The Shang Bronze Foundry-Site at Xiaomintun in Anyang City

Yinxu Xiaomintun Archaeological Team

Key words: Anyang City, Henan; Xiaomintun site; bronze foundry-site; Shang period

In April 2003 to May 2004, in coordination with capital construction, our team carried out a large-scale archaeological excavation at Xiaomintun Village in Anyang City. The work covered an area of approximately 60,000m^2. The revealed late Shang bronze-foundry-site is one of the important discoveries in the excavation.

Bronze Foundry Vestiges

The main vestiges include large-sized-bronze casting places, a mold-clay preparing pit and mold blank drying-in-the shade pits.

1. Casting places were discovered two, namely F43 and F54. Below is a description of the former. It is opened beneath a layer of disturbed soil and, in the northwestern corner, is intruded by a modern pit and a Yinxu IV tomb (M423). Originally it was a single-room semi-subterranean house, which left over only a part of the subterranean. The pit opening is irregularly rectangular in plan and measures 354cm in maximum length from the north to the south and 320cm in maximum width from the west to the east, and the whole is 5–30cm in remaining depth. No post-holes and doorways were found, but the indoor floor is rather hard owing to repeated stepping. In the center of the house remains a bottom mold for casting a type of large-sized bronze vessel, which has been damaged in the west by a rectangular robbing trench. It is livid in color, round in plan and about 54cm in diameter, and has an out-turned inclined rim about 7cm in width. Judged by the rim, it may be a part of the core and the bottom mold joined with it that were used for casting large round *ding* tripods or plates. The core bears a layer of burnt clay in the center and the bottom mold is surrounded by a circle of straw-mixed clay for reinforcing the mold from outside. This clay protection is again enclosed by a circular groove, which is filled with fragments of molds and lumps of burnt clay to reinforce the casting platform. Outside the groove is a layer of fine sand for heat insulation and scattering. Judged by the burnt straw-mixed clay and charcoal ash discovered on the outmost side and the layer of burnt clay above-mentioned, the core and mold must have been heat-treated from the inner and outer sides. F43 was a work-room specially built for casting large-sized bronze vessels, maybe a building of the work-shed type, and goes back to the time no later than the fourth phase of the Yinxu culture (Figure 1).

Figure 1. Bronze casting place F43 (photo from west to east)

2. A mold-clay preparing pit (numbered H254). It is opened beneath the seventh stratum (Shang cultural layer), intrudes the eighth

stratum (another Shang cultural layer) and immature soil, and is intruded by H261. The opening is oval in plan, 510cm long and 335cm wide, and the bottom is at a depth of about 80cm. The walls are roughly vertical and the bottom is rather flat. In the upper part of the pit is a heap of loose light gray soil, which contains lumps of burnt clay and grains of charcoal in association with Shang pottery shards, molds and animal bones. On the bottom are quantities of more compact immature soil lumps, light yellow in color, varied in size and shape, and slightly sandy in texture. They must have been raw material of pottery molds and models. In date the pit goes back to the fourth phase of the Yinxu culture (Figure 2).

3. Mold blanks drying-in-the-shade pits were discovered four (two square and two round). Take H453 for example. It is opened beneath a layer of disturbed soil, intrudes immature soil, and is intruded by a later ditch and a Shang tomb (M775). The opening is sub-rectangular in plan, 210cm long and 166–172cm wide; and the bottom is at a depth of 270cm. The northern, western and eastern walls are steep, with the surface flat and smooth, and bearing traces of mud plastering and tool working. The southern wall is slightly curved, which may have resulted from its collapse. The inside is filled by ashy soil, which is loose for the upper part and compact for the lower one. It contains quantities of burnt clay lumps and charcoal grains and yielded Shang pottery shards, molds and animal bones. The bottom is paved with a 6–8cm thick layer of charcoal powder. But the layer does not cover the whole bottom, with a 10–16cm wide circle along the walls remaining blank, which must have resulted from covering with something. In the northwestern corner of the bottom, some hard clay lumps were found to bear traces of cutting or still clearer traces of working after their slightly drying in the shade. They are very similar to cores for casting bronzes but have not been baked. So H453 must be the remains of a place for drying clay molds in the shade. It functioned no later than Phase IV of the Yinxu culture (Figure 3).

