

Chu-style bronze vessels from the Chengdu Plain during the Eastern Zhou period: insights into Shu–Chu relations from a material circulation perspective

Zhen Yang

Sichuan Provincial Institute of Cultural Relics and Archaeology, Chengdu, China

Xiaotian Zeng

University of Science and Technology Beijing

Xiaohan Zhang

Shandong University

Gang Qiao

csmotuo@126.com

Sichuan Provincial Institute of Cultural Relics and Archaeology, Chengdu, China

Research Article

Keywords: Eastern Zhou period, Chengdu Plain, material circulation, Chu-style bronze vessels, Shu–Chu relations

Posted Date: October 19th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10495347/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Additional Declarations: No competing interests reported.

Chu-style bronze vessels from the Chengdu Plain during the Eastern Zhou period: insights into Shu – Chu relations from a material circulation perspective

Zhen Yang^{1†*}, Xiaotian Zeng^{2,3†}, Xiaohan Zhang⁴, Gang Qiao^{1*},

¹ Sichuan Provincial Institute of Cultural Relics and Archaeology, Chengdu, China

² Institute for Cultural Heritage and History of Science and Technology, University of Science and Technology Beijing, Beijing 100083, China

³ Key Laboratory of Materials Archaeology and Conservation, Ministry of Education, China

⁴ School of Archaeology, Shandong University, Jinan, China

† These authors contributed equally and share first authorship.

* Corresponding authors: Gang Qiao, Zhen Yang

Zhen Yang: yangz95@qq.com; Xiaotian Zeng: kellyzeng0603@163.com

Xiaohan Zhang: kzgsx60662@gmail.com; Gang Qiao: csmotuo@126.com

Abstract

Cultural interaction between the states of Shu and Chu during the Eastern Zhou period was a key issue for understanding the political landscape and social transformations of Southwest China from the late Western Zhou-early Eastern Zhou transition to the eve of Qin unification. This study examines Chu-style bronze vessels excavated from the Chengdu Plain, dating from the mid-Spring and Autumn to the late Warring States periods. Integrating archaeological typology with lead isotope analysis, the research investigates vessel form and decoration as well as patterns of material circulation, systematically tracing the technological characteristics and developmental trajectories of Chu-style bronzes in Shu, and interpreting the dynamics of Shu-Chu interactions. Results indicate a distinct chronological pattern in Eastern Zhou Shu-Chu bronze exchanges: during the mid to late Spring and Autumn and early Warring States periods, vessels were primarily imported from Chu, with a small number of locally imitated vessels from Shu. By the mid-Warring States period, intensified geopolitical interactions, including the Shu campaigns against Chu, facilitated widespread local imitation. In the late Warring States period, the number of Chu-style vessels sharply declined following Qin's conquest of Shu. Beyond serving as evidence of material circulation, bronze vessels reflect multilayered interactions encompassing technological transmission, institutional emulation, and cultural identification. Throughout this process, Chu cultural influence dominated Shu's bronze ritual practices and technical standards, while the Shu adapted their resource strategies in response to external pressures, gradually establishing an indigenous bronze craft system with distinct regional characteristics.

Keywords Eastern Zhou period · Chengdu Plain · material circulation · Chu-style bronze vessels · Shu–Chu relations

Introduction

During the process of Qin unification, the strategic positions of Shu and Chu were of vital importance. As recorded in the *Records of the Annals of Huayang Country*, “If Qin gains Shu, it gains Chu; once Chu falls, the entire realm is unified” (Chang 2010). The dynamics of Shu–Chu relations shaped the political landscape from the Eastern Zhou to the Qin period.

