



Liangzhi-style bronze daggers excavated from the stone mounds in Muju (or Sangju)



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THE BRONZE CULTURE OF KOREA

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First published in the catalog of the special exhibition entitled
The Bronze Culture in Korea held at
the National Museum of Korea in 1992

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I THE INCIPIENT BRONZE CULTURE OF KOREA

The incipient bronze culture of Korea is traced back to the earliest bronze artifacts such as the bronze hand-knife and bronze button excavated from the second stratum of location no. 3, a historic site in Sinam-ri, Yongcheon-gun, Pyeonganbuk-do Province; tubular jade beads; and disk-shaped artifacts. The incipient Korean bronze culture should not be considered to be part of the Liaoning bronze dagger culture in many ways.

Numerous archaeological sites dating to the incipient Bronze Age have recently been found nationwide. The incipient Bronze Age shares some basic similarities with many previous Neolithic traditions such as settlement locations on riverside plains, dwelling floor plans, stone tools, pottery designs including perforation

motifs, and etc. The available evidence suggests that the incipient Bronze Age can be dated to from 1500 B.C. to 1000 B.C. although more careful examination is needed to confirm the estimation as a fact.

II THE LIAONING-TYPE BRONZE DAGGER CULTURE

The Liaoning-type bronze dagger culture represents the early bronze culture of Korea. It refers to the bronze culture that originated and developed in Liaoning Province in the northeast of China. It had first appeared in the beginning of the 10th century B.C. and lasted for several hundred years. The Liaoning-type bronze dagger culture differs slightly from region to region and can be classified into four major distinct cultural groups: the Upper Layer Culture of

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the Xiajiadian site, a Bronze Age archaeological culture in Liaoxi Province; the Liaoning-type bronze dagger culture in Liaotung Province (including Liaochung Province); Xituanshan culture in Jilin and Changchun Province in northeastern China; and finally Liaoning-type bronze dagger culture on the Korean Peninsula. All of these cultural groups, however, share the Liaoning-type bronze dagger as their unique cultural element. These daggers are called lute-shaped bronze daggers or bronze daggers with curvilinear edge because of their forms. They are also called Manchurian bronze daggers according to their geographical distribution.¹ Liaoning-type bronze daggers are characterized by S-shaped cutting edges and bodies and handles made from two separate pieces which are to be joined later. These characteristics differ greatly from Chinese-type bronze daggers or Ordos-type bronze daggers in northern China. The bronze culture of Liaoning Province represented mainly by daggers was introduced to the Korean Peninsula and spread all over the country, marking a full-fledged bronze culture.

It is not known exactly by what route Liaoning-type bronze dagger culture was introduced to the Korean Peninsula. It is hardly likely, however, that it spread southward through Pyeonganbuk-do Province. The distribution of Liaoning-type bronze dagger culture on the Korean Peninsula defies such a possibility. Besides, Misong-ri type pottery, which is closely related to Liaoning-type bronze daggers, has not yet been found in the south of Pyongyang. Most likely, Liaoning-type bronze dagger culture was introduced from the Liaotung Peninsula first to the northwestern and central parts of the Korean Peninsula via the west coast.

Liaoning-type bronze dagger culture in Korea is much simpler than that of the Liaoning Province. The only bronze weapons made were daggers, spears, and arrowheads and hand knives, axes, and chisels are the only bronze tools found so far. Horse equipment, bronze ornaments, or bronze ritual implements have not been discovered on the Korean Peninsula and bronze artifacts are rarely found together in large numbers. In many excavations, only bronze daggers have been discovered together with stone artifacts such as polished stone daggers, stone arrowheads, and stone axes.

01 ARCHAEOLOGICAL SITES

Liaoning-type bronze dagger culture is represented by sites of ancient tombs including stone cists, dolmens, and pit tombs; ritual sites where bronze implements were hoarded in stone mounds; and dwelling sites including shell mounds. These sites are distributed throughout the Korean Peninsula but are concentrated mainly in the west. Stone cists are further classified into several types. Each of the four walls of the stone cists excavated in Daea-ri in Baekcheon, Seonarm-ri in Sinpyeong, and Sangmae-ri in Sariwon-si² is a single stone slab

while the walls of tombs excavated in Songguk-ri, Buyeo were made of a number of stone slabs. Dolmens have been found in Usan-ri in Seungju, Deokchi-ri in Boseong, Cheokryang-dong in Yecheon, Undae-ri in Goheung, and Orim-dong in Yeosu, Jeollanam-do Province.³ Almost all of these dolmens are of the so-called southern style and are concentrated in Jeollanam-do Province. No wooden coffin tomb has yet definitively been identified in Korea but tombs in Gosan-ri in Jaeryeong and Geumgok-dong in Yeonan are presumed to be of this type.⁴ The hoarding sites of stone mounds are believed to have been used for rituals. Various bronze objects have been found beneath stone mounds created with stones that fell down from the mountains. Such stone mounds have been discovered in Yejeon-dong, Cheongdo, and Haepyeong-ri, Gaepung. Three bronze daggers attributed to Muju (or attributed to Sangju) were also found in such stone mounds.⁵

No Liaoning-type bronze dagger has reportedly been found in dwelling sites yet. However, a mold for fan-shaped bronze axes similar to those from Liaoning-type bronze dagger culture had been excavated from dwelling site no. 55-8, Songguk-ri, Buyeo. Comma-shaped jades excavated from Gonam-ri site, Anmyeondo,⁶ of which cultural elements are similar to those of Songguk-ri type culture, are very much like comma-shaped jade discovered along with a Liaoning-type bronze dagger from dolmen at Usan-ri, Seungju. Stone implements discovered from dolmen sites in Jeollanam-do Province, where Liaoning-type bronze daggers were excavated, are similar to those from a dwelling site at Songguk-ri. This shows that in the southwestern part of the Korean Peninsula, Songguk-ri type culture, Liaoning-type bronze dagger culture, and Southern style dolmens might be made by the same cultural group or at least they are closely related to each other. A large number of bronze artifacts were excavated in North Korea. A fan-shaped axe was found in a cave in Misong-ri, Pyonganbuk-do Province; fragments of a mold were discovered at a dwelling site in Yeongheung-eup (today's Geumya-eup), Hamgyeongnam-do Province;

and a bronze axe and bronze chisels were discovered at a dwelling site in Toseong-ri, Hamgyeongnam-do Province, which is of the same type of culture as the Yeongheung-eup site.⁷

02 ARTIFACTS

The bronze objects of the Incipient Bronze Age in Korea include a bronze hand-knife and bronze buttons. Bronze artifacts from Liaoning-type bronze dagger culture dated to the Early Bronze Age in Korea include weapons such as daggers, spearheads, and arrowheads and tools such as fan-shaped axes, chisels, and hand-knives. Jade ornaments such as comma-shaped jades, tubular jades, and round jades were also excavated from the sites of Liaoning-type bronze dagger culture. Few pottery vessels have been excavated, however, and they vary in type from region to region. However, it is presumed that the pottery vessels in the northern region were closely related to Misong-ri type pottery and top-shaped pottery, while those of the southern area were related to the Songguk-ri type pottery.

Of all bronze artifacts discovered thus far in Korea, Liaoning-type bronze daggers are the greatest in number. As many as 60 Liaoning-type bronze daggers have been found.⁸ As mentioned above, the dagger body and the handle were separately molded and the two parts were combined later. Plate 1 shows the typical shape of the dagger. On the upper part of the cutting edges is an angled protrusion on each side. On the spine is also a protrusion at the same location as that of the cutting edges. The body tapers towards the lower part and then widens again. The entire shape resembles a lute and such pieces are in fact called lute-shaped daggers. The tang is rather long and some daggers have grooves on the side. In some cases, the cutting edges do not have curves and the spine has no protrusion. The particular type of dagger with a groove on the tang has never been discovered in Liaoning or northern Korea. This type of dagger is only found in Chungcheong-do, Jeolla-do, and Gyeongsangnam-do provinces. Thus, the

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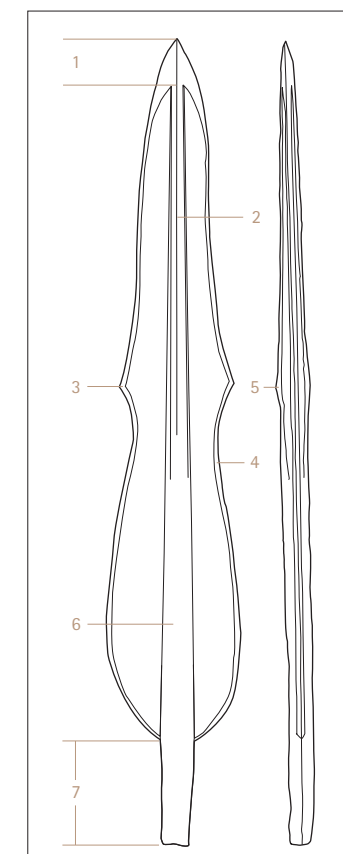
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(Plate 1)

Liaoning Bronze Dagger

- 1 Tip
- 2 Edge on spine
- 3 Shallow arc
- 4 Cutting edge
- 5 Protrusion
- 6 Spine
- 7 Tang

presence of daggers with grooves on tangs only in southern Korea indicates that they were of a unique style locally produced in the southern and central parts of the Korean Peninsula.