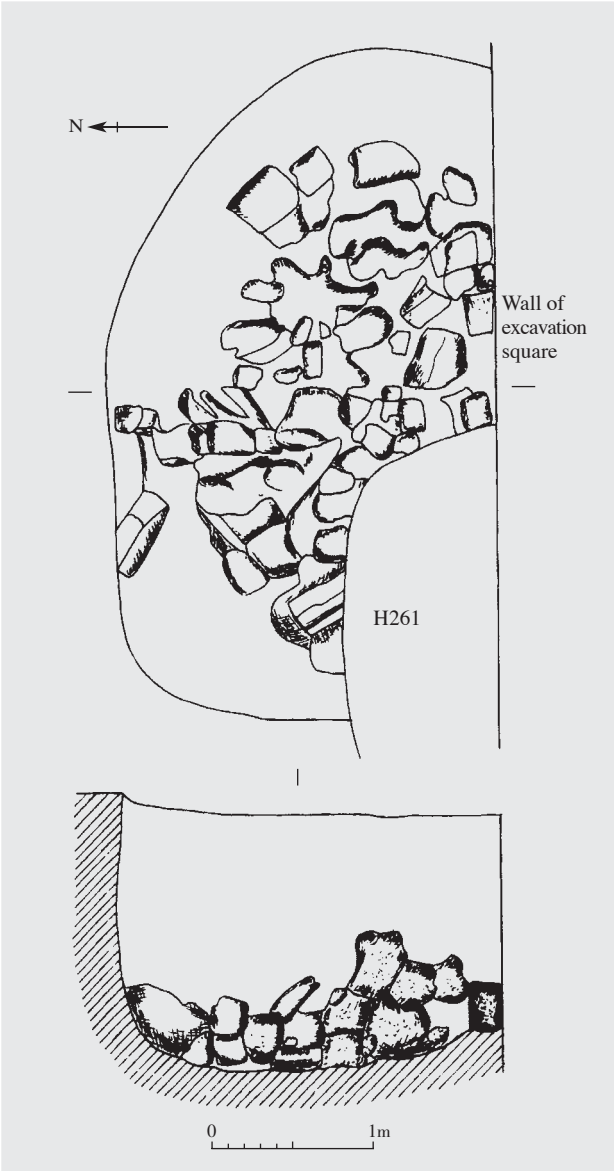

Figure 2. Plan and section of 2003AXSH254

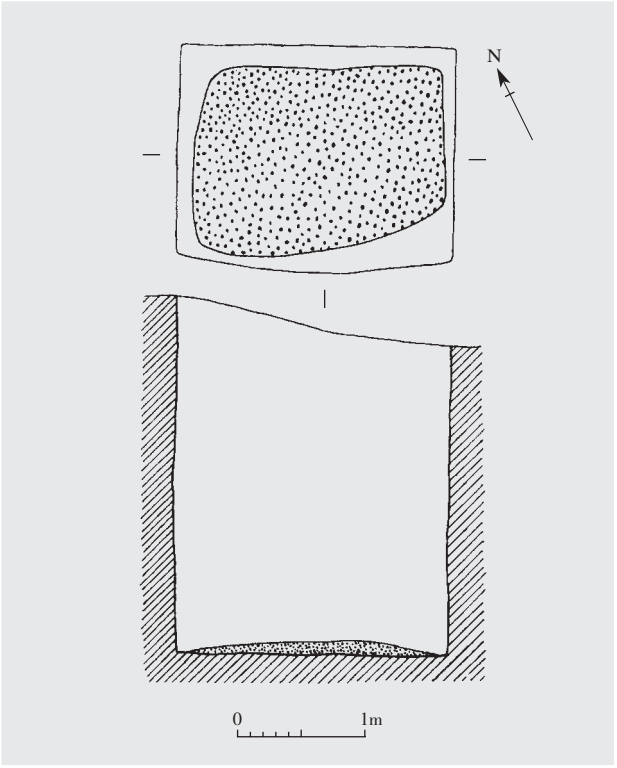

Figure 3. Plan and section of pottery mold drying-in-the-shade Pit 2003AXSH453

Bronze Founding Objects

The great number and complete range of the bronze founding objects unearthed from the site are incomparable among the so far discovered Shang remains. According to their function, these objects can be classified into bronze melting, bronze casting, cast retouching and miscellaneous implements.

1. Bronze melting implements. Only melting furnaces were discovered. They are made of straw-mixed or sandy clay.

The straw-mixed clay furnaces are known from over 3,000 lumps of clay, almost all belonging to furnaces that were demolished and abandoned after repeated use in melting processes that made them useless. There were two making techniques: ring-building and piling up, the former being used more frequently. This type of furnace has a wall formed of four layers, i.e., from the inside to the outside, a lining, a basic body, a straw-mixed clay covering and a protection. The piled-up furnace has only two layers in the wall: the lining layer and the straw-mixed clay one on the inner and outer sides respectively. The lining is usually light gray and shining in slightly melted zones; the basic body and the straw-mixed clay layer are blackish-gray. Some fragments of furnaces show multi-layer linings, which evidence repeated repairs and use. Some linings bear traces of bronze liquid, grains of charcoal, and even impressions of charcoal. It indicates that the charcoal and bronze lumps were placed together and these furnaces belong to the internal-combustion type. H420:1 is a ring-built furnace of straw-mixed clay; it left over a lining, a basic body, a straw-mixed clay covering but no reinforcing layer. The lining is livid with the lower part shining due to being slightly melted, and bears a crack pattern on the surface. The basic body is ring-built of clay mixed with quantities of wheat straw, and is blackish-gray. Its outside is covered with a layer of wheat-straw mixed clay, which is also blackish-gray. The reconstructed furnace measures about 20cm in chord length, 1cm in chord height, 100cm in diameter and 5cm in thickness.