In terms of spatial and temporal scope, the territory of Shu state was centered on the Chengdu Plain. The Late Shu culture is generally considered to have emerged around the mid-Spring and Autumn period (ca. 600 BC) and to have persisted until after Qin’s conquest of Shu (221 BC). Chu’s territory was centered on the middle Yangtze region (Fig. 1), with Chu culture emerging in the late Western Zhou (ca. 877 BC) (Wang 2003). Its characteristic styles became increasingly prominent around the mid-Spring and Autumn period and continued to develop until the late Warring States period (221 BC). Accordingly, archaeological interactions between Late Shu culture and Chu culture primarily occurred from the mid-Spring and Autumn to the late Warring States period, with the upper chronological limit potentially extending back to the late Western Zhou period.

For a long time, research on the Shu-Chu relationship has been extensive, focusing primarily on the influence of Chu culture on the formation of Ba-Shu cultural identity. Previous studies have examined multiple aspects, including ritual and utilitarian practices, funerary customs, ethnogenesis, among others (Huang 2006, 2007; Zhu 2010; Peng 2024). Some scholars have also paid attention to the spread of Shu culture into Chu territories (Wang 1991; Yang 1993).

However, existing research has largely concentrated on the identification of cultural elements and the chronological framing of their development, while paying comparatively less attention to the underlying mechanisms of cultural interaction between the two regions. In terms of material evidence, bronze vessels constitute an important medium for investigating Shu–Chu cultural exchanges. Their research significance lies in their dual functions: first, as high-status ritual objects, bronze vessels reflect the aesthetic preferences and institutional norms of their makers and users, serving as key markers of cultural identity; second, as a valuable metal resource, the extraction, smelting, and circulation of bronze involved complex social networks and economic activities, thereby revealing regional interaction at the material level. Through this medium, it is possible not only to trace the pathways of cultural transmission but also to reconstruct the patterns of technological transfer and resource allocation.

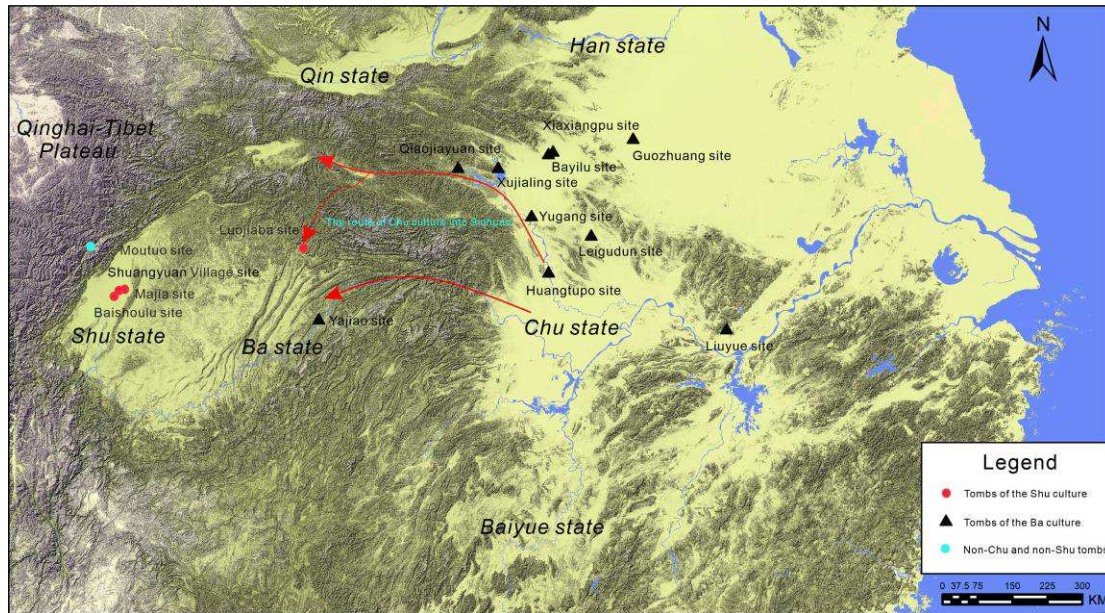


Fig. 1 Schematic map showing the distribution of the Shu and Chu states and the locations of major cemeteries.

