we could see the overall shape of the kiln and its ceiling at a glance.

Based on our performance of such long-term research and excavation, we could finally restore and build a jar-coffin kiln. Nonetheless, another challenge emerged. It was unexpectedly difficult to move and put big jar coffins into the kiln. We attempted various methods. We rolled a jar-coffin on the sand or rice husks to put it through the small kiln entrance. In addition, multiple people tried to move a jar-coffin after winding cloth around it. Nonetheless, the jar coffins were still standing outside the kiln. After agonizing over how to move the jar coffins, we asked Master Onggi Artisan Lee, Hyun-bae for advice. He said, “Think from a perspective of an onggi jar artisan. Remove the entrance and rebuild it later.” It was ridiculously simple. We examined the excavation research results thoroughly and found traces of the entrance wall being rebuilt. The master artisan was right.

After many complications, we could finally restore a jar-coffin kiln using mud in the Naju National Research Institute of Cultural Heritage in 2012. One of the Research Institute’s long-cherished projects was completed.

Master Onggi Artisan Lee, Hyun-bae visiting the Kiln Site in Oryang-dong and comparing onggi jar kilns and jar-coffin kilns with Researcher Jeong, Seong-mok

Investigating and recording the sedimentation features inside the kiln
(Assistant Researcher Gang, Myeong-seok)

Whom We Worked With

An excavation on the Jar-coffin Kiln Site in Oryang-dong was first launched in 2001. It took the Naju National Research Institute of Cultural Heritage almost 10 years to finish the project. This long-term excavation research could not have been conducted without numerous people's efforts. The excavation research was participated in by dozens of researchers and workers as well as those who made a plan and a blueprint.

Most field workers who helped in the excavation research on the Kiln Site in Oryang-dong were local seniors living in Oryang-dong.

Many people were with us from beginning to end. Note, however, that some researchers who had joined us at the beginning left the Research Institute for their other goals. Assistant Researcher Oh, Dong-sun returned to the Naju National Research Institute of Cultural Heritage after becoming a Researcher. Most field workers who helped in the excavation were local seniors living in Oryang-dong. Local seniors felt proud of participating in the cultural heritage research while helping in the excavation for a long period of time. They are still helping us, considering themselves archaeologists. We could conduct the excavation research without any trouble for a long period of time, thanks to them. When the Research Institute had just been founded, we encountered many difficulties in securing the research period and manpower due to our limited budget for the excavation research. Administrative staff members and official vehicle drivers as well as researchers had to participate in the excavation. Understandably, they were probably not happy about it. Still, it was a good opportunity for the employees of the Research Institute to understand the importance and difficulty of the excavation research.

After the Excavation Research on the Kiln Site in Oryang-dong

The excavation of ruins is never possible with one person's effort and ability alone. The most important thing in the ruin's excavation research is the combined efforts of all the participants. To obtain the best data, archaeologists, natural scientists, site excavation officials, participants, and local residents and officials of the area where the archaeological site is located should cooperate with each other.

Those who have been participating in the excavation of Oryang-dong for about 10 years are now very skilled in excavating. They participate in the excavation with pride.

The Kiln Site in Oryang-dong, Naju is the only archaeological site found to have produced jar coffins. Therefore, comprehensive research should be conducted regarding road facilities, workshops, and living spaces as well as the kilns at the Kiln Site in Oryang-dong. Based on such research, we should pave the way for the public to have an in-depth understanding on the life and culture of ancient people. An archaeological site is not dead ruins under the ground but living history. It lets us talk with the past and enables us to imagine that the present will become the past in the future.

In that sense, proper management and maintenance are required for the Kiln Site in Oryang-dong, which has been designated as a historic site. Of course, we need to identify the scope of the archaeological site accurately. We need to establish a conservation measure to prevent the archaeological site from being damaged and a proactive plan to enhance its values.

Those Who Reawakened Jar Coffins

Since the Naju National Research Institute of Cultural Heritage was founded in 2005 for systematic studies and research on cultural heritages spreading over Honam, we have agonized over our roles and the tasks to focus on. At that time, we concentrated on figuring out the society of the political bodies of ancient jar coffins and the excavation and shapes of ancient tombs such as big jar-coffin tombs and keyhole-shaped tombs. We realized that we needed a more advanced, in-depth study based on such research. On the premise of concentrating on figuring out the characters and true nature of the ancient society of Honam, we drew up an archaeological site research plan focusing on the base of the political bodies that had used ancient tombs. As part of this plan, we published jar-coffin source books at home and abroad including Japan and Vietnam, collecting and organizing basic data. We established an archive under the theme of jar coffins.

During this process, people focused on the jar-coffin kilns found at the Kiln Site in Oryang-dong, Naju, which was designated as a historic site. We wondered how jar coffins had been made and realized that there were no research studies about this subject at all. Thus, we decided to conduct the research to identify the shape and production technology of jar-coffin kilns. At that time, Gwangju MBC aired a documentary about jar coffins, but they failed to make a jar-coffin. After watching the documentary, we doubted more and more whether we could really make a jar-coffin. Some scholars raised the question that the Kiln Site in Oryang-dong, Naju, might not have been jar-coffin kilns, taking into consideration that it is hard to make and bake a jar-coffin with the current technology. Note, however, that there were no research studies investigating such facts academically.

The unsolved jar-coffin production technology was selected as a major project of the Research Institute. We began to form an innovative plan to approach the unknown technology from an experimental archaeological perspective. In addition, we wanted to figure out where the clay constituting jar coffins came from and how jar coffins were moved to other areas. The questions were our other major projects. Not only was this research intended to restore production techniques; its ultimate goal was to identify the life of the people who had lived in ancient Honam.

The Beginning

Difficulties from the Beginning

Our ambitious production experiment plan, Ancient Jar-coffin Production Technology Restoration, finally embarked on a long journey. We first held a workshop with people from various fields including academic researchers and master onggi artisans as well as researchers of the Research Institute. To ask whether we could really make a big jar-coffin, we invited master onggi artisans from Jeollabuk-do and Gyeonggi-do as well as Jeollanam-do's intangible cultural assets specializing in onggi jars, which are deemed to be similar to jar coffins.

Most master onggi artisans had a negative opinion about big jar-coffin production. They might have gotten such idea from the documentary of Gwangju MBC. They were aware that we asked some well-known onggi jar workshops in Jeollanam-do to make a jar-coffin several times but failed. They would also be probably aware that we finally succeeded in making a jar-coffin but broke it while moving it into the kiln. Still, the academic researchers thought that we might be able to make a jar-coffin. Most attendees during the meeting said that it would be difficult to make a jar-coffin because it is too big and thick. They added that it would collapse easily even if we succeeded in making its shape.

Experts from various fields exchanging their opinions to start a big jar-coffin production experiment

The situation was not good. Nonetheless, big jar coffins made by ancient people were standing in front of us. Believing we could do it, the Naju National Research Institute of Cultural Heritage finally began to work on a production experiment in 2008. The first goal we tried to achieve at the time was making and baking a big jar-coffin. Although we would successfully bake a jar-coffin in the kiln, we still had a lot of problems to solve. We had to find out the source of texture clay used for jar coffins and conduct an archaeological verification on the jar-coffin production technology. In addition, we had to restore the shape of a jar-coffin kiln and find out the baking method. Nonetheless, we decided to focus on our immediate goal.

Sharing various opinions about kiln restoration, looking at an actual kiln at the Kiln Site in Oryang-dong

Cooperation with Master Onggi Artisan

Jar-coffin production is not possible only with researchers who majored in archaeology. Experts from various fields such as master onggi artisans, natural scientists, and art historians have to bring their expertise and experience together and take a new step forward while complementing each other in order to succeed in such convergence work. First of all, we needed the skills of a master artisan who could build a jar-coffin. This is when we first met Master Onggi Artisan Lee, Hyun-bae of Sonnae Onggi Workshop, Jinan who has been helping us so far with various big jar-coffin projects of the Naju National Research Institute of Cultural Heritage. Of course, it was important for the Research Institute to make a jar-coffin well. Still, the most important thing was making a jar-coffin based on archaeological materials. We and Master Onggi Artisan Lee, Hyun-bae agreed on it. He was very curious about the archaeological factors and interested in the process of understanding and figuring them out. He was the best partner for the big jar-coffin project.

In an actual production experiment, it was very important how the master artisan's experience and researchers' research results on jar-coffin production interrelated with each other. The discussion with the master artisan, which could not be obtained through archaeological research, and his practical wisdom that fueled researchers' academic imagination, was very helpful in overcoming the difficulties. A jar-coffin production experiment would have been difficult without Master Onggi Artisan Lee, Hyun-bae's enthusiasm.

After the first experiment, we realized a general fact. Of course, success is important, but failure is also equally important. The process of a production experiment is significant itself. One success does not mean that we restored the production process accurately. We should be able to produce the same results in repeated trials. Nonetheless, it is not that easy. Sometimes we do not know why it fails. Sometimes we find out the reason later. One failure after another. Finally, we achieved success.

The master artisan first thought that he was going to participate in an experiment just one time. He said he changed his mind and decided to keep helping us with the experiment when he saw that the Research Institute kept working on it. Since the first experiment, which was considered by the master artisan to be a failure, he still continued participating in the experiment. He first knew about archaeology through the production experiment. He said he has been able to see onggi jar production from different angles since then. He was modest enough to say that he learned a lot of things by challenging himself with unfamiliar things. Now, he considers the production experiment of the Research Institute to be his duty.

Master Onggi Artisan Lee, Hyun-bae, who decided to participate in a big jar-coffin restoration experiment, visited the Kiln Site in Oryang-dong with Senior Researcher Lee, Jong-hun.