The T-shaped handle is typical of the Liaoning-type bronze dagger but very few daggers with T-shaped handles have been found in Korea. Only three such pieces were excavated in Hwanghae-do Province including one found in Gosan-ri, Jaeryeong and another reportedly in Sincheon.⁹ Presumably the reason for the scarcity is that many daggers had handles made of wood. A T-shaped dagger handle consists of a grip held by the hand and a pommel with pommel fittings. The bronze dagger handles produced in the earlier period in Liaoning Province have pommels with slightly raised ends and surfaces decorated with a meandering and triangular pattern. Those produced in the later period have pommels that droop down slightly at each end and usually bear a triangular serrate pattern on the surfaces. Those produced in the late period are decorated with patterns only on the lower part of the grip or have no decoration at all. The pommel of a handle attributed to Sincheon now in the collection of the National Museum of Korea is slightly raised and decorated with a serrate pattern. This piece is classified as type T II according to Jin Fengyi's classification and as type T I according to Akiyama Shingo's classification.¹⁰ Another handle presumably found in Sincheon (Kyoto University Dagger Handle No.4) has a pommel that bends down slightly and is decorated with a triangular serrate type pattern on the pommel and a linear pattern as well as successive □-shaped pattern only on some areas of the lower part of the grip. This piece is classified as type T VI by Jin Fengyi and T II by Akiyama Shingo. The T II type dagger handle has been discovered only in the areas of Liaoxi/Shenyang while the T VI type has been discovered mostly in the Liaotung area.

The pommel fittings of bronze daggers served as decorations on the pommel and added extra momentum when stabbing. They were made of iron ore or bronze. Some were made of clay, which was shaped and baked. In Korea, no pommel fitting has been found together with a Liaoning-type bronze dagger. Pommel fittings have been discovered along with polished stone daggers or Korean-type bronze daggers.

Compared with Liaoning-type bronze daggers, there are relatively few Liaoning-type bronze spearheads. Unlike bronze daggers, spearheads have sockets instead of a tang. In Liaoning Province, bronze spearheads have been found only in the Jicheng district. Although bronze spearheads with sockets were discovered in Liaoxi, the holes made into the sockets are shallow and the cross sections of the sockets are generally lozenge-shaped. Thus, they are classified as bronze daggers with curvilinear cutting edge and socket. In Korea, a total of fourteen

bronze spearheads including molds have been found.¹¹ Some of them look like those excavated from Jicheng. Bronze spearheads excavated in Korea are classified into three types. Type I has a slender body and the socket is relatively long, like those excavated in Jeongnyang-dong, Yecheon and those attributed to Boryeong. Type II has a wide body, like those excavated in Yeongheung-eup (today's Geumya-eup). Type III has a less curvilinear body, like those excavated in Pyeongyang. The Type I spearhead is similar to those excavated from stone cists in Xingxing Shao, Yongji, Jicheng, and Type II is similar to those excavated from a site in Changsheshan, Jilin.¹² However, nearly all Type I spearheads have been excavated south of the peninsula's central west region. For this reason, the Type I likely shows regional characteristics, together with bronze daggers with grooves on the tang. Bronze spearheads have also been discovered at a Liaoning-type bronze dagger culture site in Liaoxi¹³ but the blades are willow leaf-shaped and a loop is attached to the side of the socket, very unlike those discovered in Korea.

Far fewer bronze arrowheads have been found than bronze daggers or bronze spearheads. In Korea, only one bronze arrowhead has so far been found, together with a Liaoning-type bronze dagger, in the stone cist tomb in Daea-ri, Baekcheon. Viewed in cross-section, it presents lozenge. At the center of the arrowhead is a curvature with grooves to the right and left side. This type of notched, tanged arrowhead with two wings was discovered in the stone cist site in Sangmae-ri, Sariwon-si. It is clear that the sites such as Daea-ri and Sangmae-ri both belong to the same Liaoning-type bronze dagger culture because at each site were found stone cists and polished stone arrowheads with the same double-stepped tangs. Stone arrowheads and bronze arrowheads of the double-stepped tang type were excavated together from the Northern-type dolmen in Yaksa-dong, Euncheon.¹⁴ Single-stepped tang type stone arrowheads and bronze arrowheads with tangs were excavated together from the stone cists in Honghyeon-ri, Baekcheon,¹⁵ the Southern-type dolmens in Mugye-ri, Gimhae,¹⁶ and

Southern-type dolmen No. 15 in Deokchi-ri, Boseong. Bronze arrowheads found at the dolmens in Yaksa-dong are assumed to date from the same culture as those excavated from the stone cist in Daea-ri, given the type of stone arrowhead and location of the site. Bronze arrowheads excavated from the sites in Honghyeon-ri, Mugye-ri, and Deokchi-ri are of the same type as stone arrowheads excavated together with Liaoning-type bronze daggers in the southern region, although the type of these stone arrowheads came from the later period. Given that bronze arrowheads from Deokchi-ri were a reused product made by grinding shards of Liaoning-type bronze daggers, the bronze arrowheads from Deokchi-ri should belong to the later stage of Liaoning-type bronze dagger culture. Two of the bronze arrowheads from Mugye-ri have grooves but the tangs are stepped and of a flat rectangular shape. They cannot, therefore, be classified as the same type as the arrowhead with two wings, discovered from Deokchi-ri. It is possible that they were made by processing bronze daggers or spearhead shards, like the arrowheads excavated in Deokchi-ri.

One bronze arrowhead was discovered at a dwelling site in Ponam-dong, Gangneung-si.¹⁷ It is of a unique shape. Viewed in cross-section, it is octagonal. At the center of the arrowhead is a curvature with grooves to the right and left side. It is a two-stepped tanged arrowhead with two wings but it is not notched. Among artifacts excavated together were polished stone daggers with two-stepped handles, stone arrowheads without tangs, and stone arrowheads with two-stepped tangs. These artifacts indicate that the bronze arrowhead is likely related to the Liaoning-type bronze dagger culture.

Chinese-type bronze arrowheads from ancient times were found separately on the Korean Peninsula. Noteworthy is that most of them were discovered in the Gyeongju area, the southeastern part of the Korean Peninsula—the part of Korea that is farthest from China. Of these, three pieces are tanged arrowheads with two wings. Two of the three pieces (one is Umehara

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material 1569 and the other is in the collection of Tenri Sankokan Museum)¹⁸ are of the same type as the arrowhead with two wings found at a West-Zhou-period dwelling site in Jangjiapo, Shanxi Province.¹⁹ As this type of bronze arrowhead has been discovered at sites of the Upper Layer Culture of the Xiajiadian site in Liaoxi Region together with Liaoning-type bronze daggers, these Chinese-type bronze arrowheads are clearly important toward understanding the introduction of Liaoning-type bronze dagger culture into Korea in addition to typical Liaoning-type bronze daggers discovered at Cheongdo near Gyeongju.

A tanged arrowhead with two wings excavated in Sindang-ri, Gyeongju (Umehara material 3401) is of the same type as a bronze arrowhead excavated from a site in Shangcunling, Shanxian from the early Spring and Autumn Period (Chunqiu Period).²⁰ It is presumed that the bronze arrowheads with two-stepped tang (Umehara material 1569-1/1872/2248/3401) discovered at this site were all from the Spring and Autumn Period of China and are thought to have been introduced to Korea during the Liaoning-type bronze dagger culture period.