Previous studies have examined bronze production in the Eastern Zhou period in the Ba-Shu region, focusing primarily on tin-plating and alloying techniques. Research on tin-plating has largely targeted bronze weapons, suggesting that the Ba-Shu region, while adopting hot tin-plating (Emei Region Cultural Relics Management Office and Institute for the History of Natural Science 1986, He 1987), also drew on the partial tin-plating styles of weapons from the middle and lower Yangtze region (Zeng 1993), thereby developing a partial tin-plating technique characteristic of the Ba-Shu region (Sun et al. 2008).

Studies of alloying techniques have included bronze weapons, tools, and vessels, with compositional analyses primarily focused on copper and tin, while lead content shows considerable variation. These variations are generally considered as functionally related to the type of object (Zeng 1992; Zeng 1987). Based on existing analytical data, Zhou (Zhou 2021) roughly divided the development of alloying techniques of copper objects in the Chengdu Plain during the Shang-Zhou period into three stages, noting that copper objects in the second and third stages generally exhibited high tin and low lead content. Regarding technological interaction and provenance of bronzes, Li et al. (Li et al. 2018, 2020a, 2020b, 2021; Li 2020) conducted analyses of alloy composition, trace elements, and lead isotope ratios on bronzes excavated from sites and cemeteries in Chengdu, including Jinsha, Xinghelu, Baishoulou, and Moutuo in Mao County. His study suggested that bronze production in the Chengdu Plain primarily relied on local copper sources, while the provenance of lead remains uncertain but shows a clear chronological trend. Early lead sources were relatively uniform, whereas during the Warring States period, the composition of lead changed: the main lead source matched that of samples from the Zeng and Chu states, some lead was sourced from the Central Plains, and a minor portion may have been sourced from local western Sichuan. Subsequently, Wang et al. (2022b, 2024, 2025) carried out typological and lead isotope studies on bronze Yue and Jin from the Shuangyuan Village cemetery, revealing the complexity of lead sources in Late Shu culture. During the mid-Warring States period, the composition of lead in Shu bronzes changed significantly, and while locally styled

objects differed in lead isotope characteristics from Chu-style vessels, the latter were more likely to have been imported directly from Chu state. In discussions of bronze production between the Han and Huai valleys and the Ba-Shu region, Zhang (Zhang 2020) suggested that Ba-Shu metal resources may have experienced delays in adoption and possible recycling of existing resources, noting that lead used in the mid-to-late Warring States period in the Chengdu Plain was consistent with mainstream Central Plains lead sources. Previous studies have recognized the close relationship between bronze technology and metal resources in Shu during the Eastern Zhou and those of the middle and lower Yangtze region, and have considered vessels of different styles in their analyses. However, they have largely overlooked mixed-style objects combining local and non-local features. These mixed-style vessels were primarily locally cast in imitation. Although their forms reflect Chu-style characteristics, it was likely the metal, rather than the finished objects, that was imported, so they are essentially local products. Moreover, there is still debate over the delineation of key chronological markers, as the dating of burials does not necessarily correspond to the production dates of the objects. The lag in appearance of externally-styled vessels may cause chronological discrepancies. Bronze objects in Shu were often used over extended periods, so the date of production and the date of deposition represent two different temporal scales (Song 2004).

Overall, research on Chu-style bronzes excavated in Shu state has tended to focus on chronological framing and the analysis of cultural elements (Zhu 2010). While mixed-style bronzes¹ have been noted, there has been little detailed differentiation between locally cast or modified objects with external stylistic features prior to scientific analyses. Furthermore, there has been comparatively limited discussion of the Shu–Chu interactions and their historical development, and little integration of stylistic evolution with changes in material sources. In response, this study draws on recent archaeological discoveries and scientific analyses to examine Chu-style bronze vessels from Shu state. By considering both form and decoration as well as material composition, it aims to illuminate the appearance of cultural exchange between Shu and Chu during the Eastern Zhou period and to explore its broader historical context.