We diversified the direction of the experiment based on archaeological information as well as the master onggi artisan's experience.
(Master Onggi Artisan Lee, Hyun-bae discussing with Researchers Jeon, Yong-ho and Jeong, Seong-mok)

The First Simulation in a Temporary Tent

When we first began a production experiment in 2008, the Research Institute did not have its own office, so it rented office space. In such circumstances, it was difficult to find a workshop for the production experiment. We installed a tent, as a temporary measure, on the paddy field in front of the Natural Dyeing Culture Center in Bogam-ri, Naju for the experiment.

How would we make a jar-coffin? The Research Institute decided to make a jar-coffin using clay strings stacking in an archaeological way based on the results of theoretical research and experimental archaeological analyses. In the MBC documentary mentioned earlier, a jar-coffin was made with the board technique for onggi jars. Note, however, that we could not make a jar-coffin using that technique. After explaining jar-coffin production using clay strings stackingg to Master Onggi Artisan Lee, Hyun-bae, the Research Institute began the experiment. He said clay stripe piling would not be a problem because the principle of big jar making is the same as that of small jar making.

In 2008, the first production experiment was conducted at the temporary tent in front of the Natural Dyeing Culture Center in Bogam-ri, Naju.

He said we should mix a little bit of sand, different from the clay used for onggi jars, since jar coffins are too big and heavy.

He thought we should use mud between pottery and porcelain. We prepared clay and temper, which were deemed most similar to the master artisan's advice. Texture clay were finally prepared.

We began to make a jar-coffin in earnest. The most difficult work in jar-coffin production was making its round base. We first made the upper part of a jar-coffin upside down. Narrowing the shape, we made a round base at the last step. After several failures, we finally succeeded in shaping a 180-centimeter tall jar-coffin with a round base.

It was time to make a kiln to bake the jar-coffin. We decided to model a jar-coffin kiln after a relatively intact kiln among the kilns found at the Kiln Site in Oryang-dong. We prepared materials to make a kiln and made a hill next to the tent by piling soil in order to create an environment similar to the Kiln Site in Oryang-dong. We began to make a kiln with the master artisan. "We should have chosen a smaller one." It felt as if we chose the hardest one.

The first jar-coffin made by Master Onggi Artisan Lee, Hyun-bae

The Research Institute focused on whether a kiln could be made. We did not conduct a detailed analysis on the kiln shape since we had already understood the kiln structure through the excavation at the Kiln Site in Oryang-dong. We only focused on making a jar-coffin kiln and producing a jar-coffin. Despite the researchers' concerns, the master artisan made a kiln step by step without much difficulty. The kiln had to have a very high ceiling to contain a 180-centimeter tall jar-coffin. Once the kiln was completed, it seemed different from the general kilns we knew. Unlike onggi jar kilns, the jar-coffin kiln was short and had a very high ceiling, which looked weird at first. When the master artisan saw the finished kiln, he said he was not sure whether a jar-coffin would be baked properly since he had never used such a kiln.

The most difficult matter for the master artisan was moving the jar-coffin into the kiln.

The first kiln was made with soil bricks, led by Master Onggi Artisan Lee, Hyun-bae.

He said he could bake the jar-coffin somehow once it was put inside the kiln. After watching the documentary of MBC, he said the most difficult issue was moving the jar-coffin. He was very concerned about this issue. “A jar-coffin is in the most stable state when it contains moisture somewhat. It becomes fragile when it is completely dried. So, it would be difficult to move after it dries.” After putting our heads together and conducting some experiments to solve this issue, we decided to move the jar-coffin into the kiln using sand. First, we had a rehearsal with a small jar-coffin. It felt as if we were approaching the goal step by step.

It was probably thanks to the rehearsal, but we finally moved the jar-coffin safely into the kiln without breaking it. We believed that the master artisan would be able to make a fire in the kiln well. In addition, we discussed it several times during the experiment. We did not worry about it too much. Thus, we were indescribably delighted when we succeeded in moving the jar-coffin into the kiln. It blew our mind, as if we have achieved everything. Nonetheless, another issue came up as soon as this happy moment passed. Did ancient people put a jar-coffin on its side or make it stand when baking it in the kiln?

We spread sand thickly on the ground and rolled the jar-coffin to the kiln.

Finally, the fire went out in the kiln. It was time to check the jar-coffin. Researchers seem to put processes before results. Note, however, that the master artisan seemed to place more importance on the results than processes. Researchers were satisfied that all processes proceeded properly in terms of archaeology. The master artisan seemed to have felt happiest when he opened the kiln and saw the jar-coffin for the first time.

We spread jar-coffin pieces on the ground and made the jar-coffin stand on them inside the kiln.

Several days after we made a fire in the first kiln, the jar-coffin began to be baked.

Making and Baking Again

Basic Data Collection Requiring as Much Effort as Restoration

We needed accurate data to restore the jar-coffin production process. First of all, we collected reference materials about the jar coffins found in the Yeongsangang River basin. We made a list of archaeological sites of jar coffins, what types of jar coffins were excavated, and how many jar coffins were excavated. We began to work on an investigation, focusing on how jar coffins were shaped and baked.

Based on the collected data, we visited numerous national museums, college museums, and research institutes housing jar coffins. We decided the order:

starting from the nearest to the Research Institute. We contacted them for cooperation in the order decided. We visited the institutes, checked the materials in person, and collected samples for analysis. We had to make great efforts to collect more jar-coffin samples. Collecting samples from intact jar coffins was damaging the artifacts. Thus, we collected samples from partially damaged jar coffins or jar-coffin pieces. Jar-coffin pieces used to be of no value to us during excavation because there were too many of them. Nonetheless, they became very precious while collecting samples. It was difficult to collect data when visiting other institutes, because we had to take photos, record data, and touch jar coffins during one visit. We were able to collect all the data, thanks to the other institutes' full support. They collected their jar-coffin data in one place for us and allowed us to collect samples except when it directly affected the jar coffins. Observing jar coffins and collecting samples took longer than expected.

Through our jar-coffin research at other institutes, we found out some facts. ① Lattice patterns were engraved the most on the surfaces of jar coffins. Denticulate patterns were engraved on the necks. ② The jar-coffin bases were broken in lumps at a certain height. The bodies were broken at a certain height as well. ③ Traces of clay strings were found on the broken parts of jar coffins. Sometimes, artisans' fingerprints (clear as if fingerprints were just made) were found. ④ The directions of patterns engraved on the surfaces of the jar coffins were not consistent. ⑤ We checked all black spots that might tell us how ancient people put jar coffins into a kiln and baked them. Black spots tell us whether jar coffins were standing straight or lying on their side while being baked.

Basic data was collected through a final natural scientific analysis. Since the Conservation Office of the Research Institute was not well-equipped at the beginning of a production experiment, we conducted a sample analysis and ran a 3D scan, an X-ray scan, and a CT scan with the Cultural Heritage Conservation Science Center of the National Research Institute of Cultural Heritage. A natural scientific analysis entrusted to Kongju National University Professor Lee, Chan-hui became more systematic after 2012.

Assistant Researcher Choi, Mi-sook is observing and recording jar coffins to collect the results of the latest research studies on Korean jar coffins.

Researchers were collecting samples for jar-coffin composition analysis and comparative research.

A Struggle at the Second Temporary Workshop

Researcher Jo, Mi-sun and Assistant Researchers Sung, Yun-gil and Lee, Hyeon-min found and made texture clay for jar coffins. Experimental archaeology was an unfamiliar field of study to Assistant Researcher Sung, Yun-gil who majored in art history. A production experiment would be much more difficult to him since he did not know about the restoration project, which required long hours of manual labor. He mainly entrusted the texture clay analysis and collected soil in person at places assumed by Chonnam National University's Department of Geological Environment to be where ancient people would collect clay. The places assumed to have been clay collecting points were mostly near Yeongsangang River. He visited the sites and collected soil in spite of their rough terrain.

Something unexpected happened. As Yeongsangang River flooded, the workshop in Bogam-ri, Naju disappeared without a trace. We were supposed to move to the new research institute building, but construction work was

Collecting clay from the Yeongsangang Riverside

not yet completed. Thus, we needed another temporary workshop. We had no choice but to live with Master Artisan Lee, Hyun-bae. We had to work at the Sonnae Onggi Workshop in Jinan. As such, we needed to move all the collected soil to the Sonnae Onggi Workshop to make texture clay. A long business trip to an unfamiliar place began.

The experiment conducted in the Sonnae Onggi Workshop in 2009 gave them special memories. We worked in modern hanboks bought at the Natural Dyeing Culture Center. Contrary to their appearance, the white fabric was too thin and cold. In November, we had to dress in layers and worked in the middle of the mountain, shivering with cold. Such experiences would later be unforgettable for the team. While we were working at the Sonnae Onggi Workshop, we talked with Master Onggi Artisan Lee, Hyun-bae a lot about life as well as the experiment. The master artisan emphasized several times that we should understand and handle soil tactfully. Still, it was too difficult for the researchers, who had never done any manual labor. We tried to do all work using their physical strength alone, and it had to be finished for a short period of time. It must have been arduous.

