Research Report on Royal Capital Sites in the Post-Angkor Period

Nara National Research Institute for Cultural Properties 2015

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Notes

1. This document is a report of the Exchange Project to Protect the Oudong and Longvek archaeological sites in Cambodia. The project was funded by the projects as Networking Core Centers for International Cooperation on Conservation of Cultural Heritage under the Agency for Cultural Affairs, Government of Japan.

2. This document has been written and edited by Hiroshi Sugiyama and Yuni Sato from Nara National Research Institute for Cultural Properties with the advice from the member of the International Coordination Section, Tomo Ishimura and Akiko Tashiro and relevant researchers.

3. Photos shown as photo plates were taken by Tadao Inoue and Ai Okada (then) of the Photography Section in the Department of Planning and Coordination. Local photos were taken by the above-mentioned members.

Part 1. Research of the Krang Kor Site

Chapter 1. Background and Outline of Research

Section 1. Background of the Study

Studies of the Angkor Monuments comprise the mainstream of studies in Cambodia, and little attention has been given to studies of the post-Angkor period. Nara National Research Institute for Cultural Properties, however, has conducted archaeological researches on the Post-Angkor period with Ministry of culture and Fine Arts, since 2003. This study, focused on the royal capital sites of the post-Angkor period, and was implemented with the Ministry of Culture and Fine Arts as the counterpart, under the subsidy of Networking Core Centers for International Cooperation on Conservation of Cultural Heritage by of the Agency for Cultural Affairs, JAPAN. In addition to cultural heritage conservation, the study also aimed to develop human resources mainly among students and alumni of the Royal University of Fine Arts in Phnom Penh.

Field work was carried out at royal capital sites in Oudong and Longvek, located near Phnom Penh. Among such sites, the Krang Kor site, which was discovered in recent years, is garnering attention as a burial site of the post-Angkor period. Based on field work at these sites, human resource training was implemented with an emphasis on three points: i.e., geophysical survey, archaeological excavation and public archaeology. The study team visited the Cambodian Ministry of Culture and Fine Arts in January 2010, and had the opportunity to view a number of artifacts that have been discovered from the village of Krang Kor. Accompanied by H.E.Mr.Ouk Socheat, Minister's Secretariat, the team visited the site on the following day, and confirmed many artifacts that have been excavated from them, with the cooperation of local villagers. However, taking into account that the site was discovered as a result of burial rooting, the necessity of urgently assessing the expansion and state of the site and defining a policy for its protection was discussed. The scope of the exchange project for international cooperation initially included only the post-Angkor sites of Oudong and Longvek, but the Krang Kor site was decided to be investigated at the same time, in consideration of its significance and urgency of conservation.



Fig.1 Inspection by Minister of Culture and Fine Arts



Fig.2 Meeting with H.E.Mr.Ouk Socheat



Fig.3 Scattered ceramics at Krang Kor site



Fig.4 The situation of burial rooting

Section 2. Overview of the Study

First survey

From November 27 to December 4, 2010, exploration and excavation activities were implemented at the zone No. 4 and No. 6. The geophysical survey performed at the two locations respectively yielded good results. The analysis results of the survey are shown below. There were small responses here and there at zone No. 4, which seemed to indicate the possible presence of burials, but no burials were found in the excavation. At zone No. 6, a wide, circular ditch shape was detected on the north side of the survey area. The No. 1 trench was located there. However, the response had actually come from deposits of manganese in the soil, and no noteworthy remains were found. A cluster of responses was acquired from the south side of the survey area, and bricks that were dismantled during the burial rooting lay scattered in the vicinity. From this area, brick remains were found that are assumed to be of a cremation, as will be discussed in the next section.

Second survey

From February 16 to 21, 2011, additional surveys were conducted at zone No. 4, and a new excavation survey was launched at zone No. 8. An artifact survey was also carried out of artifacts owned by the villagers. At zone No. 4, one of two areas where a pit was made by burial rooters was selected, and a trench was dug around the pit. As a result, what appeared to be two trace of coffin burials were found, and traces of wooden coffins were found from one of the burials. This survey suggested the possibility that burial remains from where no large cinerary urns are found might be a coffin burial. Zone No. 8 is located within a village, unlike zone No. 4, 6 and 7 surveyed so far. According to the villagers, a Khmer brown-glazed stoneware jar with four lug-handles was discovered from an area immediately north of the survey area, and that it contained human bones. The survey was thus conducted near the house where the discovery was made. No burial sites were found, however, although the entire strata were confirmed. Nevertheless, by conducting the survey, exposed surface items in the area were able to be sampled, surface artifacts that were collected by nearby villagers were able to be surveyed, and other artifacts that have so far been excavated were able to be examined.

Third survey

From July 27 to August 9, 2011, a survey was conducted in the primary school zone of the Krang Kor site and at the Longvek site. To take wide-area photos of the sites, the team obtained the cooperation of Mr. Nishida from Nihon Chisui Fukuoka



Fig 5.Geopenatrating Rader Survey





Fig 7.Excavation in Zone No. 4



Fig 8. Drawing of objects

Corporation in taking aerial photos using a multi-rotor helicopter. At the Krang Kor site, a ground penetrating radar survey and aerial photo were conducted, followed by an excavation survey at zone No. 7 and the school zone. The survey of the school zone yielded a relatively large number of artifacts and a burial. At the Longvek site, aerial photo were mainly taken of the conditions of mounds and moats.

Fourth survey

From February 8 to 13, 2012, local surveys were conducted, and on February 22, the results of the surveys were presented to the Ministry of Culture and Fine Arts in Phnom Penh. As a burial was discovered in the school zone in the third survey, a trench was dug on the east side of the discovered burial to further explore the surrounding area, and another trench 15m long was dug on the east side of a burial zone from where many pieces of earthenware ware have been found. Fifth survey

The fifth survey ran over the period from August 12 to 19, 2012. In response to the discovery of Burials 1 and 2 in the third and fourth excavation surveys, trenches were dug in four locations near the previous excavation areas, to confirm the possible presence of more burials in the fifth survey. However, instead of discovering burials from the four new trenches, a thick layer of earthenware fragments was confirmed. This layer was accumulated from a depth of 20cm to 100cm from the ground surface, and the fragments discovered from the layer were determined to be of earthenware production in the region. Additionally, 25 pieces of paddling tools used in making earthenware, 59 pieces of terracotta bracelet fragments and 4 pieces of stone bracelet fragments were also found from the sedimentary layer.

Also included in the sedimentary layer of earthenware fragments that was discovered in this survey were Si Satchanalai celadon fragments, believed to date from the mid to late 15th century. Considering the fact that Si Satchanalai celadon from the same period was also in Burial No.1, the sedimentary layer of earthenware that was discovered in this survey could be assumed to date from roughly the same period as the already discovered burials. The excavation survey revealed the existence of a thick earthenware layer of near Burials No.1 and No.2. Judging by the dates of imported ceramic items that were excavated, the two burials and the earthenware layer are estimated to date from the mid-15th century to the late 15th century or early 16th century.



Fig 9. Aerial photo of school zone





Fig 11. Explanation for the villegers

Fig 10. Aerial photo of school zone from school zone to zone No.4,6,7



Fig 12. Geopenatratin Rader Survey in the school zone

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Fig.13 Excavation in the scool area



Fig.14 Symposium in the Ministry of Culture and Fine Arts



Fig.15 Excavation of burial No.2



Fig.16 Excavation of burial No.2

Chapter 2. Remains

Section 1. Overview of the Survey Area

The survey began in January 2010 by exploring the site of the burial rootings based on information of the rooted burials that was brought to the attention of the Ministry of Culture and Fine Arts. The area that was plundered by burial rooters and lay strewn with ceramic fragments on the ground was mainly divided into eight zones, from No. 1 to No. 8, and a surface survey of artifacts and a surveillance of the landscape were conducted. As a result, an excavation survey was conducted at the zones No. 4, 6, 7 and 8 from where particularly large numbers of artifacts have been found, and which were deemed suited to the survey also from the topographical perspective. With respect to zonesNo. 6 and 7, a ground penetrating radar survey was conducted prior to the excavation survey.

Furthermore, upon learning from local interviews that a brown-glazed jar was also discovered from the school zone on the east side of the survey area, a ground penetrating radar survey and excavation survey were conducted at the school zone. The locations of the survey area are shown in Fig. 17.



Fig.17 Map of Krang Kor site

Section 2. Remains at the Zone No. 4

Zone No. 4 was the site of concentrated burial rooting, particularly near the south boundary fence, and many pieces of ceramic ware lay scattered. Assuming that these pieces were items were grave goods buried in coffin burials, etc. the area around the pit made by burial rooters was demarcated as the survey zone. As a result, two burials were found from a $3m \times 3m$ trench. Hardly any artifacts, however, were found, since the burials had already been thoroughly rooted. Burial No.1 was 1.32m long and 0.78m wide, positioned in the north-northeast to south-southwest direction. Traces of a wooden coffin were found from inside the burial, measuring 1.10m long and 0.40m wide. Burial No.2 was 1.74m long and 0.82m wide, positioned in the north-northwest to south-southeast direction. Burial No.1 was a wooden coffin burial, but Burial No.2 was so extensively rooted that it is difficult to determine whether it was a dirt burial or coffin burial.



Fig.18 Remains of excavation in zone No.4



Fig.19 Horizontal plan of excavation in zone No.4

Section 3. Remains at zone No. 6

Trenches were dug in two places at zone No. 6. From the No. 1 trench, a ditch running in the north-south direction was found in the upper layer, but no other significant remains were discovered. At the No. 2 trench, an excavation was conducted with an expectation of finding architectural remains, as brick elements lay scattered on the ground. As expected, remains were found, which displayed a 27cm-wide, 6cm-deep groove in the center of a two-tier stack of bricks measuring 1.5m long and 1m wide. Burnt soil was deposited around the bricks, and the bricks were also burnt and had black surfaces. Taking into consideration the possibility that the groove was a vent hole and the surrounding area was a burial, it was assumed that the body of a deceased or a coffin was placed on the bricks and cremated. However, it should be mentioned that no remains of a cremation burial were found in the recent series of surveys. If the brown-glazed jar discovered by the villagers to date were cinerary urns, there is greater possibility that these remains are those of a cremation site.



Fig.20 Remains of excavation in zone No. 6 (from south)







Fig.22 Horizontal plan of excavation in zone No. 6

Section 4. Remains at the Zone No. 7 and No.8

A ground penetrating radar survey was also conducted in zone No. 7, and a $2m \times 2m$ trench was dug in places where a reaction was obtained. As a result, an oval burial with a roughly 60cm major axis and 20cm minor axis was found, filled with carbide. Zone No. 8 is located within a village, unlike the zone No. 4, 6, and 7 that have so far been surveyed. According to the villagers, a Khmer brown-glazed stoneware jar with four lug-handles was discovered from an area immediately north of the survey zone, and that it contained human bones. The survey was thus conducted near the house where the discovery was made. No burial sites were found, however, although the entire strata were confirmed. Nevertheless, by conducting the survey, exposed surface items in the area were able to be sampled, surface artifacts that were collected by nearby villagers were able to be surveyed, and other artifacts that have so far been excavated were able to be examined.



Fig.23 Pit in Zone No. 7 Upper Left: Trench in zone No.7, Upper Right: Pit, Lower Left: Section of pit





Fig.24 Trench in zone No.8

Fig.25 Horizontal drawing of trench No.1 in zone No.8

Section 5. Remains at the School zone

Trench Locations

In the school zone, a survey area was demarcated based on information acquired from school officials that brown-grazed jar have been discovered in the past. First, a 50m × 20m area in the open space on the west side of the school was demarcated as the area for geophysical survey, following the lay of the land. As a result, a response was obtained on the south side of the survey area, so trench A was dug centered in the area where the response was obtained, measuring 4m east to west and 2m north to south. Since burial No.1 was found from this trench, new trenches were dug to its north and south. The one to the north, referred to as trench C, was long in the north-south direction, and was dug with the goal of discovering other burials near burial No.1. Trenches were also dug to the south of Burial No.1 and were referred to as trenches B and D. They were also dug with the goal of discovering more burials. Fortunately, as burial No.2 was discovered from trench D, the trench was expanded in the east-west direction to further excavate and completely expose burial No.2.

