

Tile Kilns and Roof-Tile Production in Ancient China

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Abstract: This essay describes the development of roof-tile production, discussing how craftsmen began to divide into groups working for pottery kilns and those working for roof-tile kilns from the Western Zhou to the Han period. The firing chamber of flat kilns is easy to widen and enlarge, and so they are appropriate for firing goods used in architecture like tiles and roof tiles. The kiln shape and structure that were perfected during the Han period continued to be used for centuries without major changes, mainly in northern China. During this process, the influence of roof-tile production technology and kiln structure spread widely through East Asia. It is significant that a separate history of kiln technology was revealed, different from that of porcelain and celadon-producing kilns.

Keywords: Roof tiles, structural changes in kilns, division of labor, Western Zhou, Qin and Han period

8.1. Introduction

Most of the roof tiles disseminated throughout East Asia are well known to originate in China. There is evidence for the manufacture and use of roof tiles in China during the Western Zhou period, some 3000 years ago, and there are some reports of roof tiles dating back even earlier. In the Han period, 2000 years ago, Chinese roof tiles traveled as far as the Korean peninsula in the east and Vietnam in the south, spreading throughout East and Southeast Asia in subsequent centuries. The investigation of ancient Chinese roof tiles and their production is thus also an investigation of the origins of roof tiles throughout East Asia.

In recent years, ceramic objects that resemble flat tiles have been unearthed in the Shang city at Zhengzhou in Henan Province, and there are reports of their use as construction materials in palaces of the early Shang period (Henan Provincial Institute of Cultural Relics and Archaeology 2007). At the Taosi site in Shanxi Province, which dates back some 4000 years to the late Neolithic period, many sheet-shaped ceramic objects thought to be roofing materials have been unearthed in locations where the remains of large buildings cluster within the enclosure (Shanxi Archaeological Teams of the Institute of Archaeology CASS et al. 2005). Further, at the Qiaozhen site in the city of Baoji (Baoji Municipal Institute of Archaeology 2011) and the Lushanmao site in Yan'an City (Shaanxi Academy of Archaeology et al. 2019), both in Shaanxi Province, there have been reports of round and flat tiles from the Longshan period of the late Neolithic, increasing the possibility that partial use of roof tiles dates back to the late Neolithic period.

However, while scattered discoveries of roof-tile-like remains dating from the late Neolithic to the Shang period

have been made, such tiles were clearly not in continuous use. It is not possible to find a lineage that connects the roof-tile remains from the Shang period and earlier that have been discovered so far. Most likely, the roof tiles of this era were undergoing a process of trial and error in which they repeatedly appeared and disappeared. Likewise, because the kilns used to fire them have not been discovered, it is difficult to pin down the specifics of their production.

The full-scale production and use of roof tiles came into its own in the Western Zhou period (Owaki 2002; Mukai 2012). The only remains of kilns that were certainly used to fire roof tiles that have been reported so far date from the Western Zhou and later; therefore, this paper will address shifts in tile kilns from the Western Zhou to the Qin and Han periods in northern China, centering on the Yellow River area. Ceramic kilns were used in China well before the tile kilns that have been found, and the earliest roof tiles were fired in kilns that had the same structure as those used for ceramics. This paper will first briefly outline previous research on shifts in kiln forms, then discuss examples from each period, and finally consider workers and modes of operation involved in kiln-firing.

8.2. Structural shifts in kilns

The kilns used for firing roof tiles in ancient China, particularly during their earliest period, were structurally almost identical to ordinary ceramic kilns; in fact, roof tiles and other ceramics were often fired in the same kilns. Here, following the example of prior research, we begin with an overview of shifts in kiln structure, mainly in the Yellow River region.

The kilns that appeared from the mid-Neolithic Cishan period through the early Yangshao period used a structure

that guided the flame from the stokehole and firebox (fuel-burning space) of the kiln laterally or diagonally to the firing chamber (where ceramics or roof tiles were placed) and discharged smoke from a flue at the top. During the late Yangshao period, while the basic structure remained the same, a flame-passage hole was added in some kilns that led between the firebox and firing chamber (Fig. 8.1: 1). This became more widespread in the late Neolithic Longshan Culture. In the Shang period, kilns generally came to use a two-layer structure, guiding the flame from the firebox below through a flame-passage hole to the firing chamber above (Fig. 8.1: 2), and this remained widely in use through the Zhou period (Ozawa 1993). All of these were updraft kilns that conveyed the heat generated in the firebox upward or diagonally to the firing chamber and then discharged the heat and smoke upward from there.

By contrast, the kilns that appeared in the Western Zhou period were semi-downdraft kilns (Fig. 8.1: 3), called flat kilns in Japanese archeology due to their shape. The floor of the front half of these kilns is further depressed and forms the firebox, while the raised back half forms the flat-floored firing chamber. The heat that is generated in the former rises to the top of the latter and then is drawn down to the flue at the base of the back wall of the firing chamber for discharge. This structure likely made it easier to control the flame, allowing for the firing chamber to be enlarged. Tile kilns used this structure almost without exception from the Warring States period through the Qin and Han periods as they grew larger and larger.

8.3. Tile kilns and roof-tile production in the Western Zhou

Most the roof tiles found from the Western Zhou period (from the eleventh century BCE until 771 BCE) have been discovered around Zhouyuan in western Shaanxi. The plateau southeast of Mt. Qi on the north bank of the Wei River may be where the Zhou Gugong Danfu established his base at Zhouyuan. He built a castle and created a village

at the site. His grandson, King Wen, transferred the Zhou capital to what is now the southwest suburbs of Xi'an City, naming it Fengjing. Then his son, King Wu, brought down the Shang Dynasty and replaced it with the Zhou, building his capital city Haojing. The area of Chang'an County in Shaanxi where the Fengjing and Haojing remains are scattered has also yielded many Western Zhou roof tiles.

8.3.1. Western Zhou period roof tiles

8.3.1.1. Early Western Zhou roof tiles

Beginning in the 1970s, large architectural remains from the Western Zhou period have been discovered in the village of Fengchu, Qishan County, and the village of Zhaochen, Fufeng County, both in Shaanxi (Zhouyuan Archaeological Team in Shaanxi Province 1979; 1981). Investigation of these remains has clarified the state of early Western Zhou roof tiles, which were invariably flat (Luo 1987). In the Zhouyuan region, round roof tiles began to appear in addition to flat ones only in the middle Western Zhou period. Clay coils were built with paddles and anvils to form clay cylinders, and these were then cut into flat tiles. The flat tiles unearthed from the lower building levels in Zhaochen are 47 cm long, 30 cm by 29 cm wide, and 1.3 cm thick, showing traces of paddling with a rough cord-wrapped paddle on the sides and edges as well as on the exterior. Some of these tiles have cord marks on their interiors as well. It is likely that the clay cylinders were cut when still soft, and their insides and edges were adjusted. Additionally, some flat tiles have interior or exterior clay protrusions to facilitate their fixation on roofs. Some also have holes near both ends, and these are thought to be for string-threading to bind tiles together.

8.3.1.2. Mid-Western Zhou roof tiles

The roof tiles found at the upper building levels in Zhaochen largely belong to the mid-Western Zhou period, with little material from the late period (Zhouyuan Archaeological Team in Shaanxi Province 1981). The major changes in

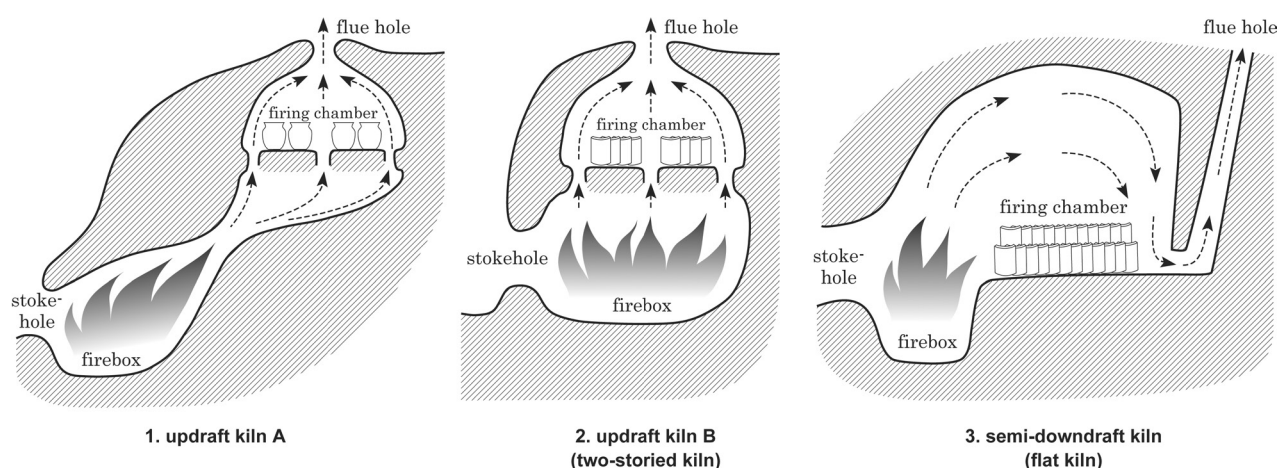
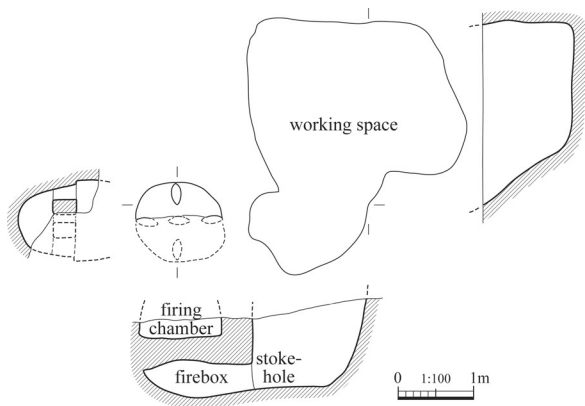


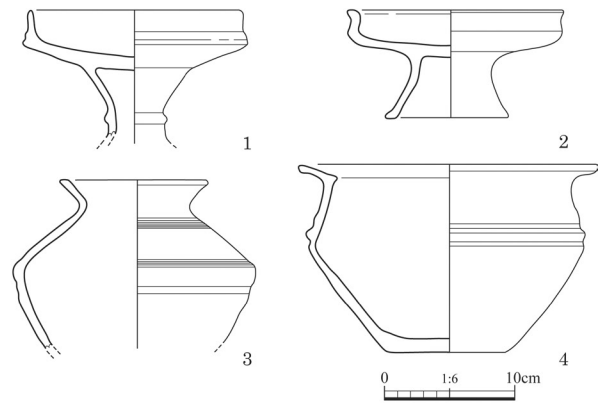
Figure 8.1. Structural shifts in kilns.

the middle period include the appearance of round tiles in addition to flat ones, as well as half-round eave-end tiles. Each type of roof tile appears in large, medium and small sizes, probably divided according to their intended

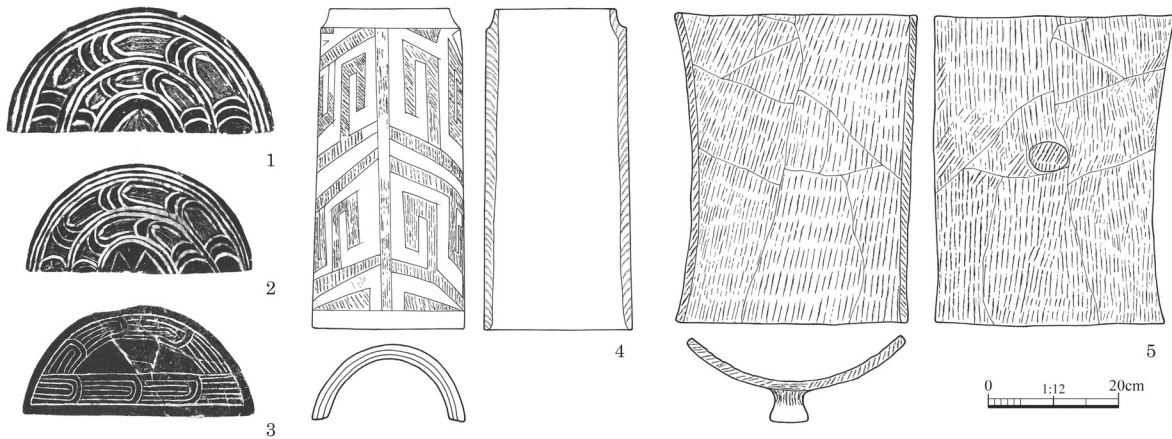
place of use. The half-round eave ends include some with patterns made by spatulas and some undecorated ones; the former display concentric arc patterns on the half-round eave-end side (Fig. 8.2: 3.1, 2, 3). Both round and flat



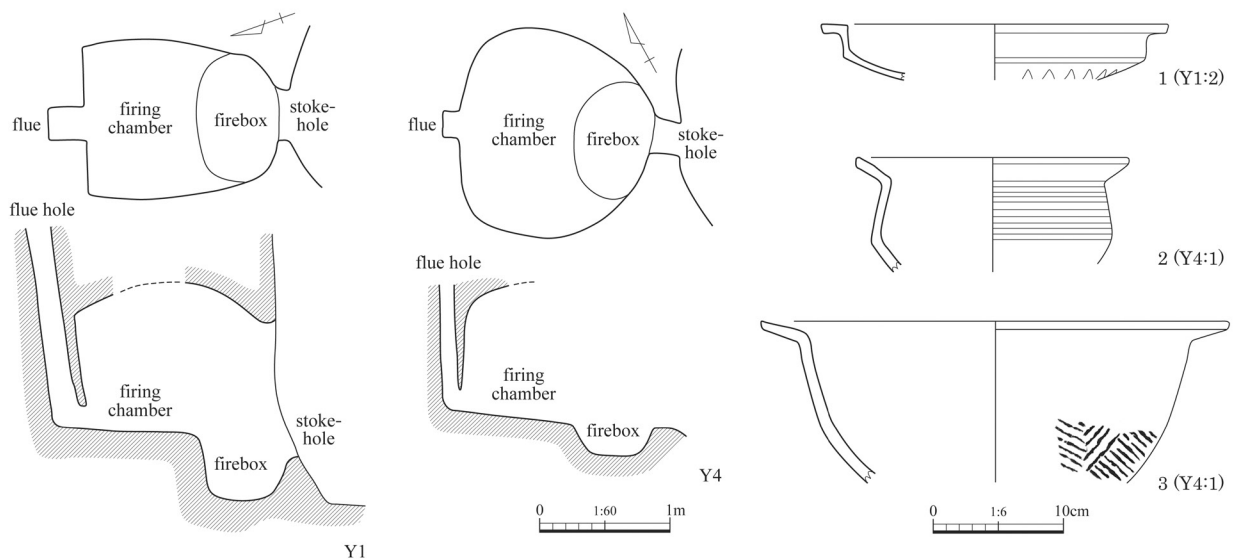
1. Western Zhou ceramic kiln (Y5) at Luoshui village



2. Western Zhou ceramics unearthed from kiln Y5



3. Roof tiles unearthed from Western Zhou building foundations at Zhaochen (1-3), Yuntang and Qizhen (4,5) in Fufeng



4. Kilns and ceramics unearthed at Liliavao site

Figure 8.2. Ceramic and tile kilns from the Western Zhou to early Spring and Autumn period (traced from Feng Hao Archaeological Team 1963, Zhouyuan Archaeological Team 1981, 2002 and Sanmenxia Municipal Archaeological Team 1993).

tiles were made by cutting clay cylinders formed with paddles and anvils, and cord-wrapped paddle marks were left on their exteriors. Some exteriors of round tiles have had their cord marks smoothed away and borders made by spatulas and geometric patterns added. The addition of protrusions to both flat and round tiles is even more common in the middle period, where tiles have conical, cylindrical or mushroom-like forms, and many also have loop handles.

8.3.1.3. Late Western Zhou roof tiles

Investigations conducted in 1999 and 2000 found two late Western Zhou period building groups in the villages of Yuntang and Qizhen, Fufeng County (Zhouyuan Archaeological Team 2002). The tiles unearthed from the sites were essentially the same as the tiles from the middle period described above. The half-round eave-end tiles had concentric arc patterns made with a spatula; the round tiles were undecorated on the inside and had geometric patterns on the outside. The flat tiles were marked on the exterior with a relatively fine cord-wrapped paddle, and they were undecorated on the inside (Fig. 8.2: 3.4, 5). There were no major changes in the types, forms or methods of production of roof tiles during the late Western Zhou, but tiles were thinner and more uniform than those of the middle period and had finer cord marks on the surface (Luo 1987). The late period also exhibited fewer protrusions for roof-fixing.

Overall, the major changes that occurred within the Western Zhou period were in its middle period: the production of round tiles began alongside flat tiles; eave-end tiles were produced for the first time; and buildings appeared whose entire roofs were covered with tiles. In other words, from the middle Western Zhou period forward, there was a clear increase in the types and number of roof tiles used in a single building. However, even so, the use of roof tiles was limited to the major architecture of the royal capitals, such as palaces and ancestral shrines. While there was demand for large numbers of roof tiles for new constructions at this time, such demand was not consistent; it is likely that the workers who normally manufactured ceramics would temporarily switch to roof tiles to meet the demand as it arose. The close ties between the production of roof tiles and ceramics during the Western Zhou period can be deduced not only from commonalities in their methods of production but also from their being fired within the same kilns.

8.3.2. Western Zhou period tile kilns

In the southwest suburbs of Xi'an, Shaanxi Province – the location of Haojing, one of the capitals of Western Zhou – an excavation in 1961–62 discovered six kiln remains from the late Western Zhou period in the western part of the village of Luoshui (Feng Hao Archaeological Team 1963). All of these were two-layer kilns with fireboxes below and firing chambers above, and had a work shaft that was dug in front of the stokehole (Fig. 8.2: 1). When the site

was excavated, the kiln body and shaft interior were found buried in earth mixed with ash, from which ceramic shards and roof tiles were unearthed, as well as raw clay pieces. Jars were the most common type of artifact (Fig. 8.2: 2), followed by pedestaled dishes and roof tiles, with a few pots (including three-legged pots). The other kilns appear to be in a similar state, with operations seeming to have been largely focused on ceramics while also including roof tiles.

In the village of Liulongzui, Qishan County, Shaanxi, two Western Zhou kiln remains were discovered in 1979 (2.5 km west of the village of Fengchu, where buildings from the early Western Zhou period have been found) (Ju 1989). The first kiln was 1.75 m in diameter; its upper structure is unclear, but it was probably two-layered. Many round and flat tile shards and unfired tiles were found, along with a few pieces of ceramics in the upper layer. The second kiln had a similar structure, and it revealed many jars and other ceramic artifacts. Researchers theorized that the first kiln was dedicated to roof tiles alone, and the second fired only ceramics, but the two were just 0.5 m apart and had the same structure. Even if the products to be fired were separated by type, it is inarguable that the production of roof tiles and ceramics took place in closely adjacent locations, if not in the same kiln.

At the Lijiayao site in Sanmenxia City, Henan Province, six kilns from the late Western Zhou or early Spring and Autumn period have been found (Sanmenxia Municipal Archaeological Team 1993). The flat type includes horseshoe and round shapes, and both small flat kilns are no more than 1.5 m long in total, with a single flue on the back wall (Fig. 8.2: 4). Many ceramic pieces, including pedestaled dishes, have been unearthed from the kiln remains and surrounding pits, along with many round and flat tiles, including half-round eave-end tiles without decoration. These roof tiles may have been supplied to Shangyang, the capital of the Western Zhou vassal Guo State.

8.4. Tile kilns and tile production in the Spring and Autumn and Warring States periods

Full-scale tile-roofed buildings developed in the Western Zhou period only in those regions that were directly governed by the Western Zhou Dynasty, such as Zhouyuan, Fengjing and Haojing. At this time, the use of tiles was monopolized by the Western Zhou Dynasty, and only scattered examples have been found in other regions. However, during the Spring and Autumn period of the early Eastern Zhou (770 BCE to 453 BCE), tile production and usage had spread to other major states, and diversely decorated tiles appeared widely in the Warring States period of the late Eastern Zhou (453 BCE to 221 BCE). Below, we describe the status of tile kilns and tile production in this period, with reference to states where evidence for tile production and use has been excavated: Qin, Zhou, Yan, Qi and Chu.

8.4.1. Tile production in Qin Yongcheng

Roof tiles from Spring and Autumn period Qin have been unearthed mainly at the Yongcheng site in Fengxiang County, Shaanxi. Yongcheng thrived as the Qin capital for some 280 years, from 677 BCE, when Duke De acceded to his position and began building the city, until the capital was moved to Yueyang during the Warring States period. Excavations have found the remains of many large buildings within the Yongcheng enclosure, including palaces and ancestral shrines from the Spring and Autumn period. Outside, to the southwest, contemporaneous mausolea have been found.

Within the Yongcheng remains, the status of the roof tiles unearthed at the Majiazhuang No. 1 Building Group Site – which is thought to have been an ancestral shrine – is well known (Archaeological Team of Yongcheng 1985). The roof tiles that have been unearthed from around the site's central building include unusual flat tiles with a U-shaped cross-section. Some feature a triangular decoration that wipes out half of the exterior cord marks; these tiles are thought to have been laid on roofs with the decorated part projecting from the eaves. There are also half-round eave-end tiles that combine cord marks and arc patterns, as well as round tiles that have their exterior cord marks brushed away in patterns. It is also notable that many marks on the round and flat roof tiles from this site were inscribed with spatulas. According to the archaeological report, these marks appear on almost all of the round and flat tiles and are in 70 to 80 types. Their number and frequency indicate that they may be manufacturers' marks.

From late 2005 to May 2006, a roof-tile workshop that dates from the late Spring and Autumn to the Warring States period was excavated near the village of Doufu in northwest Yongcheng (Shaanxi Academy of Archaeology et al. 2013). This location, north of the area where major buildings such as palaces and ancestral shrines are found, is thought to be where the workshops were that supplied building materials, including roof tiles (Fig. 8.3: 1). Five flat kilns and many clay pits have been discovered (Fig. 8.3: 2). Around 2000 artifacts have been unearthed, including eave-end tiles, round tiles, flat tiles, bricks and terracotta figurines. Most of the eave-end tiles are round and bear animal decorations of deer, birds and tigers, as well as some cloud patterns. Many tools used for roof-tile production, such as ceramic antefix molds and anvils, have also been unearthed.

Round eave-end tiles with patterns of fauna have hardly ever been found in Yueyang, the capital from 383 BCE on, or Xianyang, built in 350 BCE: most of the roof tiles unearthed from the kiln remains are thought to be from the early Warring States period. We can thus conclude that workshops that specialized in roof-tile manufacture mainly existed at the Yongcheng site in the early Warring States period. These tiles were probably supplied to the palaces and ancestral shrines scattered within the site.

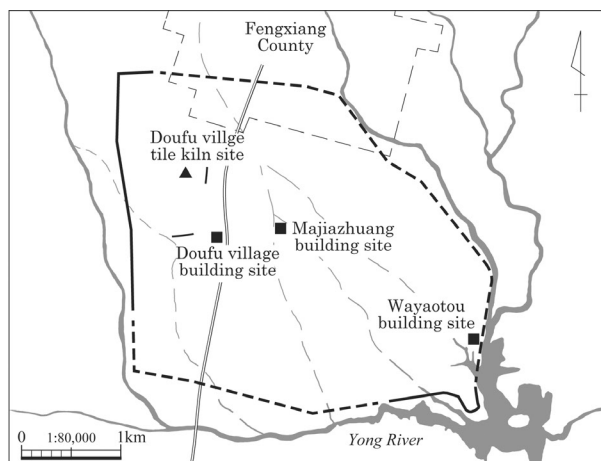
8.4.2. Tile production at the Wangcheng site in the Eastern Zhou Dynasty

In 771 BCE, the Western Zhou Dynasty fell and was replaced, the following year, with the Eastern Zhou, which had its capital at Luoyang. However, the Western Zhou tradition of roof-tile production was not passed on to the Eastern Zhou. Roof-tiled buildings had developed in Western Zhou centers like Zhouyuan, Fengjing and Haojing, with patterned half-round eave-end tiles decorating the eaves, whereas only undecorated half-round eave-end tiles have been reported in Luoyang, royal capital of Eastern Zhou, during the Spring and Autumn period, and cloud-patterned tiles using molds appeared only in the Warring States period (Institute of Archaeology, Academia Sinica 1959). Undecorated half-round eave-end tiles were used in the Warring States and Qin and Han periods as well as in the Spring and Autumn period; the latter were somewhat softer and gray-brown or black-gray in color, while the roof tiles of the Warring States period were hard and blue-gray. Additionally, roof tiles with cloth-mark impressions on their interiors appeared during the Warring States period.

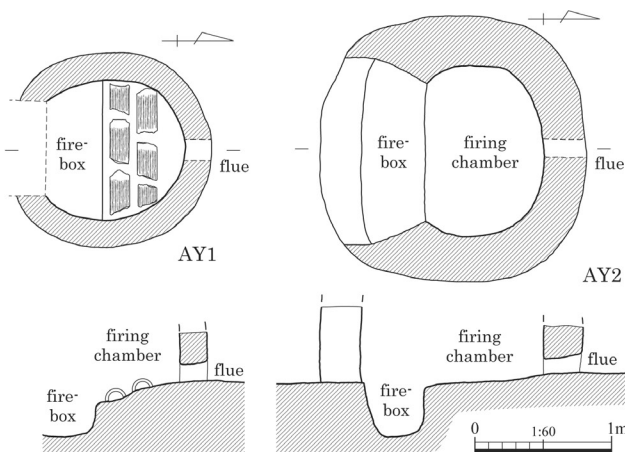
Kiln-group remains from the mid to late Warring States period have been found at the Eastern Zhou Wangcheng site (Fig. 8.3: 3, 4) within the northwest outer wall of Luoyang, east of the Jian River (Institute of Archaeology CASS 1989). In addition to antefix molds, many ceramic anvils and tools used for burnishing have been unearthed, showing that the roof-tile and ceramic workshops were probably adjacent. To the southeast of the kilns, there was a bone workshop, and to the south of that, there were gem and stone workshops. Copper molds have also been found, indicating that the area was a center for artisan workshops.

Of the 15 kilns, 6 are unclear in structure and 5 are ordinary flat kilns, with a flat oval shape, a vent in the back wall of the flat firing chamber, and a firebox and stokehole dug deeply at the front. Some of the kiln walls are made from sun-dried bricks. The products of these kilns include everyday ceramics, construction materials such as roof tiles, and funerary objects to be buried with the dead. These three types of product have been unearthed mixed at many kilns, in ratios that vary by kiln. The artifacts found in the flat kiln H415 and its surrounding pits were mostly ceramics, with a few roof tiles as well. Around H437, likewise a flat kiln, both roof tiles and ceramics have emerged in quantity. In contrast to these, the round kiln H453 has a two-layer structure, with its fire lit under the bottom firebox layer and reaching the upper firing layer through multiple holes for flame passage. Reports indicate that while both roof tiles and ceramics have been unearthed from H453 and its surroundings, it is not clear whether all of them were fired in that kiln.

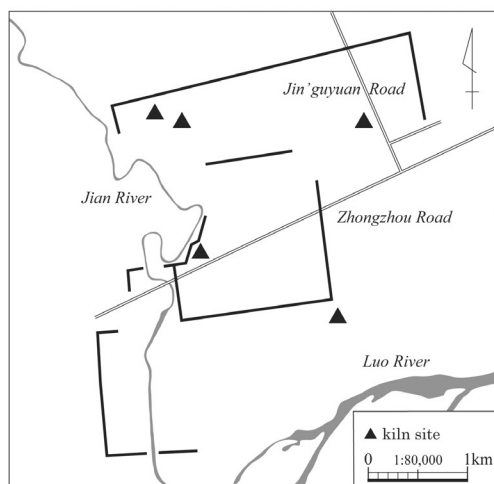
In 1974, near Jin'guyuan Road at the northeast outer wall, 22 kilns from the Eastern Zhou through the Han periods were found (Work Team of Luoyang City on Cultural Relics 1983). Of these, two were ceramic kilns, and one was a roof-tile kiln, all from the Eastern Zhou period. Ceramic