Another thing happened as well. It happened when we moved the clay collected from Yeongsangang River to the Sonnae Onggi Workshop. There was a huge amount of soil. Thus, two persons were not enough to move it. We needed others' help. Assistant Researcher Lee, Jin-woo joined the project. We rented a 5-ton truck to move the clay. It was really difficult to load the clay onto the truck. Wet soil was heavier than expected. In addition, we had to pass a narrow farm road to get to the truck. The truck driver often complained due to the bad road conditions. Loading soil onto the truck by relying on their strength alone, without any equipment, having to bear the driver's tantrums. It must have been a depressing experience that we never want to go through again. We loaded all clay onto the truck somehow and arrived at the Sonnae Onggi Workshop at night. Unloading was hard as well. Soil seemed endless even though we kept unloading it. It was finally over at around 9 p.m. It must have been one of the hardest jobs we ever did.

Assistant Researcher Sung, Yun-gil mixing and kneading clay using a wood shovel

> “While I was making texture clay, I had a lot of doubts as to whether we could really make a jar-coffin. In 2008, I thought we cannot make a jar-coffin with the current technology at the time of the experiment. Nonetheless, I saw how a jar-coffin was made through our experiment conducted with Master Artisan Lee, Hyun-bae. The moment I saw the finished jar-coffin, I forgot all the difficulties we went through. It felt as if I realized the truth through a special experience. I was interested in porcelain since my major was art history. Still, I was not that interested in its manufacturing process. I became interested in it through this experience and realized that such a difficult process was required to make a pottery vessel.”

Sung, Yun-gil

Endless Repetitive Work

The next work seemed to require us to make something out of nothing. We started with nothing, without any jar-coffin materials and tools. We could create an experiment environment thanks to the master onggi artisan's help. Researchers just focused on making a jar-coffin through clay strings stacking.

We tried various methods to make a jar-coffin. Making from the base in an upright position, making from the mouth, making from the base and turning over to make the mouth, making from the mouth and turning over to make the base. We tried all possible methods we could think of. One time, we made a jar-coffin from the mouth to the base. When we tried to turn the jar-coffin over to retouch the mouth, it broke. In particular, we tried various methods to make the base. The base should be thin to make the vessel stable. Note, however, that the bases of actual jar coffins were very thick. We had many questions about it. We made a round base frame by digging wood, but it had a problem in drying and engraving patterns on the bottom. Finally, we found the most suitable method. We made the base part first from a certain height. We turned it over and made the mouth. Since then, we have stuck to this method to make jar coffins. Nonetheless, we should keep working on this method as well.

Jar coffins are huge vessels. According to an ethnographic study, potters are still making large pottery by going around it without using a pottery wheel in some areas. The Research Institute asked Master Onggi Artisan Lee, Hyun-bae to try this method as well. As a result of an experiment, it was found to be possible to make a jar-coffin by going around it without using a pottery wheel. Still, this method was not suitable to make a 2-meter-tall jar-coffin, considering human height.

I thought that failures could have been more beneficial than success while building a jar-coffin. We learned and agonized over many things. We never would have known them had we succeeded without any failure. One success did not mean that it was right.

We tried various methods to make the round base of a jar-coffin. We made a round frame by digging wood and added clay to make the base, but failed because the surface did not dry.

A jar-coffin broke when we tried to turn it over after making it upside down.

We had to be able to produce the same results in every trial. Our repeated experiments and experiences became the foundation for us to approximate the ancient jar-coffin production technology.

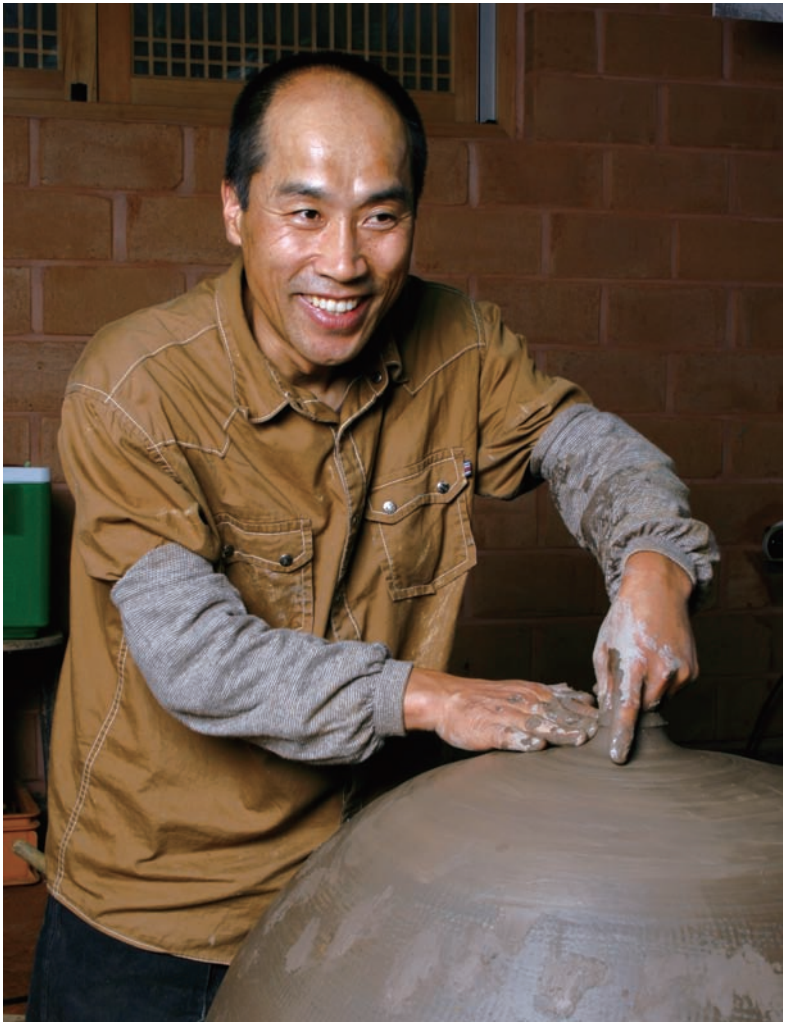
Turning Point in Production, A New Start at the Research Institute

In 2011, a jar-coffin workshop finally opened its doors at the Research Institute. Of course, the production experiment conducted at the Sonnae Onggi Workshop was a work of restoring the production process based on research papers. Once the workshop opened its doors at the Research Institute after a long wait, we could try more diverse methods. As a result, we were able to establish our own standards for jar-coffin production. The year 2011 was the turning point in our production experiment.

When the Research Institute's workshop was ready, we had to bring all the jar coffins and texture clay we made for the experiment at the Sonnae Onggi Workshop. The jar coffins were too huge, and the entrance to the Sonnae Onggi Workshop was too small. We had to remove the workshop door to take the jar coffins out. We found it hilarious that the jar coffins were too huge to go through the doors of general buildings other than kilns. Jar coffins were moved in the boxes made by a carpenter's shop in Iksan with texture clay to the Research Institute's workshop, where we could conduct a production experiment in a stable environment.

Nonetheless, the production experiment at the workshop was not easy as well. Basically, the Research Institute and Master Onggi Artisan Lee, Hyun-bae cooperated with each other for the production experiment. The Research Institute provided academic data, and the master artisan made a jar-coffin. Note, however, that the Research Institute was located in Naju, and the master artisan was in Jinan. To do an experiment at the Sonnae Onggi Workshop, we had to

travel from the Research Institute to Jinan. To do an experiment at our workshop, the master artisan had to come to Naju. Time management was essential to conduct an experiment with Master Onggi Artisan Lee, Hyun-bae since he needed some time for his own work as well. At least one week was required to conduct an experiment once. Time management was one of the difficult issues to solve.



Master Onggi Artisan Lee, Hyun-bae finishing the base of a jar-coffin

Archaeological Researcher Making Jar Coffins

The Research Institute had been conducting a production experiment since 2008. We realized that researchers majoring in archaeology needed to make jar coffins in person. In addition, some scholars said that people who majored in archaeology are expected to make jar coffins. The officer-in-charge of the production experiment and Master Onggi Artisan Lee, Hyun-bae began to look for someone who was interested in jar-coffin production among our researchers. We asked numerous people to participate in the experiment, but they all avoided giving an answer. It's probably because they have already experienced that jar-coffin production was tough work. Meanwhile, Assistant Researcher Lee,

An archaeological researcher (Assistant Researcher Lee, Hye-won) started jar-coffin production under the guidance of Master Onggi Artisan Lee, Hyun-bae.

Hye-won joined the Big Jar-coffin Production & Restoration Program Team in 2015. While participating in the excavation research as a team member, she was agonizing over her career, whether she should stick to archaeology or not. She joined the jar-coffin production experiment at Researcher Jeon, Yong-ho's recommendation. It may have been another option for Assistant Researcher Lee, Hye-won, who had an interest in the jar-coffin production experiment.

At the time Researcher Lee, Ji-yeong was appointed as successor to Researcher Jeon, Yong-ho, we had an atmosphere where researchers could learn jar-coffin production. Research Institute Director Lee, Sang-jun also thought that archaeological researchers should learn about jar-coffin production. He provided an opportunity to learn it. Assistant Researcher Lee, Hye-won went on a long business trip alone for one month to the Sonnae Onggi Workshop in Jinan. She learned how to make big jars at the Sonnae Onggi Workshop, living with Master Onggi Artisan Lee, Hyun-bae and his family. She systematically learned how to make clay strings by rubbing clay, how to stack them, and how to trim potteries using tools. While making potteries, she also made tools for jar coffins from time to time. She climbed the mountain and gathered proper wood with the master artisan. She made tools for jar coffins one by one.

She finally returned to the Research Institute after a long business trip. During the first jar-coffin production experiment after her business trip, she helped Master Onggi Artisan Lee, Hyun-bae make jar coffins. It took a lot of time to make a jar-coffin. Whenever she made a mistake, she had to cut it off and remake it. Finally, she made a jar-coffin on her own. Through such process, the archaeological researcher got to make jar coffins on her own. 4 years passed. The more jar coffins she made, the less time it took to make a jar-coffin. In addition, her skills improved. She is still improving her skills at the Sonnae Onggi Workshop when she gets the time. In jar-coffin production, baking is as important as shaping. The Research Institute let the researcher learn how to make a fire in the kiln.