Analysis of Form and Decoration

Bai has pointed out that “different places of production give rise to different product types and regional production styles; places of production shape product styles, while circulation shapes product distributions. The provenance of archaeological objects with different stylistic features can therefore be inferred from their spatial distribution (Bai 2016).” In other words, product style has a certain indicative value for determining provenance, and form and decoration are key criteria for identifying such style. According to differences in the production style and provenance of bronze vessels, they can be broadly divided into two categories: imported objects and imitations.

Imported objects

Among the Eastern Zhou bronze vessels unearthed in Shu, some are highly consistent in both form and decorative motifs with comparable vessels from Chu. These objects can therefore be inferred to have been cast in Chu and circulated to Shu as “imported objects”. Since some of them were probably modified after entering Shu, they can be further divided into two subcategories: unmodified imports

¹ This study draws a distinction between two terms, “Chu-style bronzes” (Chu shi qingtongqi) and “Chu-lineage bronzes” (Chu xi qingtongqi). In the former, *shi* (“style”) refers to formal style and denotes the stylistic type of Chu bronzes; in the latter, *xi* (“system, lineage”) denotes bronzes produced in the Chu heartland and in areas under Chu cultural influence. Except where otherwise specified, this study uses the term “Chu-style” throughout.

and modified objects.

Unmodified imports

Objects in this category have close parallels in Chu in terms of both vessel form and decorative style, and they appear to have retained their original form after circulating into Shu. The earliest example currently known is the tripod *Zhan* from Shuangyuan Village M15:14 in Qingbaijiang, dated to the late Spring and Autumn period. It has a relatively deep belly, a lid with a circular knob, paired ears on the belly, and low feet (Fig. 2:1). Its overall form and decoration are similar to bronze *Zhan* commonly found in Chu state.

From the end of the Spring and Autumn period to the early Warring States period, Chu-style bronze ritual vessels in Shu increased substantially. They have been found in tombs including Huacheng Residential Quarter M1 in Chengdu (Chengdu Archaeological Team 1996), Baihuatan Middle School M10 in Chengdu (Sichuan Museum 1976), Jinsha Lane M2 in Chengdu (Chengdu Municipal Cultural Relics and Archaeology Work Team 1997), Shiren Residential Quarter M8 in Chengdu (Chengdu Municipal Institute of Cultural Relics and Archaeology and Chengdu Municipal Cultural Relics and Archaeology Work Team 2002), and Shuangyuan Village M46 in Qingbaijiang (Chengdu Cultural Relics and Archaeology Institute 2023). The vessel types include flat-bottomed basins, *Ding* with side ears and a straight lip serving as tenon, globular *Dui*, rimless *Fu*, *Ding* with a banded mouth, and *Hu* with a ring foot (Fig. 2:2, 3, 5). Their stylistic features are consistent with Chu-style bronze ritual vessels, and their fine workmanship suggests that they should be identified as imported objects.

By the middle Warring States period, the number of such objects had declined markedly. One example is the *Yi* from Shuangyuan Village M154, waist-pit no. 3, in Qingbaijiang.² Fish and tree motifs are incised on the spout and interior surface, while two intertwined water snakes are incised on the base (Fig. 2:4). Its overall form and decorative arrangement closely resemble the bronze *Yi* from Yugang M173:4 in Xiangyang (Xiangyang Municipal Institute of Cultural Relics and Archaeology 2011), which is dated to the early phase of the middle Warring States period. The “Shao zhi si *Ding*” unearthed from the wooden-chamber tomb at Majia, Xindu, bears a Chu-style inscription (Fig. 2:6), and is clearly an imported object. A group of bronze ritual vessels of different styles from Yangzishan M172 in Chengdu should also be regarded as imported objects. Among them, the *Ding* with attached handles and hoof-shaped feet is broadly comparable in form to similar vessels from the tomb of the Chu king at Shouxian (Fig. 2:7).