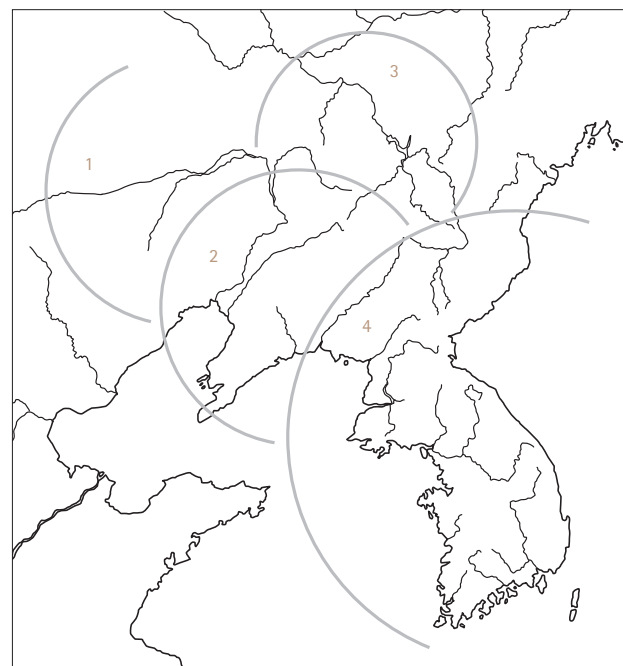
Relatively few bronze tools have been found. There are two types of bronze axes: fan-shaped bronze axes and rectangular-shaped bronze axes. Fan-shaped axes were found at sites including Misong-ri, Uiju. Molds for bronze axes have been found in Yeongheung-eup and Songguk-ri, Buyeo. A bronze axe has been found at the Toseong-ri site, Pyeonganbuk-do Province, but it is uncertain whether it is fan-shaped. Fan-shaped axes are small—most are about five centimeters long. However, one of those found in Yeongheung-eup, Geumya is longer than 10 centimeters and bears an incised triangular pattern on the head. In the Liaoning Province, more were found in the Liaotung region than the Liaoxi region. Fan-shaped bronze axes have been discovered in stone cists of early Korean-type bronze dagger culture. Only one rectangular bronze axe was found in Gosan-ri, Jaeryeong, together with a Liaoning-type bronze dagger that has a T-shaped dagger handle.

Two bronze chisels were found on the Korean Peninsula. One was made by processing a tang fragment of a Liaoning-type bronze dagger and was found in a stone cist in Songguk-ri, Buyeo. The other was found at dwelling site no. 8, Geumtan-ri, Pyeongyang. The one from Geumtan-ri²¹ is thin and flat without a socket. Bronze chisels with sockets like those found in the Liaoning region have not yet been discovered in Korea.

One bronze hand-knife was discovered in Korea. It was excavated from the Yongheung-ri site in Gaecheon. It has three protuberances at the handle. In the Liaoning region, hand-knives of this type have been discovered mostly at sites related to the Upper Layer Culture of the Xiajiadian site. It was found together

with a Liaoning-type bronze dagger, a jade pendant, and a stone axe. The body of the bronze dagger narrows towards the cutting edge, is short in length, and has an edge on the spine.

Personal ornaments made of comma-shaped jades, tubular jades and round jades have been found. Comma-shaped jades or gogok have a hole at one end and most have been found in burials such as stone cists and dolmens. Most of the comma-shaped jades discovered from Liaoning-type bronze dagger culture sites are made of amazonite and can be divided into two types: those in the shape of a semi-circle with a large head and a small, straight tail slightly trimmed down toward the edges and those of smaller sizes and varied shapes. Jade pieces of the first type were found in a stone cist in Songguk-ri and in dolmens in Usan-ri, Seungju. Jades of the second type were discovered in dolmens in Usan-ri, Dolmen no. 17 at Hwangseok-ri, Jewon (formerly Jecheon); Stone cist at district IV-1, 3 in Sinchon-ri, Changwon; and a shell mound in Gonam-ri, Anmyeondo Island. Those discovered in Gonam-ri, Anmyeondo Island are reported to be jadeite. Comma-shaped jades excavated from Yongheung-ri, Gaecheon are semicircular. In Liaoning Province, jades of this shape were discovered at the Chengchiawatzu burial, Shenyang²² and were



used for necklaces together with tubular jade beads. We cannot know exactly what types of personal ornaments such comma-shaped jades were used for. However, it is thought that they were used for earrings because larger ones have generally been discovered in pairs around the area where the ears of the buried must have been at the time of burial. Such examples were found in stone cist no. 4 at Daepyeong-ri, Bukchang and in another stone cist in Chopo-ri, Hampyeong (a Korean-type bronze dagger culture site).²³ It is also possible that comma-shaped jades were used for long necklaces threaded with tubular jade beads.

A tubular jade bead or gwanok is a long, pipe-shaped jade bead commonly strung on a necklace. In many cases, tubular jade beads came in a set with comma-shaped beads. Most tubular jade beads are made of Egyptian jasper, but some are made of tuff or clay. They can be classified as either large or small. The large ones are longer than three centimeters and wider than one centimeter. Such jade beads were found in a stone cist in Songguk-ri, Honghyeon-ri, Baekcheon, Daepyeong-ri, Bukchang. Small ones were discovered in a dwelling pit, a jar coffin in Songguk-ri, and a burial (presumably dolmen) in Mugye-ri in Gimhae, a dolmen from Usan-ri in Seungju including other dolmens from Bonggye-dong in Yecheon, Cheokryang-dong in Yecheon, and Pyeongyeo-dong in Yecheon. Another type of jade bead is smaller than one centimeter in diameter and is called so-ok. Most beads of this type are round and they were found from the sites in not only Usan-ri in Seungju but also Bonggye-dong, Cheokryang-dong, and Pyeongyeo-

(Plate 2)
Liaoning Bronze Dagger Culture

- 1 the Upper Layer Culture of the Xiajiadian site
- 2 Liaotung Liaoning-type Bronze Dagger Culture
- 3 Xituanshan Culture
- 4 Korean Liaoning-type Bronze Dagger Culture

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dong in Yeochon including Orim-dong in Yeosu. Most of these tiny jade beads are found in Southern-type dolmens in Jeollanam-do Province. Tubular jade beads and these tiny round jade beads are presumed to have been used for long necklaces.

No pottery has been discovered together with Liaoning-type bronze daggers from burial sites in Korea, unlike burial sites in Liaoning Province. This may be due to differences in burial customs between the two regions. Misong-ri type pottery was discovered along with a fan-shaped bronze axe²⁴ at the Misong-ri cave site in Uiju, Pyonganbuk-do Province. Misong-ri type pottery was also discovered at a Liaoning-type bronze dagger culture site in Jilin Province, China, suggesting that Liaoning-type bronze dagger culture was related to Misong-ri type pottery. Top-shaped pottery, small jars with handles and perforated rims, and Songguk-ri type pottery are thought to have been closely related, given the form of stone arrowheads excavated together with pottery from stone cists in Pyeongannam-do and Hwanghae-do provinces, top-shaped pottery and small jars with handles and perforated rims from the site in Yeongheung-eup, Hamgyeongnam-do Province, and Songguk-ri type pottery from a dwelling sites in Songguk-ri south of the central part of the Korean Peninsula.

In summary, early bronze culture in Korea basically originated from Liaoning-type bronze dagger culture in today's Liaoning Province, China. It can be said that Korean bronze culture comprises a part of Liaoning-type bronze dagger culture. Liaoning-type bronze dagger culture is divided into four sub-cultures: Liaoxi (the Upper Layer Culture of the Xiajiadian site), Liaotung (Liaotung Liaoning-type bronze dagger culture), Jicheng (Xituanshan Culture), and Korean Peninsula (Korean Liaoning-type bronze dagger culture). Thus, Korea is one of the four largest regions of Liaoning-type bronze dagger culture. The discoveries of more than 78 Liaoning-type bronze daggers, T-shaped dagger handles, and Liaoning-type bronze axes that are indicative artifacts of Liaoning-type bronze dagger culture at some 63 sites in Korea prove that the Korean Peninsula was more important than the Liaotung region, not to mention Jicheng. Of the four regions, Korea was the second most important after the Upper Layer Culture of the Xiajiadian site. Until recently, the Korean Peninsula had generally been considered a peripheral region of Liaoning-type bronze dagger culture but this view should be revised, separate from the discussion of the origin of the culture.