In the jar-coffin production technology restoration project, the importance of continuous exchange with the master artisan cannot be emphasized enough. You cannot learn how to make jar coffins in one lesson. You need to learn it repetitively and continuously to restore ancient jar-coffin production technology.

> “I like making something with my hands. Thus, I enjoyed learning how to make jar coffins. It would be a lie if I said it was not physically demanding, but I really enjoy working with soil and making tools. Physical strength is as important as professional knowledge when making jar coffins. Thus, I work out steadily to develop my physical strength. When I first learned how to knead clay, I was heavier but weaker than now. After 10 minutes, I thought I couldn’t do it. I wanted to throw the clay; I could not crouch down anymore because my legs were getting numb. I thought it would be better to sit at the desk and study. As I became more familiar with kneading clay by relaxing my arms and making potteries as well as jar coffins, I could feel I was getting better. Now, I really appreciate having learned this skill. I expect to continue this work in the future.”
>
> Lee, Hye-won

Assistant Researcher Lee, Hye-won stacking clay strings up on her first jar-coffin

Kiln Made of Mud

The brick kiln in the temporary workshop in Bogam-ri, Naju was the first kiln we made for a production experiment. After many trials and errors since 2012, we tried to restore a jar-coffin kiln using mud. 3 kilns are now standing in the workshop. It was hard work to make a kiln using mud in the traditional way. In particular, the kiln made in 2014 was the hardest one.

First, we piled the soil high in front of the workshop to make a kiln. We mixed lime to firm up the soil so that it did not collapse. In the past, we used to dig in the ground using an excavator to make a kiln. It was different this time, however. We carried out the entire processes in the traditional way. Assistant Researcher Lee, Dong-gon made a kiln with two workers. He called Master Onggi Artisan Lee, Hyun-bae from time to time to ask for advice. They dug the firm soil mixed with lime using shovels and pickaxes. Sometimes they mixed soil and water and filled holes with the muddy water. The shafts of some shovels and pickaxes were broken because the ground was too firm. Their hands blistered, and they were covered in sweat. Their work was slow and inefficient. Exhausting days continued.

After digging the ground, it was time to make the wall and ceiling frames. They built a frame at the walls and at the center of a kiln. Afterward, they made an arched ceiling. Initially, they bent a bamboo to make an arch. Later, however, they adopted a new method. They built an arched ceiling by making a triangular frame and filling cogon grass. The latter method was much easier. After the ceiling frame was formed, they applied soil mixed with sliced straw about 5 centimeters thick and dried it. They applied and dried soil again around 5 to 7 times. After that, they waited until the ceiling was completely dried.

After natural-drying it for about a month, they lit the kiln and burnt the structure inside in order to bake a jar-coffin. They lit the kiln to dehumidify the inside of the ceiling as well as to remove the structure inside.

“When we lit the kiln to burn the structure inside, too much smoke came out. The bamboo structure made popping sounds. The black smoke covered the entire Research Institute completely, and then spread to adjacent apartments. We panicked. The fire was out of control until it burnt up the structure inside the kiln. Someone from the apartments called the fire station, and fire trucks came. We felt embarrassed and dizzy at the same time.”

Jeon, Yong-ho

Making an arched ceiling structure using bamboos, led by Researcher Jeon, Yong-ho

Applying clay on the ceiling frame meticulously several times

Unstable Transport of Jar Coffins

Jar coffins are baked in the kiln after being dried in a shaded cool place for about a month. The works, such as unloading a jar-coffin from the pottery wheel and moving it to a drying place, and then, moving it to the kiln after drying, all require the largest number of people for a short period of time. Shaping and baking a jar-coffin are most important in a production experiment. Still, you will never finish this production process if you cannot move a huge and heavy jar-coffin to the kiln.

How did ancient people move such a heavy jar-coffin weighing around 200 kilograms? How many people did they need? We had to find the answers to these questions. All the employees of the Research Institute had to move the jar coffins together. We used to roll a jar-coffin on sand or rice husks in the early stage of the jar-coffin production experiment. But now, we use muslin cloths.

When moving a jar-coffin, it was generally led by Assistant Researcher Lee, Dong-gon. After unloading a small jar-coffin from the pottery wheel, we moved it to a drying place with its stand. We hung muslin cloths on the stand at regular intervals. 3 or 4 people had to lift a jar-coffin with its stand and move together. Cooperation between a leader and his people was very important. If a jar-coffin had gotten out of balance and had leaned on one side, we could have dropped it. We moved a jar-coffin to the scale first to weigh it. It was estimated to have weighed around 80 to 90 kg, but we needed a more accurate weight measurement. While moving a jar-coffin to the scale, however, we broke it by mistake. Since it was a comparatively small jar-coffin, we thought 3 persons were enough to carry it. When we got slightly careless, we lost our balance and dropped the jar-coffin. It shattered completely. Someone hurt his arm, but he could not even say he was in pain.

We had to find out the reasons why the jar-coffin broke. The first reason was that we did not distribute the force evenly by hanging muslin cloths on the stand at regular intervals. Second, we did not check whether all the muslin cloths were hung on the stand properly. Finally, we lost our balance and made the jar-coffin lean on one side when we should have lifted it at the same time under the direction of one person. The broken jar-coffin was very special and meaningful since it was the first jar-coffin made by Assistant Researcher Lee, Hye-won. So, we felt terribly sorry.

We used straw mat and muslin cloths to move a dried jar-coffin into the kiln. Two muslin cloths were wound around the center of a jar-coffin. Four people lifted the jar-coffin up on both sides and put it on a straw mat. They moved the jar-coffin into the kiln while holding the four corners of the straw mat. The balance of force was very important at this moment as well.

To move a jar-coffin safely, numerous people put their heads together and tried various methods.

Since dried jar coffins were fragile, we had to minimize various risk factors that might cause their breakage. The more important thing was the role of the leader and the cooperation between people.

6 male employees of the Research Institute had to move a big jar-coffin into the kiln and take it out again. It was not easy, though.

It was comparatively easier to carry small jars than the large jar.

Jar-coffin Moved into the Kiln, All We Have to Do Now is Wait

It was time to place the jar coffins in the kiln. The restored jar-coffin kiln has the highest ceiling at the center. The kiln was enough to put three jar coffins. We put the largest jar-coffin at the center. Small jar coffins were placed in the front and back of the largest jar-coffin. We saw that the jar coffins had a black spot on their bottoms. So, the jar coffins were placed in an upright position. We used jar-coffin pieces as a base to prevent the jar coffins from tilting. Jar-coffin pieces were found on the floor and edges of actual jar-coffin kilns at the Kiln Site in Oryang-dong, Naju, suggesting that the jar-coffin pieces were used as a base. Therefore, we used the same method in our experiment.

We placed jar coffins in various ways to conduct the experiment on black spots. We went the extra mile to find out why black spots were generated, for example, we spread rice husks or sand on the floor for jar coffins or dug holes and put jar coffins in them. We found out that black spots were generated when a jar-coffin was baked on the straw mat that was used to move it or on rice husks. Incomplete combustion of organic matter generated black spots on the contact surface.

Numerous people were required for a jar-coffin production experiment in all processes. In addition to the personnel in charge of production experiment, many people were needed occasionally for manual labor. When we had to move dried firewood near the kiln, we asked all the employees of the Research Institute for help.

After putting the jar coffins into the kiln, the Conservation Science Team began to move around the kiln busily right before making a fire. Multi-channel thermometers were installed to measure the temperature of the kiln ceiling accurately. Around 10 sensors were installed in the front and back, at the center, and on both sides. They drilled holes and installed sensors in accurate spots, which raised the tension somehow. The fire did not go out in the kiln for 5 days while the jar coffins were being baked.

> “Once the kiln was lit, it received the most attention in the Research Institute. On the 3rd day, we brought some food and shared it with all the employees of the Research Institute in front of the kiln. It was to express our gratitude for helping us a lot in the hard work. A small furnace made by Master Onggi Artisan Lee, Hyun-bae was situated next to the kiln. The master artisan always made new food for everyone.”
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> Choi, Mi-sook

Assistant Researcher Lee, Hye-won and Assistant Researcher Gang, Myeong-seok making a starting fire to dehumidify the inside of the kiln

Filling the entrance of the kiln with firewood to make a large fire, which is the last step of kiln firing

We once made a fire on our own. Of course, we asked nearly all employees of the Research Institute for help. We organized groups for day and night shifts and kept the fire burning in sequence. Researcher Jeon, Yong-ho, Assistant Researcher Lee, Jin-woo, and Assistant Researcher Lee, Dong-gon kept the fire at night. Assistant Researcher Lee, Jin-woo, a member of the Jar-coffin Production Team, was generally assigned to a dawn shift. Based on the records of the earlier experiments, we added firewood while monitoring the temperature sensors, and called Master Artisan Lee, Hyun-bae occasionally and asked for his advice, reporting the fire conditions, the situation inside the kiln, and the temperature changes. We sometimes questioned whether we could bake a jar-coffin properly. We had to check the change in temperature with the sensors and decide whether more firewood should be added or not. It was really hard to control the temperature of the kiln only with thermometers without any experience. Although we thought that we could do it when we observed the artisan making a fire, there was nothing we could confidently do on our own.