Overall, Chu-style bronze vessels identified as imported objects began to appear in Shu from the middle and late Spring and Autumn period. Their number increased sharply from the end of the Spring and Autumn period to the early Warring States period, but declined significantly from the middle Warring States period onward.

Modified objects

Objects in this category are, overall, imported objects, but they show local modifications in certain parts. These modifications can be divided into two types: modifications of form and modifications of motifs.

The *Ding* with a banded mouth from Shuangyuan Village M11:1 in Qingbaijiang has a basin-shaped body, two symmetrical upright ring knobs on the belly, and is decorated with *yunlei* motifs,

² The original excavation report dated this tomb to the late phase of the early Warring States period. On the basis of artefacts such as the pointed-bottomed *zhan*, it is re-dated here to the early phase of the middle Warring States period.

inverted-triangle motifs, and other patterns (Fig. 2:8). These features are almost identical to the belly form and decoration of the *Zhan* from Huangtupo M31:4 in Zhongxiang (Jingzhou Museum and Zhongxiang Museum 2009). However, the handles and three feet show clear traces of soldering. Mold clay remains visible inside the vessel, and the mold seams on the feet were not polished away. This is inconsistent with the refined finishing normally pursued in Chu bronze *Ding*. The three splayed feet clearly reflect the style of Yue-style *Ding*. Given that Yue-style *Ding* had already appeared in the Chengdu Plain during the same period, this object may represent a modification inspired by non-local Yue-style *Ding*. The flat-bottomed *Zhan* from Shuangyuan Village M200:2 in Qingbaijiang, also referred to as a bronze basin, has a lid decorated with tongue-protruding *panchi* pattern (Fig. 2:9). Its overall form and decoration are similar to bronze *Zhan* commonly found in Chu. The excavators have already noted that “the lid shows traces of repair casting, and the *jiaoye* motifs on the lower belly are shallowly chased and may have been added later (Chengdu Cultural Relics and Archaeology Institute 2023).” Similar decorative patterns are also found on the bellies of lacquer vessels, such as lacquer *Dou* and lacquer *Gui*, from Boat-coffin Tomb No. 2 at Shangye Street in Chengdu (Chengdu Municipal Institute of Cultural Relics and Archaeology 2002, 2009). Such patterns are rarely seen in other regions, but in the local tradition they can be traced back to the Shang and Zhou periods. Wang identified them as *chanbei* motifs (Wang 2018), while Bai Jiujiang regarded them as heart-shaped motifs (Bai 2025), interpreting them as part of a distinctive local decorative tradition. However, since the chased decoration is located near the lower middle belly of the bronze *Zhan*, it is more likely to represent *jiaoye* and *juanyun* motifs. This decoration may therefore have incorporated new features of *jiaoye* and *juanyun* motifs on the basis of local decorative patterns. The shallow and somewhat rough chasing on the lower middle belly of this bronze *Zhan* provides important evidence for local modification of decoration.

Overall, modifications of imported objects can be identified no later than the middle and late Spring and Autumn period, broadly corresponding to the period when imported objects began to enter Shu in succession.