Figure 4. Pottery model for crotched ding tripods (H683:1)

The sandy clay furnace is known from over 100 fragments. Its wall consists of two layers: the lining on the inside and the basic body on the outside. The former is stained with bronze liquid without exception, and the latter is usually red and contains a large amount of course sand. The unearthed remains are all small fragments with a concave inside. The original shape is unknown, maybe round or oval, with the diameter smaller than that of the straw-mixed clay furnace. Most of the sandy clay furnaces are furnished with several linings, and of which bear traces of bronze liquid, a piece of evidence of their repeated repairs and use. The bronze liquid stained parts are grayish-green and are largely burnt into tiny-holed honeycomb-like zones. These furnaces belong also to the internal-combustion type. For example, H315:1 is furnished with two lining layers, both bearing slag of bronze melting. The basic body contains a large amount coarse sand. The surface of the lining is grayish-green, and the basic body, pink. Chord length about 7.8cm, chord height 0.3cm, diameter 47cm, and thickness 2.5cm.

2. The casting implements fall into models, molds and cores.

The unearthed remains of models total more than 100 fragments. They are largely clay in material, fine and compact in texture, and pink or light gray in color. Most of them are for casting accessories, such as animal heads, handles, ears and caps, a part for the main bodies of *ding*, *gui* food containers, *you* swing-handled pots and *gong* wine vessels, and some for spearheads. H683:1 is a model of crotched *ding*. It is broken, clay-made and pink-bodied with the surface blacked by smoking. In shape it is hollow and has an out-turned rim with standing ears. The decorations are animal-mask and inverted *kui*-dragon designs foiled with cloud-and-thunder pattern. The model measures about 9.4cm in belly height, 5.2cm in ear height and about 5.2cm in body thickness (Figure 4).