There was an order for each of us to keep the fire. There were many people who could keep the fire during the day, but only three people could take care of the fire in sequence at night. Assistant Researcher Lee, Jin-woo told us a story. He had to keep the fire from 4 a.m. to 6 a.m. The next researcher did not show up even though it was already past 6 a.m. For a second, he agonized over whether to call the next person or not. He decided to wait instead. He suddenly got drowsy. His eyelids were heavier than a big jar-coffin. He woke up from his sleep shivering and felt that something was wrong. It was just a couple of minutes, but the kiln temperature fell. He was surprised and put firewood hurriedly. After this, he was worried about being unable to wake up for his turn at dawn, so he did not go home. Instead, he crashed at the other researchers' place.

We sealed the entrance to the kiln when kiln firing was almost over. A jar-coffin turns red if oxygen flows in the kiln. Otherwise, it turns gray. We tried various methods to reproduce the colors of jar coffins. Sealing the entrance to the kiln to prevent oxygen from flowing in was extremely dangerous. Flames sometimes flew backward to the entrance. We might have had our hands burnt with the heated kiln. Once the kiln cooled down after a week, we took the jar coffins out.

> "Lastly, I blocked the entrance to the kiln with Researcher Jeon, Yong-ho. Since heated bricks for the entrance were too hot, it was too painful to hold them as if my hands were burning. I did not know whether to let go of the bricks or keep holding them. A flood of thoughts crossed my mind. I could not stand it anymore. I was going to drop the bricks. Fortunately, Researcher Jeon, Yong-ho did not drop the bricks needed to block the entrance. His sense of responsibility as the team leader was admirable."
>
> Lee, Jin-woo

Applying muddy water on the surface to steam after sealing the entrance to the kiln

We took a photo together in front of the kiln that was emitting steam after completing the hard final touches for the kiln baking experiment in 2012.

Accurate Record Enhancing Experiment Reliability

We needed to record all the ancient jar-coffin restoration processes one by one accurately. We took photos, filmed, and wrote a daily log on all the processes during the production experiment. Assistant Researcher Choi, Mi-sook mostly recorded the experiment, with the Conservation Science Office measuring the temperature during baking. Every year, a production experiment was conducted in two parts: jar-coffin making and baking. Sometimes, they are conducted at the same time. Everyone got exhausted when jar-coffin shaping and baking were conducted at the same time in the middle of summer. We had to record both processes in a hot weather. We were out of breath due to the heat from the kiln.

Before conducting the production experiment in earnest, we had to make a plan and arrange our schedule with the master onggi artisan. An experiment generally took around 5 days. We had to focus more since it was an experiment conducted for a short period of time. Before the production experiment started in earnest, we checked our camcorders, cameras, and daily log in advance.

Assistant Researcher Lee, Jin-woo taking photos of the inside of the kiln with Assistant Researcher Gang, Myeong-seok and Assistant Researcher Lee, Dong-gon

We videotaped all processes using a camcorder and took photos of important moments with a camera. In addition, we recorded the experiment progress of the day and our opinion on the next experiment on the daily log. They were all essential for accurate records.

We needed accurate records on the change in temperature inside the kiln during baking. The Conservation Science Office's records were needed as well for this. Researcher Lee, Hye-yeon and Assistant Researchers Lee, Ha-yan and Kim, Min-jae handled this job. They measured the temperature using a multi-channel thermometer and a thermal imaging camera. They monitored the change in temperature and took images using a thermal imaging camera at regular times during firing.

In experimental archaeology, the reliability of results depends on the accurate records of the processes. Accurate records on the process of making a plan and producing a result are needed. Not only do accurate records enhance the reliability of experiment results; they are also important references for the next plans.

The big-jar-coffin restoration experiment of the Naju National Research Institute of Cultural Heritage, which began in 2008, has been continuing with various attempts so far. To find out the merits and errors in the jar-coffin

Researcher Lee, Hye-yeon recording the change in kiln temperature using an infrared thermal imaging camera

production method of the previous experiment, we check photos, videos, and daily logs again and make a plan for the next experiment. This is because the same results should be produced using the same procedures and methods in experimental archaeology. The Research Institute published two general reports on the production experiments as well as multiple books containing the jar-coffin data collected through the production experiments. We could deliver such performances because we recorded accurate data in various ways.

> “Initially, we took images using a thermal imaging camera at various points without any standards. We decided to take images at the same points from the next experiment in order to obtain accurate results. Before I joined the Research Institute, I participated in the pottery production experiment at another institute. At the time, however, I was just an observer. At the Naju National Research Institute of Cultural Heritage, I had to know whether the temperature sensors were working well, understand how the temperature was changing, and find out which side was better for taking images with a thermal imaging camera. I needed to participate in the experiment in more proactive ways. I had not known before how difficult it was when I was just observing. Still, taking care part of the experiment and witnessing the jar-coffin production process in person were worth it.”
>
> Lee, Ha-yan

Encompassing Knowledge

Convergence in the Field of Research

The Naju National Research Institute of Cultural Heritage was able to conduct the Ancient Big Jar-coffin Production Technology Restoration Project, thanks to the cooperation of researchers from various fields. Archaeology became the basis for the research since we approached production technology through ancient artifacts called jar coffins. We deliberated on whether we could make jar coffins and how we would make them, discussing with master artisans making onggi jars and porcelain. Natural science researchers' analyses were added in the process of experimenting with the same materials as actual jar coffins and verifying the experiment results. It was especially significant from an academic point of view since this jar-coffin production technology restoration project could produce meaningful results based on the synergy effects of archaeology and natural sciences.

Experts from various fields as well as archaeologists got to share their opinions through this project.

Archaeologists' Participation

The Naju National Research Institute of Cultural Heritage collected a huge volume of data to find out the features of jar-coffin production technology. In addition, a workshop was held several times to verify and improve the Research Institute's research results. Through the workshops, a variety of opinions were reflected to our research project.

Professor Lee, Jeong-ho at Dongshin University, a leader in the research on jar coffins of the Honam region, was able to analyze the production technology features of various jar coffins based on his expertise accumulated through numerous excavation research studies on ancient jar-coffin tombs and jar-coffin kiln sites. He showed immense interest in the Research Institute's production technology restoration project from beginning to end. He proactively gave advice on our project and helped us a lot. He was the first person who looked into the jar-coffin kilns in Oryang-dong, Naju. He was very pleased to hear that the Research Institute finally began a production experiment since he was always wondering how jar coffins were baked. He thought shaping and baking a thick jar-coffin would not be easy at all. Nonetheless, he commented that the first simulation that showed the possibility of the jar-coffin production provided the background for conducting the following experiment in earnest. He also said that not all could make jar coffins in ancient society because jar-coffin production was a long and complicated process. He believes that there must have been a jar-coffin production expert group. He said we need to study about them.

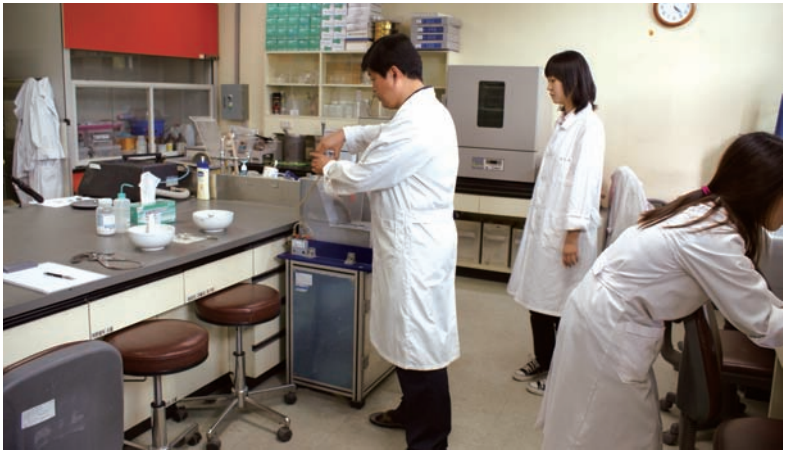
Professor Choi, Sung-rak at Mokpo National University is one of the revered representative archaeologists who study the ancient jar-coffin society of the Yeongsangang River basin. He is working on this project based on his excavation research on ancient jar-coffin tombs such as Archaeological Site in Ogya-ri, Yeongam and Archaeological Site in Gusan-ri, Muan. He has shown consistent interest in ancient jar-coffin tomb construction and jar-coffin production. He played an important role in conferences and books related to the big jar-coffin production technology restoration project. In particular, he suggested the necessity and direction of experimental archaeological research methods.

Korean and foreign researchers gathered for a conference

Kim, Mi-ran from the Jeolla Research Institute of Cultural Heritage was the first scholar to model a kiln after a kiln in Gungok-ri, Haenam, bake potteries in it, and conduct a composition analysis on the baked texture clay in order to study the characteristics of pottery of the Proto-Three Kingdoms period of Korea. Based on her experience, she offered more diverse views on jar-coffin production technology restoration at the conference.

Natural Scientists' Participation

We needed to conduct a composition analysis on the texture clay of actual jar coffins in order to answer our questions about the texture clay ingredients that became the basis of the big jar-coffin production experiment. The Naju National Research Institute of Cultural Heritage collected around 100 jar-coffin samples and conducted a composition analysis to understand their properties.



Professor Lee, Chan-hui preparing samples at a lab of the Department of Cultural Heritage Conservation Science of Kongju National University

For a more systematic research, we entrusted the soil analysis to Kongju National University Professor Lee, Chan-hui. In addition, he was commissioned to conduct a comparative analysis on the texture clay of jar coffins found in Oryang-dong, the producing area, and those of jar coffins excavated from the neighboring jar-coffin tombs, the consuming area. Based on this, he conducted a jar-coffin distribution network restoration study. In addition, he verified the experimental conditions by analyzing the restored jar coffins and jar-coffin kilns through production experiments and conducted a comparative study between actual and restored jar coffins and jar-coffin kilns.