Trench C was planned to stretch 15m north to south, but due to time constraints, the excavation survey was conducted over two 5m-segments on the north and south sides. The south 5m-segment was referred to as trench C1, and the north 5m-segment as trench C2.





Fig.26 Location map of excavation Trench in school zone

Burial No.1

Burial No.1 was found in trench A at a depth of about 0.7m from the ground surface. It measures 2.66m long and 1.20m wide, and is positioned in the south-southeast to north-northwest direction. As traces of a wooden coffin measuring 1.64m long and 0.45m wide were found from the burial, it was assumed to be a coffin burial. No human bones were found, but judging by the arrangement of burial goods, it is thought that the head pointed in the east-southeast direction.

A variety of burial goods was found from the burial. A pair of earrings made of zinc and copper alloy was found on either side of the assumed position of the head, and a total of 118 blue and white small glass beads were scattered around the area from the head to neck. Two earthenware pots were placed on the southeast side of the assumed position of the head, and a similar pot that was slightly larger was placed at the feet. A iron knife was found on the outer side of where both arms were assumed to be positioned. A concentration of imported ceramics, all celadon, was found on the south side. They included a Chinese celadon plate with petaled rim and celadon bowl, and Si Satchanalai celadon plate. Only the Chinese celadon plate with petaled rim was found retaining its full shape, and the others were found as fragments from different locations. These imported ceramics are estimated to date from the mid to late 15th century. The entombed was probably an adult, judging from the size of the burial, but since no human bones have been found, the gender of the entombed cannot be known.

The burial is thought to be a coffin burial, as traces of a wooden coffin and burial goods were found. However, no wire nails or other such nails were found from around the traces of a wooden coffin, so it is highly likely that the coffin was hollowedout or made of a combination of materials using organic binder. Additionally, since no human bones were found, there is the possibility that the buried bones were disinterred for secondary burial. However, taking into account the fact that no traces of re-digging holes were found that would normally be made when disinterring the remains, there is also the possibility that the site was a primary burial grounds.

Artifacts are thought to retain the conditions in which they were buried, but particularly with regard to ceramic ware, only one Chinese celadon plate with petal rim retained its full shape, and the other three?i.e., the Chinese celadon bowl and the Si Satchanalai celadon plate and bowl?were buried as fragments on the side of the coffin. The three pieces of ceramic ware that were found in fragmented form were all almost fully restored to their full shape, but are thought to have been buried after intentionally breaking them into fragments. With regard to the three round-bottom earthen ware pot ware that were excavated, two were placed at the position of the head andone at the feet. It is thought that they respectively contained different items. Glass beads were clustered at the head of the coffin, but some were also found from around the burial pit outside of the coffin. It is thought that they were sprinkled over the head of the body placed in the coffin at the very end, and that some fell outside



Fig.27 Horizontal drawing of Burial No.1

the coffin. The positions from where these burial goods were found and their conditions should shed light on burial manners and customs of the time to a certain degree, and should also make a large contribution to estimating the dating of each item as useful, comprehensive materials.



Fig 28 Burial No.1(from south)



Fig 29 Burial No.1(from north west)

Burial No.2

Burial No.2 was found in trench D. It is long-oval in shape, measuring 2.6m long and 0.9m wide, positioned in the eastsoutheast to west-northwest direction. Initially, trench D was dug as a narrow trench running in the north-south direction when the excavation was begun. However, because a blue and white bowl was discovered from the northern part of the trench and a burial was thought to exist, the trench was expanded in the perpendicular direction to uncover the entire burial pit, and the trench ultimately turned into a T-shaped trench. The shape of the burial pit was ambiguous near the blue and white bowl, but expanding the trench revealed its outline. Even so, the burial pit was irregularly shaped, and it was difficult to distinguish the wooden coffin, as was possible in Burial No.1. Thus Burial No.2 was assumed to be used for direct burial in the burial pit without using a coffin. As with Burial No.1, no human bones were found, but a number of burial goods were found in location that differed from those of Burial No.1.

Burial goods that were found included the following: a blue and white bowl produced in Jingdezhen, bronze bowl, bronze ring, bronze bracelet, seven glass beads, and an earthenware round-bottom pot. The blue and white bowl was stacked on top of the bronze bowl face down, and both were found in that condition. The bronze ring was discovered from inside the bronze bowl. The glass beads were found from the surrounding area, but were fewer in number compared to those in Burial No.1. These items were found from the east side of the burial pit, while an earthenware round-bottom pot ware was found from the west side. When considering the positions of the burial goods in Burial No.1, the side with the blue and white bowl and bronze bowl was probably the head, and the side with the round-bottom pot was probably the feet. A bronze bracelet was also found near the center of the burial pit, where the arms of the entombed were assumed to be positioned.

The blue and white bowl has a cross-flower pattern on the inside the bowl at the bottom, and can be estimated as dating from the late 15th century to early 16th century. Thus, there does not seem to be a large different in the dating of Burials 1 and 2. Burial No.2 was deep and the remains were in poor condition, so the burial pit was unable to be discovered in part at the position of the head. Neither were traces of a wooden coffin confirmed as in Burial No.1. Therefore, the burial goods could not be restored in detail as those in Burial No.1. Nevertheless, the basic composition is similar to Burial No.1, in that imported ceramics, bronze items and glass beads were placed at the head, an earthen ware pot was placed at the feet. Burials 1 and 2 are merely 1.2m apart at the closest, and the heads both point virtually east. They are thought to belong to a set of burials. No human bones existed, but as with Burial No.1, Burial No.2 indicate no signs of a removing the bones after buried, so it can be assumed that this two burials are original graves, and that its bones did not remain due to the sandy soil.



Fig.30 Horizontal drawing of Burial No.2





Fig.31 Blue and White Bowl excavated from Burial No.2

Fig.32 Bronze Bowl excavated from Burial No.2



Fig.33 Western part of Excavation Burial No.2

Trench C

Trench C was dug on the north side of the burials that is narrowly long in the north-south direction. Originally, more burials were hoped to be found following of the discovery of Burial No.1, but none were found. Nevertheless, large numbers of artifacts were discovered from the soil layer that gradually slopes down toward the south, including many fragments of earthenware, stone and clay bracelets, and paddling tools that were used to paddle and form earthenware. Since no remains were found, and the simple aritifacts layer gradually slopes down toward the south, it is thought that an earthenware workshop existed further north of the trench, and that defects and production tools that were used in the workshop were discarded in the area.



Fig.34 Horizontal and Section drawing of Trench C

Chapter 3. Artifacts

Section 1. Artifacts Excavated from Burial No.1

1. Chinese celadon

A Chinese celadon dish (Fig. 36-7) and bowl (Fig. 36-1) were found. The dish is 12.4cm in diameter, 2.9cm high, and has a foot that is 5.6cm in diameter. The rim is shaped like flower petals. It was found in complete shape. It is coated with greenish gray glaze. A character or symbol can be seen on the inside bottom. The bowl is 14.6cm in diameter, 6.6cm high, and has a foot that is 5.0cm in diameter. A circular line runs around the inside bottom, which is slightly bulged in the center.

2. Thai celadon

Only fragments were found, but they were restored to two pieces, a basin (Fig. 36-3) and a bowl (Fig. 36-2). The basin is 26.0cm in diameter, 7.6cm high, and has a foot that is 9.6cm in diameter. It has a flange rim and a circular line on the inside bottom. The inside body shows a lotus petal design and circular lines, but the outside is plain. It is coated with an olive-green glaze, except for the foot, which is bare. The inside of the foot shows traces of a 5.5cm-diameter cylindrical support. The bowl is 21.3cm in diameter, 9.9cm high, and has a foot that is 9.0cm in diameter. Concentric lines run around the perimeter of the bowl below the rim on the both the outside and inside. It is coated with a grayish-green glaze, all the way down to the bottom of the outer body. Traces of a 4.3cm-diameter cylindrical support remain on the inside of the foot.

3. Earthenware round-bottom jars

The two that were found near the assumed position of the head were found in practically complete shape, and the one found from the feet side was found with a broken rim. Of the first two, the round-bottom jar that was found on the east side (Fig. 36-4) is 18.5cm high in its present state, and is 22.4cm at the largest diameter near the center of the body. Two serrations encircle an area near the outer shoulder. The outer surface displays careful smoothing and paddling traces in the horizontal direction, and the inside surface has traces of hand and finger shaping marks. The round-bottom jar that was found on the west side (Fig. 36-5) is 14.6cm in diameter, 19.2cm high, and a maximum diameter of 21.7cm around the center of the body. There are horizontal smoothing traces on the outside and traces of hand and finger marks on the inside. The round-bottom urn found by the feet (Fig. 36-6) is slightly larger than the jars found from near the head position. It is 19.3cm high in its present state and has a maximum diameter of 26.6cm around the center of the body. There are smoothing traces in random directions on the outside, and traces of a small anvil tool on the inside. There is also a pre-firing hole that is around 1cm large on the bottom.



Fig. 35 Artifacts excavated from Burial No.1 in the school zone













Fig. 36 Artifacts excavated from Burial No.1 in the school zone 1. Chinese celadon bowl, 2. Thai celadon bowl, 3. Thai celadon basin, 4. Eathenware round-bottom jar, 5. Earthenware roundbottom jar, 6. Earthenware round-bottom jar, 7. Chinese celadon dish

Bronze earrings

A has an outside diameter of 3.4cm, an inside diameter of 2.7cm, and is 0.4cm thick. B has an outside diameter of 3.3cm, an inside diameter of 2.6cm, and is 0.3cm thick. It appears that both were made by rolling up a stick-like item and shaping it into a circle, but the connection part cannot be seen due to rusting. Through a fluorescent X-ray analysis, it was found that they are metal alloy, mainly made of copper mixed with zinc.

Glass beads

A total of 118 small glass beads were found scattered near the position of the head. There were three types of beads—blue (light blue), white and blue/white mixed. By number, the blue beads were by far the most numerous, counting 106, while 11 were white and only one was blue/white mixed. Almost all of the beads show spiral traces of something that had coiled around them. On the whole, all types range in size from 4mm to 6mm in diameter. A chemical analysis of the beads by the Nara National Research Institute for Cultural Properties has revealed that these glass beads are made of potassium lead glass, which has been found on many occasions in China dating from the Song Dynasty era (Tamura 2012). Iron knives

An iron knife was found on both the east and west sides of the traces of a wooden coffin. The one found on the west side is 25.1cm long. It is similar in shape to the scythe that is still used locally today, but slightly smaller. The knife that was found on the east side is 12.8cm long. The blade is slightly curved. It may have been curved intentionally when burying it as a burial item, when also considering the fact that pottery pieces had been fractured. Both knives have a narrow stem, which suggests that a cylindrical metal fitting had been attached between the blade and stem to tighten the hilt and stem together.



Section 2 Artifacts Excavated from Burial No.2

1. Chinese blue and white bowl

A Chinese blue and white bowl was found stacked on top of a metal bowl face down from the eastern side of Burial No.2 (Fig. 38-2). Judging by the arrangement of artifacts, it was found near the assumed position of the head. It is a wide-hipped bowl that is 17.6cm in diameter, 7.6cm high, and has a foot that is 7.1cm in diameter. The outside body shows an arabesque design, the inside body, a bead pattern, and the inside bottom, a cruciform flower design.

2. Bronze bowl

The bronze bowl that was found is 12.9cm in diameter with 8.3cm-diameter bottom and a height of 7.5cm (Fig. 38-1). The edge of its rim is rounded and thickened, but it is 0.2 to 0.3mm thick on the whole, including the body. It has relatively little rusting, but displays a black color overall. The inside bottom is in good preservation condition, and shows a yellowish-brown color. Marks from a potter's wheel remain on the inside and outside surfaces, excluding the inside of the foot. Through a fluorescent X-ray analysis, the bronze item was found to be made mainly of copper mixed with tin and lead.