The mold fragments number approximately 70,000 pieces. They fall into two types. The first type is un-

even at the back, bears many finger impressions and has protruding stands in some cases. The second type is smooth-backed and has ridges on some finds. In number the former is far greater than the latter. Most of the unearthed molds were used in casting processes as is known from the breakage of their bodies, the wear of their corners and ridges, and the peeling-off of their designs. The parts of sectional molds are joined together by tenons and mortises. A few molds were smeared with fine red slurry for tightly joining their sections and preventing the fire from intrusion and bronze liquid from seepage. The casting surface of molds are usually black, which may have resulted from pine smoking with the purpose of improving the quality of casts and making them liable to take out from the molds. Some molds are stained with straw-mixed clay or bear remains of coarse sandy clay covering layers on the surface of the back. In type the molds for casting vessels account for an overwhelming majority, and the rest include those for weapons, tools and horse-and-chariot trappings. The vessel molds are largely for making round *ding*, *gu* cups and *jue* three-legged cups, and partly for *gui*, *you* and *lei* pots.

T1907:1 and 2 are two sections of a mold for casting crotched *ding*. They are roughly complete and have no tier-dividing lines. The body is made of clay mixed with a little fine sand and is livid with reddish zones. The face is decorated, below the mouth, with a circle of cicada pattern and, on the belly, with animal-mask design, which is filled with inverted *kui*-dragon design. The decorations are all clear and without foil on the ground. The back is uneven, bearing a lot of finger impressions. T1907:1 is furnished with a tenon on either of the joining facets that flank the vessel ear; its belly and leg, with four mortises on either of the left and right joining facets; and the middle of the inner joining facet of the leg, with a semi-circular mortise. The back bears some remains of sandy clay in finger impressions. T1907:2 is also furnished with tenons: two on the upper joining facet and four on either of the left and right ones. On the inner side of the leg, in the middle of the joining facet, a semi-circular mortise is made to form a round mortise with the semi-circular one on T1907:1. The two sections suggest that this type of mold is vertically divided into six sections with no division in the horizontal direction. Both finds measure 22cm in height, 4.4cm in ear height, and 1.4–3.3cm in thickness (Figure 5).

H683:3 is a mouth-and-belly mold-section for *gui* food containers. It is broken in the lower right corner. It has no tier-dividing lines and is pure-clay-made and livid with the back reddish in some zones. The upper joining facet is furnished with a tenon, and the lower one with a mortise; the left joining facet has three mortises, and the right one, two mortises. On the face are decorations: the zone below the rim bears *kui*-dragon design with the head and tail joined together; the belly, animal-mask motif with a cloud-and-thunder pattern as the ground; and the left and right sides are furnished with flanges. The back is smooth with shallow finger impressions. It can be inferred that this type of *gui* mold is vertically, along the flanges, divided into four sections, each of which is further divided into two sections with the dividing line running between the lower belly and the ring-foot. The specimen is 17.3cm high and about 5.6cm thick (Figure 6).

H570:1 and 2 are two rather complete sections of a *gu*-cup mold that can be tightly joined with each other. Either bears a tier-dividing line, and both the face and back are pure-clay-made and livid with reddish zones on the back. The face is decorated with animal-mask, strung-beads and bowstring patterns all remaining clear. The back is uneven with a number of finger impressions, and has two conic legs for either section. H570:1 is furnished with tenons: one on the upper joining facet, and three on either of the left and right ones. H570:2 has a tenon on the upper joining facet, three mortises on the left facet with the lower one broken, and two mortises on the right facet. H5704:1 is furnished on the right joining facet with three tenons that fit just the three mortises on the left facet of H5704:2. From the two model sections it can be inferred that this type of *gu*-cup mold is vertically divided into four sections, each of which horizontally, into two sections, with the dividing line running in the middle of the upper belly. Both finds are 5cm high and 1.8–2.2cm thick (Figure 7).