Kongju National University Professor Lee, Chan-hui was a researcher involved in a porcelain composition analysis conducted by the National Research Institute of Cultural Heritage in 2009. Based on this experience, he became in charge of a jar-coffin texture clay analysis commissioned by the Naju National Research Institute of Cultural Heritage. He had academic interest in provenance studies through an analysis on jar-coffin pieces excavated from the archaeological sites in Oryang-dong and Ungok-dong, Naju. He encountered many difficulties in collecting a large volume of data due to lack of time during the analysis. Nonetheless, students of Kongju National University including Kim, Ran-hui helped him a lot.

Kim, Ran-hui was a PhD student at Kongju National University. Her academic adviser was Professor Lee, Chan-hui, so she naturally participated in his analysis. She joined the lab as a full-time student in her second year of the Doctoral course. She developed a longer and deeper relationship with jar coffins. She wrote her PhD thesis while participating in the jar-coffin production technology restoration project. She had extraordinary interest in the production experiments of the Naju National Research Institute of Cultural Heritage. The most important thing in a natural scientific analysis is the representativeness of samples. Can a single jar-coffin piece represent a whole jar-coffin, which is extremely huge? Did we collect samples that can represent numerous jar coffins found in the Yeongsangang River basin?

They always had such doubts. It made all researchers worry. They had to preprocess hundreds of samples including restored jar-coffin samples and soil samples as well as jar-coffin samples collected from archaeological sites. In addition, they had to analyze those samples and process data. All these processes were hard work. Traditionally, all available students should participate in sample powdering at the lab at Kongju National University. She said she always felt sorry for putting up a notice. Since there were a great number of samples, a problem might have arisen if they had been mixed during preprocessing. Researchers tended to become more sensitive than usual.

Kim, Ran-hui measuring the magnetic susceptibility of a jar-coffin restored by the Research Institute

They had more archaeological sites and samples than other projects. Thus, they had difficulty analyzing properties when they preprocessed samples and processed data by analysis stage. Therefore, it was regrettable that they investigated the entire Yeongsangang River basin. It would have been better if they had divided the basin into several groups depending on their archaeological features and selected some available groups for analysis.

Researcher Lee, Jae-seong was assigned to the Naju National Research Institute of Cultural Heritage in 2012. He was in charge of jar-coffin composition analysis. He made samples for a jar-coffin composition analysis. He checked and analyzed the change in temperature during kiln baking. In addition, he divided the analysis into two -- an analysis on the actual artifacts and an analysis on the restored jar coffins -- for the first time. He encountered many difficulties since he tried to analyze a lot of samples with a small budget. When he analyzed kiln wall pieces after baking, he was so surprised because they were very similar to those excavated from the archaeological sites. Through analysis, rice straw was found to have been mixed in the clay applied on the walls of the kilns. As a result, we decided to use the same materials during the kiln restoration process. He told us a funny story. When the researchers collected samples for a restored jar-coffin analysis, they had to wear safety helmets since the jar coffins were so thick that their pieces might hit them. Researchers collecting samples from big jar coffins while wearing safety helmets. It would have been difficult to imagine if we did not hear this story.

Researcher Lee, Hye-yeon naturally participated in the project when she was appointed as a successor to Researcher Lee, Jae-seong in 2015. After collecting samples from restored jar coffins, she filled up empty parts. She also smoothed the surface and matched the colors. The hardest work was filling the bottoms of the restored jar coffins. It was difficult since she had to go into a small space. In addition, she studied the thermal flow and temperature change inside the kiln. It was difficult to record the kiln using an infrared thermal imaging camera due to the change in the external circumstances. Nonetheless, it was meaningful that she was able to find out the overall thermal flow. Lastly, she installed around 10 multi-channel thermometers inside the kiln to check the change in temperature.

Researcher Lee, Jae-seong collecting samples from the wall of the kiln and Assistant Researcher Jeong, You-jin recording it

Thoughts about Convergence Research

Professor Lee, Jeong-ho believes that there is a limitation only with a humanities approach in dealing with the doubts and questions about jar-coffin production. He stressed that a natural scientific analysis should be conducted as well. According to him, we cannot depend solely on a natural scientific analysis. He believes we need an archaeological approach again at the interpretation and completion stages. It means that archaeology, that is to

say humanities, should be used for interpretation even though the natural scientific analysis results are meaningful. In conclusion, convergence research studies are necessary. After academic research, we should make jar-coffin production technology into cultural contents.

Professor Choi, Sung-rak believes that archaeology is a field of study closest to natural sciences. He thinks archaeology can be considered a field of convergence studies. He said there is a limitation in restoring a culture only with artifacts. He added that experts from various fields have to work together since the jar-coffin production project requires experiments, research, restoration, and utilization.

Researcher Kim, Mi-ran believes that convergence research studies between different academic fields are necessary. According to her, we cannot understand ancient artifacts only with archaeological observations (representatively typological categorization, etc.). She says that we have to study jar coffins from different angles for better understanding. In particular, it is not an exaggeration to say that natural scientific research methods are now essential. She thinks numerous fields should be added, including texture clay composition analysis, mineralogical property analysis, and provenance study. Since the accurate

The result of a natural scientific composition analysis was interpreted with archaeology experts.

understanding of ancient artifacts is a foundation for the cultural and social restoration of that time, historic, social, and cultural anthropological research studies are very important as well.

Professor Lee, Chan-hui thinks that even the research on a single relic should be participated in by various fields. He thinks that archaeology has the most natural scientific factors among the fields of humanities, and a wide range of research studies are being conducted regarding homogeneous materials. He exemplified his point with geological research on the Paleolithic Age and cultural anthropology research associated with paleogeomorphology and paleontology.

Kim, Ran-hui believes that it is difficult for individual researchers to understand the archaeological, art historical, and material values of cultural heritages completely. Numeric data obtained through a natural scientific analysis cannot be interpreted without archaeology and art history. An interpretation requires a consortium of natural scientists, archaeologists, and art historians. It was not easy to draw a conclusion by interpreting and discussing the same research subject through a variety of research methods based on their own specialties. Still, she believes that the research results obtained through such process are much more satisfactory than any other research studies conducted by individual researchers. Convergence research cannot be conducted only through communication between individual researchers. Thus, she considers the convergence research project of the Naju National Research Institute of Cultural Heritage to be an optimal model. She said she expects convergence research to be applied to a wider range of fields in the future.

Roles of Experts' Workshops and Conferences

Conferences and workshops were held several times under the theme of jar-coffin production technology. At the conferences and workshops where archaeologists, natural scientists, and master artisans shared their opinions, attendees seemed to have difficulty communicating with each other at first

due to a lack of understanding of unfamiliar fields. After some time, however, they gradually became interested in a variety of perspectives. In particular, they showed great interest in the review on experimental data. It was a good opportunity for researchers from different fields to communicate with each other. At the conferences held under the theme of big jar-coffin production technology, both the audience and the speakers shared their opinions actively unlike in other conferences. I think it was possible because the conferences were an opportunity wherein they could take a peek at the outcomes of some people's lives. In addition, the conferences participated in by experts from different fields somewhat resolved some issues that had not been solved only by archaeologists.

Kim, Ran-hui remembered how the researchers of the Naju National Research Institute of Cultural Heritage showed their enthusiasm at such academic gatherings. She was impressed by the fact that the researchers asked questions and tried to understand the natural scientific research results even though they must have had difficulty comprehending the results. She said meeting Choi, Mong-ryong and Shin, Suk-jeong at a workshop held at the beginning of the project was a memorable encounter. She found it helpful that they could share the thoughts and philosophies of the pioneers in convergence research.

The results of the big jar-coffin production experiment were newly analyzed and shared with researchers through numerous conferences and workshops.

Accomplishments and Significance of the Project

Researcher Kim, Mi-ran said that the big jar-coffin production project was realized because it was conducted by the Naju National Research Institute of Cultural Heritage. According to her, such a huge project was possible since the Research Institute's human and material resources met in the area where big jar coffins had been made. She mentioned that one of the greatest achievements was that the Research Institute tried everything to understand the jar coffins of Mahan. Excavations of ruins (archaeological sites of big jar-coffin production, ancient jar-coffin tombs, etc.), baking experiments on the features found in the excavated archaeological sites as conducted in the restored kiln, and various natural scientific analyses on big jar coffins including baked soil analyses are undoubtedly the biggest accomplishments.

It was very meaningful since we tried to understand big jar coffins, which were one of the most prominent features of the Yeongsangang River basin and the icon of ancient culture, through experimental archaeological jar-coffin production. In particular, the project was meaningful in the sense that we studied and restored jar-coffin production, which was the life of the ancient people who produced jar coffins, by considering it to be an academic research subject. Still, there might be a gap since we are dealing with someone's life as an academic field. We may have interpreted unintended phenomena naturally generated on jar coffins as the results of intended actions. We need to ruminate on this issue in depth.

The thought that our approach to jar coffins might have been unnatural and contrived crossed our minds. Was our restoration too timid or too careful? When making a jar-coffin, it may collapse or get broken in the middle of the production process. We may not have been able to enjoy experimental archaeology enough since we tried to be too perfect. We, however, believe that we could broaden the horizons of archaeology and come closer to the truth of jar coffins since such a huge project was planned and implemented by an academic research institute, the Naju National Research Institute of Cultural Heritage. We hope this project continues.

Professor Lee, Jeong-ho thinks that the jar-coffin production project is not yet finished and should not be finished. He says that the project is still ongoing since the final results have not come out yet even though we have intermediate results. He believes we just took our first step to the pottery production technology restoration research. He emphasized the necessity of continuous research.

Demonstrating how to move a big jar-coffin in front of researchers

According to Professor Choi, Sung-rak, we took a step forward in terms of natural scientific application and experimental archaeology. Still, he thinks that we are still not good enough when it comes to archaeological research. He believes that additional research should be conducted regarding the significance of jar coffins in ancient society and ancient tomb culture.

Professor Lee, Chan-hui said it was meaningful to expand and develop the same project for a long period of time even though researchers and participants were changed a lot during the span of 10 years while planning a production experiment and interpreting the distribution network. Nonetheless, the problem is interpretation. Archaeology tends to make a single interpretation into a widely accepted theory. The big jar-coffin project went through homogeneity analysis, jar-coffin production, and distribution network analysis. Jar coffins found in the mainstream and branches of Yeongsangang River have slight differences but are very similar to each other. In addition, some jar coffins show the features of each branch. Why do we think about it only in terms of distribution? In archaeology, jar coffins were deemed to have been baked in a single production site and distributed to other places since we did not find traces of jar-coffin kilns in many places. Still, we may have to consider human travel. Technicians may have produced jar coffins while traveling from place to place. We need to collect and interpret data from the viewpoint of technician exchange (human resources exchange).

According to Kim, Ran-hui, it was a huge accomplishment that we could conduct a single project with researchers from different fields for a long period of time. She also said that she was honored to take part in the production technology restoration research. She believes that we should establish a system for accumulating basic data related to the research on the jar-coffin distribution network of the Yeongsangang River basin.

Researcher Lee, Jae-seong said that our project became an example in experimental archaeology. According to him, he could see that our project was improving through repeated experiments. He mentioned kiln construction materials as an example. Even though data was so clear that we could see the materials in actual artifacts, we proved them through natural scientific analysis

and used them for a production experiment based on accurate facts. He said it was one of our greatest achievements. He believes that we could unlock the secret of the jar-coffin production process through our research on jar coffins, which was a unique culture in Naju. It was meaningful since we saw the potential for jar-coffin production through natural scientific analysis based on an excavation at the Kiln Site in Oryang-dong, Naju, and we are now able to suggest how to realize it.

Researcher Lee, Hye-yeon was very surprised that a jar-coffin kiln was restored, and that at least 3 jar coffins were made and baked every year. In addition, she was impressed with our initiative. With this long-term project, the Naju National Research Institute of Cultural Heritage established its identity with big jar coffins.

The jar-coffin workshop is open for student visitors.

Future Task

Even though we restored jar coffins that are almost the same as actual jar coffins, it is still hard to say we completely restored the ancient technical knowledge. Not only should we continue our research on jar-coffin production technology; we also need continuous research on the ancient jar-coffin tombs and the ancient society thereof. In addition, we should establish a foothold for the restoration of culture and society by connecting the results of archaeological research and natural science research. As a result of a natural scientific analysis, the data of jar-coffin samples excavated from Oryang-dong, Naju, which is an archaeological site of jar-coffin production, has a considerably high correlation compared to other archaeological sites. Nonetheless, the correlation between the archaeological sites of consuming areas was somewhat low. Therefore, the natural scientific analysis data of jar coffins should be continuously accumulated and complemented. In addition, we should become a mecca of the jar-coffin database by collecting pottery pieces excavated from jar coffins and ancient jar-coffin tombs and by conducting the sample analysis and establishing the database.

We need to keep improving hands-on programs for ordinary people. In addition, we should provide accessible social education programs encompassing experiences and experiments for local residents and all nationals as well as persons engaged in archaeology. We should enhance our pride in local culture by using the results of the jar-coffin production technology restoration project as a brand and creating an image. Lastly, we should find a way to utilize our achievements in association with citizens' daily lives.

Fourth

With Reborn Jar Coffins

1. Utilization of Restored Jar Coffins

2. Sharing of Ancient Technical Knowledge

It has been 10 years since the Naju National Research Institute of Cultural Heritage first launched the Ancient Big Jar-coffin Production Technology Restoration Project in 2008. During this period, a jar-coffin workshop and three kilns were installed in the Research Institute, and around 30 restored jar coffins were made. As a production experiment, we made texture clay, jar coffins, and jar-coffin kilns and baked jar coffins stage by stage. The relevant academic research results have been accumulated as well.

One of the most important assignments of the Research Institute is to find a way to share its research achievements and information actively with the public. The research achievements can be utilized in various aspects. We may utilize the restored jar coffins directly. In addition, we may share our research and experimental data and researchers' knowledge including production technology with the public. These are the easiest ways to consider.

Utilization of Restored Jar Coffins

Restored jar coffins were the outcomes we achieved through archaeological and natural scientific research studies based on ancient artifacts. Therefore, the restored jar coffins could be utilized in a variety of ways, replacing actual artifacts. The Research Institute has jar coffins made during the experiments, and it will make more jar coffins through further experiments. How are we going to utilize our jar coffins? Restored jar coffins may be used as supplementary materials for research, substitutes for ancient tomb maintenance and restoration, or exhibits.

Restored jar coffins were included in Master Onggi Artisan Lee, Hyun-bae's private exhibition and were open to the public.

Restoration of Burial Rituals

Restored jar coffins may be used as experimental archaeological research materials to restore the ancient jar-coffin tomb construction process and the burial procedure representing the ancient tomb culture of the Yeongsangang River basin. By moving a jar-coffin made in the kiln to a tomb and reproducing the ancient tomb burial, we may be able to interpret a burial ritual. For example, we may speculate a variety of things through experiments such as how ancient people loaded a jar-coffin onto a ship or a cart, which was assumed to have been used at that time, how they moved a jar-coffin, and how they used it. Using restored jar coffins, we may be able to reproduce how they put a body as well as grave goods into a jar-coffin and how they put two jars together to make a jar-coffin and bury it.

Restoration that a jar-coffin being buried in a tomb during the funeral

Substitutes for Ancient Tomb Maintenance and Restoration

An investigation on ancient tombs is conducted during an academic research or development. Significant ancient tombs are designated as cultural heritage -- maintained and managed consistently.

Big jar coffins were often used as burial facilities in the ancient tombs of the Yeongsangang River basin. Since the jar coffins of ancient jar-coffin tombs are traces and artifacts, they are all collected and moved to the museum during the excavation research. Therefore, an ancient jar-coffin tomb is just an empty hill of earth after the excavation research. Professor Choi, Sung-rak thought it was a shame that only a hill of earth remained after jar-coffin tomb maintenance. He suggested we bury a restored jar-coffin in the tomb instead of the actual jar-coffin in order to keep the cultural heritage as intact as possible.

There are some cases that we can refer to. Excavated artifacts are collected in Korea. In the US, the Acts stipulate that artifacts must be reburied after the excavation research in order to prevent cultural heritage investigations

Maintenance of ancient tombs in Yeongsangang River basin (Ancient Tombs in Bogam-ri, Naju)
The Ancient Tombs in Bogam-ri, Naju are designated as Historic Site No. 404. After covering the ancient tombs with soil, grass was planted.

from damaging the culture of the Native Americans. In Japan, there is a case of haniwa (cylindrical pottery) restored and displayed near ancient tombs. In Korea, burial facility replicas were displayed in Cheonmachong Tomb, which had been used as an exhibition hall before it was designated as a world heritage.

Naju Bokamri Ancient Tombs Hall

Restored the full-size Bogam-ri Tomb No. 3 is displayed in Naju Bokamri Ancient Tombs Hall. Visitors can also see various other burial facilities.

Ancient tomb(Hachimanzuka Tomb, Japan) maintenance using ancient pottery (Haniwa: Cylindrical Pottery)

Local residents of Gunma Prefecture, Japan made and used haniwa, which is symbolic ancient pottery, for ancient tomb maintenance.

Exhibits

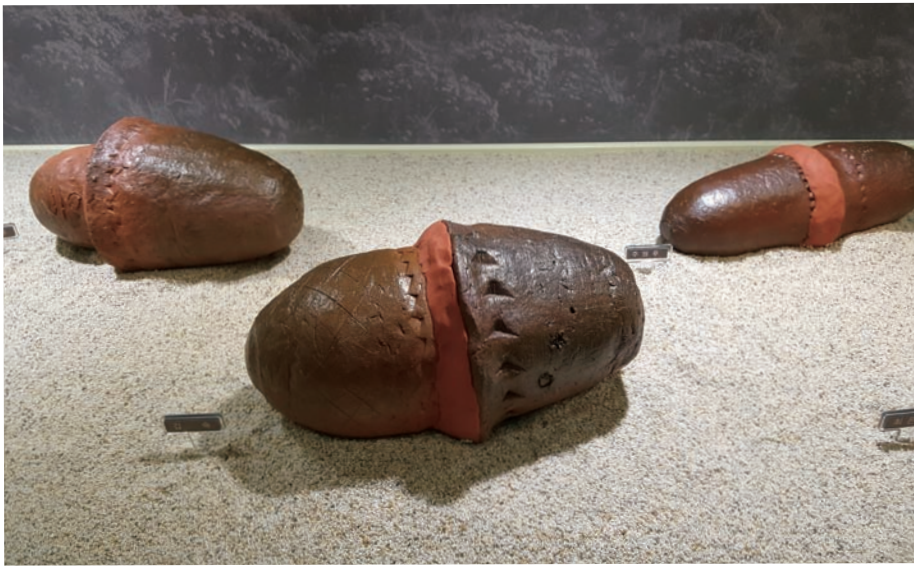
A variety of exhibitions can be held with the restored jar coffins. We may show the big jar-coffin production experiment process to the public or utilize the jar coffins as hands-on education materials. There are some instances wherein jar coffins symbolizing the ancient culture of Honam were used as time capsules and displayed as works of art.