3. Bronze ring

The ring has an outside diameter of 2.05cm and an inside diameter of 1.65cm (Fig. 38-3). It is made by bending a stick-like item into a circle. The stick, however, displays 14 waveforms on the outside. As a result of a fluorescent X-ray analysis, it was found to be made of a metal alloy composed mainly of copper mixed with zinc and tin, like the result for the bracelet.

4. Bronze bracelet

The bracelet has an outside diameter of 6.4cm, an inside diameter of 5.4cm, and is 5mm thick (Fig. 38-4). It appears to be made by bending a bronze stick-like item with a circular cross section into a circle, but the connection of the two ends is slightly off. It is made of the same material as the earrings.











Fig. 38 Artifacts excavated from Burial No.21. Bronze bowl, 2. Chinese blue and white bowl, 3. Bronze bracelet, 4. Bronze ring



Fig. 39 Drawings of artifacts excavated from Burials No.1 and No.2 in the school zone Artifacts excavated from Burial No.1: 1. Chinese celadon dish, 2. Chinese celadon bowl, 3. Thai celadon basin, 4. Thai celadon bowl, 5. Earthenware round-bottom jar, 6. Earthenware round-bottom jar, 7. Earthenware round-bottom jar Artifacts excavated from Burial No.2: 8. Bronze bowl, 9. Bronze bracelet

Section 3. Artifacts Excavated from the Trenches in the School Zone

1. Anvils

Anvils were found in the school zone. It is thought that they were used to support the inside surface when creating pottery. A number of fragments were excavated. The curved cap part that is pressed against the inside of the pottery and the handle that is held will be described below. The tools can be divided into three types-small, medium and large- according to the size of their cap. Large anvils (1 - 4): 1 is the largest, with a cap measuring 10.5cm in diameter. The center of the cap is worn from use, and the end face of the handle is also worn away. 2 has a cap measuring 9.7cm in diameter. 3 has a cap measuring 9.4cm in diameter. 4 has a cap measuring 9cm in diameter. 5 is thought to be a fragment of the end of the handle of a large anvil. Like 1, the end face of the handle is worn from use.

Medium anvils (8 - 12): The size of the cap ranges from 6.8 to 5.1cm. It is similar in shape to the large anvils, but the end of the handle is characteristically flat. 10 is an exception. The end face of its handle is also rounded, indicating the possibility that it was also used as an anvil. 11 has an inscription on the end face of the handle.

Small anvils: Drawings of two small anvils are provided. 6 has a cap measuring 3.6cm in diameter, and 7, 3.5cm in diameter. The end face of the handle of 6 is indented. These small tools show no traces of use, and their size is also unpractical, so there is some doubt as to whether they were actually used as anvils.



Fig. 41 Photo of anvils

2. Bracelets

Many earthen and stone bracelets were found from the trenches in the school zone. They are all circular, and most are earthen, but four sandstone bracelets have also been found. Their frequency distribution by diameter is shown in the below chart. According to this chart, the diameters of the bracelets vary widely. Those with a diameter of less than 40mm may have been earrings, rather than bracelets. As bronze bracelets and earrings have also been found in the burials, it can be said that they were principal accessories in the region.

Diameter	Number
<20mm	1
21-30mm	19
31-40mm	20
41-50mm	11
51-60mm	7
61-70mm	3
71mm>	2

Earthen bracelet												
Number	Diamotor (mm)	Si Width (mm)	ze Thicknoss (mm)	Woight (g)	Color	Trench	Inv. No.					
1	38	7	6	3	Red	E	K284					
2	38	7	5	4	Gray	F	K383					
3	27	8.5	5	2	Gray	F	K395					
4	23	14.5	7	4	Gray	F	K495					
5	54	11	7	7	Gray	F	K585					
6	30	13	5	3	Gray	F	K598					
1 7	39	1	4	3	Black	F	K978					
8	46	10	10	9	Gray	C	K1165					
9	47	9	9	12	Gray	C	K1160 V1167					
10	60	0	0	6	Gray	C	K1107 K1169					
12	62			8	Gray	Č	K1169					
13	72			7	Gray	č	K1170					
14	42	8	8	4	Grav	Č	K1171					
15	45	5	5	3	Grav	Č	K1172					
16	33	7	7	3	Gray	С	K1240					
17	55	9	7	9	Gray	С	K1265					
18	32	9	8	4	Gray	С	K1366					
19	26.5	9	8	2	Gray	C	K1367					
20	32	7	10	3	Gray	C	K1368					
21	30	8	8	3	Gray	С	K1370					
22	35	7	6	3	Gray	С	K1383					
23	20	9 7	8	3	Gray	E	K1440					
24	50		0	4	Gray	E E	K1504 K1565					
26	21	8	8	2	Gray	D	K1500					
27	33	8	8	4	Red	D	K1668					
28	36	13	13	5	Grav	Ď	K1690					
29	36	12	12	5	Gray	2	K1845					
30	50.5	12.5	12.5	8	Gray	D	K1962					
31	40	6	6	3	Gray	С	K1963					
32	42.5	9	8	4	Gray	С	K1964					
33	32	6	8	3	Gray	C	K1965					
34	32	6	6	2	Gray	C	K1966					
35	30	8	8	4	Gray	C F	K1967					
27	40	0	0	6	Gray	Г	K1970					
38	30	7	8	3	Cray	F	K1971 K1972					
30	30	5	6	3	Red	F	K1972					
40	29	6	8	3	Red	F	K1974					
41	26	6	6	2	Grav	Ĝ	K1979					
42	36	10	6	3	Red	G	K1981					
43	23	11	5	3	Yellowish-gray	G	K1984					
44	38	9	9	4	Gray	G	K1985					
45	40	7	5	3	Red	G	K1986					
46	25	8	5	2	Gray	G	K1987					
47	26	15	1	2	Gray	G	K1988					
48	38	0	ð 1	0	Crow	G	K1001					
49	42	8	4 1	1	Gray	G	K1002					
51	41	9	6	4	Gray	G	K1994					
52	22	7	5	2	Grav	Ğ	K1996					
53	30	5	7	3	Gray	G	K1997					
54	24	8	5	2	Gray	G	K1998					
55	24	8	7	3	Gray	G	K1999					
56	30	8	8	4	Gray	G	K2000					
57	45	8	8.5	6	Gray	G	K2001					
58	22	5	7.5	2	Gray	G	K2002					
59	51	8	9	0	Gray	Н	K2004					
0. 1	1.											
Stone brace	elet 56	5	5	6	Pod	C	K1080					
	30	7	ن ۵	2	Grav	G	K1080					
3	51	8	5	6	Gray	G	K1993					
4	41	5	3.5	ž	Gray	Ğ	K2003					



Fig. 42 Earthen bracelets

Section 4. Artifacts Collected from the Ground Surface in Zones 4, 6 and 7

It is thought that artifacts that were collected from the ground surface were dug up from the ground in recent years and were left abandoned in a scattered state on the ground surface. In this survey, such artifacts were collected and basically sorted. The surface artifacts include an even larger variety of imported ceramics compared to artifacts excavated from the burials.

1. Chinese blue and white

Chinese blue and white porcelain are all bowls dated mainly from the latter half of the 15th century to the early 16th century. Chinese blue and white bowl 1 (Fig. 43-2) is measuring 13.2cm in diameter and 6.4cm in height, and has a foot that is 5.6cm in diameter. The inside bottom shows a cruciform flower pattern. The outside body is decorated with an arabesque design. Chinese blue and white bowl 2 (Fig. 43-3) is measuring 15.0cm in diameter and 6.4cm in height, and has a foot that is 6.6cm in diameter. The inside bottom and the outside body shows a natural landscape design.

2. Thai celadon

A large number of Thai celadon pieces have been found from throughout the village. Most are basin and bowls. Fig. 45-1 is a celadon basin with a flange rim. It is 23.1cm in diameter, 8.2cm high, and has a foot that is 9.2cm in diameter. It is coated with a grayish-green glaze, except for the foot, which is bare. The inside of the foot shows traces of a 4.8cm-diameter cylindrical support. Fig. 45-2 is a basin with a flange rim. It is 22.7 in diameter, 8.3cm in height, and has a foot that is 9.8cm in diameter. The inside body shows a successive lotus petal design, and the outside body shows a pattern of vertical streaks. It is coated with a grayish-green glaze. The inside of the foot shows traces of a 5.2cm-diameter cylindrical support.

3. Thai or Myanmar opaque white-glaze bowl

Fig. 45-3 is only one opaque white-glaze item, a bowl measuring 17.6cm in diameter, 10.0cm in height, and has a foot that is 8.4cm in diameter (Fig. 43-4). It is thick, with a thick rim, and appears weighty. A line runs around the inside bottom, and the outside body shows a pattern of vertical streaks. A gloss-less, opaque white glaze is applied over a thick engobe. For the time being, it is thought to be a product of Thailand and Myanmar, but further examination needs to be made in the future.

4. Myanmar celadon

Two bowls have been almost fully restored to their complete shape (Fig. 44-1, 2). Fig. 45-4 measures 11.7cm in diameter, 7.2cm in height, and has a foot that is 5.0cm in diameter. The rim curves slightly inward, and a very shallow line runs around the inside bottom. Its outer surface has been slightly shaved off, and the foot edge is rather irregularly shaped. It is coated with a grayish-green glaze, all the way down to the bottom of the outside body. As its displays characteristics that are similar to celadon items that were produced near Twante during the 15th to 16th centuries, it is assumed to be a product of that region. 5. Central Vietnamese celadon

Three Central Vietnamese Binh Dinh celadon pieces have been confirmed (Figs. 44-3, 4). Fig. 45-6 is a bowl with 16.3cm in diameter, 6.5cm in height, and has a foot that is 5.0cm in diameter. The inside bottom has an unglazed ring. The outer surface of the foot has been slightly shaved off, creating a slight level difference. It is covered by a light coat of glaze in yellowish-gray color. Fig. 45-7 is a bowl measuring 16.4cm in diameter, 6.4cm in height, and has a foot that is 5.2cm in diameter. The inside bottom has a unglazed ring , and both the inside and outside surfaces are plain. The glaze is a slightly glossy olive-green color. 6. Chinese brown glazed jar with four lug handles

Fig. 45-8 shows a jar measuring 9.2cm in diameter, 18.2cm in height, and having a base that is 10.4cm in diameter. Its largest diameter measures 19.2cm at the middle of the body. It has a short neck, and four handles are attached to the sides of the shoulder.

7. Khmer brown glazed jar with four lug handles

Fig. 45-9 shows a fragment of a brown-glaze four-handled jar. Straight lines run around the neck of the jar, and handles that serve a design purpose only are attached to the sides below the lines. The shoulder has straight lines and wavy lines, and below these lines are another set of wavy lines in the vertical direction. A blackish brown glaze is applied to the entire outside surface.

8. Myanmar pottery bowl

Fig. 45-10 is a pottry bowl with rim 15.2cm in diameter, hight 7.7cm and a foot that is 8.8cm in diameter. The traces of smoothing and reddish color can be seen on the surface of the outside body(Fig.44-6). This bowl is supposed to be the production of Payadyi kiln site in Myanmar where the same type of bowls were discovered (Toyama Sato Memorial Museum 2004).



5. 6. Thai celadon bowls





Fig. 44 Artifacts collected from the ground surface (2)

- 1. 2. Myanmar celadon bowls
- 3. 4. Central Vietnamese celadon bowls
- 5. Thai celadon plate

- 6. Myanmar pottery bowl
- 7. Khmer brown glazed jar with four lug handles
- 8. Chinese brown glazed jar with four lug handles



- 3. Thai or Myanmar opaque white-glaze bowl
- 4. 5. Myanmar celadon

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- 6. 7. Central Vietnamese celadon bowl
- 8. Chinese brown glazed jar with four lug handles
- 9. Khmer brown glazed jar with four lug handles
- 10. Myanmar pottery bowl

Part 2. Research of the Longvek Site

Chapter 1. Background and Overview of the Research

Section 1. Background of the Study

Longvek was the royal capital of post-Angkor Cambodia. The existence of the 16th-century royal capital that lay surrounded by earthen walls and moats has been acknowledged since earlier times, but no full-scale archaeological surveys have ever been conducted. The period from the end of the Angkor period to the post-Angkor period was marked by invasions from neighboring countries and domestic instability, and was an especially complicated period within the history of Cambodia. After Angkor, the royal capital was moved to different locations a number of times, including Srei Santhor, Phnom Penh, Longvek and Oudong, and the internal situation is thought to have been unstable. The actual state of affairs remains unknown so much that the period from the end of the Angkor period to the post-Angkor period is sometimes called the "dark ages" This dark ages, from the 15th to 16th centuries, is precisely the focus of this project, and this paper is a report of an archaeological survey carried out for the first time at the royal capital of Longvek. It also provides a collection of basic materials for future surveys.

Nara National Research Institute for Cultural Properties conducted an archaeological survey of the post-Angkor capital of Longvek and Krang Kor from fiscal 2010 to 2012 as the "Exchange Project for Conservation of the Oudong and Longvek Archaeological Sites in Cambodia," under the scope of Networking Core Centers for International Cooperation on Conservation of Cultural Heritage funded by the Agency for Cultural Affairs, Government of Japan. Implemented with cooperation from the Cambodian Ministry of Culture and Fine Arts and the Department of Archaeology at the Royal University of Fine Arts in Phnom Penh, the survey focused on the exploration and survey of monuments and human resource development. At Longvek, the survey was carried out in three separate missions.

Section 2. Overview of the Survey

First survey

From July 29 to August 1, 2011, a survey was carried out at Longvek. As the Longvek site spreads across a large area, aerial photos (Fig. 46, 47) were taken by Mr. Kensuke Nishida from Nihon Chisui Fukuoka Corporation using a multi-rotor helicopter prior to implementing a full-scale exploration of the monument. Photo shoots were taken at the northwest corner of Longvek, the center of the mound on the west side, the southwest corner, the northeast corner and at Tuol Bayok.

Second survey

The south side of Longvek was explored from January 9 to 12, 2012. The exploration revealed numerous mounds near the south side mound, and remains and artifacts were confirmed at a number of the mounds. Thus, after



Fig. 46 Earthen walls and moats on the western side of Longvek



Fig. 47 Earthen walls in the southwest corner of Longvek

numbering the mounds for convenience and creating an inventory, a small-scale trench survey was carried out at mound No. 2 (Fig. 48) and brick remains No. 1 (Fig. 49). As a result, no remains were found from the trench at mound No. 2, so it is assumed that some form of activity took place using the natural mound. At brick remains No. 1, a brick structure had stood on the mound. It was already severely collapsed (Fig. 50), and a shaft made by rooters was also found (Fig. 51), so the trench was dug in front of the brick structure. No conspicuous artifacts were found from the trench, and findings were limited to several pottery fragments, but a Ming blue and white porcelain was found from around the mound.

Third survey

An exploration was launched at the Longvek site from August 13 to 16, 2012, to create a basic inventory for assessing the distribution of remains and artifacts in Longvek. This was decided to be done by creating an inventory sheet for recording basic information. The GPS of spots where remains and artifacts were confirmed, the types of artifacts and other such information were recorded on the inventory sheet to accumulate information. As a result of the exploration, data was collected from a total of 53 spots.

Fourth survey

An exploration was conducted in the Longvek site from November 30 to December 3, 2012, to create an inventory of Longvek. Through the exploration, data was successfully collected from 41 more spots, such that the distribution of remains and artifacts was ultimately confirmed in 94 spots in all. However, exploration surveys still need to be continued hereafter, as the previous surveys could not fully cover the entire grounds of the Longvek site.



Fig.48 Survey of mound No. 2



Fig.49 Survey of brick remains No. 1



Fig.50 Brick remains No. 1



Fig.51 Shaft made by rooters at brick remains No.1

Chapter 2. Overview of the Site

Section 1. Location of the Site

Longvek was the royal capital of the post-Angkor period. It is located in a region approximately 35km north of the present capital of Phnom Penh along National Road No. 5, in the Kompong Tralach district of Kompong Chhnang province in eastern Cambodia. Roughly 7km to the south of Longvek is Oudong, which later became the royal capital from the 17th to 19th centuries, and the lofty sacred peak of Phnom Preah Reach Troap.

Longvek is situated on a slight elevation on the west bank of the Tonle Sap River, which flows from Lake Tonle Sap and converges with the Mekong River. It is surrounded by triple earthen walls and moats extending approximately 2km east to west and 2.5km north to south. It has no walls on the east side, however, and displays a structure that is open toward the flood plain of the Tonle Sap River. It can be said that the location provides the convenience of both river and land routes.

Section 2. Historical Background of Longvek

A detailed prior study based on documentary materials such as the Cambodian Royal Chronicles, which is virtually the only documentary material in Cambodia with reference to the post-Angkor period, has been made by Takako Kitagawa (Kitagawa 1998). According to Kitagawa, when the Angkor Empire was invaded by neighboring Ayutthaya, King Ponhea Yat abandoned Angkor and moved the capital to Bassan in Srei Santhor in 1431. In Chinese annals called Da Ming Shi Lu, there is a record of a visit made by "King Bassan" of Chenla to China in 1372 and 1373, so it is believed that some sort of power had originally existed in Bassan around the end of the Angkor period. Thereafter, King Ponhea Yat moved the capital to Phnom Penh. Around this time, the war between the Bassan forces and the forces of the legitimate king intensified. In the fight between Sdech Kon of Bassan and Chan Reachea, the younger brother of the legitimate king, Chan Reachea defeated Sdech Kon in 1525, assumed the throne, and built his capital in Longvek in 1529. However, it is said that Longvek fell to Ayutthaya in 1594. The royal capital was then moved to Srei Santhor for a while, but King Chey Chetta unified Cambodia in 1620 and moved the capital to Oudong. Oudong continued to be the royal capital until 1855, when it was moved to Phnom Penh.Although it is said that the capital was moved from Longvek to Oudong in 1594, a Dutchman who visited Cambodia in the 17th century noted the capital of Cambodia as Leweeck or Eavweck, thought to refer to Longvek. This means that either Longvek continued to function as a capital even after the capital was moved to Oudong, or that it continued to be used in some way, since Longvek and Oudong are only 7 km away in direct distance. Thus, studies of Longvek need to be made with consideration also to its vestiges after the 17th century, although literary references in Cambodia define it as the royal capital during the 16th century.

Reference: KITAGAWA Takako, 1998, "Capitals of the Post-Angkor Period Longvek and Oudong", Southeast Asia History and Culture 27





Fig. 52 Location of Longvek

Section 3. Remains

As mentioned earlier, studies based on literary materials are being pursued, but it is also a fact that the Cambodian Royal Chronicles lacks credibility. That is to say, the Chronicles was compiled in the 19th century, and poses an issue of how to assess its historical value. For this reason, it is considered effective to study Longvek by adopting the archaeological method of squarely addressing its actual remains and artifacts. Nara National Research Institute for Cultural Properties launched an archaeological exploration of Longvek in fiscal 2010 by numbering the spots from where remains or artifacts were found, documenting GPS and artifact information, and creating an inventory. Initial efforts were directed to gaining comprehensive knowledge of Longvek, as even basic information such as of the distribution of remains and artifacts in the site had been lacking. Remains

The survey revealed that Longvek was a royal city that had a square shape, surrounded by earthen walls and moats on three sides, and diverse remains have been found inside the Longvek, including Buddhist terraces and Theravada Buddhist temples, and mounds. As of the present, 20 temples and Buddhist terrace remains and 9 mounds have been confirmed. In an interview survey, villagers say there are as many as 108 remains in Longvek. The recent survey was unable to explore all of Longvek, and a considerable area remains unexplored, so further surveys need to be made in the future. This section presents an overview of earthen walls, moats and temples that have been found so far.

Earthen walls and moats

Longvek is surrounded on three sides by earthen walls and moats (Fig. 53). At present, part of the earthen walls has been cut open to create a farm road in recent years, and cross sections of the earthen walls are exposed in some places (Fig. 54), but overall, it appears to have remained in good condition. The moats are being used as rice fields. The earthen walls of Longvek seem to have been made within a scope that takes advantage of the natural landform, and the edges of elevations slightly higher than the flood plain were used to create the earthen walls. The north and west sides have three layers of walls, and the south side, one layer. There is no earthen walls on the east side, perhaps because it faces the flood plain of the Tonle Sap River. The earthen walls are made by clay without using bricks or laterite. They are about 4-8m high as a whole, but differ in places. The southwest corner is demarcated by an earthen wall that intricately projects outward in the form of an external corner, and is thought to have served as the entrance to the royal city of Longvek or as a defense facility. From the earthen walls on the south side, three earthen walls spread further southward in the direction of Oudong city, and require further surveys in the future.



Fig.53 South earthen walls and moat (viewed from west)



Fig.55 West earthen walls (viewed from the south-southwest)



Fig.54 Cross section of the earthen wall on the west side



Fig.56 West earthen walls that has been cut open

Temples

Temples in Longvek are all Theravada Buddhist temples. However, it must be said that it is difficult at the present stage to determine the date of construction of the temples seen in Longvek. One of the reasons is because no reliable inscription materials exist. Although the dates of construction cannot be determined, the characteristics of temples in Longvek are presented below. Types of temples

Theravada Buddhist temples in Longvek can be roughly divided into two types. The first are terrace temples (vihara) built on a mound (Fig. 57), and the second are relatively large Theravada Buddhist temples (pagoda) that stand on flat land (Fig. 59). Terrace temples have a simple structure. In front of a vihara that ensconces a Buddha image, spreads a flat rectangular terrace or ritualistic space, and these structures as a whole are bounded by sema stones. This terrace style is frequently seen in the Angkor region as well, as such Buddhist terrace temples were built one after another in Angkor Thom from the end of the Angkor period to the post-Angkor period. However, the terrace temples in Longvek are mostly built on a natural mound. Theravada Buddhist temples, on the other hand, still function as temples today, and have been expanded or otherwise modified in recent years. For this reason, it is not possible at the present stage to restore the temple structures of the Longvek period. Nevertheless, the basic structure comprises a main temple, monastery, hall and pond inside a complex. It seems such temples were built not on a mound, but in flatlands to avoid floods.

Structural modifications

There are a number of temples where precedent structures that belong to the Angkor or post-Angkor period are found within the temple grounds today. For example, at Wat Tralaeng Kaeng (Fig. 60), an Angkor period sandstone structure and mound exist in the center of the temple grounds, and a seated Buddha image is ensconced on the mound today. At the terrace temple of Vihear Bakko, the vihara that exists today stands on a brick foundation that is thought to be a precedent structure (Fig. 58). It can thus be said that the position of the precedent structure is respected in continuing the faith today.

Building materials

The foundations of stupas and viharas seen in the temple complex are mostly made of brick. The majority of temples in the Angkor period were made using sandstone and laterite, but at Longvek, using bricks seemed to have been the mainstream. However, the sema stones that border the temple grounds are sandstone. Thus, sandstone was also used, albeit in a limited scope.



Fig.57 Vihear Bakkor on a mound



Fig.59 Main vihara of Preah An Tep



Fig.58 Former structure beneath the vihara of Vihear Bakkor



Fig.60 Angkor period remains at Wat Tralaeng Kaeng

Sema stones

Sema stones (boundary stones) were found in some temples in Longvek. They were originally placed in a total of 8 places in the four corners of the temple and in the center of each side—to signify the boundaries of the temple grounds. Such stones are characteristic of Theravada Buddhist temples in Cambodia, but in this study, only a few of them were found, namely from Wat Tralaeng Kaeng, Vihear Bakkor and Tuol Bayok. Moreover, most of the stones were regrettably not found in their original locations, and many simply lay abandoned on the ground. The only exception was the sema stone of the main sanctuary of Wat Tralaeng Kaeng, which was reburied in its original location accompanying the renovation of the building.

The sema stones found in Longvek can be roughly divided into two types. One type is shaped like a cannon shell or a spearhead with a constricted lower portion. A vertical line runs down the center of the stone but displays no other decoration neither on the front nor back, and is with a lotus bud on the top(Fig. 61). The other is also shaped like a cannon shell or a spearhead, but is decorated with an arabesque pattern on the surface (Fig. 62). This type with a decoration has been found only at Wat Tralaeng Kaeng so far.

Buddha images

Most of the Buddha images that are seen in Longvek today are those that have been newly made, but images that appear to date from the Longvek period have been found in a few of the temples. The main sanctuary of Wat Tralaeng Kaeng enshrines a four-direction standing Buddha image. The image today is one that has been made in later years, but the feet part of the original image that is assumed to date from the Longvek period still exists today (Fig. 63). As the feet measures more than 1m, the original four-direction Buddha image is believed to have been considerably tall. Additionally, Vihear Bakkor enshrines a seated Buddha image made of pink sandstone that were diverted from an Angkor-period temple (Fig. 64).



Fig. 61 Sema stone at Tuol Bayok



Fig. 62 Sema stone at Wat Tralaeng Kaeng



Fig. 63 Feet part of the four-directions Buddha image at Wat Tralaeng Kaeng



Fig. 64 Seated Buddha image at Vihear Bakkor

Section 4. Artifacts

In the exploration of Longvek, large numbers of artifacts were collected from the ground surface. They were a wide variety of artifacts, but it is particularly worth noting that more than half were fragments of Chinese blue and white porcelain. They are proof of the lively trading activities that took place during the post-Angkor period. Of the 1,500 surface artifacts that have been collected in all, 60% were Chinese blue and white porcelain, 10% were glazed pottery, another 10% were unglazed stoneware, 11% were earthenware, and the rest included Khmer stoneware, Chinese celadon, white porcelain, and five-color porcelain.

Chinese blue and white porcelain

Bowl: Fig.65-1 is a blue and white bowl. It has a rim diameter of 14.1cm, a height of 6.0cm and a base diameter of 5.6cm. A horse design is drawn below a pattern band around the outer rim. A conch is shown on the inside bottom (Fig.67-1). Fig.65-2, 3 is a blue and white bowl with an incised flower design. It has a rim diameter of 18.1cm, and a base diameter of 6.6cm. The inside bottom shows a landscape design. (Fig.67-2). Fig.65-4 is a fragment of a blue and white bowl. The outside body shows a flower design, and the inside bottom shows a fern design. The characters "永保長寿" are inscribed on the inside of the base(Fig.67-3). Fig.65-5 a fragment of the bottom of a blue and white bowl. A fern design is drawn on the inside bottom, and the characters "大明年造" are inscribed on the inside of the base (Fig.67-4). Fig.65-6 is a fragment of the bottom of a blue and white bowl with a base diameter of 9.2cm. A fern-like design is drawn on the inside bottom (Fig.67-5). Fig.65-7 is a fragment of the bottom of a blue and white bowl. It has a base diameter of 8.0cm, and a rounded inside bottom. A flower design is drawn on the inside bottom, and on the inside of the base are the characters "精製" within a square frame (Fig.68-1). Fig.65-8 is a fragment of the bottom of a blue and white bowl, with a base diameter of 4.6cm. A design of figures is drawn on the inside bottom, and the character "福" is inscribed on the inside of the base (Fig.68-2). Fig.65-9 is a fragment of a blue and white bowl with a design composed of Reishi mushroom, plum, bamboo and crane. (Fig.68-3). Fig.65-10 is a fragment of the bottom of a blue and white bowl. A dragon design is drawn on the inside bottom, and a character is displayed on the inside of the base. Plates: Fig.65-11 is a fragment of the bottom of a blue and white plate. A portion of a phoenix design can be seen on the inside bottom. Characters that appear to be " 萬福倣同 " remain on the inside of the base. Fig.65-12 is a fragment of the rim of a blue and white plate, so-called Kraak porcelain. It has a brimmed rim with the edges forming a petal design (Fig.68-4).

Jar: Fig.66-1 is a fragment of a blue and white lid for a jar with a diameter of 4.0cm. The outside is decorated with an arabesque pattern, while the inside has no design (Fig.68-5).

Covered box: Fig.66-2 is a fragment of a lid of a flat covered box with 6.4cm in diameter. A flower design is drawn on the outside (Fig.68-6). Fig.66-3 is a body of covered box. It has a rim diameter of 1.8cm, a height of 2.1cm, and a base diameter of 1.2cm. A Floral motif is painted on the outside of the body (Fig.68-7).

Unknown artifacts: Fig.66-4 is the foot part of a small blue and white footed bowl or other small item. It is shaped in the form of animal legs. There are patterns on the outside of the foot, but none on the inside (Fig.69-1).

Porcelain with underglaze blue and overglaze green enamels: Fig.66-5 is a fragment of the rim of porcelain with undeglae blue and overglaze green enamels bowl with a rim diameter of 8.2cm. The outside is entirely glazed with green glaze, and the inside displays a blue and white cross-bracing in four directions (Fig.69-2 center).

Porcelain with underglaze blue and overglaze yellow enamels: Fig.66-6 is a fragment of the bottom of a small blue and white bowl with yellow glaze with a base diameter of 3.6cm. Yellow glaze is applied to the outside. The inside of the base and inside of the vessel are decorated with blue and white, and a flower design is drawn on the inside bottom (Fig.69-2 left).

Porcelain with underglaze blue and overglaze enamels: Fig.66-7 is a body of a porcelain with underglaze blue and overglaze enamels bowl. Green and red glaze remain on the outside, and the inside body has a blue and white design (Fig.69-2 right).

Thai celadon and ceramic with underglaze iron painting: Fig.66-8 is a fragment of the bottom of a Thai celadon bowl. The base diameter is 6.8cm. The glaze is a greenish-gray color. The inside of the base shows traces of a cylindrical support (Fig.69-3). Fig.66-9 is a part of a Thai underglaze iron painting item, but the shape is unknown. It is made as though to enwrap the clay in the form of a knob. The outside body displays an iron design that gives off black color, and the inside is unglazed(Fig.69-4).

Khmer brown-glazed stoneware: Fig.66-10 is a fragment of the rim of a Khmer brown glazed stoneware jar. The rim diameter is 14.4cm. Both the inside and outside are coated with blackish brown glaze (Fig.69-5).







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Fig.65 Drawings of Unearthed ceramics 1









2.Blue and white bowl 2



3.Blue and white bowl 3



4.Blue and white bowl 4



5.Blue and white bowl 5











Fig.67 Photo of Unearthed ceramics 1



7.Body of blue and white covered box

Fig.68 Photo of Unearthed ceramics 2





1. Animal shaped leg of blue and white container



2. Underglaze blue and overglaze yellow enamels (left), green enamels (center), five colored enamels (right)





3. Thai celadon bowl



4. Thai underglazed iron paintings



5.Khmer brown glazed stoneware jar





Fig.69 Photo of Unearthed ceramics 3



Part 3. Discussion

Chapter 1. The Ceramics Unearthed from Longvek and Krang Kor

Yuni Sato

Department of Planning and Coordination, Nara National Research Institute for Cultural Properties 1. Introduction

Conventionally, archeological studies of Cambodia focused mainly on the prehistoric times and the Angkor period, and the post-Angkor period were virtually ignored. This "post-Angkor period" points to the approximately 430-year timeframe between the fall of Angkor in 1431 until 1863 when the French colonial rule began. These 430 years had been cloaked in mystery for a long time. In has only been in recent years that first steps in archeological research of the said period was started mainly by the Nara National Research Institute for Cultural Properties (Nara 2008). Research was conducted at Longvek, the royal capital of the post-Angkor period, and Krang Kor, a site at which burials was discovered, and many artifacts were excavated there. The unearthed artifacts serve an important role in explaining Cambodia during the post-Angkor period. This chapter will look back on the ceramics, which were excavated at both of the sites, and discuss their characteristics and significance.

2. Ceramics Excavated at the Krang Kor Site

As explained in Part 1, the archaeological research of the Krang Kor site can be considered an important case, as two burials were discovered in good condition and a large volume of assemblage that are highly likely connected with each other had been excavated. Of imported ceramics, Si Satchanalai celadon, Chinese celadon, and Jingdezhen blue and white porcelain were all given the general dates of mid-15th century to early 16th century (Chart 1). Further, from surveying the ground surfaces, a greater variety of ceramics found. Among those found were many Ming blue and white porcelain, Si Satchanalai celadon, Binh Dinh celadon, Myanmar celadon, Khmer brown-glazed stoneware and earthenware, majority of them can be hypothesized as being from the period between 15th century to early 16th century. This is after the Angkor collapsed in 1431 and the location of the capital was moved, marking the beginning of a period of political instability for Cambodia. In such a time, there was likely a force in Krang Kor that had the ability to acquire the kind of ceramics that we excavated in our research.

3. Ceramics Excavated at Longvek

For this archaeological research conducted in Longvek, we were not able to fine comb through the entire area of 500 hectares, which spanned two kilometers east to west and 2.5 kilometers north to south. However, at least at the current stage, an abundant amount of artifacts were found on the grounds surface mainly in Longvek's southern area, particularly around the earthen wall there (Fig.1). For example, the earthen wall at the southern area of Longvek had a high density of imported ceramics, particularly Ming blue and white porcelain (Fig.2). Additionally, from the ground's surface around the mound near the Preah An Tep, a few slag-like artifacts were found (Fig.3). Although further research is necessary in order to determine whether iron was being produced at that time, this discovery offers the possibility of it being the first step toward understanding the situation surrounding metal production inside of royal capital in the post-Angkor period.

The ceramics excavated at Longvek are attributed the dates that is one stage later than those given to the abovementioned ceramics excavated at the Krang Kor site. Of the ceramics found at Longvek, 60% are Chinese blue and white porcelain. Many have the characteristics of chiefly late Ming period, or late 16th century to early 17th century (Chart 2). Majority of these being Jingdezhen blue and white bowl, five-color blue and white porcelain and blue and white porcelain with green glaze. According to the Royal Chronicle, Longvek lasted from 1529 to 1594. Majority of the artifacts excavated at Longvek could be given the approximate date of late 16th century to early 17th century, which is not much different from what is stated in the Royal Chronicle. However, because around 40% of the artifacts found at Longvek are from the late 17th century or later, it cannot be said at this point that they directly reflect the historical events found in the Royal Chronicle. In fact, we perhaps ought to consider the possibility that in late 17th century, Longvek was still being used in some capacity even after the royal capital was moved to Oudong about seven kilometers to the south.

4. Distribution of Ceramics

From the Krang Kor site, we found Ming blue and white porcelain and a variety of ceramics made in Southeast Asia from 15th to early 16th century. On the other hand, from the royal capital of Longvek, many pieces Chinese blue and white porcelain, and mainly the Ming to Qing blue and white porcelain from the early 17th century through 18th century were found. Of the artifacts excavated at the Krang Kor site that date back to 15th century through early 16th century include Jingdezhen blue and white porcelain, Si Satchanalai celadon, Myanmar celadon, and Binh Dinh celadon, but unfortunately very few of these were found within Cambodia. However, ceramics with commonalities were found among the materials found in shipwrecks in Asian seas—for example, those found off the coast of Koh Samui and Santa Cruz (Brown 2009). The said period is when the active overseas exporting of ceramic made in Thailand, Myanmar, and Vietnam began. We need to conduct further research in order to determine through what routes the ceramics made in Southeast Asia and excavated at the Krang Kor site ended up there, but it is presumed that it happened via a combination of sea, land, and river routes. The ceramics from Thailand and Myanmar, for example, could have crossed the Gulf of Siam and been brought on shore on Cambodia's side, or they may have optimized the use of land routes to arrive in Cambodia. Moreover, the Binh Dinh celadon could have arrived through land routes, or they could have been loaded onto a trade ship along with Chinese blue and white porcelain and brought in to Cambodia. Whatever the case, we need to accumulate more research findings related to sites in different regions from the same

At the same time, this is in no small amount influenced by the fact that Longvek is situated on the western banks of the Tonle Sap River and at a location beneficial for trade. Gaspar Da Cruz, the Portuguese missionary in 16th century traveled upstream on the river and came ashore in Cambodia (Gasper 1987), and this allows us to presume that trading vessels could also have traveled the river route from the Mekong River to Tonle Sap River and arrived in the area of Longvek via Phnom Penh. The pictorial map drawn by the Dutch in the 17th century (Muller 1917) is entitled Eavweck (Fig.4), and it shows the

Longvek, the royal palace believed to be Oudong, houses that stand along the Tonle Sap River, and land routes that connect these and stretch beyond the mountain ranges. Included in the map presumably are elements necessary for political and trade activities. In this research, we specifically examined the royal capital and the sites around it, along with the excavated ceramics, thereby uncovering however slightly some aspects of the societal and economical activities of the relevant time period. Using these findings as the starting point, we will likely need to continue to further research the areas around Longvek, Oudong and Krang Kor site in order to empirically discover what the conditions were in Cambodia during this particular time period.