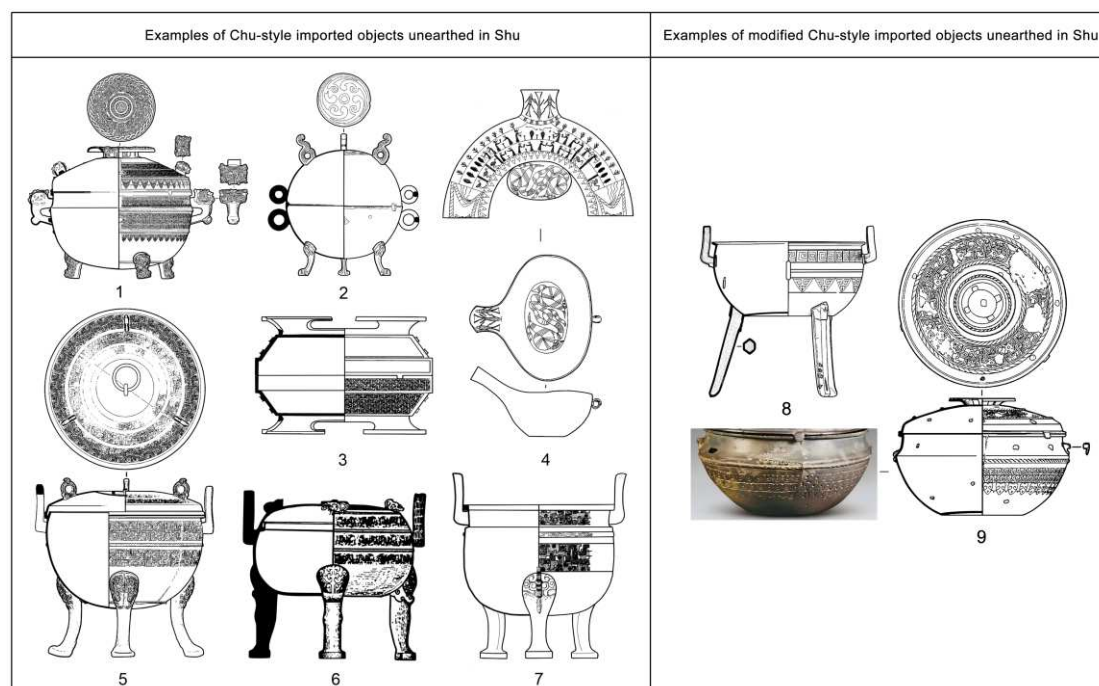


Fig. 2 Examples of Chu-style imported and modified objects unearthed in Shu

1. Bronze *Zhan* (Shuangyuan Village M15:14, Qingbaijiang); 2. Bronze *Dui* (Shuangyuan Village M46:38, Qingbaijiang); 3. Bronze *Fu* (Wenmiao West Street M1:2, Chengdu); 4. Bronze *Yi* (Shuangyuan Village M154, waist-pit no. 3, Qingbaijiang); 5-7. Bronze *Ding* (Shuangyuan Village M46:42, Qingbaijiang; wooden-chamber tomb at Majia, Xindu; Yangzishan M172:1, Chengdu); 8. Bronze *Din* (Shuangyuan Village M11:1, Qingbaijiang); 9. Bronze *Zhan* (Shuangyuan Village M200:2, Qingbaijiang)

Imitations

Among the Chu-style bronze vessels unearthed in Shu, many were also imitations based on bronze vessels from Chu. These can be divided into two types: overall imitations and partial imitations.

Overall imitations

Overall imitation refers to objects that imitate the form and decoration of comparable Chu vessels as a whole. One example is the “imitation Shao zhi si *Ding*” unearthed from the wooden-chamber tomb at Majia, Xindu, dating to the middle Warring States period (Fig. 3:2). Compared with its prototype, the “Shao zhi si *Ding*” (Fig. 3:1), this vessel is generally more roughly made and bears no inscription.

From the early to middle Warring States period, another type of bronze *Dui* in Shu also represents overall imitation, although with a slight chronological mismatch in the imitated features. These *Dui* have relatively thin walls and a flattened drum-shaped belly, characteristics associated with early Chu-style bronze *Dui*. Their lids, however, lack the whorl motifs commonly found on Chu-style bronze *Dui* of the same period. At the same time, their “S”-shaped animal-form flat feet are frequently seen on Chu-style bronze *dui* of the early to middle Warring States period (Fig. 3:3-5), even though by this time the bellies of Chu *Dui* vessels had generally become round or oval. During this period, the number of imitations among bronze vessels in Shu increased substantially. It is generally believed that a considerable proportion of the bronze vessels unearthed from the waist pit of the wooden-chamber tomb at Majia, Xindu, were imitations. These include *Yan*, *Dui*, and *Yu-Fou*. Compared with comparable vessels from Chu, these imitations have highly unnatural forms, rigid decorative lines, and clear casting traces such as spacers and mold seams. Their walls are also generally thin, suggesting that they were locally cast imitations.