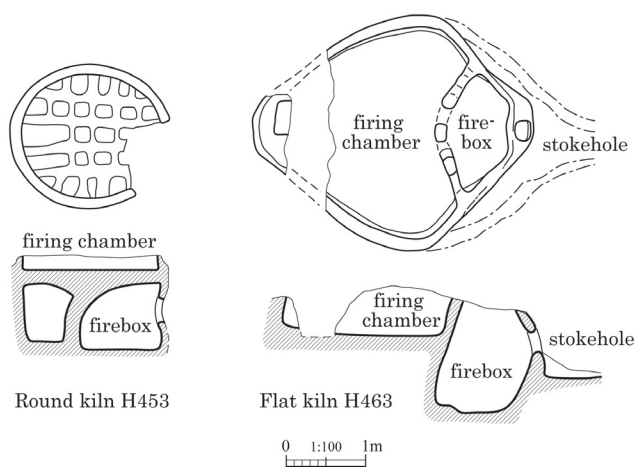
1. Qin capital remains of Yongcheng



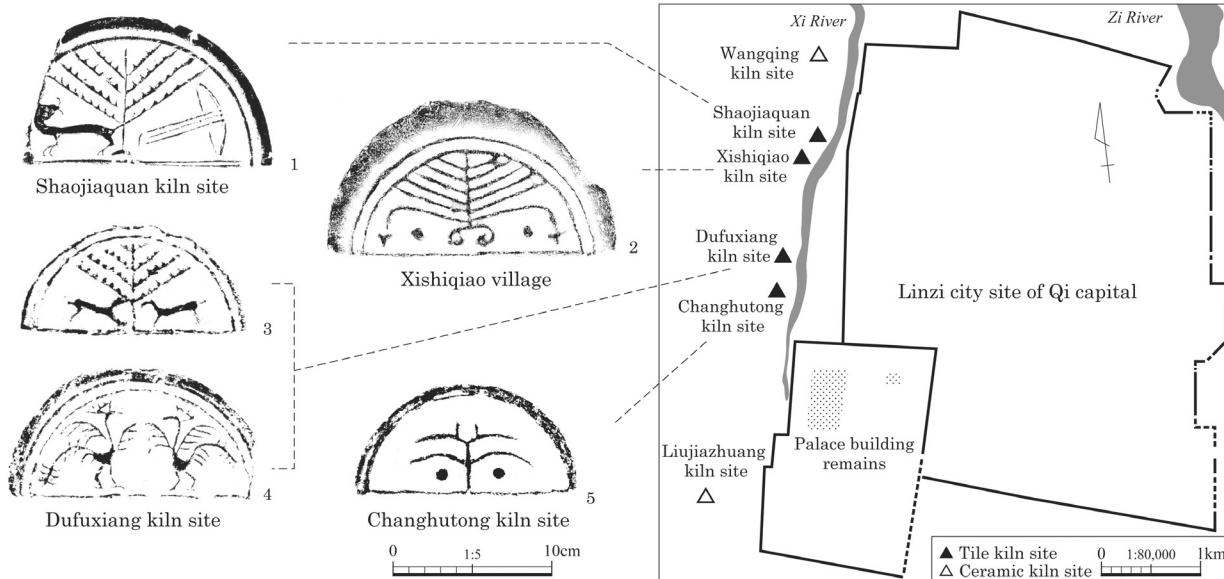
2. Qin Yongcheng tile kilns at Doufu village



3. Kilns excavated from Wangcheng Site of Eastern Zhou Dynasty



4. Ceramic and tile kilns unearthed from Jian River area



5. Kilns and tiles unearthed from Linzi city site of Qi capital

Figure 8.3. Kilns in the Warring States period (redrawn from Shaanxi Academy of Archaeology et al. 2013, Institute of Archaeology CASS 1989 and Zhang 2006).

kilns No. 5 and No. 4 had different structures, but both were two-layer kilns: the former may date back to the Spring and Autumn period. The No. 1 roof-tile kiln was a flat kiln with an almost rounded firing chamber. The kilns that are considered to be from the Qin and Han periods are all typical flat kilns, with the smaller ones used for ceramics and the larger ones for roof-tile or brick firing. Ceramics stamped with “He Ting” and “He Shi” marks have been found, indicating that during the Han period, these kilns were controlled by the market management organization. In all of these kilns from the Spring and Autumn through the Han periods, ceramic and roof-tile kilns were separate, with two-layer kilns firing only ceramics and flat kilns only roof tiles.

8.4.3. Roof-tile production at the Yan-Xiadu site

Many Yan roof tiles have been unearthed from the Yan-Xiadu site in Yi County, Hebei Province, the site of the capital during the late Warring States period (Hebei Provincial Institute of Cultural Relics 1996). This capital is generally thought to have been built in 311 BCE; while theories on the chronology of the Yan-Xiadu roof tiles vary, we assume here that half-round eave-end tiles with Taotie designs first appeared during the Warring States period and further developed during the later portion of the period (Tani 2006).

The city of Yan-Xiadu was divided into eastern and western halves, with the palace located in the north-northeast of the eastern city and some foundations spreading north of the wall. Artisans’ workshops were built close to the area of the palace in the northern part of the eastern city. While ceramics and roof tiles have been found in the workshops to the northwest of the palace, they largely produced bronze and iron objects, mainly weapons; by contrast, the workshops south of the palace were dominated by roof-tile and ceramic production, with traces of bone products and coins as well. Workshops for arms and those for other products were essentially separated.

Roof tiles and ceramics unearthed were carelessly mixed around the Yan-Xiadu workshops. While the kilns themselves have not been discovered, roof tiles and ceramics were certainly manufactured in close proximity. However, the characters stamped on the roof tiles and ceramics make it clear that the artisans for each were clearly distinct, and that they were managed and organized separately. Although no definitive statement can be made without evidence of the kilns, it is clear that in Yan-Xiadu, roof-tile and ceramic production were independent of one another and that the two types of products were probably mixed when defective items were disposed of from adjacent workshops or kilns.

8.4.4. Roof-tile production in Linzi, the capital of Qi State

Qi roof tiles have emerged in large quantities from the old capital at Linzi, in the city of Zibo, Shandong Province.

While theories of their chronology vary (Nakamura 2007), it is certain that a range of patterns, including tree patterns, developed in the late Warring States period. Tile kilns have been found and examined here and there outside the old capital walls (Fig. 8.3: 5), with ceramic-firing kilns also discovered (Zhang 2006). In particular, the Warring States kilns where eave-end tiles, round tiles and flat tiles have been unearthed were all dedicated workshops for roof-tile firing and supply. However, no photographs or diagrams of these kilns have been published; reports indicate that they existed from the Spring and Autumn period through the Han period. While it is difficult to confirm the beginning and end of their operating periods, the center of roof-tile production was almost certainly the late Warring States period.

Unlike the bone, bronze and iron workshops scattered within the old Qi capital, the roof-tile and ceramic kilns were located outside the walls. The failure to discover tile kilns within the walls suggests that the five found outside the walls were officially managed workshops. On the other hand, the characters stamped on ceramic products have led to the theory that the ceramic workshops were run by private citizens. Both types of kiln were outside the wall, but their distribution does not match, suggesting a difference in modes of operation.

8.4.5. Chu roof-tile production

The site of Ji’nancheng, Jiangling County, Hubei Province, which is believed to have been the Chu capital, has produced undecorated half-round eave-end tiles, round eave-end tiles, and round and flat roof tiles that are dated to the late Spring and Autumn period through the Warring States period (Hubei Provincial Museum 1982). The majority of building foundations appear in the Songbai area, southeast of the center, which is thought to have been the heart of the palace area. Kilns used to fire roof tiles and ceramics have also been found there, with many tile kilns found north of the central palace area and ceramic kilns scattered to its west.

A tile kiln was found in 1965 in Fanjiayuan, within the Songbai area, and two more (He River Kilns Nos. II-1 and III-1) were discovered elsewhere in 1975. Little is known of the III-1 kiln structure, and the Songbai Fanjiayuan and II-1 kilns are typical semi-sunken flat kilns, having oval shapes and one flue at the back wall. The firebox is a shallow dugout in front of the flat firing area that is connected to the stokehole.

From the artifacts found around these kilns, they are generally thought to date from the mid-Spring and Autumn period or later. Five undecorated round eave ends have been unearthed from the Songbai Fanjiayuan kiln, indicating that it dates from the time when these came into use, likely during the Warring States period; thus, the kiln was clearly in operation at some point during the Warring States period.

By contrast, four Warring States flat ceramic kilns have been found at the Xinqiao site in western Ji'nancheng (Hubei Provincial Institute of Cultural Relics and Archeology 1995). The ceramics found there imply a date from the late mid-Warring States period through the beginning of the late Warring States period. Thus, the ceramic and tile kilns at the Ji'nancheng site operated at different locations and featured clearly differentiated production.

8.4.6. Separation of tile and ceramic production

Tile kilns in the Western Zhou period made use of small-scale ceramic-firing kilns, with minimal structural differences between the tile and ceramic kilns, and likewise without separation between their workers (Owaki 2002). By contrast, through the Spring and Autumn and Warring States periods, the production of ceramics and of roof tiles became more and more distinct. By the Warring States period at the latest, the two were handled by different workers who rarely shared kilns. In response to this, roof-tile kilns in these periods became much larger than ceramic kilns, and structural differences appeared as well.