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period in order to further examine the distribution routes of the aforementioned period.



Chart 1. Ratio of periods of artifacts excavated at Krang Kor





Fig. 1 Outline map of Longvek



Fig. 2 Artifacts found at the southeast corner of Longvek



Fig. 3 Slag-like artifacts found near Preah An Tep



Fig. 4 Pictorial map of the area around Longvek (Muller 1917).

Chapter 2. Scientific Study and Conservation Treatment of Artifacts

Excavated from Krang Kor

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1. Glass Beads

An excavation survey conducted at the Krang Kor Ruins located in Kampong Chhnang Province in the suburb of Phnom Penh, Cambodia yielded numerous glass beads. Based on the understanding that acquiring information on bead-making technique and chemical compositions is indispensable to studying the production areas and distribution routes of glass artifacts, we launched an examination of the bead-making technique, glass system, and colorant of the excavated glass beads using analytical methods.

(1) Materials and method

The examination was conducted on 10 glass beads from among 118 that were excavated during the third excavation survey at the Krang Kor site. The 10 beads included 8 opaque light blue beads with relatively good preservation conditions (Nos. 13, 17, 21, 26, 37, 38, 40, 52); 1 pale yellowish-white bead that is heavily weathered (No. 5); and 1 bead showing an alternating pattern of opaque light blue stripes and white weathered stripes (No. 12).

The bead-making technique was estimated by observation through a stereo microscope. Then, the density of a number of the more well-preserved beads was measured using Archimedes' principle, and their glass system and coloring factor were estimated by nondestructive surface analysis based on X-ray fluorescence analysis. The nondestructive measuring method is not effective for identifying the original chemical composition of materials that are weathered or have distinct shapes, but it can estimate glass system and coloring factor. The measurement results were standardized according to a fundamental parameter (FP) method using standard glass samples and displayed in terms of oxide weight percentages. The measurement was conducted in a vacuum using an energy dispersive X-ray fluorescence analyzer (EAGLEIII manufactured by EDAX) under the following specifications: X-ray target. Mo, voltage. 20/50 kV, current. 100 µA, time. 300 seconds.

(2) Results

Bead making technique

Judging by the etch streaks running in perpendicular direction to the hole and the small projection at the end that looks to be the beginning or end of a spiral coil, we believe the beads were made by winding a heat softened string-like glass two, three times around a rod (Fig 1). Bead No. 5 is entirely pale yellowish-white in color due to severe weathering, but we assume it was made according to the same coiling method, as it displays faint traces of etch streaks running perpendicular to the hole.

Glass system

According to X-ray fluorescence analysis, the beads, excluding Nos. 5 and 12 which were severely weathered, are chemically composed of 29.1 - 36.6% PbO, 7.04 - 10.8% K₂O, and 49.3 - 51.6% SiO₂. This means that the beads are made of potassium lead glass.

The severely weathered No. 12 bead contains 30.1% PbO and 5.6% K₂O, so we assume it is also made of potassium lead glass as the above beads that were found in relatively good condition. The slightly lower K₂O content is probably due to weathering, as potassium lead glass is known to have reduced levels of K₂O in surface layers as an effect of weathering (Koezuka 1997).

Bead No. 5 is the most severely weathered among all other beads. It contains 20.3% PbO but an extremely small amount of K₂O, probably for the same reason as mentioned above. The possibility of its being a lead glass not including K₂O was considered, but in the case of a two-component lead glass, the weathered surface should normally have a significantly high PbO level and a largely reduced SiO₂ level. However, since the bead in question has only a small amount of PbO and a large amount of SiO₂ compared to the other beads, it seems more likely that it is made of potassium lead glass that originally contained a certain amount of K₂O.

Coloring factor

All of the beads are an opaque, light blue color, excluding Bead No. 5 whose original color cannot be confirmed. The color

apparently comes from their color-related content of 0.14 - 0.29% Fe₂O₃ and 0.43 - 0.81% CuO. However, it is difficult to know whether Fe₂O₃ was intentionally added as a coloring agent, because Fe₂O₃ is also found in quartz sand, the raw material of basic glass. The beads also characteristically contain around 0.1% of ZnO, which is seen as an impurity associated with the copper material that was added as a coloring agent.

The source of the opaqueness was difficult to identify. However, where transparent potassium lead glass typically contains less than 1% Na₂O and CaO, the beads in question had from 2 to 4%, so these components may have some bearing on producing the opaqueness.

Bead No. 5 contained a rather larger amount of Fe₂O₃ and a rather smaller amount of CuO compared to the other beads. In regard to Fe₂O₃, it has been noted that large amounts of iron adsorb to substances that are derived by weathering in cases where the artifact has been buried in an iron-rich environment. Taking this into consideration, Bead No. 5 may have exhibited a higher level of Fe₂O₃ content than usual because soil in Cambodia is mainly composed of eluvium such as iron and aluminum. CuO, on the other hand, is known to largely remain constant, although it may increase slightly on weathered surfaces, so Bead No. 5 probably contained only a small amount of CuO to begin with. Similarly, CaO content, which is also said to remain relatively constant even with the effect of weathering, is low. When taking all of the above into consideration, it is possible that the color of Bead No. 5 originally differed from the other glass beads.

(3) Discussion

All conditions indicate that the glass beads excavated from the Krang Kor site are potassium lead glass made by coiling method, and potassium lead glass is known to have existed in China at least from the Song Period (An 1984).

In the Southeast Asian region, including Cambodia, glass beads called Indo-Pacific Beads, which were made by drawing method, were widely traded between the 3rd century BC and the 17th century AD. Most of these beads were made of alkali silicate glass. Meanwhile, glass beads that were made by coiling method are called Chinese Coil Beads, and are said to have been introduced from China around the 12th century (Francis 2002). Therefore, the recent discovery of potassium lead glass beads at the Krang Kor site provides important insight into relationships that existed during this period.

Chinese potassium lead glass was also introduced to Japan, but the lead isotope ratios for potassium lead glass in Japan around the 12th century revealed in most case a similar composition with that of lead ore of the Taishu mine in Japan. Similarly, the original production region of the glass beads excavated at the Krang Kor site also needs to be ascertained in future. Since there are few data on the analysis of glass beads that circulated throughout Southeast Asia during the Middle Ages, we feel we have been able to provide valuable information in this regard.

Reference

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<Supplementary Discussion>

In our study, we also examined glass beads that were collected from around the Krang Kor site, as discussed below.

The beads that were examined included 4 opaque yellow beads (Nos. 1 - 4), 2 opaque light blue beads (Nos. 5 - 6), and 1 transparent, reddish-brown bead (No. 7).

All seem to be made by the coiling method. However, while all beads except for Bead No. 1 seem to be made by coiling a softened string-like glass one to two times around a central rod and have an unpolished surface, Bead No. 1 seems to be made by coiling the glass a larger number of times around a central rod and has a polished surface (Fig. 2).

The basic glass type appears to be potassium lead glass for all of the beads. Compared to typical potassium lead glass, however, these beads have smaller amounts of K₂O despite the fact that they are in good condition. They can therefore be said to have a slightly unique composition.

The opaque yellow color of Beads Nos. 1 to 4 seem to come from artificial yellow pigment PbSnO₃, since prominent traces of Sn were detected from these beads, and also because a spectrum indicating the characteristics of PbSnO₃ was obtained in a Raman spectroscopic analysis of Bead No. 2. This coloring technique was used to make Indo-Pacific Beads since before 1 BC. However, no examples of this coloring technique have been found in potassium lead glass in China and Japan. The original production region of these beads should be investigated in future.

The opaque light blue color of Beads Nos. 5 and 6 seems to come from copper ion. However, unlike the earlier-mentioned beads excavated from the Krang Kor site, no Zn content was detected, so a different copper material may have been used as the coloring agent. Additionally, the beads contain around 2% Na₂O and CaO, so it is possible that these components have some bearing on their opaqueness.

The transparent reddish-brown Bead No. 7 hardly contains any components related to coloring, but it has a 0.35% content of CuO. It is possible that the color comes from metal copper colloid.

These glass beads are made by the same bead-making technique using the same type of glass as those excavated from the Krang Kor site, but they differ in size, shape, and coloring. These differences may perhaps be attributable to the time or place of their production, or to both.



Fig.1 Glass beads excavated from Burial No.1

Sample		D 14	Chemical composition (wt%)													Nata				
No.	Color	Density	Na ₂ O	MgO	Al ₂ O ₃	SiO_2	$P_{2}O_{5}$	K20	CaO	TiO ₂	MnO	Fe ₂ O ₃	CuO	ZnO	PbO	Rb <u>2</u> O	Sr0	ZrO_2	SnO_2	Notes
5	White opaque		0.39	0.38	4.52	71.2	1.42	0.07	0.63	0.1		0.59	0.19	0.03	20.3		0.03	0.09	tr	Heavily weathered
12	Light blue opaque / white opaque marble		0.89	0.34	1.16	58.6	0.28	5.6	2.38	0.02	-	0.14	0.43	0.08	30.1	-	0.05	-	tr	Weathered
13	Light blue opaque	3.4	2.31	0.27	0.92	51.6		10.3	3.88	0.02		0.27	0.79	0.14	29.2		0.12	0.15	tr	
17	Light blue opaque	\sim	2.64	0.35	0.57	49.3	-	7.04	2.64	0.02	-	0.14	0.48	0.09	36.6		0.09	0.04	tr	
21	Light blue opaque	3.4	2.22	0.22	0.75	50.5	-	10.5	3.92	0.01	-	0.28	0.8	0.13	30.4		0.05	0.19	tr	
26	Light blue opaque	3.3	2.13	0.14	0.66	50.9	-	10.6	3.94	0.03	-	0.29	0.79	0.11	30		0.05	0.37	tr	
37	Light blue opaque	3.3	1.96	-	0.54	51.3	-	10.8	4.22	0.03	-	0.28	0.8	0.09	29.9	-	0.04	0.12	tr	
38	Light blue opaque	3.4	1.81	-	0.52	50.4	-	10.6	3.96	0.03	-	0.26	0.81	0.13	31.2	-	0.04	0.23	tr	
40	Light blue opaque		2.17	-	0.58	51	-	10.6	4.03	0.02	-	0.27	0.79	0.12	30.2	0.01	0.04	0.2	tr	
52	Light blue opaque	\geq	3.14	0.27	0.73	50.6		10.6	4.09	0.03		0.26	0.8	0.12	29.1		0.08	0.16	tr	

Table 1 Chemical composition (wt%) of the glass beads excavated from Krang Kor analyzed by XRF