Cores. There are two types of cores: open and blind. The former cores number more than the latter ones, which occur seldom as they were kept in bronzes upon casting. These implements are lower in firing temperature, loose in texture, difficult to preserve and easy to confuse with burnt clay lumps, so only a small number of specimens, about 2000 pieces, were discerned in the fieldwork. For most of the finds, the outer side is looser and pink or light gray, while the inner part is rather compact and retain the original color of core clay, as well as traces of ramming. An overwhelming majority of the specimens belongs to the cores for vessels, such as *ding*, *lei*, *you*, *gu*, *jue* and dishes; and cores for spear-

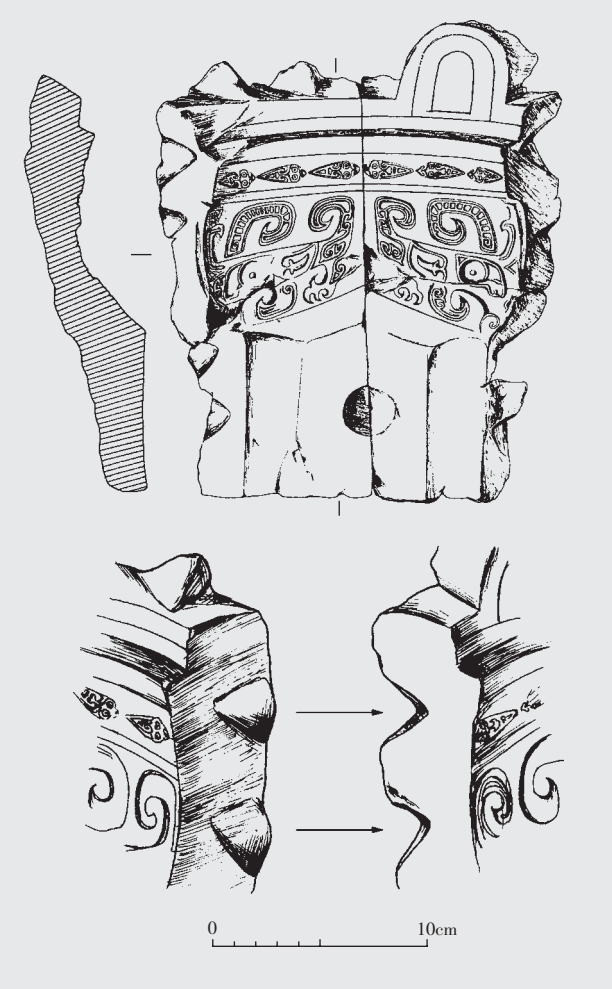

Figure 5. Pottery mold for crotched ding tripods (T1907:1 and 2)

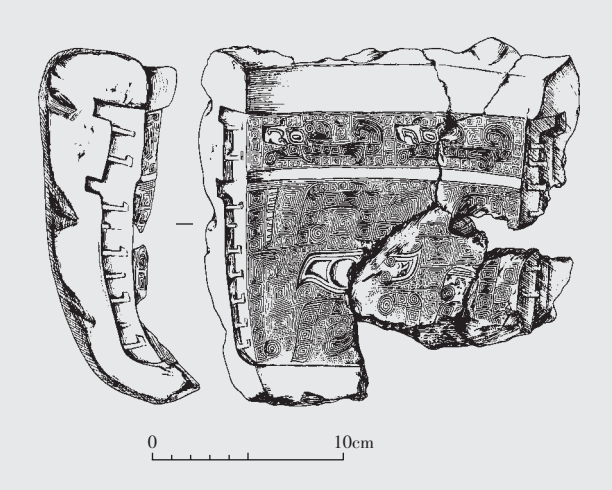

Figure 6. Pottery mold for gui food containers (H683:3)

heads occur in a small number. In addition, there are cores for button-shaped ornaments of horse-and-chariot trappings. All finds have no designs except for a few specimens.