In the Warring States countries of Qin, Yan, Qi, Chu and others, roof-tile production was clearly separated from that of ceramics. At Qin Yongcheng and Chu Ji'nancheng, kilns dedicated to the firing of roof tiles were built near the interior palace areas in response to demand for the tiles. At the old Qi Linzi capital, however, iron, copper-casting and bone workshops were built within the outer walls, but dedicated roof-tile and ceramic-firing kilns were scattered outside the walls. Civilian-run ceramic kilns also existed. At Yan-Xiadu, workshops for arms, roof tiles and ceramics were concentrated near the palace area, suggesting that the national authorities were responsible for the management of these industries. Roof tiles were stamped with marks that represented control by central management, distinct from those marking ceramic artifacts. While roof tiles and ceramics have been unearthed together where they were disposed of, they were clearly separated at the production stage.

8.5. Tile and ceramic kilns in the Qin and Han periods

From the Warring States through the Qin and Han periods, major changes appeared in methods of roof-tile production. First, techniques of patterning on eave-end tiles using molds began to be used, and they spread across various regions during the Warring States period. In some areas, molds were used to produce clay cylinders, creating cloth marks on the round and flat tile interiors. Roof tiles with cloth marks date back as far as the Eastern Zhou Wangcheng site at Luoyang, and appeared widely during the mid to late Early Han period around Chang'an (Tani 1984). Roof tiles, which were first produced using ceramic-based methods, were by this point being manufactured with specially developed techniques and tools. These

differentiated techniques and tools further accelerated the separation of the production of ceramics and of roof tiles, and the two became distinct professions. Large numbers of tile kilns have been found from the Qin period onward, and during the Han period in particular, making it difficult to characterize all of them in one discussion. Here, let us concentrate on three groups of dedicated tile-firing kilns found from the Qin period (221 BCE to 206 BCE) through the beginning of the Early Han period (206 BCE to 8 BCE), to identify the specific characteristics of tile kilns during this time.

8.5.1. Tile kilns at the Mausoleum of the First Emperor

The Mausoleum of the First Qin Emperor is found in the eastern suburbs of Xi'an City, Shaanxi. It is recorded that its construction began in 246 BCE, and it became a massive mausoleum park construction project employing 700,000 workers after the unification of China in 221 BCE. The First Emperor died in 210 BCE and was buried there, but his palace and mausoleum were both destroyed after the Qin Empire fell in 206 BCE.

Investigations of this mausoleum have found multiple buildings in and around the mausoleum park, and many roof tiles have been unearthed from their remains. The kilns that produced this large quantity of roof tiles have been discovered in various places around the park (Qinyong Archeological Team 1985): in particular, three mainly tile-firing kilns have been found in the village of Zhaobeihu, west of the park, with three more near the village of Shangjiao, to the southeast (Fig. 8.4: 1). These kilns mainly produced roof tiles, together with a little ceramic. The Zhaobeihu kilns are triangular in shape and have three flues in the back wall, whereas the Shangjiao kilns are in the shape of a horseshoe or a round-cornered triangle; some have five flues in the back wall and show notable differences in shape.

During this period, the construction of the Qin palace and the Mausoleum of the First Emperor involved large numbers of civilians from all regions, together with workers from official workshops, as is made clear by the stamps engraved on the tiles and ceramics. In other words, the diverse shapes of the kilns found near the mausoleum, if they are dated correctly, most likely derive from the diverse origins of and techniques used by the kiln workers. By contrast, the tile kilns at the First Emperor's Jieshi Palace and at the Han Dynasty Northern Palace in Chang'an show a more uniform structure in their remains, suggesting that they were officially managed roof-tile workshops.

8.5.2. Tile kilns at the First Emperor's Jieshi Palace

The Qin Dynasty resort in Jiangnüshi, Suizhong County, Liaoning Province, resembles the Jieshi Palace built by the First Qin Emperor (Fig. 8.4: 2). Records indicate that after

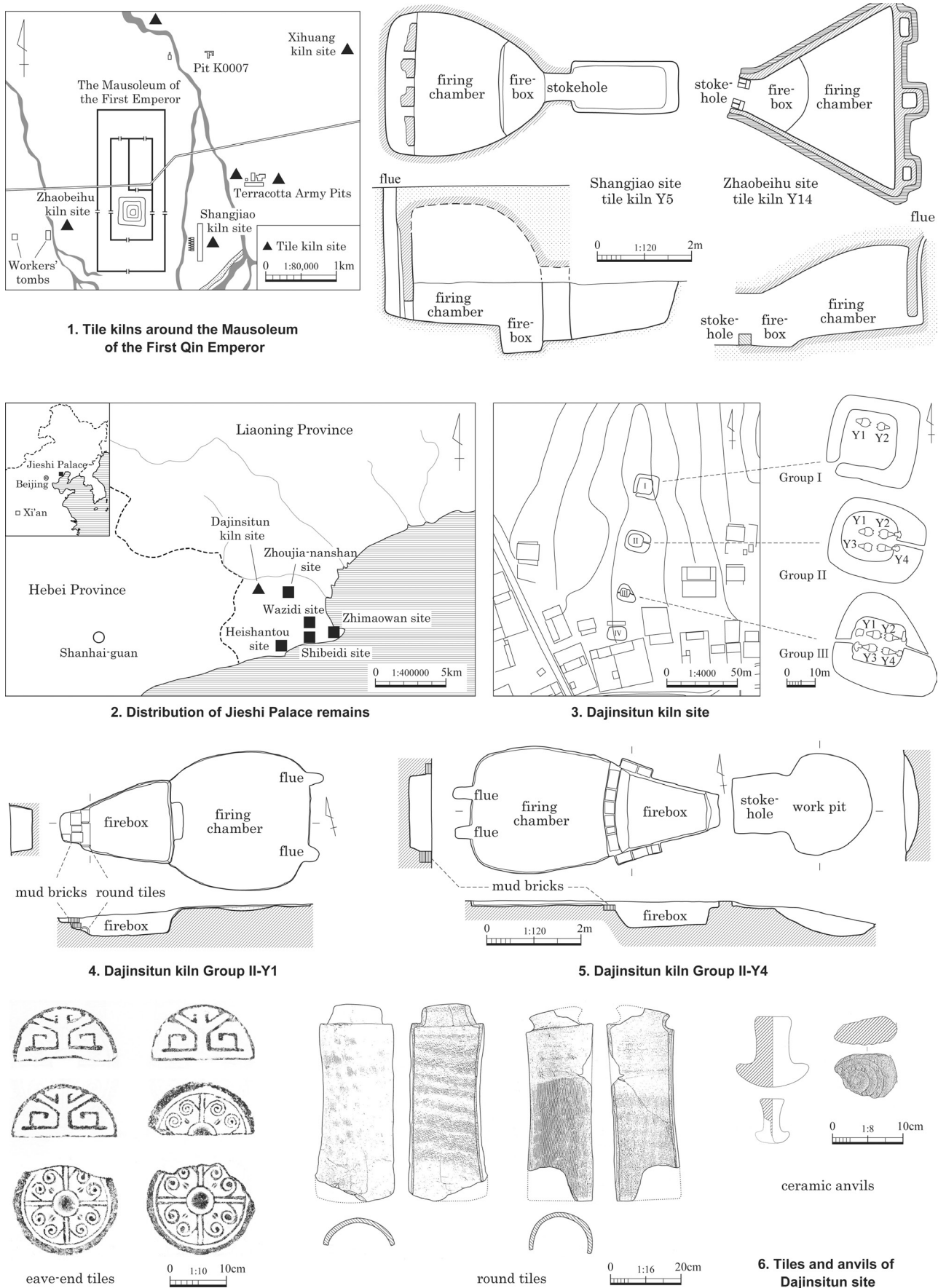


Figure 8.4. Kilns for the First Emperor of Qin Dynasty (redrawn from Qinyong Archeological Team 1985 and Liaoning Provincial Institute of Cultural Relics and Archaeology 2010).

unifying the country, the First Emperor took five imperial tours, visiting Jieshi to perform rites during his fourth tour in 215 BCE. The Shibeidi site is central to the Jieshi Palace, and features large tile-roofed building foundations with keystones at the Zhimaowan and Heishantou sites on its eastern and western capes. In the surrounding area, tile kilns have been found alongside buildings at the Wazidi and Dajinsitun sites, together with artifacts suggesting that these sites were related to the building of the Jieshi Palace (Liaoning Provincial Institute of Cultural Relics and Archaeology 2010).