Restored jar coffins are on display in the exhibition hall and jar-coffin workshop of the Research Institute. Visitors can see the different features of jar coffins -- which vary depending on the experimental conditions -- and compare the restored jar coffins with actual jar coffins excavated from archaeological sites.

Also the Research Institute displays mini jar coffins made during hands-on programs as time capsules. The jar coffins will be unsealed one year later.

Restored jar coffins on display at the Research Institute

Jar coffins made through experiments are on display in the exhibition hall and the jar-coffin workshop.



Mini jar coffins on display at the Research Institute

Mini jar coffins made by program participants using ancient jar-coffin production technology are displayed in the exhibition hall. Mini jar coffins that look like time capsules contain the participants' wishes. (Exhibited from Oct. 22, 2018 to Oct. 23, 2019)

Restored jar coffins are donated to and displayed in various institutes. Some restored jar coffins are donated to the Daehan Institute of Cultural Properties, a buried cultural heritage investigation agency. The restored jar coffins are displayed with other restored artifacts at the entrance of the institute so that visitors can easily see them. Some are donated to Korea Power Exchange, one of Naju's representative public organizations. The restored jar coffins are displayed with explanations about the donor and jar coffins in the lobby of the building. Restored jar coffins donated to the Naju National Museum will be used as hands-on educational materials. We hope that more and more people become familiar with jar coffins through the donated restored jar coffins even though they are not actual artifacts.

Master Onggi Artisan Lee, Hyun-bae reinterprets and makes onggi jars from a different perspective from the Research Institute. He displays his onggi jars in various ways. He already held an exhibition several times in small art galleries.

Restored jar-coffin on display at the Daehan Institute of Cultural Properties

Restored jar coffins are exhibited with other restored potteries for hands-on education. (Donated on Jan. 26, 2015)

Restored jar coffins on display in Korea Power Exchange

The jar-coffin, one of the most representative cultural heritages in the area, was reborn as time capsules containing their symbolic meaning. (Donated on Aug. 22, 2014)

Master Onggi Artisan Lee, Hyun-bae's Private Exhibition at the Seoul Museum of Art

As the restored jar coffins made by the Research Institute through experiments and the master artisan's work were displayed together, the restored jar coffins were reborn as artistic exhibits. (Exhibited from Dec. 13, 2016 to Feb. 28, 2017)

Sharing of Ancient Technical Knowledge

We can come up with various ways to share the jar-coffin restoration experiment results and expertise such as production technology with the public. Big jar-coffin production technology restoration will continue based on the production technology we have unveiled so far. We hope that The Rebirth of the Big Jar-coffin is utilized in various fields.

Visitors looking around jar coffins during a education program

Cultural Programs

The Research Institute provides cultural programs for the public. Jar coffins are widely known to be the unique tomb style of the Yeongsangang River basin and the artifacts that represent the area. Nonetheless, many people do not know how big jar coffins were made and how they were used for tombs. Not only does the Research Institute provide theory classes in a lecture room; visitors can also see the jar-coffin workshop and restored kilns as well as the ancient jar coffins and the jar-coffin kiln strata of the Kiln Site in Oryang-dong, Naju in the exhibition hall. Through the exhibits, you can learn the jar-coffin production process as well as the society of ancient jar coffins and the meanings of jar coffins.

Visitors looking around the workshop during a cultural program

Hands-on Programs

The Research Institute provides an experience program to make a big jar-coffin and a mini jar-coffin. In particular, Big Jar-coffin Making is the Research Institute's own unique hands-on program available courtesy of jar-coffin production technology-trained researchers. Big Jar-coffin Making provides children with a good education opportunity and grown-ups with a chance to relive old memories.

After listening to an explanation about the jar-coffin production process, participants can make clay strings by kneading clay, stack them, and smoothen the walls of a jar-coffin using tools. Multiple people stack clay strings one by one together and finally finish a big jar-coffin.

Participants stacking clay strings to make a big jar-coffin

A participant adding firewood to light the jar-coffin kiln

After shaping, a jar-coffin is dried for a certain period of time and then conveyed to the kiln. Participants can light the kiln in person.

A restored jar-coffin engraved with participants' messages

Time Capsule Jar-coffin Making was provided for participants. They make a mini jar-coffin in the same way one makes a big jar-coffin. A jar-coffin consisting of two jars in contact with each other resembles an egg. Eggs have been symbolizing birth since the ancient times. Through this program, participants learn that jar coffins mean rebirth even though they are artifacts related to death.

Mini jar coffins are one-twentieth the size of actual jar coffins. Although mini jar coffins are small, they are made through the same process as big jar coffins. Participants make a mini jar-coffin using clay strings. They make the round bottom first and the upper part later, and then also engrave some symbolic patterns on the mini jar-coffin.

Participants make a time capsule by putting their messages in a mini jar-coffin symbolizing regeneration. After some time passes, they will open the time capsule. Then, they will think about themselves again.

What do you think the current you would like to tell the future you?

Participants are writing their wishes after making a mini jar-coffin.

The finished mini jar coffins are sealed with participants' wishes as a time capsule, and they are kept in the exhibition hall.

“Jar-coffin production technology restoration will continue based on the production technology we have unveiled so far, We hope that The Rebirth of the Big Jar-coffin is utilized in various fields.”

Epilogue

We interviewed numerous people who have participated in the jar-coffin production technology restoration project in order to jog their memory about The Rebirth of the Big Jar-coffin. They told us their memories going as far back as about 10 years ago. Numerous people told us numerous stories, and their memories were recorded here. The Rebirth of the Big Jar-coffin was born, thanks to them.

An interview about archaeology and excavation research

Choi, Sung-rak (Mokpo National University), Lee, Jeong-ho (Dongshin University), Kim, Mi-ran (Jeolla Research Institute of Cultural Heritage), Park, Cheol-won (Dongseo Research Institute of Cultural Heritage), and Jeong, Seong-mok (National Research Institute of Cultural Heritage)

An interview about natural sciences

Lee, Chan-hui (Kongju National University), Kim, Ran-hui (Kongju National University), Lee, Jae-seong (National Research Institute of Cultural Heritage), and Lee, Hye-yeon (National Palace Museum of Korea)





An interview about production experiments

Sim, Yeong-seop (National Research Institute of Maritime Cultural Heritage), Lee, Jong-hun (Gyeongju National Research Institute of Cultural Heritage), Jo, Mi-sun (Cultural Heritage Administration), Lee, Hyun-bae (Sonnae Onggi Workshop Master), Lee, Jin-woo (Naju National Museum), and employees of Naju National Reseach Institute of Culural Heritage

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The Rebirth of the Big Jar-coffin, Records on the production of the big jar coffin

Jar coffins constitute one of the major ancient cultural heritages to have been discovered along the Yeongsangang River in the southwestern region of the Korean Peninsula.

It is noteworthy that people along the Yeongsangang River used Big Jar coffins. An individual jar-coffin measures taller than the height of an average adult and so heavy that an adult could not possibly carry one unassisted. Two separate jar coffins were assembled together to create one Big Jar-coffin, the form of which resembled an egg-shape. According to the researchers, it was associated with their hope and belief that the deceased would be reborn as if by hatching from an egg.

The Naju National Institute of Cultural Heritage has conducted a considerable amount of research on this unique custom of the Yeongsangang River region, and has attempted to restore the skills required to produce such Big Jar coffins. The researchers concerned initially had many questions about these skills, but they eventually succeeded in producing a Big Jar-coffin by closely examining those unearthed from ancient tombs. The discovery of Jar-coffin kilns in Oryang-dong, Naju was also very timely in this respect, as at that point experiments were being conducted to restore the attributes associated with the production of jar coffins. The two books published by the end of last year are based on the results of the research.

The present book presents the results of the recent research in such a way as to make them easily comprehensible to laypersons. Its content includes an introduction of the characteristic features of the Jar coffins found along the Yeongsangang River and the method of producing them, together with an account of the researchers' experiences while conducting experiments aimed at reconstituting the production process and thereby assembling them.

As such, we hope that readers will not take this book as an imposing work of research results, but rather an open book for any layperson to get a grasp of the subject. And we wish that "The Rebirth of the Big Jar-coffin" serves as the initial stepping-stone.

The Rebirth of the Big Jar-coffin

Records on the Production of the Big Jar-coffin

Date of publication	September 30, 2020
Director	Im, Seung-gyeong (Head of the Naju National Research Institute of Cultural Heritage)
Planning/Editing	Oh, Hyun-dok (Senior Researcher, Naju National Research Institute of Cultural Heritage) Choi, Yu-ji (Researcher, Naju National Research Institute of Cultural Heritage) Lee, Ae-jin (Assistant Researcher, Naju National Research Institute of Cultural Heritage)
Publisher	Naju National Research Institute of Cultural Heritage 263-23, Yeongsanpo-ro, Naju-si, Jeollanam-do Contact Tel. +82-61-339-1114 Fax. +82-61-339-1139 http://www.nrich.go.kr/naju/index.do
Design/Printing	Jungwoo Communications
ISBN	978-89-299-1919-1 93910
Government Publications Registration Number	11-1550110-000060-01

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Naju National Research Institute of
Cultural Heritage

ISBN
978-89-299-1919-1 93910