In general, bronze vessels produced through overall imitation became more numerous in later periods. A few bronze *Zhan* unearthed from the stone-cist tomb at Moutuo in Mao County (Mao County Qiang Museum et al. 2012) were roughly made and date to the middle and late Spring and Autumn period. They are therefore very likely to have been imitations. Since these bronze ritual vessels are generally thought to have reached Moutuo through Shu, it is possible that Shu had already acquired the capacity to produce overall imitations of Chu-style bronze vessels as early as the middle and late Spring and Autumn period.

Examples of bronze Ding produced through "overall imitation" unearthed in Shu



Examples of bronze Dui produced through "overall imitation" unearthed in Shu

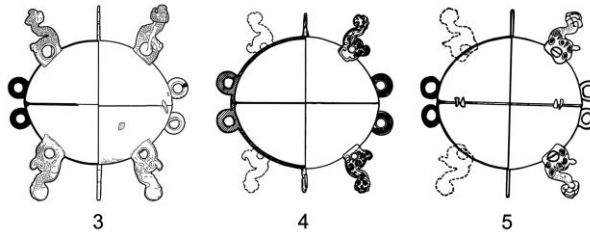


Fig. 3 Examples of bronze *Ding* and *Dui* produced through "overall imitation" unearthed in Shu
1. Majia Shao zhi si *Ding*, Xindu; 2. Majia Imitation Shao zhi si *Ding*, Xindu; 3. Shuangyuan Village M84:20, Qingbaijiang; 4. Chengguan M74B:27, Shifang; 5. Tongxin Village 87M1:6, Yingjing.

Partial imitation

Partial imitation refers to the selective imitation and modification of certain aspects of Chu-style bronze vessels, either in form or decoration. It can be further divided into three types: imitation through modification of vessel form, imitation of decoration motifs, and imitation of both form and decoration motifs.

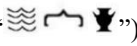
Form-modifying imitation

This type refers to partial modifications of vessel form that make an object display Chu cultural features in certain respects, or to simple adjustments made on the basis of an original Chu-style bronze vessel so as to give it local characteristics.

One example is the chain-handled *Hu* from Qingdao M1:6 in Mianzhu (Fig. 4:1). The body of the vessel belongs to a typical Central Plains style. It has paired ring knobs on the neck and banded decoration on the belly. However, the terminal of the chain handle is not bow-shaped, as is commonly seen on comparable vessels from the Central Plains (Fig. 4:2), but is instead made in a *tu* (𠂔)-shaped form, which was mainly popular in Chu (Hubei Museum 1989) (Fig. 4:3). This indicates that the vessel combines both Central Plains and Chu stylistic features. The *Dou* from Yanjinggou 06M2:31 in Pujiang has a dipper-shaped body and a garlic-bulb-shaped handle terminal (Chengdu Municipal Institute of Cultural Relics and Archaeology 2013) (Fig. 4:4), which represent typical Chu and Qin cultural elements, respectively. The *Zun-Fou* from Xinyicun M1:20 in Chengdu shows more substantial changes when compared with Chu-style bronze *Zun-Fou*. Its neck is shortened, and the junction between the lid and mouth changes from round to square (Chengdu Municipal Institute of Cultural Relics and Archaeology 2004). The overall form was therefore markedly altered (Fig. 4:5). Since this vessel form is not found in other regions, it should also be regarded as a case of local modification.