At least four units (No. IV remains unexcavated) of two to four flat tile kilns, each encircled by ditches, have been discovered at the Dajinsitun site (Fig. 8.4: 3). The kilns are all similar in shape and structure and feature a trapezoidal firebox, oval firing area and two flues, the first depressed about 70 cm below the firing area (Fig. 8.4: 4, 5). They are semi-sunken kilns, built into the ground, plastered on the interior with mud mixed with fibers, and partially constructed of sun-dried bricks. The yard area outside the stokehole of the kilns includes a work pit. The work pit and outer ditch at No. II are linked, whereas the work pit at No. III is dug into a raised area within the ditch, suggesting that the ditch was used for wastewater and the disposal of defective products, rather than for work processes.

8.5.3. Tile kilns at the Chang'an Han Dynasty Northern Palace

The Northern Palace of early Han Chang'an is located in the north center. In a 1994 survey, 20 tile kilns were found outside its southern gate, of which 11 (Y31–Y41) have been excavated (Han Chang'an City Archaeological Team 1996). These are all flat oval kilns, standing in three rows of three to four kilns, each facing east (Fig. 8.5: 1).

The kilns are approximately 3 m long and up to 2.5 m wide, with fireboxes dug deeper than the firing chamber floors by 1 m or more. There are either one or three flues in the back walls, and rectangular work pits outside the stokeholes. These semi-sunken kilns are dug into the natural loess strata and have firing-chamber floors partially constructed of sun-dried bricks; their interior walls are plastered about 3 cm thick with mud mixed with fiber (Fig. 8.5: 2, 3, 4, 5).

The roof tiles and bricks unearthed in and around these kilns include undecorated and lattice-patterned, half-round eave-end tiles and cloud-patterned, round eave-end tiles (Fig. 8.5: 7); the accompanying flat tiles show cord marks on their exteriors and are either blank or anvil-marked inside. The stamp “dajiang” (great master), seen on round and flat tiles (Fig. 8.5: 6) in particular, is frequently found from the Qin through the very early Han periods, and uses characters close to those from the latter period. Therefore, these kilns are thought to have been in operation around the beginning of the Early Han period.

8.5.4. Changing tile-kiln shapes during the Qin and Han periods

In the early Warring States period, kilns were generally small and circular, with some still being two-layered, whereas in the mid to late Warring States period, flat oval kilns with a single flue became standard. Two-flue flat kilns appeared sometime later, and from the later Early Han period on, there was a rapid movement toward uniform, flat, horseshoe-shaped kilns with three flues (Li 2014; Wang 2011). The tile kilns of the First Qin Emperor's Jieshi Palace and the Han Dynasty Northern Palace at Chang'an exhibit this transition; however, the results of kiln excavations around the First Qin Emperor's Mausoleum also show that these changes were mainly seen in officially managed Qin and Han workshops, while contemporaneous civilian-run kilns continued to have diverse shapes.

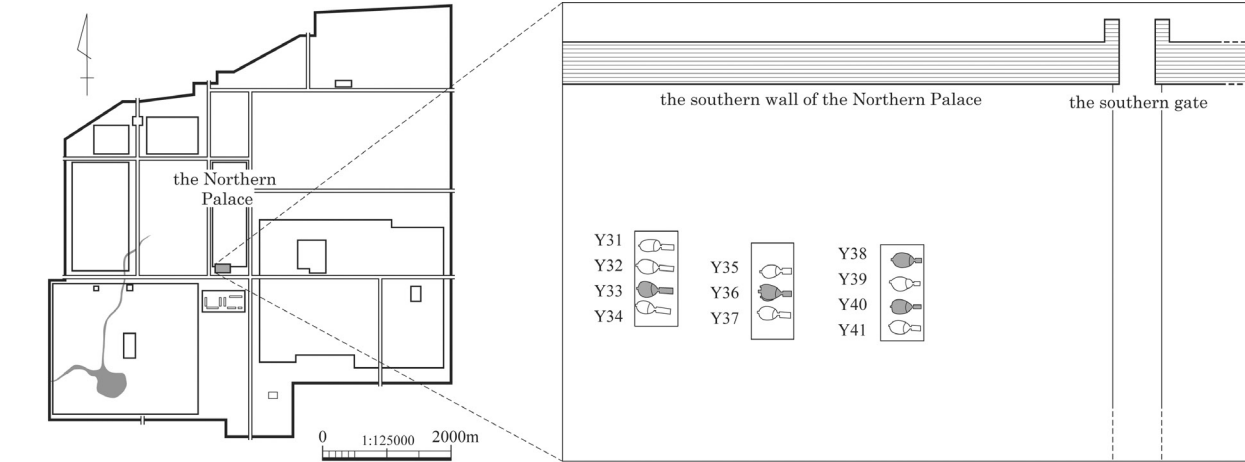
Structurally, tile kilns kept roughly the same structure from the Warring States through the Qin and Han periods. However, they steadily grew larger throughout this time, and the back-firing chambers in particular expanded. This enlargement enabled larger-scale production and the firing of larger products. The steadily increasing number of flues at the back wall of the firing chamber also supported larger tile kilns; the straight back wall with three flues at its base represented a means of retaining firing-chamber space while ensuring that products at the back were fully fired.

8.6. Conclusion

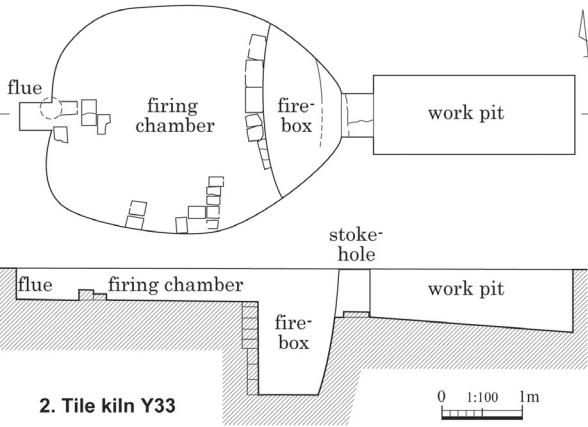
We have discussed the shape of and structural changes in tile kilns and roof-tile production from the Western Zhou through the early Han periods, together with their relationships to ceramic production. The conclusions of this paper are given below.

1) Tile kilns during the Western Zhou period and earlier used a two-layer structure, with ceramics and roof tiles being unearthed together in sites such as the village of Luoshui at Haojing. Examples of separate firing have also been discovered, such as at the two kilns found in the village of Liulongzui, Qishan County. However, in both cases, roof tiles and ceramics were produced and fired in extremely close proximity. This suggests that roof-tile and ceramic workers were not yet separated, and the same workers may have engaged in production of both forms.