Sample	Color	Density		Chemical composition (wt%)															Notos	
No.	Color	Density	Na ₂ O	MgO	Al_2O_3	SiO_2	P205	K ₂ O	CaO	TiO ₂	MnO	Fe ₂ O ₃	CuO	ZnO	PbO	Rb ₂ O	Sr0	ZrO_2	SnO_2	Notes
1	Yellow opaque	3.9	0.34	0.13	0.51	43.3	-	2.36	1.72	0.02		0.33	0.09		50.7	0.02	0.14	0.3	0.12	White translucent area
			0.64	0.24	1.36	60.7	•	2.3	1.16	0.02	•	0.58	0.06	•	32.2	•	0.07	0.39	0.34	Yellow particle
2	Yellow opaque	3.8	0.62	0.31	0.76	44.2	-	3.84	0.68	0.01	-	0.28	0.04	-	39.6	-	0.11	0.33	9.26	
3	Yellow opaque	3.8	0.54	0.11	0.71	40	-	3.82	0.1	0.01	-	0.37	0.17	-	51.5	-	0.18	0.46	2.07	
4	Yellow opaque	3.9	0.16	0.15	1.04	41.7		3.73	0.09	0.01		0.38	0.19		50.7		0.07	0.16	1.67	
5	Light blue opaque	3.4	2.27	0.15	0.63	45.2		6.4	2.77	0.01	0.17	1.2	1.59		39.4		0.06	0.22	tr	
6	Light blue opaque		1.31		0.64	47.6		5.87	2.65	0.01		0.3	1.38		39.9		0.17	0.26	tr	
7	Reddish brown transparent	3.7	0.26		0.56	46.3	-	5.6	0.31	0.01		0.24	0.35		46		0.17	0.21	tr	

Table 2 Chemical composition (wt%) of the glass beads excavated from Krang Kor analyzed by XRF

2. Metal Items

The excavation survey at the Krang Kor site yielded a total of 4 metal items. They included 2 iron knives and 2 earrings that appear to be made of bronze. Metal items found in the earth frequently show rapid corrosion after being excavated, due to the sudden change in environment. For this reason, excavated metal items must be placed in temporary storage in a dry state without exposing them to oxygen, and proper conservation treatment must be applied in accordance with their materials and conditions to prevent further corrosion. Based on this understanding, conservation treatment was applied to the metal items excavated from the Krang Kor site, as reported below.

(1) Survey Preceding Conservation Treatment

Before applying proper conservation treatment to excavated artifacts, it is necessary to examine the materials and structures of the artifacts and to gain an accurate grasp of their existing condition. Therefore, prior to applying conservation treatment to the metal items excavated from the Krang Kor site, we performed a microscopic observation, an examination of the inner structure by X-ray imaging, and a nondestructive materials examination by X-ray fluorescence analysis. The X-ray fluorescence analysis was based on a nondestructive method, so we were able to obtain information only about the weathered surface of the items, and could not use the measurement results to estimate the original content of each component contained in the items.

As a result of microscopic observation and X-ray imaging, there were no "bad" corrosion product on the knives or earrings indicating continuous corrosion. However, there were portions at the tip of the blade of the knives and the surface of the earrings that had little X-ray absorption (Fig. 3). This result suggested weakening of the items, so we judged that reinforcement treatment is necessary. The earrings appear to be made by coiling a cord-like metal around a cylindrical rod.

X-ray fluorescence analysis detected iron (Fe) as the main component of the two knives, as well as silicon (Si) and titanium (Ti), but the latter two are probably components from the soil that adhered to the surface of the items (Fig. 4). A similar result was obtained from the cylindrical metal fitting.

The main component of the earrings was copper (Cu). Hardly any traces of tin (Sn) were found, but zinc (Zn) was detected instead. Additionally, there were slight differences between the components detected from the inner core and the surface. The surface had trace amounts of lead (Pb) and bismuth (Bi), which were not found from the inner core (Fig. 5).

(2) Conservation Treatment

1) Knives

As a result of observations, the knives were found to be covered with a stable corrosion product, which indicated that there was little possibility of the advancement of new corrosion. Therefore, we cleaned the knives to the minimum extent necessary, taking care not to destroy the layer of stable corrosion components. Using brushes, bamboo picks, scalpels, and grinder, we removed soil particles from the surface. Then, after cleaning the knives, we reinforced them by conducting vacuum impregnation three times using a 20% concentration of Paraloid NAD-10 acrylic resin.

2) Earrings

As with the knives, the earrings were also covered with a stable corrosion product, indicating little possibility of the advancement of new corrosion, so we cleaned the earrings to the minimum extent necessary, taking care not to destroy the layer of stable corrosion components. We refrained from using a grinder, however, because copper and copper alloy are softer and more susceptible to scratches compared to iron.

New corrosion of copper and copper alloy can be effectively prevented by applying stabilization treatment using BTA (bensotriazol). The method prevents further advancement of corrosion by causing a reaction between uncorroded metal remaining on the inside and BTA and creating a stable layer. Therefore in this study, we attempted to stabilize the materials by conducting vacuum impregnation in a BTA 2% ethyl alcohol solution for 24 hours after cleaning.

Then, as the last step, we applied reinforcement treatment by conducting vacuum impregnation two times using a 5% concentration of Paraloid B72 acrylic resin.

(3) Storage

Metal items should preferably be stored in a low-humidity environment that allows no exposure to oxygen. In this case, we adopted a system that maintains a relative humidity below 10% and an oxygen concentration of less than 0.1% by placing an RP agent inside a bag specially made of impermeable film.



Fig.3 X-ray images of metalic objects excavated from Burial No.1(left:knife, right:bracelet)



Fig.4 XRF spectrum of Knife No.1



Fig.5 XRF spectrum of Earing Left (above:interior, below:exterior)

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Introduction

Using the research method of confirming information about a site in a nondestructive method helps in formulating a research plan and understanding the scope of the site, when the details of a particular site (e.g., the arrangement of artifacts) are unknown. Further, it can also provide necessary information for how to preserve the site. In conducting such research on the Krang Kor site, we were able to determine—thanks to the local residents who had found or looted objects as well as objects collected from the ground surface—that there was great likelihood that artifacts existed underground. However, because there was no history of research, and therefore no existing information on the presence or locations of artifacts, nor could any traces of artifacts be found by observing the ground surface, we determined that using physically-based investigation technique would be most effective. Additionally, we implemented the investigation on two separate occasions with the goal of having the Cambodian researchers understand, through practice and lectures, the effectiveness of this investigation technique as a way to provide a model for future research and preservation of monuments. This section will outline the investigation methods and their results. The investigation periods were November 27 through December 4, 2010 for the first survey, and July 27 through August 9, 2011 for the third survey. See Part 1, Section 2 for details of the periods.

Exploration Method

For this research, we used ground-penetrating radar (GPR). It is a way to locate abnormalities by sending electromagnetic waves into the ground from an antenna and gaging the reaction time and intensity coming from underground. The electromagnetic waves reverberate strongly against areas in the ground where there are gaps in physicality, such as difference in materials and in between geographical layers. Because it takes a shorter time and it has a higher resolution compared to other methods, it has been a highly effective method in conducting archeological surveys in Japan. Depending on the goals, the depth and resolution can be changed by selecting different frequencies of the antenna. Since this survey was being conducted overseas, there was a limited selection of devices that could be brought into the country. We used the equipment SIR-3000 by GSSI. For the antenna, we used the central frequency of 400MHz (30cm angle). The area to be surveyed was determined by setting arbitrary coordinates to establish a rectangular space within which was measured at 1-2m intervals as lines to go by. The space between the survey lines was 0.5m (Figure 1). For analysis, we used the GPR-Slice (created by Dean Goodman). A flat slice of the ground at every certain interval of depth was displayed based on the Time-Slice method using temporary profile data.

Survey Results of Zone 4

For Zone 4, in the interest of work efficiency, the survey was conducted by separating the survey zones into two parts. The maximum depth was 80ns. In the eastern section, a rectangular survey area of 16 x 49m was set up (Figure 2). Like the dot-like reflection at the Y=11m line, there are sections in which small reflections exist in circular patterns that are not related to the fa-



Fig. 1 Survey is being conducted.

cilities that can be observed aboveground. The area of Y=1-31m of the survey area is an example of this. In observing the surface aboveground, there is an area around large trees where dirt has formed large mounds, and we determined that in great likelihood the circular reflection was created due to a similar situation. At the depth of 27-58ns at X=0-6m and Y=14-25m, there is a flat, circular reflection, but we believe this is due to the roots of a living tree. In the western section, we set up a rectangular survey area of 15 x 50m (Fig. 3). A strong dotted reflection is seen in a relatively shallow area, and from the depth of 13ns and beyond we were conversely able to capture a rectangular reflection at



Fig. 2 $\,$ Results of the GPR survey in the eastern part of Zone 4.



Fig. 3 Results of the GPR survey in the western part of Zone 4



Fig. 4 Results of the GPR survey in Zone 6



Fig. 5 Results of the GPR survey in the school zone



Fig. 6 Results of the GPR survey in Zone 7

X=2-15m and Y=20-40m. Looking at the details along with the profiles, we were able to detect a possible structure of some kind, and therefore, conducted an excavation by setting up a survey area. As a result, we found that the structure was a beehive.

Survey Results of Zone 6

In Zone 6 we set up a rectangular survey area of $30 \times 15m$ (Figure 4). The maximum depth is 80ns. The first noteworthy point is the reflection that exists immediately under the grounds surface at around X=0-8m and Y=0-10m. Because bricks were found scattered in the area, we presumed there might be a small-scale architecture. Further, at X=23-30m, there was a strong reflection in the form of an arc. While we presumed the possibility of a groove or a mound-like structure, the result of an excavation proved that it was a reflection to manganese that had accumulated underground.

Survey Results of Zone 7

In Zone 7, we set up a survey area of 38×50 m (Fig. 6). The survey could not be done in some parts of this area due to such obstructions as a fence. The maximum depth was 70ns. Most of the reflections that exist in shallow parts are mostly due to tree roots. As many parts of the survey area have a low-humidity environment, there were many places in which deposits of aggregated manganese were found. Areas with strong reflection were found in the exploration of Zone 6 as well, and as a result of an excavation, we concluded that one of the reasons for this was likely the accumulation of manganese. Therefore, it is possible that the reflections we found in this zone, too, are cause by metallic substances such as manganese that accumulate around tree roots. Areas with dotted reflections such as at X=10m and Y=11m, and at X=22-33m and Y=20m in which the possibility of the cause being roots was low, we set up a survey zone for the purpose of determining the characteristics of these reflections. Because it was possible to collect materials such as ceramics from the periphery, we determined the excavation area under the assumption that such items may have been used as an urn or burial articles. From one of the trenches, we confirmed a pit filled with carbide.

Survey Results of School Zone

In the school zone, we set up a survey area of 50 x 25m. The maximum depth was 70 ns (Fig. 5). On the eastern side, which is the side of the school, at Y=15-25m, there is a strong reflection coming from a relatively shallow place. However, because we saw that the distribution changes occurred in an irregular manner, we assumed that it is not due not to distinct artifacts, but rather, to changes in geographical formations, distribution of underground water, or accumulation of substances such as manganese. The reflection near the depth of 23-30 ns at (1) around X=4m and Y=12m, (2) around X=38m and Y=16m, (3) around X=9m and Y=14m, and (4) around X=17m and Y=17m were not reflection coming from above, and profile images of reflections that showed hollowness, which could point to the possibility of them being items such as an urn. Therefore, for (1) and (2), we set up survey areas as "A trench" and "B trench," and conducted an excavation. Of them, we were able to confirm a Burial No.1 in (2).

Conclusion

This survey greatly differed from those normally conducted in Japan in terms of target objects and soil environment. Therefore, there was much trial and error involved as we had very little past experiences regarding the characteristics of abnormal sections underground. But by combining excavation work, we were able to gather information that need to be considered for this particular region, such as reflections due to bechives, tree roots, and accumulation of manganese. We were able to provide information that will be valid for future surveys and their interpretation. Furthermore, we were able to discover the existence of Burial No.1 as a result of our research. This, we believe, was a fruitful result as it has allowed us, together with the Cambodian researchers, to prove the effectiveness of the survey techniques in this region. In closing, we would like to express our gratitude to the residents of the local village and everyone who participated in the research.

Chapter 4. The Longvek Site as a "Living Heritage"

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Lovgvek as the Capital Site of the Post-Angkor Period

It cannot be denied that the capital sites from the post-Angkor period including the Longvek site received little attention thus far compared to the other Khmer civilization sites that exist within Cambodia. The splendid monuments such as the Angkor site that serve as Cambodia's national symbol have received much attention both academically and as tourist sites. Two of the sites from the Angkor period—the Angkor monuments and the Preah Vihear site—have been registered as UNESCO World Heritage Sites. Also, while there are nine sites in Cambodia on the Tentative List in preparation to be listed as World Heritage Sites, six are from the Angkor period and two are from pre-Angkor period, but there is only one site from the post-Angkor period, which is the Udong site.

However, some circles have begun to stress the importance of the sites from the post-Angkor period, as well as the necessity of their conservation. Worthy of particular note is the Nara National Research Institute for Cultural Properties, which has worked in Cambodia for many years since the end of the country's civil conflicts. In 2010, the institute signed a letter of agreement with the Cambodia's Ministry of Culture and Fine Arts and began a joint research as part of a program commissioned by the Agency for Cultural Affairs Networking Core Centers for International Cooperation on Conservation of Cultural Heritage Project the capital sites of post-Angkor period, focusing mainly on the Udong and Longvek sites. At the Longvek sites, in particular, in addition to test pitting that was done in several locations, the entire grounds was carefully surveyed. Based on this work, the distribution of structural remnants was mapped out and a list of their characteristics and conservation status was compiled. The reason for carrying these things out was to ascertain the structure of the Longvek site, whose details had not yet been understood, as well as to specify the existence of the structural remnants in order to formulate a conservation and management plan including zoning and to protect the site from destruction and damage due to development work and other reasons.

What we realized as we carried out the survey of the Longvek site was that the "unpretentiousness" of this and other palace sites from the post-Angkor period is precisely an important characteristic that defines them. Indeed, one hardly finds from this period the kind of majestic stone-built monuments that were constructed during the Angkor period, and the representative remnants are mounds believed to have been foundations for temples and houses, mounds and moats that surrounded the palaces, and areas in which pieces of ceramics are scattered indicating traces of residential sites. What's more, many of these have mostly gotten buried under current village landscapes and therefore are difficult to recognize. The remnants of moats, for example, can be observed fairly easily from the air (Fig. 1), but in actuality, many places have been buried and used for paddy fields and are difficult to decipher when viewed from land (Fig. 2). Additionally, during the survey of the Longvek site, we found a case in which a portion of the clay walls and mounds had been destroyed due to road expansion and earth removal work (Fig. 3). We also saw that near the site was a brick factory in operation, and earth removal had been done because of it within the immediate proximity of the site (Fig. 4). As such, in order to protect the site from damages caused by development work and other reasons, it is essential to create, as basic reference material, a map and list for the site.

Furthermore, as we conducted such research, we were also able to discover that not all parts of the remnants found around the Longvek site are in danger of damage. Rather, we found some examples of cases in which the local residents protected them as they included the remnants as part of their religious faith. In the next section, we will look at some of these cases.

Conversion of Monuments at the Longvek Site

Longvek was built in 1528. It served as the royal capital of Cambodia until it fell under Siamese attack in 1594. The palace capital had a slightly distorted square-shaped layout that extended three kilometers east to west and two kilometers north to south. The Wat Tralaeng Kaeng was built at its center, where four standing Buddha statues facing the four directions, and four Buddha's footprint stones are enshrined (Fig. 5). Including this one, 108 temples were said to have been built both inside and outside the palace grounds (Kitagawa 1998).

After the fall of the palace, however, this area presumably returned to the rural landscape that we see today. While under the on-site survey conducted by the Nara National Research Institute for Cultural Properties and Ministry of Culture and Fine Arts, not all of the structural remnants for all 108 temples could be confirmed but many of them were. Of them, there are some, such as the Wat Tralaeng Kaeng and Wat Preah Tep (temple for god Indra), that were build during the time in which Longvek was the royal capital and still exist today. On the other hand, we also found that many remain only as mounds indicating the foundations for former temples or that they had been rebuilt into new temples at a later time. Of these sites, for the temple that stands on the south side of the Longvek site and is currently called either Preah Vihear Preah Bakko or Preah VihearTuol Ong Kiesal, we saw that a new building was being built using concrete and bricks at the top part of the mound that is considered to be a remnant of a former temple (Fig. 6). Also at this temple we found, mixed in with Buddhist statues that were clearly made in recent years, a stone sculpture of Buddha that could date as far back as post-Angkor period or even the Angkor period (Fig. 7). Also, the temple that is situated at the center part of the Longvek site and is currently called the Vihear Kok is today a wooden thatched roof structure that stands on the top part of a mound that is presumably a remnant of a temple foundation. Found scattered in the periphery of the mound were sandstone materials with decorative molding (sculptures) (Fig. 8). These are presumed to be stone materials that formed the foundation of the temple that used to stand there and are thought to date back to the time of when Longvek was the royal capital in the post-Angkor period. In other wods, it is likely that after the original temple deteriorated or was torn down, the current smaller-scale temple was built on the same spot.

The abovementioned cases are examples in which even after the original temples broke down or got destroyed, new temples were built again in the same locations and the religious faith has continued. And it is interesting that, as in the first example above, people are taking artifacts (sculptures) from the past and using them in ritualistic practices today.

This example of such practice of incorporating the structural remnants and artifacts from the past into the religious practices taken place today can be found not only in such Buddhist (Theravada Buddhist) temples, but also in the shrines of Neak Ta, which is the local folk religion. Neak Ta is the so-called the land spirit or guardian deity of the indigenous religion that was originally not related to Buddhism, but in actuality, it is worshipped as a god connected to Buddhism as well as Hinduism (Ang 1986). For instance, in Angkor Wat, which is the most prominent monument of the Angkor site, a number of Neak Ta can be found. Among them is Ta Reach, which is considered a representation for Vishnu, and is considered the most powerful Neak Ta in the Angkor region. It is believed that many Neak Ta also exist within the Longvek site. Of them, according to the Royal Chronicle of Ayutthaya, the one called Neak Ta Khleang Moeang possesses powerful spiritual powers and it succeeded in beating back Siam's invading army multiple times (Kitagawa 2006). Many shrines for Neak Ta called Naak Ta Ap Paang (Fig. 9). While it is not certain whether or not the timing of the cut goes back to the time when Longvek was the royal capital, but if it does, it is highly likely that this area was an important location at which the castle gates were built.

Also, at the junction of three streets at the northern part of the Longvek site are a small Theravada Buddhist shrine called Prasat Preah Miet Dah, as well as a Neak Ta Preah Ko, Preah Kaeu in which a sculpture of a cow is enshrined (Fig. 10). We do not know if this three-street junction dates back to the time of Longvek being the royal capital either, but if it does, its position can be considered a location of importance within the palace. At the Neak Ta shrines, too, we can find examples of past artifacts and structural remains are being used today. For example, in the Neak Ta sanctuary called Tuol Krapau Ni Tung located at the east part of the Longvek site a sculpture of a human figure riding an alligator placed on a concrete foundation is enshrined. Here, we were able to confirm that a sema stone made of sand was placed there (Fig. 11). Sema stones are kekkaiseki ("bound-ary stones") which are placed in Theravada Buddhism temples at the boundaries that separate the inside and outside of temple grounds. These sema stones, judging from their design, are estimated to date back to the post-Angkor period. Based on these facts, it can be speculated that around this Neak Ta shrine likely stood Buddhist temples which have since been destroyed, and enshrined here are articles that were dug up from the grounds.

Further, a number of Neak Ta shrines were confirmed within the temple compounds of the Wat Sotpee Reangsay, located at the northeastern part of the Longvek site. In one of them, some pieces of presumably Buddhist statues that are believed

to date back to the post-Angkor period or even the Angkor period are enshrined (Fig. 12). This can also be considered an example of Buddhist statues that were enshrined temples that were destroyed by are now being enshrined in the current Neak Ta shrines. In these ways, there were many findings at the Longvek site in which the structural remnants and artifacts from the past have been preserved by their being used for today's Buddhist or Neak Ta faith. This in a sense could be considered a form of cultural asset preservation. While it is not the academic or technical preservation of cultural assets carried out by experts, but it can be considered one that is carried out within the logical thinking of the local community.

This type of cultural asset conservation is not peculiar to areas related to religious faith. As previously pointed out, most of the palace moats have been filled and the area is being used as rice paddies. However, the way the land has been sectioned reflects the former structure of the palace grounds, and this can still be confirmed today by taking an aerial view of the area. If the same land use continues to be observed in the future without any land readjustment such as farmland development being done, these traces of palace grounds will likely continue to exist.

The Longvek Site as a Living Heritage

The expression "living heritage" has become a widely used term in recent years. While there are a variety of definitions attached to it, it is perhaps most appropriate to define it as assets that have been inherited by the local residents that live there today and are still continue to be used by them. In understanding the concept of "living heritage," it is important to consider the charter The Preservation and Restoration of Architectural Monuments that was adopted at the 6th International Congress of Architects, which was held in 1904 in Madrid, Spain. In it, the concepts of "dead monuments" and "living monuments" are indicated, and the policy for their preservation and restoration are explained as thus:

"Dead monuments should be preserved only by such strengthening as is indispensable in order to prevent their falling into ruin; for the importance of such a monument consists in its historical and technical value, which disappears with the monument itself. Living monuments ought to be restored so they may continue to be of use, for in architecture utility is one of the bases of beauty."

To borrow these ideas, many of the palace remnants at the Longvek site, even while some have gotten buried under the current village landscape, are still in use while having been converted or overwritten. These are "living assets" rather than "dead assets," and therefore, we believe it more appropriate to considered them "living heritage."

In order to preserve cultural assets like the Longvek site, countries and their governments must use their administrative means to designate them as cultural assets in order to protect and maintain them. However, we believe it is also important to respect, as "living heritage," the ways in which local residents have maintained their religious beliefs and land usage, and to take advantage of this. In other words, instead of viewing the Longvek site as a the remnants of a destroyed royal palace of the past, we should regard it as a living heritage that still continues today, and as a landscape of today that contains the "memories" of the past as "memories." And based on this approach, we believe it beneficial to adopt the viewpoint that the local residents' religious faith and land use make up one element of the asset.

Currently, the Ministry of Culture and Fine Arts is leading an efforts to protect the royal palaces of the post-Angkor period like the Longvek site, along with the Undong site which has already been added to the Tentative List, and the Nara National Research Institute for Cultural Properties intends to continue to offer its cooperation to this end. In doing so, we believe it desirable to adopt the concept of "living heritage" as a key in developing a mechanism for managing the assets by involving the local residents as important stakeholders.

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Fig. 1 Aerial view of the Longvek site



Fig. 2 Moat of the Longvek site. It clearly has been changed into rice paddies.



Fig. 3 Remnant of an earthenwall, a portion of which has been cut out with heavy machinery for road expansion.



Fig. 4 Borrow pit work being done right by the site



Fig. 5 Wat Tralaeng Kaeng Temple (left) and one of the Buddha's foot stones enshrined in the temple (right).



Fig. 6 Vihear Bakko Temple building under construction.



Fig. 7 Sculpture enshrined at the Vihear Bakko.





Fig. 8 The current building at the Vihear Kok (background) and pave of the platform in the post-Angkor (foreground).





Fig. 10 Small sanctuary of Prasat Preah Miet Dah (left) and the cow sculpture of Neak Ta Preah Ko Preah Kaeu (right)



Fig. 11 Shrine of Tuol Krapau Ni Tung and sema stone





Fig. 12 Neak Ta shrine at the Wat Sotpee Reangsay (left) and a sculpture enshrined within that dates back to before the post-Angkor period (right)

Published in March 2015 by NARA National Research Institute for Cultural Properties 247-1, Saki-cho, Nara City, Nara 630-8577 JAPAN Tel: +81-742-30-6733 Fax: +81-742-30-6730 http://www.nabunken.go.jp

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