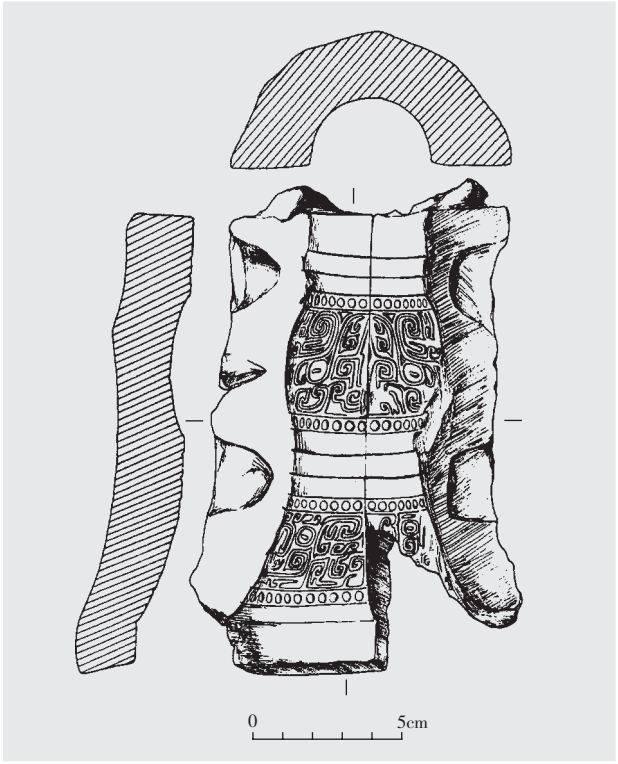

Figure 7. Pottery mold for gu cups (H570:1 and 2)

Figure 8. Ring-footed clay core for you swing-handled pots (T1906:1)

T1906:1 is a rather complete ring-footed core for *you* swing-handled pots. It is oval and pure-clay-made, with the body retaining the original color of the clay. A runner is made in the body and two tenons are symmetrically arranged on the wall. Two supports are symmetrically added to the ring-foot and soot is seen in this part and on the runner. The core measures 13.4cm in body height, 5cm in ring-foot height and 10.2–14.5cm in ring-foot diameter (Figure 8).

3. Retouching implements include polishing stones,

pottery-making paddles, small bronze knives, pointed bronze burins and bone awls.

4. Miscellany: pottery pipes and helmet-shaped objects, burnt clay lumps, charcoal, *etc*.

Conclusions

Through several times of excavation on the Xiaomintun site we have preliminarily understood that the bronze foundry-sites at Locus West and Locus Southeast of Xiaomintun and that at Locus South of the village reported in the present paper in the abroad sense belong to the same group of remains and can be called Shang period Xiaomintun bronze foundry-site group. It consists of an eastern area and a western one, which are located to the southeast of Xiaomintun and to the west and south of the village respectively, and occupy 40,000m^2 for the former and 10,000m^2 for the latter. Totaling over 50,000m^2, this is the largest Shang bronze foundry complex discovered so far in the Yinxu area, and is a large-scale high-grade bronze founding base of Shang period that produced mainly ritual vessels and may have been under the control of the House of Shang. The revealed bronze foundry remains go back to Yinxu III and IV except for a small part belonging to the second phase. It indicates that the Xiaomintun bronze foundries functioned and flourished mainly in Phases III and IV of the Yinxu culture. The discoveries enriched further our knowledge of the cultural contents of the western Yinxu area. The revealed mold clay preparing pit, pottery mold and model making places, model drying pits, large-sized bronzes casting places, sacrificial pits concerned with bronze founding activities, waste material pits and house-foundations, ash-pits, wells and cemeteries related to bronze foundry are extremely valuable to the reconstruction of the then bronze founding processes and scenes.

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