Liaoning-type bronze dagger culture in Korea had the same features as Liaoning-type bronze dagger culture in other regions. This may simply be due to the geographical location. As it is a peninsula, new cultural influences were continually being transmitted into Korea from the north. The type of spearhead of the bronze mold discovered at the site in Yeongheung-eup was also discovered in Jicheng, China. The hand-knives with serrate handles like the one found at the

Yongheung-ri site were also found in Liaoxi and are from the Upper Layer Culture of the Xiajiadian site. The fan-shaped axe is a characteristic of Liaotung Province. Liaoning-type bronze dagger culture represented by the Chengchiawatzu site, Shenyang is similar to the early Korean-type Liaoning bronze dagger culture. The most common types of tombs of each region, that is, box-shaped stone coffin, stone-lined tombs, stone cists, and pit tombs are all found in Korea. However, dolmens are a characteristic tomb type that is only found in Korean Liaoning-type bronze dagger culture. Also, sites of stone mounds on hills have been discovered only in Korean Liaoning-type bronze dagger culture thus far. Another difference is that no indication of horse-riding or chariot fixtures has yet been found in Korea. Broken and whole bronze daggers, processed bronze chisels, and bronze axes were buried as votive objects in Korea. These patterns represent one of the features of Korean Liaoning-type bronze dagger culture, which cannot be found in neighboring regions.

Bronze daggers with grooves on the tangs have not been found in the cultural sphere of other Liaoning-type bronze culture. In Korea, they are distributed only in the central western part and southern part of the country, and the distribution is similar to that of Songguk-ri type dwelling sites. Furthermore, most of them have been found in Southern-type dolmens, which are similar to Songguk-ri type culture in southern region. A shard of a tanged bronze dagger with grooves was also found in North Kyushu in Japan suggesting that this type of bronze dagger might have been introduced to Japan at the height of Songguk-ri type culture that is represented by Songguk-ri type dwelling sites, Southern-type dolmens, and rice farming. There has been a great deal of debate as to who was the major player of Liaoning-type bronze dagger culture. The Dongho, Sanyung, Donggi, Yemaek, Gojoseon, Yemaek Toungus, and other tribes have been mentioned as a possible candidate. Because the features of archaeological sites and artifacts (especially pottery) in each region show great differences, it is difficult from an archaeological

point of view to determine the origin of Liaoning-type bronze dagger culture.

Many hypotheses have been proposed about the beginning date of Liaoning-type bronze dagger culture in Korea. A Liaoning-type bronze dagger excavated at the site of Yejeon-dong, Cheongdo is 34.8 centimeters long and has a heavy wide blade and very short tip. Compared with other daggers, the protrusion is oriented toward the tip and the lower part of the blade displays a rather circular shape. These features are exactly the same as those of pieces from the early stage of Liaoning-type bronze dagger culture in Liaoning Province (bronze dagger with curved edge and tang Type B) and this Korean dagger is of an ancient style close to the bronze daggers of the Shihertaiyingtzu Assemblage and Shuangfang Assemblage. If there is any difference at all, the Korean dagger has no edge on the spine. However, given that the edge on the spine moved to the lower part of the cutting edge in the latter period bronze daggers, there is no reason at all to believe that Korean daggers are of the later period. As mentioned earlier, given the tanged arrowheads with two wings from the end of West Zhou period to Spring and Autumn Period excavated at Gyeongju nearby Cheongdo, I think that Korean Liaoning-type bronze dagger culture could have begun as early as the first half of the Spring and Autumn Period, which is the 8th century B.C. Stone arrowheads were found together with bronze daggers of atypical shapes that are similar to the bronze daggers discovered in Daea-ri and Seonam-ri. These stone arrowheads are of similar appearance as those of Okseok-ri and Gyoha-ri in Paju.²⁵ The fact that these arrowheads date from 9th to the 7th century B.C. lends further credence to the argument. It is also difficult to determine exactly when the latest period of Liaoning-type bronze dagger culture ended in Korea. Nevertheless, the discovery of small polished stone daggers with grooves on the tangs and stone daggers with single-stepped handles at dolmens in Jeollanam-do Province, where Liaoning-type bronze daggers have been discovered in sites dating to the latter half of the

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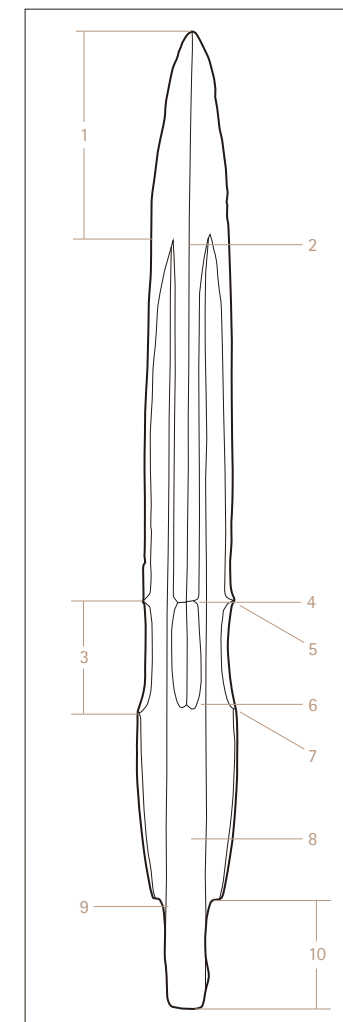
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(Plate 3)
Korean style Bronze Dagger

- 1 Tip
- 2 Edge on Spine
- 3 Shallow arc
- 4 2nd protrusion
- 5 2nd indentation
- 6 1st indentation
- 7 1st protrusion
- 8 Spine
- 9 Base
- 10 Tang

late Jomon period to the early Yayoi period in Japan,²⁶ suggests that Liaoning-type bronze dagger culture in Korea continued until around the 4th century B.C. A Liaoning-type bronze dagger excavated at the Gosan-ri site can be seen as a type of the latest period and, because Chinese-type bronze daggers excavated along with it can be seen as imitated ones, Liaoning-type bronze dagger culture may have actually continued into the 3rd century B.C. in Korea.

III KOREAN-TYPE BRONZE DAGGER CULTURE

If Liaoning-type bronze dagger culture shaped the early bronze culture of Korea, Korean-type bronze dagger culture represents the late bronze culture of Korea. It exhibits unique typology and styles especially in bronze daggers, spearheads, halberds, multi-knobbed mirrors with geometric designs (a bronze mirror with knobs on the back), and ritual objects. It is a derivation from the Liaoning-type bronze dagger culture, which originated in Liaoning Province in China. But Korean-type bronze dagger culture developed its distinctive styles as to be considered uniquely Korean by incorporating the bronze cultures of Siberia and Scythia in addition to those of northeastern China. It is believed that Korean-type dagger culture crossed to Japan and shaped the bronze culture of Japan. It ultimately declined with the introduction of the iron culture from China.

01 KOREAN-TYPE BRONZE DAGGER CULTURE AND LIAONING-TYPE BRONZE DAGGER CULTURE

As many scholars have indicated, the origin of Korean-type dagger culture can be clearly traced back to Liaoning-type bronze dagger culture by comparing artifacts from the two cultures.²⁷ Korean-type bronze daggers and typical Liaoning-type bronze daggers share some features in common. First, both are about the same size. The body and handle were separately made from different pieces and joined together later. Second, the lower section of cutting edges on both daggers has grooves that trace a shallow arc. Third, the dagger handles are T-shaped and the handles have pommel fittings. Bronze daggers with such features are only found in Korean-type bronze daggers and Liaoning-type bronze daggers. Bronze axes, chisels, multi-knobbed mirrors, and stone molds similar to corresponding objects discovered at the excavated sites related to Liaoning-type bronze dagger culture have been recovered from the archaeological sites related to Korean-type bronze dagger culture. The trumpet-shaped bronze implement and the shoulder-armor-shaped bronze implement and other features have been commonly discovered in sites from both cultures as well.

We cannot, nonetheless, find evidence at any archaeological site that suggests that Korean-type bronze dagger culture indeed developed from Liaoning-type bronze dagger culture. What is more, the structures of stone cists of the two cultures show some differences. In the southern regions, a number of Liaoning-type bronze daggers but very few Korean-type bronze daggers have been discovered in Southern type dolmens. Not a single Liaoning-type bronze dagger has been discovered along with bronze mirrors with coarse lines on the back. There have also been no reports of later Liaoning-type bronze daggers being found along with Korean-type bronze daggers. If Liaoning-type bronze dagger culture and Korean-type bronze dagger culture had been correlated in their successive development, both the number and quality of bronze artifacts should have increased in the later period.

It seems that Korean-type bronze dagger culture was more closely related to Liaoning-type bronze dagger culture in Liaoning Province in China, rather than Liaoning-type bronze dagger culture in the Korean Peninsula. It is believed that in the latter period of Liaoning-type bronze dagger culture in Korea, the culture in Liaozhong Province around Shenyang deviated from Liaoning-type bronze dagger culture and was then introduced to Korea.

02 CLASSIFICATION OF KOREAN-TYPE BRONZE DAGGER CULTURE

Korean-type bronze dagger culture can be divided into three phases: Phase I, Phase II, and Phase III.²⁸ Phase I is the period when Korean-type dagger culture came into being. Due to the spread of Liaoning-type bronze dagger culture, Korean-type bronze daggers, bronze mirrors with coarse linear design, shield-shaped bronze implements, split-bamboo-shaped bronze implements, and trumpet-shaped implements began to appear in Korea. The influence of Liaoning-type bronze dagger culture was dominant during the formative period of Korean-type bronze dagger culture, so much so that

the shapes of bronze objects from Liaoning-type bronze dagger culture and those in Korea were almost the same. However, elements of the northern culture were also introduced to Korea and incorporated into Korean culture.

Only burial sites have been discovered from the first phase. The stone cists represent this phase and they are characterized by the use of trimmed stones covered with stone layers on top. Given the structure of the tombs, it is unlikely that they are directly related to the burial system of Liaoning-type bronze dagger culture.

The one type of bronze artifact that best represents the first phase is the Korean-type bronze dagger. The Korean-type bronze dagger has a central edge on the spine that runs only from the tip to the first indentation and a blade that widens toward its lower section, and it traces a gentle curve from the base of the hilt to the lower blade. Although the archetype of the Korean-type bronze dagger is the Liaoning-type bronze dagger, it can be considered unique to Korea because the shape originated in Korea and its distribution was not related to the northeast region of China. The shape is basically the same as the Liaoning-type bronze dagger. The greatest difference between the two, however, is that the body of the Korean-type dagger is straighter and sharper. Both the shallow arcs of blades and the indentations on spine are more clearly defined on the Korean-type bronze dagger.

Dagger handles have not been discovered because they were made of wood, which obviously does not survive under most conditions. Most pommel fittings are made of stone but there are also many made of iron. The pommel fittings have various shapes, such as a cocoon, cross, and cross with protrusions. Of these, the type in the shape of a cross with protrusions is unique to Korea.²⁹ It is believed that the archetype of the cross with protrusions was a cocoon-shaped pommel fitting of Liaoning-type bronze dagger culture. Except for bronze daggers, no other bronze weapons have been discovered from Phase I. Bronze objects, except for weaponry from

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this period, include ritual implements such as shield-shaped and split-bamboo-shaped bronze implements, tools such as fan-shaped axes, and chisels. The pottery from this phase was pottery with clay stripes and long-necked black-burnished jars. Arrowheads without tangs and ornamental jade and tiny jade beads from this period have been discovered as well.

Very few bronze mirrors with coarse linear designs have been found together with Korean-type bronze daggers. They were discovered from Goejeong-dong site in Daejeon, Dongseo-ri site in Yesan, and Namseong-ri in Asan. In addition, there is another example of a ritual bronze implement attributed to Jeollabuk-do Province. Early bronze mirrors with coarse linear designs produced in Liaoning Province have double-lined Z-shaped designs. In Korea, there are bronze mirrors with coarse linear designs and with double-lined designs, which have been attributed to Pyeongyang, Seongcheon, and Chungcheongnam-do Province.³⁰ It is uncertain whether they were produced during the same period as Korean bronze daggers. Based on what has been found in Liaoning Province, they are thought to have been produced together with Liaoning-type bronze daggers. However, the fact that not a single mirror with coarse lines on the back had been discovered along with Liaoning-type bronze daggers suggests that those with double-lined designs were produced along with Korean-type bronze daggers. Besides mirrors of this type, bronze mirrors excavated from Yeonhwa-ri in Buyeo, Goejyeong-dong in Daejeon, and Dongseo-ri in Yesan generally belong to Phase I.

Of heterotypic bronze vessels, trumpet-shaped and shoulder-armor-shaped objects had been excavated at the Chengchiawatzu Site, Shenyang.³¹ It is thought that these bronze objects were used to decorate horse equipment, purses for hand-knives, and gimlets in Liaoning Province. Similar objects found in Korea, however, are conjectured to be ritual objects because the designs of a deer, hand, and falcon engraved on these heterotypic bronze implements seem closely related with Siberian shamanism. It is also possible that one object can be used for different purposes from region to region in different contexts³² and the fact that Bronze Age horse equipment has never been discovered in Korea at the time further suggests the ritualistic purpose of these objects. That these bronze implements appeared as ritual objects in Korean-type bronze dagger culture is thought to be related to the social conditions in Korea of those who accommodated the culture.

Fan-shaped bronze axes were discovered from Namseong-ri site in Asan, Yeoui-dong site in Jeonju, and Jeongbong-ri site in Singye. They were small and may be considered adzes rather than axes. They can also be considered artifacts typical of Phase I. Of pottery from this period, long-necked black-burnished jars have been discovered at Liaoning-type bronze dagger culture sites in Liaoning,

so they are naturally thought to have been related. Pottery with clay stripes, however, has been found south of the central region on the Korean Peninsula, which is too closely related with Korean-type bronze dagger culture to be separate. Stone arrowheads without tangs and with a hexagonal cross section began to appear in this period. Some arrowheads of this type have been found along with bronze mirrors with coarse lines on the back, archaic Korean-type bronze daggers, and archaic ritual implements. These stone arrowheads are as closely related to Korean-type bronze dagger culture along with pottery with clay stripes. On the other hand, except for examples such as multi-knobbed mirrors with coarse linear designs attributed to Seongcheon and Pyeongyang, a multi-knobbed mirror from Soa-ri in Yeonan, and a mold for mirrors from Maengsan, no site has yielded a multi-knobbed mirror in the northern province during Phase I. As discussed above, the sites such as Seongcheon and Pyeongyang can be related to Liaoning-type bronze dagger culture.

Korean-type bronze dagger culture developed during Phase II. Breaking from the influence of Liaoning-type bronze dagger culture and with new northern cultural elements introduced to Korea, bronze ritual implements that came in sets of bronze bells began to appear. Due to rapid changes including advancement in casting technology, the design of bronze mirrors became more refined. The coarse linear design was replaced with fine linear designs and bronze bells began to be used as ritual implements. The change in the second phase occurred rather suddenly and this rapid change cannot be attributed merely to technological development or changes in designs. Such changes could be possible only through contact with a new bronze culture. The only conclusion we can make is that a new northern culture was introduced to Korea. The impact of this new bronze culture can be found to some degree in split-bamboo-shaped bronze implements and the designs of shield-shaped bronze implements.

Some designs with northern cultural elements

continued to appear on ritual objects from Phase II. In particular, the sunlight design that symbolizes the sun (that is believed to have been a northern cultural element) was used on round bronze implements with designs, bronze pole-tops, and bronze mirrors with fine linear designs since Phase II.³³ Given the designs on bronze ritual objects such as deer, hand, falcons, sun cross, and hunting scene, these objects are presumed to have been shamanistic tools used for rituals related to agriculture, hunting, and shamanism. The owners and users of these kinds of ritual objects are believed to have been in charge of ritual services and political affairs (i.e. they had political power and supervised religious rituals). At this time, following the spread of northern culture, the Culture of Central China began to influence Korea and early type bronze spearheads, bronze halberds, and bronze engravers began to appear. All of these bronze implements were so unique that they could be considered Korean type, suggesting that the influence of the Culture of Central China was not very strong. In North Korea, cast iron axes, which are believed to have been introduced from China, appear in some places but were not common.

The burial practices of Phase II were almost the same as the one in Phase I. However, as seen from the example in Daegok-ri, Hwasun, it is believed that wood coffin tombs with stone layers were built in the southern region.³⁴ Although artifacts related to Korean-type bronze daggers have been found at some dolmen burial sites, we do not yet have enough examples.

During Phase II, breaking away from the elements of the Liaoning-type bronze dagger culture, a new bronze dagger culture unique to Korea began to develop. The body and shoulder of the Korean-type bronze dagger became straighter than that of the Liaoning-type bronze dagger. Bronze daggers identified as Type II were produced along with Type I (Dr. Yun Mu-byeong's classification system). Bronze spearheads began to appear in this period. Most of them are short, only around 20 centimeters long. Some spearheads with

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no ears have holes and raised bands around the bottom of the sockets. Bronze spearheads excavated in Jeongbong-ri in Singye, Dunpo-ri in Asan, Tanbang-dong in Daejeon, and Gubong-ri in Buyeo are representative of this period (Type I spearheads by Dr. Yun Mu-byeong's classification). Although they are believed to have been designed after Chinese spearheads, certain details such as the shape of the tip, spine, and the notch are different. Given that Liaoning-type bronze spearheads had been used in the preceding phase (Phase I), there is a need for further investigation and discussion on the development of shapes. During the period from the end of Phase II through Phase III, the spearheads were elongated. Some spearheads discovered at archaeological sites in Chopo-ri, Hampyeong and Ehwa-dong, Hamheung are longer than 20 centimeters. Bronze halberds also began to appear in Phase II and became a representative artifact of this period. It can also be said that the Korean halberd was based on the Liaoxi bronze halberd but, as is the case with bronze spearheads, each has its own very unique features. The bronze halberd is so unique that it can rightly be called the Korean-type bronze halberd. It shows one aspect of how Korean-type bronze dagger culture developed. There are two types of Korean halberds: one with an angle on the back ridge and one without an angle on the vein. It is, however, unclear which one was developed earlier.³⁵

Bronze artifacts that have been excavated along with weaponry include bronze mirrors with fine linear geometric designs, bronze bells, bronze axes with shoulder, bronze engravers, and bronze chisels. Bronze mirrors with fine linear geometric designs began to appear during Phase II. The designs are exquisite and the geometric compositions are outstanding. The surfaces of many mirrors are divided into three decorated sections and most of the mirrors have two knobs. Compared with bronze mirrors with coarse lines on the back from the first phase, mirrors from Phase II are larger and the knobs are standardized. The engraved designs are so minute that it is difficult to determine how the designs were made. The outer section is bordered with sun-rayed design, which suggests that the mirror was used as a ritual object symbolizing the sun.³⁶ Entering the latter half of Phase II, the design composition became simplified and smaller mirrors began to appear.³⁷ Bronze bells by this time came into existence as can be seen in the cases of pole-top, two-jingle, eight-jingle, and hybrids of two-jingle types. Bronze bells excavated in Nonsan and Hwasun are exquisitely made and mirrors excavated with them were among the most exquisite of any ever found indicating that the production technique of bronze objects reached its apex in Phase II.

Bronze axes produced in this period are based on the fan-shaped axes of the first phase. The area from the socket to the body is a curved shoulder. The body is an elongated rectangle. In fact, this kind of piece is more like an adze than

an axe. Large bronze axes were rectangular or shaped like a bronze axe with the blades on both sides, and they were all discovered at Phase II archaeological sites. The artifacts found in Sunan suggest that straight rectangular axes were being produced continually into Phase III.³⁸

A bronze engraver is a carving tool. In China, bronze engravers have been discovered in the former territory of Chu from the Warring States Period (403-221 B.C.). Bronze engravers excavated in Korea are similar to those of China in shape but the relationship between the two is not clearly understood. However, in China, engravers with raised lines on the back ridge dating as far back as the Spring and Autumn Period have been discovered but most such engravers that have been discovered are from the Warring States Period. Therefore, Korean bronze engravers are thought to be closely related to engravers from the Warring States Period. Many engravers from that period have are triangular or shaped like convex-lenses in section.³⁹

Chisels dating to Phase II have been discovered in a greater quantity than those of Phase I. There are two types of chisels. One has a thick and long socket and a raised surface between the socket and body. The other has a socket linked to the body without a raised part in between. Many chisels are found as part of a set that includes a bronze axe and an engraver. Gimlets that are triangular in section also seem to be tools. Gimlets were discovered at the Izwestov Site and in a mold excavated in Yeongam, Korea.⁴⁰ Molds for gimlets had been also found in Liaoning Province, confirming that they were influenced by Liaoning-type bronze dagger culture. Accordingly, gimlets are believed to have been produced in Phase I.

Around the end of Phase II (end of the 3rd century B.C.~early 2nd century B.C.), the iron culture of the Warring States, especially that of the Yen, was introduced to Korea. Cast iron axes and iron chisels began to be produced, marking Korea's entry into the Early Iron Age. Iron axes similar in form to the cast iron

axes of the Warring States Period have been found in Yongyeon-dong, Sejuk-ri in the northern region and Songsan-ri, Seoksan-ri, and Ihwa-dong where Korean-type bronze daggers had been excavated.⁴¹ Such iron artifacts were also found from Soso-ri, Dangjin, and Hapsong-ri, Buyeo in the southern part of the Korean-type bronze dagger culture.

In Phase III, Korean-type bronze dagger culture declined. Bronze weaponry was made less and less functional and instead became increasingly ceremonial. The tang became shorter, the tip part became longer, or decoration was incised on the groove. This was entirely due to the spread of iron culture that was introduced at the end of Phase II. The introduction of more utilitarian iron implements changed the concept of bronze tools. Afterwards, due to influence from the Chinese Han Dynasty, Chinese Han-style mirrors replaced the bronze mirrors with fine linear designs. The shift from bronze to iron accelerated and, when production of iron objects began in full-scale, bronze production barely survived. It is believed that Korean-type bronze dagger culture finally came to an end by the Late Han period.

The burial practices in Phase III are assumed to have been dominated by wood coffin tombs, although we cannot confirm this.⁴²

Although bronze daggers identified as Type I and II according to Dr. Yun Mu-byeong's classification system were both produced in the third phase, more of the latter were made. Towards the end of the period, daggers with veins split up to the tang and multiple grooves were produced. Most pommel fittings were made of bronze. Spearheads became longer compared to those from the second phase and semi-circular ears were attached to the sides of the socket. Besides, spearheads with more than two grooves incised on the cutting edges or decorated with designs on the surface of the socket began to appear in this phase. Although there were short spearheads, they all had ring-shaped ears or incision of multiple grooves even if they had rivet

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holes. As for bronze halberds, those from the second phase and third phase show little difference. However, those with grooves decorated with coarse lines were excavated from Sincheon-dong in Daegu, Gujeong-dong and Ipsil-ri in Gyeongju and those with narrower and shorter butts and longer tips can be regarded as characteristic of the third phase.

Besides horse equipment, Chinese Han-type artifacts (mirrors and small coins), small bells, and bronze rings have been excavated along with weaponry. Furthermore, axes, spearheads, and daggers made of iron from this phase have been discovered. Different types of horse equipment had been produced in the northwestern and southern parts of the Korean Peninsula. In the North Korean region, various types including chariot axle ornaments, Z-shaped implements, upright cylindrical ornaments, carriage ornaments, axle fittings, and parasol caps had been excavated while in South Korea, only a few carriage ornaments and parasol caps have been discovered.⁴³ This can be explained by the fact that the western part of North Korea is geographically close to China, allowing the northern part of the Korean Peninsula to accommodate Chinese culture more easily. Along with establishment of Nangnang (Lolang) by Chinese Han Dynasty, the iron culture of Han China began to spread rapidly southward, replacing Korean-type bronze dagger culture.

As can be seen from the examples of sites at Joyang-dong in Gyeongju and Yangdong-ri in Gimhae, Korean-type bronze dagger culture remained in part until the early Proto-Three Kingdoms Period. However, the fact that the Proto-Three Kingdoms culture succeeded Korean-type bronze dagger culture has only symbolic meaning because of such archaeological patterns.

IV PRODUCTION TECHNOLOGY OF KOREAN BRONZE OBJECTS

Numerous pieces of bronze objects including daggers and axes had been produced throughout the Bronze Age in Korea. Determining how bronze pieces were made is very difficult because the processes involved were complex. It involved mining, smelting, making of molds, casting, and repairing and each of these processes was done by specialists. The most difficult and important tasks of all were the smelting of ores to be used to make metal alloys and casting. The technologies of mining raw ore and smelting are not yet known. Only the composition of bronze implements and some of the production and repair technologies are understood. This chapter addresses the production technology of Korean bronze objects based on the findings of composition analysis and casting of bronze as well as the traces of repairs on bronze artifacts.

Bronze ware	Element (%)											Total
	Cu	Sn	Pb	Zn	Fe	Sb	Nb	As	Bi	Co	Ni	
01 Korean style dagger	78.2	17.12	4.32		0.05							99.69
02 Korean style dagger from Suncheon	73.14	19.77	6.39									99.3
03 Korean style dagger from Suncheon	70.3	14.84	14.22									99.36
04 Korean style dagger from Pyeongyang	78.09	14.3	8.39									100.78
05 Korean style dagger from Pyeongyang	75.94	15.08	9.45									100.47
06 Chisel from Songsan-ri, Bongsan	40.55	18.3	7.5	24.5	1.05							91.9
07 Small bells from Ipsil-ri, Gyeongju	59.18	29.99	7.72	1.09	0.57	0.9	0.55					100.0
08 bamboo-shaped implement from Goehyeong-dong, Daejeon	56.2	19.9	7.8	0.006	0.2							84.106
09 Personal ornament from Chodo, Najin	53.93	22.3	5.11	13.7	1.29							100.0
10 Conical ornament from Eoeun-dong, Yeongcheon	77.56	15.71	6.08	0.11	0.09	0.25		0.38				100.18
11 Mirror from Namseong-ri, Asan	39.5	27.3	11.4	0.05	0.7							78.95
12 Mirror with fine linear design from Songsan-ri, Bongsan	42.19	26.7	5.56	7.36	1.05							82.86
13 Dagger from Yongje-ri, Iksan	75.3	17.1	6.8		0.001	0.001			0.01			99.212
14 Personal ornament from Chodo, Najin	83.4	7.2	8.0	0.05	0.12	0.85		0.3	0.08			100.0
15 Ingot from Chodo, Najin	67.23	25.0	7.5	0.05	0.14	0.24			0.05	0.002		100.212
16 Disk-shaped vessel from Toseong-ri, Bukcheong	57.7	25.0	7.0	1.0	2.0	2.0		5.0	0.3			100.0
17 Dagger from Seokdang-ri, Sincheon	83.33	10.0	6.4		0.09	0.01			0.05	0.05	0.065	99.995
18 Dagger from Gangan-ri, Onseong	96.96	0.25	2.0	0.009	0.55	0.09			0.02	0.05	0.07	99.999
19 Dagger from Sincheon	83.6	12.0	4.0		0.13	0.15			0.08		0.04	100.0
20 Dagger from Cheonju-ri, Hwangju	84.7	8.0	5.2		0.1	0.35		1.4	0.08	0.08	0.09	100.0
21 Dagger from Ilgok-ri, Baekcheon	88.88	11.0			0.025	0.04		0.045		0.01		100.0
22 Dagger from Hwangju	78.87	8.5	11.0		0.01	0.19		1.2	0.07	0.025	0.035	99.9
23 Dagger from Yeontan	92.64	4.0	3.1		0.11	0.01			0.02	0.06	0.06	100.0
24 Dagger from Sariwon-si	76.47	12.0	7.0		3.0	1.2			0.025	0.1	0.1	99.895
25 Dagger from Hamju	73.05	20.0	5.0	0.06	0.9	0.2			0.04	0.05	0.1	99.4
26 Dagger from Joyang-ri, Hamju	67.28	25.0	7.0		0.09	0.15			0.04	0.02	0.02	99.6
27 Dagger from Hasedong-ri, Bukcheong	67.02	25.0	7.0	0.04	0.45	0.3			0.05	0.05	0.09	100.0
28 Dagger from Nagyang no. 7	77.64	8.0	11.0					1.0	0.04	0.07	0.1	98.0
29 Dagger from Sincheon-gun	82.69	13.5	3.5	0.01	0.1	0.17			0.009		0.02	99.999

(Table)
Chemical Composition of Bronze Implements

01 COMPOSITION OF KOREAN BRONZE OBJECTS

Mining of ores is the first step of production of bronze objects. Copper and tin are the essential alloys of bronze. Lead and zinc are also added to improve the quality of the finished bronze products. It is, therefore,

believed that metal workers looked for smithsonite, cerusite, and galena in addition to malachite and cassiterite.⁴⁴ The Augmented Survey of the Geography of Korea (Dongguk yeoji seungnam), compiled in 1481, states that of five metals (gold, silver, copper, iron, and lead), copper was produced in the largest volume⁴⁵ indicating that it was mined at many locations

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throughout the country. Several ancient lead, tin, and zinc mines have been found suggesting that these metals were not in short supply at the time. However, no mines dating to the prehistoric era have yet been found leaving us know nothing of the mining technology of the Korean Bronze Age.

In order to make an alloy, it is believed that each of the raw ores was smelted and the metals were then mixed at an appropriate ratio. This is supported by the results of composition analysis of weaponry, such as Korean bronze daggers, which show a consistent ratio of each component. The properties of bronze ware vary according to the ratio of alloys. It tends to be most durable when the tin content is 19%. If the tin content is over 19%, it becomes brittle. The metal composition ratios of bronze artifacts discovered in Korea are shown in the table below.⁴⁶

Composition analysis of bronze objects shows that the Korean-type bronze daggers are composed of 79.2% copper, 13.4% tin, and 6.8% lead on average. Compared with daggers, the content of copper in ritual objects, bells, and personal ornaments is much lower, only 59.65% while the content of tin is much higher at 22.12%. The lead content is about the same at 7.35%. The content of zinc varies from very little to as much as 24%.

The ratio of the different metals was adjusted to increase the hardness, improve resistance to corrosion, and allow for easier casting as needed depending on the type of products being made. For example, bronze daggers have higher copper content and ritual objects like mirrors have higher tin content to reflect more light. Clearly, the Korean metal workers understood the principles of alloying metals.

Compared with Chinese bronze objects, Korean bronze objects have lower copper content and higher tin and lead content. Noteworthy is Korean bronze with zinc. Zinc makes molten bronze more fluid giving the finished bronze product the same texture, hardness, and corrosion resistance as those with less tin.⁴⁷ Korea had more abundant deposits of zinc than tin or lead, so bronze with zinc was naturally produced in Korea at an earlier stage. A bronze axe discovered in Songsan-ri has a very high zinc content of 24.5%. Personal ornaments discovered in Chodo and a bronze mirror with a fine linear design found in Songsan-ri also have high content of zinc. This suggests that the lineage of the Korean bronze objects is different from Chinese bronze objects that have almost no zinc. Without artificial manipulation, it is impossible to have a content of additive elements in bronze of more than 1.0%. It indicates that the method of alloying to improve the quality of bronze had already been developed by the prehistoric era.⁴⁸

02 CRUCIBLES

Extraction of metal from ore and meltdown of metal requires a crucible. In Korea, a crucible from the prehistoric era has not yet been found but a number of crucibles from the Three Kingdoms and later periods have been found. In other countries, earthen crucibles⁴⁹ were in from the Bronze Age and continued to be used with little change until the early Iron Age. It is thought that the crucibles used in the Bronze Age on the Korean Peninsula were very similar to those of the Three Kingdoms and later periods. If we assume that the same type of crucible was used in the Bronze Age as in the Iron Age, the crucible was made of clay and had a capacity of about 50-360cc.⁵⁰ Clay was mixed with sand and the wall and bottom of the crucible were much thicker than those of an ordinary pot.

There were five types of crucibles in Korea.⁵¹ Type I is shaped like a bowl with a round bottom. It has a spout. Its mouth is relatively wide in comparison with its height. Type II has a bottom resembling a round cup. It also has a spout. Type III is conical with a pointed bottom and does not have a spout. Type IV is similar to Type III, except that the pointed bottom has a protrusion and it has a spout. Type V is like a cup with a flat bottom. These crucibles are small in size and similar in shape to those of ancient Western civilizations and their periphery such as Great Britain and Sweden. Compared with Korean crucibles, those from ancient China are shaped like a

bucket or a so-called upside down helmet with a narrow flat bottom and the lower part of the body widening towards the upper part. Many Chinese crucibles are large compared to the Korean ones.⁵²

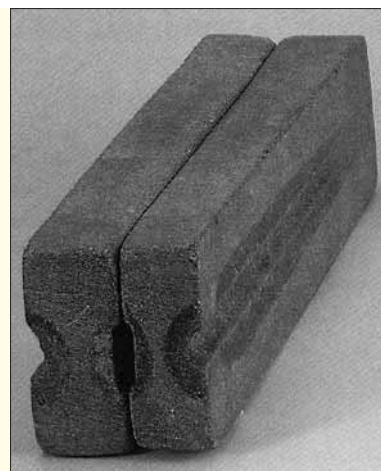
03 MOLDS

Bronze implements were cast in a mold. Numerous molds have been found all across the Korean Peninsula proving that bronze ware was locally made. Most molds are made of soapstone. Only one made of schist was reported to have been found at a Korean Bronze Age dwelling site at Songguk-ri.⁵³ It is believed that molds made of clay were widely used but none have been found in Korea. A mold was produced by flattening the surface of the material until it was planar and then carving the desired shape into it. Most molds are believed to have been made of two pieces in the same shape that were fitted together before the molten liquid was poured into them.

Most molds were made of soapstone because it was soft enough to carve the desired shapes into it; could be used repeatedly because it did not crack during casting; and gave the cast object a smooth surface. Almost no soapstone molds have been found in China, except in regions related to Liaoning-type bronze dagger culture such as Chifeng, Liaoyang, Luta, Tangshan in northeast China. Most Chinese molds were made of clay. In Japan, most molds were made of sandstone. A



(Plate 4)
Two dagger molds fitted together from
Chobu-ri, Yongin



(Plate 5)
Two molds fitted together
from Yeongam

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mold made of clay should have a mouth for pouring in the molten liquid and a hole that allowed gas to escape and it could be used only once. A mold made of sandstone was not durable enough to be used more than several times and often needed to be repaired for the next casting. A soapstone mold does not need a gas hole and is extremely resistant to heat. Therefore, the soapstone mold can be used over and over again.⁵⁴ Nonetheless, no two bronze products that were made with exactly the same mold have been discovered in Korea. Therefore, we have no way of knowing for certain if a multiple number of bronze pieces were actually cast from the same mold.

We can often see a line on the side of a two-piece mold, which was intended to make sure that the two pieces joined together precisely front and back and left and right. Several molds which clearly have a sprue were found including a mold for a bronze mirror with a coarse linear design found in Maengsan and a mold for a bronze dagger found in Jangcheon-ri. As can be seen from examples attributed to Yeongam, given the traces of heating in fire, molds for bronze daggers, axes, halberds, and spearheads have oval clay sprue towards the tang or socket, which were larger than the tang and socket so that molten liquid copper could be poured in easily.⁵⁵ Bronze implements such as axes, spearheads, and bells that have sockets or a hollow part inside need an inner mold (core) made of clay or sand. The inner mold should not touch the outer mold in order not to cause any deformity during casting. Thus, when making a socket, the inner mold was made wider towards the top (toward the socket) and the lower part (the cutting edge) was made in a narrow ladder shape. The sprue was made narrower towards the bottom to prevent the inner mold from falling down as we can see in molds attributed to Yeongam. Also, on the one side of the sprue, two small grooves were made to help fix the inner cast in place.

In order to fix the inner mold in place, a rivet was commonly used. This rivet linked and locked the inner and outer molds. Since the molten liquid could not be poured into this portion, a hole was made. Square holes on the body of a bell with clapper or mid-section of a two-jingle type bell are traces of such locking rivets. A hole on a bronze bell was intended to give the bell a certain sound but it was also meant to hold a locking rivet. The inner mold was made of clay or sand so that it could be scraped out completely after casting. However, as can be seen from a bamboo-hat-shaped bronze artifact excavated from Angye-ri in Gyeongju, only the socket part of the inner cast was scraped out and the hat part was left without being scraped out.⁵⁶ It is likely that this was meant to maintain the proper weight while reducing the amount of raw material. The inner mold made of sand was found, as can be seen in the inside of the mid-section of a two-jingle type bell excavated in Hwasun. That the mid-section was unnecessarily made hollow suggests that the makers wanted to save raw material.

If we look at the carved surfaces of molds, we can see that for some, both the front and back sides were used and for others, a multiple number of forms were carved on one side so that several products could be made simultaneously. As seen in the examples of fish hooks and buttons, two forms were carved on top and bottom pieces of molds, which were, then, aligned, so that two objects could be made at the same time.

In addition to stone molds, clay molds are thought to have been widely used. Given that no stone molds for bronze mirrors with fine linear designs have been discovered and that the designs on mirrors were repaired as can be seen in bronze mirrors excavated in Yangyang,⁵⁷ it is highly likely that the molds for the mirrors were made of clay. Among bronze objects, bronze bells such as a pole-top, two-jingle, or eight-jingle types all come in pairs but judging from the size and design, not a single pair was made from the same mold. That a pair of bronze bells, which were difficult to make, was produced separately indicates that they were made from a clay mold rather than a stone mold. Some bronze implements are thought to have been produced with a lost-wax (cire perdue) cast although a clay mold was used. Many ritual ornaments are believed to have been made with lost-wax cast because the surfaces of split-bamboo-shaped implements and shield-shaped implements used as ritual objects are curved and decorated with designs that are hard to engrave in a stone mold and there are no seams on semi-circular knobs with suspending rings.



(Plate 6)
Trace of solder on a dagger handle from Sincheon

Designs were engraved directly on the mold or the original model. In some cases, it is believed that designs were stamped. As can be seen in the pair of pole-top style bells excavated in Jukdong-ri, Gyeongju, the decorative patterns are exactly the same. Even the deformed patterns show no variation.⁵⁸ Carved and incised designs on ritual implements are presumed to have been stamped.⁵⁹ Traces of stamp use for decorative designs can also be found in T-shaped dagger handles from Liaoning-type bronze dagger culture.⁶⁰

04 REPAIR

If a mold was not properly made due to poor molding technique during the casting process or some kind of defect, the end product would also be defective. Among other things, the patterns might not show clearly: the product might have a hole in it because the molten bronze liquid failed to reach some part of the mold cavity or some part of the product might be deformed. The product would also be more likely to break when used. In such cases, the products were repaired. Engraving of patterns or soldering were two means of repair. Only one piece for which the decorative design was redone has been found: a Liaoning-type bronze dagger handle attributed to Sincheon, Hwanghae-do Province.⁶¹ Although the soldered part was polished and engraved in order to match surrounding designs and obscure the boundaries, the repair work done on this piece is still noticeable. A bronze mirror with a fine linear design found in Yangyang, Gangwon-do Province had been made with a mold that had itself been repaired before



(Plate 7)
Trace of solder on a bamboo-hat-shaped bronze artifact from Heukgyori

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casting, rather than re-engraving the pattern on the mirror.

The most common means of repair was soldering. It was done to fill in holes or to repair breakage of almost every type of bronze product such as daggers, mirrors, axle ornaments, and rings. Soldering was done throughout the Bronze Age and continued into the Goryeo and the early Joseon periods in Korea. In order to apply solder, the back side was plastered with clay and the area around the spot that required soldering was bordered with clay. Then molten bronze was poured in to fill in the crack or hole before the surface was polished.⁶²

There were four basic soldering techniques.

The first method was to solder only holes or broken spots. On the less noticeable side, the spot to be repaired was soldered a little bit wider so that the new bronze would adhere more strongly to the original piece. When the spot to be repaired was on the less noticeable back side the area surrounding the spot was also soldered for further reinforcement. The second method involved cutting the edge of one side of the part to be soldered in a serrate pattern and then applying solder as seen in bronze rings and bronze halberds. This method was not used for holes but to solder a missing part when one side of a bronze vessel was broken off. The serrated edge reinforced the soldered part by preventing it from sliding off. The third method was employed in repairing bronze rings. Soldering was done in the small semicircular ear form, which was also intended to prevent the reattached piece from sliding off. The fourth method involved carving out tiny holes on either side of the broken spot and linking the two holes before soldering to reconnect the broken part.

Of the four methods, the third method was commonly used for Japanese bronze ware. We can also see that the severed parts of a split-bamboo-shaped bronze implement excavated in Namseong-ri and the trumpet-shaped bronze object excavated in Dongseo-ri were repaired in this way. Although not a repair technique, a rivet was used to join the separated parts.

NOTES

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Liaoning bronze dagger was named after the region as are the cases with Chinese-style bronze daggers, Ordos-style bronze daggers, and Korean type bronze daggers.

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