Imitation through modification of decorative motifs

This type refers to partial modification of decorative motifs. It is generally manifested in cases where the vessel form and decorative motifs, or symbols, on the same object are associated with different cultural elements; where local-style motifs or symbols are applied to Chu-style vessel forms; or where Chu cultural motifs are added to vessels of other stylistic traditions.

This form of imitation is already clearly visible in the early Warring States period. For example, a Chu-style bronze *Bi* spoon unearthed from Qingyang Residential Quarter M1 in Chengdu has a Ba-Shu symbol (“”) incised on its interior surface (Chengdu Municipal Cultural Relics Management Office 1989) (Fig. 4:9). Such combinations were not limited to Chu-style objects. The lidded *Dou* from Jinsha Lane M2:4 in Chengdu, for instance, has a body in a typical Central Plains style, but four sets of symmetrical Ba-Shu symbols (“”) are incised on the top of the lid (Chengdu Municipal Cultural Relics and Archaeology Work Team 1997).

By the middle Warring States period, this “asymmetry” between vessel form and decorative motifs, as well as the phenomenon of “chronological mismatch”, became more pronounced. One example is the *Ding* from Qingdao M1:145 in Mianzhu. Its body represents a typical Yue-style *Ding*, yet the upper belly is decorated with triangular-cloud motifs, twisted-rope motifs, and other patterns commonly seen on Chu-style bronze ritual vessels (Fig. 4:10). It should likewise be regarded as a typical combined-style object.

Another example is the *Hu* from Qingdao M1:4 in Mianzhu (Fig. 4:6). The bird-headed dragon motifs and symmetrical inverted-triangle motifs decorating this vessel were mainly popular in both the Central Plains and Chu from the late Spring and Autumn period to the early Warring States period, and are rarely seen after the early Warring States period. By contrast, the form of the square *Hu* belongs to a style popular in the Central Plains and Chu during the middle and late Warring States period (Fig. 4:7, 8). The decorative motifs therefore show a certain chronological lag in relation to the vessel form. It is also worth noting that bronze pointed-bottomed boxes and sword sheaths with distinctive Shu characteristics were made using the mold-impressing and piece-mold casting technique. This technique should have originated in Chu, and it is very likely that some metallurgical craftsmen among the Chu migrants who moved westward into Shu had mastered it (Zeng and Li 2025). This indicates that both the decorative motifs of locally styled bronze vessels in Shu and the techniques used to produce those motifs were influenced by Chu state.

Examples of objects produced through "imitation through modification of vessel form" unearthed in Shu



Examples of objects produced through "imitation through modification of decorative motifs" unearthed in Shu

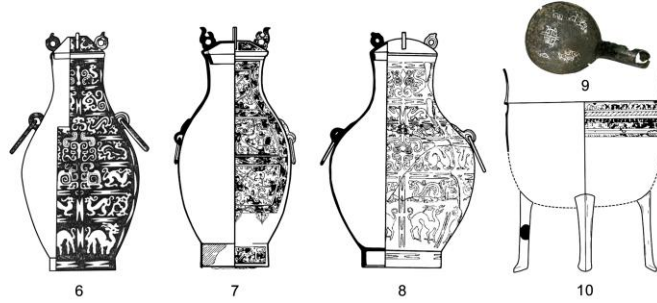


Fig. 4 Examples of objects produced through "imitation through modification of vessel form and decorative motifs" unearthed in Shu

1-3. Bronze chain-handled *Hu* (Qingdao M1:6, Mianzhu; excavated at Zhaogu, Huixian, in 1951; Guozhuang M1:227, Shangcai); 4. Bronze ladle (Yanjinggou 06M2:31, Pujiang); 5. Bronze *Zun-Fou* (Xinyicun M1:20, Chengdu); 6-7. Bronze *Hu* (Qingdao M1:4, Mianzhu; Jiuliandun M1:133, