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EXCAVATION SURVEY REPORT ON
THE ASUKA-IKE SITE

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NARA NATIONAL RESEARCH INSTITUTE
FOR CULTURAL PROPERTIES

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Separate volume:

Illustrations & photos [I]

Drawings of structural remains/ Photos of structural remains,
wooden tablets, bricks and tiles, pottery, earthenware,
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SUMMARY

A Process leading to the excavation

The Asuka-ike Site is an ancient workshop site located in Asuka village, Nara prefecture. The site lies in a small basin in the southeast of Asuka-dera Temple, the first full-fledged Buddhist temple in Japan. The site name “Asuka-ike (pond)” is derived from an irrigation pond built in the early modern period. In 1991, it was decided that the pond would be reclaimed; accordingly, an excavation survey was conducted prior to the reclamation, in order to check for the existence of any archaeological site. Consequently, it was found that workshops of the Late 7th century that had produced metalware and glass beads lie beneath the mud at the bottom of the pond.

Thereinafter, plans were conceived to build the Nara Prefecture Complex of Man'yo Culture on the site. Accordingly, the Nara National Cultural Properties Research Institute (the present-day Independent Administrative Institution, National Institutes for Cultural Heritage, Nara National Research Institute for Cultural Properties) conducted a preliminary survey between 1997 and 2001. The survey area covered 14,219 sq. meters.

The excavation confirmed that the site was extensive and preserved comprehensive workshops accumulating ancient handicraft techniques. The workshops engaged in the processing of gold and silver, manufacturing of the Buddhist altar fittings/furnishings using copper and iron, architectural hardware and tools, weapons, etc., and production of beads combining glass, quartz crystal, and amber, as well as the coinage of *Fuhonsen* copper coins, Japan's oldest coined currency. Based on the survey results above, in August 2001, the 19,981 sq. meters of land was designated as a national historic site with the name “Asuka-ike Workshop Site”.

B Location and structure of the site

The site lies in a small valley between low hills that branch off to the east and west from the southern hillside. The valley line extends from a point close to the southeastern corner of the precinct of Asuka-dera Temple to about 250 meters south. It also branches off on the way to the southwest, forming a small “West Valley” about 65 meters long. In this report, the valley line leading to the Sakafuneishi Site located innermost in the valley is referred to as the “East Valley”, while the valley line branching off to the south-west as the “West Valley”.

At the innermost area of the East Valley is the Turtle-Shaped Stonework of the Sakafuneishi Site. The Asuka-ike Site occupies a space sandwiched between the Sakafuneishi Site and Asuka-dera Temple. The hills that constitute the western boundary of the Asuka-ike Site also form the eastern edge of the Asuka basin.

Meanwhile, the Asuka Kiyomihara Palace of Emperor Tenmu and Empress Jito is located close by, just 400 meters southwest of the basin.

Through the excavation survey in the East Valley, three walls built with embedded pillars that run in the east-west direction were found closest to the east and west hills. The walls presumably formed a weir. This weir marked the dividing line between the north and south areas of the site. The workshops were operated in the south area of the East and West Valleys. Despite the fact that no workshops were built in the north area, both spaces were managed uniformly including controlling water from the valley line through a series of drainage facilities.

C Structural remains of workshops in the south area

The Asuka-ike workshops were surrounded by walls with embedded pillars and were operated on flat surfaces developed at the foot of the east and west hills.

i Workshops in the East Valley

Water control facilities in the valley In the East Valley, water flow control facilities were built stepwise descending towards the north. The facilities were structured with six bridge-shaped rises perpendicular to the direction of the valley (hereinafter, referred to as “earthen bridges”) at intervals of about 10 meters, and the spaces between the earthen bridges formed a shallow dish-shaped pond (hereinafter referred to as “water reservoirs”). The water reserved in the reservoirs may also have been used for a range of operations conducted at the workshops such as water rinsing in order to collect copper scraps generated in the production process of copperware. Seven water reservoirs have been found in the excavation area, among which the largest is the furthest downstream, measuring 22 meters north-south and 18 meters east-west. Meanwhile, the weir dividing the Asuka-ike Site into the north and south areas, described above, serves as an earthen bridge at the northern end. As a basic structure, the water collected in the reservoirs moves from a ditch located between the weirs towards the north area; and, through a narrow north-south ditch, flows down into a square pond with stones piled up on all four sides (hereinafter, referred to as the “masonry square pond”), then, is finally discharged towards the northeast.

Types of workshops The “East Bank Workshop 1”, located in the northern area of the east bank in the East Valley, is the largest metal processing workshop among all the Asuka-ike workshops. To the south of that is the “East Bank Workshop 2”. On the other hand, on the west bank in the East Valley, no structural remains have survived due to flattening conducted for creating the Asuka-ike pond in the early modern period. However, considering the distribution of excavated artifacts, “West Bank Workshops” may have existed. Additionally, in the area in which the weirs were built at the northern end of the south area, there are “Workshops Near the Weir”. Deposited to a maximum of one meter in depth in the water reservoirs,

there are various wastes including charcoals and ash, defective products, broken tools, etc., which were discharged during operations. Throughout the excavation, all sediments from the waste layers were taken to our laboratory, and the artefacts related to the workshops were collected without omission after water sieving. 105,000 sandbags were moved to the laboratory.

East Bank Workshop 1 This workshop is the largest among all the Asuka-ike workshops. On a terrace on the east bank in the East Valley, measuring approximately 9 meters wide and 30 meters long, a total of 245 furnace remains intricately lie atop one another. Furthermore, narrow ditches were dug on the hill and valley sides to prevent rainwater from entering, and a simplified building measuring about 22.5 meters north-south and about 6 meters east-west was built to cover the workshop.

The workshop also has at least three cultural layers, the upper, middle and lower one. There are 40 furnace remains on the upper layer, 133 on the middle layer, and 65 on the lower layer, crowded after repeated reconstructions. Although normal furnaces are circular shape measuring 20 to 30 centimeters in diameter, there are different types of furnaces such as larger circular furnaces with a diameter of more than 40 centimeters, elliptical furnaces, and square furnaces. The furnaces are built by laying yellow clay to prevent moisture and digging the furnace bottom into a bowl shape. The surrounding part of the furnace turned red in a ring shape due to heating, and the bottom of the furnace, filled with charcoal, was hardened and reduced to gray. Meanwhile, the superstructure of the furnaces has been cut off in later times; consequently, the original structure of the furnaces is unknown. At the entire Asuka-ike Site, more than 340 furnace remains have been found to date.

Although the East Bank Workshop 1 is a facility to produce ironware and copperware, fragments and molds of defectively cast copper coins were unearthed at the site, proving that this workshop produced *Fuhonsen* copper coins, Japan's oldest coined currency. Casting of the *Fuhonsen* copper coins presumably dates back to the period of the lower layer workshop; still, much about the furnace remains related to coinage, the beginning period of coinage, coinage operation period, etc. remains unknown.

Structural remains of dump yards for the wastes from *Fuhonsen* coin casting

At the footbridge near the southern end of the East Bank Workshop 1, two structural remains were found in which various wastes were dumped such as copper scraps from *Fuhonsen* coin casting. The wastes included 160 defectively cast *Fuhonsen* coins, molds of *Fuhonsen* coins, casting bars (through which molten copper runs into the mold), ingate (connected section between the casting bar and the product), casting fins (molten copper that leaked out from the seams of the molds), molten and hardened copper, copper drops that spattered out during casting, copper slag produced during casting, charcoal (fuel charcoal), crucible,

tuyere, the fragments generated when *Fuhonsen* copper coins were cut off from a money tree, etc. Such excavated artifacts have enabled the tangible restoration of ancient techniques to mint *Fuhonsen* copper coins.

Roof-tile kiln A roof-tile kiln was constructed at the reclaimed northern end of a working plane in the East Bank Workshop 1. The only remains are a part of the fire door of the hole kiln and the combustion part, but the combustion and the upper parts have been completely cut off in later periods. Based on the stratigraphic relationship with the East Bank Workshop 1, it is theorized that the roof-tile kiln was operated in parallel with the workshop on the middle layer, and dismantled in the period of the upper layer. The roof tiles fired at this kiln were found to be those used in the Tonan Zen Temple (a sub-temple of Asuka-dera Temple) founded by *Dosho*, a scholar monk who visited and stayed in Tang, China for study (629 - 700).

East Bank Workshop 2 This workshop lies to the south of the East Bank Workshop 1. The remains of seven furnaces are spread across the northern half of workshop 2. Among the seven furnace remains, the three remains of square furnace located at the southern end of the workshop are large as 1 meter by 0.7 meter. Considering that the firing conditions of the furnace walls and shapes are different from common furnaces, the furnaces were possibly built to fire tuyeres, crucibles, molds, etc.

West Bank Workshop No structural remains including furnaces have survived, because they were scraped off during the construction of the Asuka-ike pond in the early modern period. However, as stated above, the West Bank Workshop is likely to have existed, based on the wastes deposited along the west bank of the water reservoir. The workshop is considered to have engaged in processing copperware including copper nails, copper rivets, copper pins, round-head nails, washers, *Hyogo-kusari* (decorative loop chains), etc. as well as manufacturing metal fretwork ornaments.

Workshop close to the weir The workshop was built close to the western end of the weir that acts as a boundary between the north and south areas. Since the furnace was seemingly not rebuilt, it may have been a workshop temporarily built to manufacture copper nails.

ii West Valley Workshops

The West Valley line has a steep slope extending southwest from the confluence of the valleys. Water flow in the valley line was controlled by: (i) collecting water in a ditch dug through the center of the valley at the valley head; (ii) streaming water into a large pit formed stepwise in order to weaken water flow in the middle of the valley; and, (iii) directing water into the water reservoir in the East Valley through the ditch near the valley exit.

There are three types of workshops in the West Valley; (i) “Upper Terrace Workshop in the West Valley” located at the valley head; (ii) “Middle Terrace

Workshop in the West Valley” located on the west bank downstream; and, (iii) "Workshop Close to the Valley Confluence" located around the exit of the valley. In addition, on the upper east slope of the hill (on the west bank of the West Valley), is the “Workshop on the East Slope of West Hill,” identified through the excavation survey conducted to aim to confirm the extent of the Asuka-ike Site.

The Upper Terrace Workshop in the West Valley The Upper Terrace Workshop located at the valley head of the West Valley engaged in processing gold and silver as well as producing glass beads. Since a large number of fragments of quartz crystals and amber were excavated around the workshop, precious metals and beads were likely produced mainly in this workshop.

Middle Terrace Workshop in the West Valley The Middle Terrace Workshop located downstream of the Upper Terrace Workshop was formed by repeated ground leveling in the narrow valley line. Consequently, the structural remains are extremely intricate. At this workshop, blacksmithing specialized in copper casting and iron-nail production as well as iron casting appear to have been conducted. Two large pits formed stepwise are provided to control water flow downstream of the workshops.

Workshop close to the valley confluence This workshop is located near the exit of the West Valley, and was an area excavated in 1991. More than 10 furnace remains were found, most of which had been repeatedly rebuilt at the same location. A temporary building that covered the furnace remains was identified. Furthermore, it was confirmed that a copper workshop and an iron workshop were operated separately.

Workshop on the East Slope of the West Hill A survey to confirm the extent of the Asuka-ike Site found that the workshop extends onto the east slope of the West Hill facing the West Valley. The hill slope is created step-wise by cutting and reinforcing the embankment, and there is a flat surface where a workshop encompassing at least two or more steps existed.

Management facilities on the South Hill On the northern slope of the South Hill that acts as a boundary between the East and West Valleys, a terrace was created, on which two embedded pillar buildings stood. Based on the structure of the building, they are considered to have been warehouses to store materials and products. The surrounding area has been largely scraped off by the construction of Asuka-ike pond in the early modern period; still, it is highly possible that the management facilities of the Asuka-ike Workshops existed there.

D Structural remains in the north area

Characteristics of the north area At the northern end of the north area are facilities that set the southern limit of the precincts of Asuka-dera Temple, and an excavation survey was conducted to investigate these facilities as well. Consequently, the facilities that existed near the boundaries between the Asuka-

ike Site and Asuka-dera Temple were recognized. Although the land-use in the north area differs critically from that in the south area in which manufacturing workshops were operated, the water control facilities in the valley were maintained integrally with the south area. Based on the examination of the contents of unearthened wooden tablets in the north area, it was found that the area seemingly had a close relationship with Asuka-dera Temple.

Facilities on the southern end of Asuka-dera Temple's precincts and east-west road At the northern end of the excavation survey area, an earthen wall with embedded pillars delimiting the south end of Asuka-dera Temple was identified. Since the prop roots (underground part of the pillar) of the Japanese umbrella pine (*Sciadopitys verticillata*) remained, the annual rings of the prop roots were analyzed by dendrochronology. As a result, it was discovered that the cutting date is 586AD + a , close to the foundation date of Asuka-dera Temple. The direction of the wall deflects about 32 degrees towards the north in the eastern section. Additionally, to the south of the wall, there is an east-west road paved with ballast stones running parallel to the wall, dividing Asuka-dera Temple and the Asuka-ike Site.

Structural remains in the north area The north area had originally been a valley terrain, but was reclaimed to create a flat surface by making major changes to the water control method. The structural remains identified on the reclamation terrace include: (i) two wells surrounded by tidy stone pavement; (ii) one square stonework pond; (iii) eight buildings with embedded pillars; (iv) six walls with embedded pillars and pits, etc. These structural remains are mostly those dated to the Fujiwara Palace period (Late 7th century to Early 8th century) or later. Although many structural remains prior to the Fujiwara Palace period presumably exist in lower layers than the reclamation soil, questions still remain due to the prioritization of the preservation of the structural remains on the reclamation terrace. Based on the examination of contents of the 7,784 wooden tablets excavated from the north area, it is highly probable that in the north area there were facilities closely related to Asuka-dera Temple itself or Tonan Zen Temple (a sub-temple of Asuka-dera Temple) constructed at the southeast corner of the precincts of Asuka-dera Temple by *Dosho*, a monk who studied in Tang, China. For all that, no specific structural remains have been identified.

E Excavated artefacts

Excavated artifacts include various artefacts such as pottery, earthenware, roof tiles and bricks, as well as production-related artefacts.

Pottery, including a huge amount of *Haji* ware (plain and unglazed, field-fired) and *Sue* ware (unglazed, kiln-fired) have been unearthed. Above all, attention should be paid to lead glazed jars and lids decorated with incised lines and affixed clay ornaments), as well as pottery and green-glazed ware made in Silla, Korean

Peninsula. To date, 163 ceramic inkstones, including 60 round inkstones and 103 reused inkstones, 108 earthenware with *sumi*-ink inscriptions, and 17 pottery with spatula-written and pin-written inscriptions have been unearthed. Most of the unearthed tiles and bricks are roof tiles of Asuka-dera Temple next to the site, from which 401 round eave-end tiles of 20 types and 202 flat eaves-end tiles of 7 types were excavated. The fact that some roof tiles produced at the kilns of the Asuka-ike Workshops were found to be those used for the Tonan Zen Temple (a sub-temple of Asuka-dera Temple) founded by *Dosho*, who died in 700 AD, has become a robust chronological basis for determination of the minting age of *Fuhonsen* copper coins.

i Workshop-related artefacts

The workshop-related artefacts excavated from the south area include gold, silver, copper, iron metals, metalware, glass beads and glass production-related artefacts, beads such as quartz crystal and amber, casting-related artefacts, blacksmithing-related artefacts, urushi lacquer-related artefacts, wooden tools, etc.

Gold and silver 32 pieces of gold and 54 pieces of silver were excavated mainly from the debris layer of the West Valley. The gold includes square thin plates cut out, foil, threads, particles, etc.; meanwhile, the silver includes string clasps, *Hyogo-kusari* (decorative loop chains), square bars, particles, etc. In addition, there was a crucible in which gold and silver are melted. The silver also includes 7 fragments of *Mumon* silver coins (lit. non-patterned silver coins) cut out.

The beginning of gold mining in Japan is generally considered to be in the *Mutsu* province (today's Aomori prefecture) in 749, but the gold excavated from the Asuka-ike Site dates back nearly half a century earlier than that in the *Mutsu* province. Since the "*Nihon Shoki* (Chronicles of Japan)" tales note that in the year of 679, 681, 686, and 688, Silla and Goguryeo offered gold and silver, the unearthed gold and silver were highly likely to have been those that were mined in Goguryeo.

Meanwhile, the beginning of domestic silver mining is considered to have been in Tsushima Island in 674. Furthermore, the "*Nihon Shoki*" also describes silver mining in *Iyo* province (today's Ehime prefecture) in 691, suggesting that the excavated silver may also include domestic silver. The fact that precious gold and silver were relegated to the debris layers indicates the large scale gold and silver processing was conducted in the workshops.

Glass and beads Nearly 450 pieces of navy blue, blue, green, yellow-green, and dark brown glass fragments were excavated. The discovery of many defective products of large and small glass beads indicates that a large number of glass beads were produced at the workshops. Generally, glass beads were produced by the winding method and the casting method using molds. In addition, however, we have newly identified another method called "die-cutting method" that produces

glass beads by pressing the apricot-shaped concave mold into molten glass, and, after the beads are solidified, removing the peripheral part. According to scientific analysis, the excavated glasses were identified as either alkali glass or lead glass, finding that: (i) the glass beads produced by using molds are alkali glass; (ii) the dark brown glasses produced by using the winding method are lead glass; and, (iii) the glasses produced by using the die-cutting method include both alkali and lead glasses.

Unearthed glass production tools include crucibles, lids of crucibles, and the molds of ball-shaped gems. As for crucibles, 1,400 pieces were unearthed. Such crucibles are shell-shaped with a topped bottom, most of which are broken small fragments with the remaining green, reddish brown, and tan glasses melted-solidified inside. Shell-shaped crucibles similar to this type were also found in the Buyeo region, the capital of Baekje, Korean peninsula, indicating that the glass manufacturing technique of the Asuka-ike workshops may have been introduced from Baekje.

The felspar and quartz considered to be the raw materials for glass were crushed into large and small fragments, the number of those excavated exceeds 2,000 pieces. In regard to ancient glass manufacturing methods, “*Zobutsu-sho Tsukumodokoro*” (lit. A palace workshop to produce palace furnishings, etc./A government-run workshop of Buddhist sculptors), an ancient document written in 734 in connection with the construction of the West Main Hall of Kofuku-ji Temple has related descriptions. This document describes “white stones” and graphite as the main materials of glass; and, the felspar, quartz and lead oxide excavated from the Asuka-ike Site correspond to the descriptions. Thus, it has been found that the beginning of domestic glass production dates back to the Asuka-ike workshops in the Late 7th century.

Furthermore, the Asuka-ike workshops produced quartz crystal balls as an alternative to clear glass, and amber balls as an alternative to red and yellow ball-shaped gems. The areas in which such artefacts as glass, quartz crystal, amber, etc. were excavated are concentrated around the gold and silver workshop at the valley head of the West Valley, strongly indicating that gold/silver processing and glass/beads production were conducted at the same time.

Coinage-related artefacts Almost 560 pieces of unfinished *Fuhonsen* copper coins have been excavated from the East Valley. All are coins cut away from a money tree, most of which are fragments of mint-error coins. Specifically, casting fins remain in the central square hole and the outer circumference, and ingate cut marks remain in a part of the ring. The dimensions of a near-perfect coin measure 24.4 millimeters in diameter, 4.25 to 4.59 grams in weight, and 1.5 millimeters in thickness, with a square hole on each side of 6 millimeters in the center. As for metallic composition, the coins are an alloy composed mainly of copper and about 10% antimony. Incidentally, stibnite, the ore of antimony was unearthed at the

Asuka-ike Site. A large amount of artefacts related to the *Fuhonsen* coinage was excavated from the water reservoir close to the East Bank Workshop in the East Valley 1, including casting bar, casting fins, ingates, etc. In addition, the molds were unearthed at the structural remains at which the wastes generated when minting the *Fuhonsen* copper coins were dumped. These artefacts show how the *Fuhonsen* copper coins were mass-produced at the Asuka-ike Site.

Considering the stratigraphic relationship between the East Bank Workshop in the East Valley 1 that minted the *Fuhonsen* copper coins and the roof-tile kilns, as well as chronology of the artefacts associated with the *Fuhonsen* copper coins, it was hypothesized that the minting period of the *Fuhonsen* copper coins is earlier than the year 700 when monk *Dosho* died. Meanwhile, due to the article dated April 15, 683 in the “*Nihon Shoki* (Chronicles of Japan)” that describes the imperial order, “From now on, copper coins shall invariably be used. Silver coins shall never be used”, it has been established that the “copper coins” and “silver coins” described in this imperial edict refers to *Fuhonsen* copper coins and *Mumon* silver coins, respectively. In addition, the “*Nihon Shoki*” and the “*Shoku Nihongi* (lit. Chronicle of Japan Continued)” also have descriptions related to the appointment of coinage officers in 694 and 699. The relationship between such coinage officers and the Asuka-ike Workshops is an important theme for future research.

Copper ware The artefacts related to copperware production include casting-related artefacts such as crucibles, molds, etc. and copperware.

Although the crucibles for melting copper were mostly lipped type with a hemispherical bottom, some had a flat bottom or deep bowl-shaped round bottom. More than 2,000 pieces of molds for copperware production were unearthed, many of which were fragments inadequate for identifying casted products. There were no molds of large products, indicating that the majority of products from the Asuka-ike workshops consisted of casting of small products requiring the melting of a small amount of copper in a crucible. To date, the molds of a bronze mirror with a design of a sea animal and grapes, *Itabutsu* Buddha (a Buddha image made by hammering a copper sheet), bell, *dabi* (metal fitting to decorate the edge of a belt), etc. have been identified. Most importantly, the mold of an *Itabutsu* Buddha (a Bodhisattva standing image) closely resembles an extruded Buddha image excavated from the Torii Site (Tsu city, Mie prefecture), which may possibly indicate that it was extruded from a *Itabutsu* Buddha image cast at the Asuka-ike Workshops.

Copper ware includes: (i) the fittings related to the furnishings such as nails, rivets, metal washers, nail-head covers, padlocks, etc.; (ii) Buddhist altar fittings such as bells, scroll-end covers of sutra scrolls, Sahari (copper-tin alloy)-made spoons, chopsticks, small metal bowls, etc.; (iii) outfit accessories including belt fittings and metal ornaments; and, (iv) needles, *Hyogo-kusari* (decorative loop

chains), doll dummies, forceps, copper wire, etc. Furthermore, almost 1,600 pieces of chips generated when openwork was applied to copper sheets were excavated. The copperware includes those with engraved fine lines or fish-roe patterns, and those plated or welded with silver brazing alloy, etc., showing a variety of metalworking techniques.

Ironware The metalworking at the Asuka-ike Workshops centered upon iron smithing, and the iron slag disposed of due to blacksmithing weighs almost 2.2 tons. Accordingly, there were many bowl-shaped iron slag pieces collected at the bottom of the blacksmithing furnaces. Furthermore, even if the objects for study are limited to those that have partially retained the original shape, there are almost 950 pieces of the air pipes, demonstrating that an enormous amount of ironware was produced at the workshops. The artefacts directly connected with blacksmithing include an anvil stone and iron tongs.

The unearthed ironware includes: (i) architectural hardware such as nails and washers, iron clamps, hinges, padlocks, etc.; (ii) tools such as U-shaped plow blades, sickles, knives, axes, spear planes, gimlets, woodworking chisels, chisels, etc.; and, (iii) weapons such as arrowheads. Meanwhile, a large number of square bar-shaped artefacts, unidentified products/objects, and iron fragments were unearthed, exceeding 39,000 pieces in total.

Urushi lacquer-related artefacts Various Urushi lacquer-related tools were also unearthed, including lacquer brushes, spatulas, palettes and filter clothes, together with solidified Urushi lumps, films, containers, etc. Nearly 40 pieces of the lacquer brushes were found, many of which were discarded due presumably to abrasion or omission of brush tips. On the other hand, more than 30 pieces of spatulas used for stirring, compounding, kneading and underlying Urushi lacquer were unearthed, along with about 500 pieces of small piece of cloth to which Urushi lacquer is adhered.

There are more than 5,200 pieces of pottery to which Urushi lacquer adheres, categorized as: (i) pots to store and transport Urushi lacquer; (ii) large pots to store Urushi lacquer at the workshops; (iii) palettes; and, (iv) pottery coated with Urushi lacquer. Since the Urushi pots are a transportation container for Urushi liquid collected in various regions, some have traces of wicker baskets and straw ropes on the outer surface, indicating how the Urushi pots were transported and stored. These Urushi pots bear traces of being smashed at the workshops to rake out the Urushi liquid.

Excavated Urushi lacquer products include wooden bowls and plates, the handles of knives and woodworking chisels, wooden spoons, etc. In addition to the woodenware, there are many ironware and copperware pieces coated with Urushi lacquer. Furthermore, almost 400 pieces of Urushi lacquer-coated earthenware were unearthed. A technique called “baking finish” (thermal curing method) was used to set the Urushi lacquer.

Whetstones An enormous number of whetstones used for polishing products and tools were excavated, including almost 1,000 pieces of complete products. If fragments are counted, the number exceeds 5,700 pieces. Such a large number of excavated whetstones indicates the large-scale operations of the workshops. Incidentally, there are few of the common cuboid whetstones. Atypical whetstones and polyhedral small whetstones constitute the majority. Sandstones and quartz porphyry account for 80% of the total lithic materials.

Heated pottery Although more than 53,000 pottery sherds with heating traces were unearthed, most are showing reduction colors. Some have metal slags on the inner surface, suggesting that they were used as pouring ladles during casting or for metal refining.

By component analysis on the deposits in the tuff crucibles, cupellation method was likely to be used at the Asuka-ike Workshops to extract silver from galena consisting of lead and sulfur. Until now, the introduction of cupellation to Japan was considered to be in the 16th century. However, this discovery has pushed back the date of introduction drastically, necessitating a reconsider of the level of metalworking techniques in Japan and East Asia in the 7th century.

Woodenware and *Tameshi* (product samples) There are more than 1,700 pieces of woodenware, tools, toys, stationery, weapons, clothing ornaments, dinnerware, containers, product elements, and unknown items. There are many tools with various elements such as 160 handles for knives, gimlets, woodworking chisels, etc. Among the woodenware, “*Tameshi* (product samples)” that imitate metalware attract attention. These *Tameshi* were used for informing craftspeople of the shape of products to produce, while also acting as order slips. There are *Tameshi* models of the weapons including knives, arrowheads, woodworking chisels, gimlets, sickles, etc. and architectural hardware including tools, nails, rivets, metal washers, nail head covers, hinges, latch fittings, etc. Since the ironware corresponding to the *Tameshi* actually exist, these samples were likely those related to blacksmithing. To date, 160 pieces of *Tameshi* have been unearthed, some of which have descriptions written in *sumi* ink about the client and quantity of production.

ii Wooden tablets

Many wooden tablets were excavated from the Asuka-ike Site, accounting for 8,114 pieces in total. 93% of the total were unearthed at the north area. Wooden tablets inscribed in *sumi*(carbon) ink and dated in the year of “Yin Fire Ox (677)” and in the year of “Yang Fire Rat (676)” account for the greatest number of tablets. The wooden tablets can be roughly divided into two groups: (i) those created between 686-700; and, (ii) those created between 701-717. The tablets were created as: (i) the tags of tributes; (ii) documents related to the receipts and disbursements, lending and borrowings, and supply of assets; (iii) those related to the Buddhist Scripture; and, (iv) labels for sorting goods. Furthermore, wooden tablets that

indicate the relationships between Asuka-dera Temple and Tonan Zen Temple (a sub-temple of Asuka-dera Temple) founded by Monk *Dosho* have been found. The tablets have the following addresses such as “*Zen* temple”, “*Zenji* (lit. master of Zen Buddhism)”, “*Chicho* (a disciple of *Dosho*)”, “*Chitatsu* (successor to *Dosho*)”, “Abbot of ○○ Temple”, “*Chiji* (chief priest)”, “○*ina* (a highest-rank of priests)”, etc. written in *sumi* ink.

The wooden tablets excavated from the south area, on the other hand, are dated in the years of 677, 684, 687, etc., indicating that the workshops were operated during the period of the Emperor *Tenmu*/Empress *Jito* dynasties. Three of these tablets demand attention in considering the characteristics of the workshops located in the south area. One tablet describes types of nails, another one with which the Emperor ordered the production of short swords and needles, and the third one listed the names of the imperial princes of Emperor *Tenmu*. Incidentally, there are many wooden *Tameshi* samples on which the client and the quantity of production are written in *sumi* ink.

F Characteristics of Asuka-ike workshops

As discussed above, the Asuka-ike Workshops are huge workshop clusters operated in the Asuka region, the political and cultural center, during the construction period of the state based on the *Ritsuryo* legal codes. The scale and diversity of production items are unequaled anywhere in Japan. Judging from the excavated wooden tablets, the workshops probably commenced full-scale operations around 677, and closed operations in association with the 694 capital relocation to the Fujiwara Palace. The operation period coincides almost exactly with the period during which the Asuka Kiyomihara Palace was operated by Emperor *Tenmu*/Empress *Jito*.

The characteristics of the Asuka-ike Workshops have been discussed from a variety of perspectives immediately after the excavation. Through the analyses of more than 8,000 pieces of wooden tablets excavated from the site, this report has discussed how the north area, in which the facilities related to Asuka-dera Temple and Tonan Zen Temple (a sub-temple of Asuka-dera Temple) were set up, and is a space largely different in characteristics from the south area and its workshops.

The Asuka-ike workshops located in the south area began operations in 676, when the construction of the Fujiwara capital restarted after a temporary suspension. In this period, toward the construction of the State based on the *Ritsuryo* legal codes, Japan was rapidly proceeding with a broad range of large-scale projects including the construction of the Chinese-style capital and establishment of state-sponsored temples such as *Daikan Dai-ji* and *Yakushi-ji* Temples, introduction of a monetized economy, and the development of weapons. To meet these national demands, the huge Asuka-ike Workshops were built. Among them, the East Bank Workshop in the East Valley 1 featuring a long-

covered building shows the initial appearance that leads to workshops becoming a large-scale cooperative industry evident in the Nara (Heijo) Palace after 710. At this Workshop, the mass-production of standardized products such as *Fuhonsen* copper coins, iron weapons, and architectural hardware was apparently operated by a large-scale cooperative industry composed of a large number of craftspeople. Meanwhile, considering the descriptions on wooden tablets in which the Emperor ordered the manufacturing of knives and needles, and on which the names of the imperial and other princes were listed, the Asuka-ike Workshops located only 400 meters southwest from the Asuka Kiyomihara Palace were also probably under the direct control of the imperial court to meet imperial demands. In addition, it is thought that the workshops were closely linked to and involved in the activities of the nearby Asuka-dera Temple, including the major renovation of the Temple buildings and the construction of Tonan Zen Temple.

As described above, the Asuka-ike Workshops were comprehensive workshops that combine various aspects such as “government-operated workshops”, “temple workshops”, and “imperial family’s workshops”; and, such undifferentiated status of the government-operated workshops was conceivably an operational formation characteristic of the construction period towards the State based on the *Ritsuryo* legal codes. Further detailed analyses of the structural remains and artifacts as well as the development of multifaceted discussions on the characteristics of the Asuka-ike Workshops are expected to shed further light on ancient techniques and handicraft production systems.