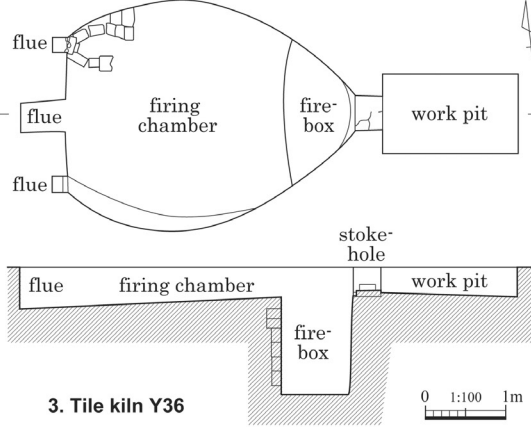
2) Much about roof-tile production in the Spring and Autumn period remains unclear, but it is clear that in Qin, Qi, Yan and Chu during the Warring States period, roof tiles and ceramics were produced separately by different workers. Unique roof-tile molds arose for use in antefix production, and as roof-tile consumption increased, the production of ceramics and roof tiles appear to have become separate. Large flat kilns for roof-tile firing came into widespread use, whereas ceramic-firing kilns remained small and two-layered until relatively late.



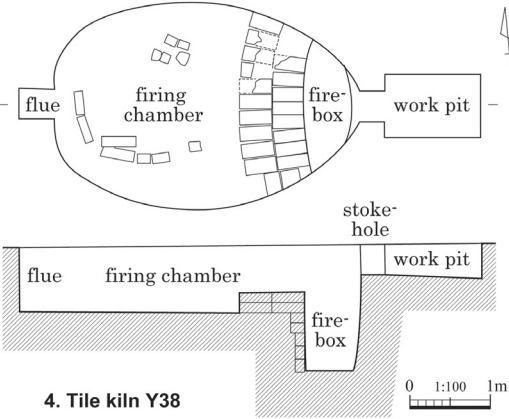
1. Tile kilns to the south of the Northern Palace in Chang'an city during the Western Han dynasty



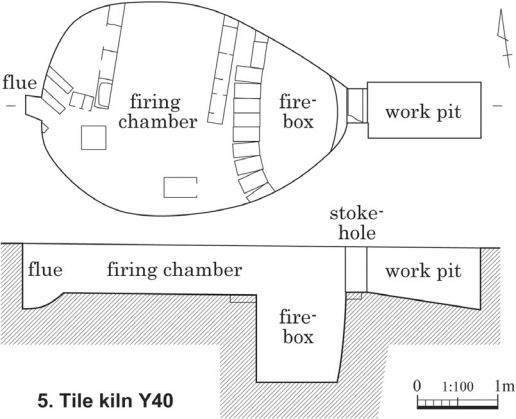
2. Tile kiln Y33



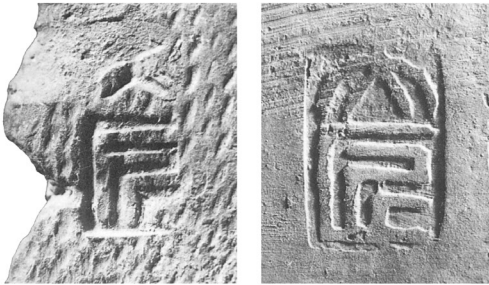
3. Tile kiln Y36



4. Tile kiln Y38



5. Tile kiln Y40



6. "Dajiang" stamp on tiles (Y41:3, Y31:8)



7. Eave-end tiles (Y36:2, 5)

Figure 8.5. Tile kilns in Chang'an City during the Western Han Dynasty (redrawn from Han Chang'an City Archaeological Team, 1A, CASS 1996).

3) This division of labor progressed further during the Han period, with roof tiles and ceramics being produced intensively in different workshops. This is clear from the large numbers of tile kilns that have been found lined up south of the Han Dynasty Northern Palace in Chang'an. Han period kilns all used the same flat structure for roof tiles, ceramics and terracotta figurines, but each kiln fired a specific model, indicating a division of functions.

The kiln shape and structure that were perfected during the Han period continued to be used for centuries without major changes, mainly in northern China. During this process, the influence of roof-tile production technology and kiln structure was felt throughout East Asia.

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Pottery and Long-Distance Trade in East Asia: Coastal Areas Around the East China Sea and Yellow Sea During the Han Dynasty

Daisuke Nakamura

Abstract: Kiln-fired pottery was widely used for long-distance trade around the Yellow Sea and the East China Sea from the third century BC to the third century AD. This essay discusses a possible value change in that type of pottery. The first widespread distribution was of large containers for transport, produced in the Liaodong and Shandong peninsulas. However, after the development of proto-celadon in the Jiangnan region, medium-sized long-necked jars were exported to other regions from the Han Dynasty onwards. In short, the wide distribution of pottery changed from pottery for transport to high-quality ceramics. In addition to the rising value of ceramic itself, it seems to have been appreciated as a tool for drinking and spread to the higher strata of societies.

Keywords: Long-distance trade, Lelang commandery, Liaodong peninsula, Shandong peninsula, proto-porcelain

9.1. Introduction

The long-distance movement of pottery is occasionally seen in the Japanese archipelago starting in the Jomon period, which was a hunter-gatherer society. Although there are some cases of movement of more than 1000 km, such as Ōbora-type pottery in the Final Jomon period, the movement was mostly contained within the Japanese archipelago, except for the southern end of the Korean peninsula. However, from the Middle Yayoi period onwards, the pottery produced in the northern part of the Korean peninsula or farther away, such as Lelang pottery and Liaodong style pottery, was brought to the Japanese archipelago. These were the types of pottery produced with the flat kiln (see Chapter 8) that developed in northern China.

Regarding the acceptance of kilns, in the south of the Korean peninsula, people adopted not only the flat kiln but also the tunnel kiln that originated from the Jiangnan region (see Chapter 6). In the Japanese archipelago, people also adopted the technology of the tunnel kiln, which formed the basis for later pottery production. In both regions, however, solid kiln-fired pottery had been introduced by trade before the production of kiln-fired pottery began. In this chapter, the author will discuss the expansion of the trade network of the East China Sea and the Yellow Sea during the Han Dynasty that accompanied the use of kiln-fired pottery.

9.2. Current issues

Lelang commandery, which is the source of Lelang pottery, was established in 108 BC after the Emperor

Wuhan defeated Wiman Joseon (Fig. 9.1, Table 9.1). The Lelang Fortress, located in present-day Pyongyang, as a capital almost dominated the Northern part of the Korean peninsula. In the Treatise on Geography of the “*Hanshu*,” there is a description as follows:

There were *Wa* people in the sea of Lelang, divided into more than a hundred countries. They came and contribute (to Lelang) in time. (Bangu, *Hanshu*, Treatise on Geography, 103 of last volume)

This text suggests that there was a close relationship between Lelang commandery and Japan (which was known as “*Wa*” in ancient texts), and archeological research conducted in the early twentieth century shows that diplomatic activities were carried out from this period, accompanied by bronze mirrors and gilt bronze products.

It has also been confirmed in the 1950s that Lelang pottery was brought to the Japanese archipelago (Mizuno and Okazaki 1954). However, it was not until Tani Toyonobu (1984–86) sorted out the pottery of the Lelang Fortress and clarified its composition that the study of Lelang pottery began to progress in earnest, which led to the identification and distribution of Lelang pottery mainly in the northern part of Kyūshū (Takesue 1991a, 1991b).

In parallel with the aforementioned studies, Korean researcher Shin Yongmin (1991: 47–50) sought the origin of Lelang tombs and mentioned the change of some types of pottery in his examination of a burial with wooden compartments and burial goods. Later, Takaku Kenji (1995) examined almost all the burial goods in Lelang tombs and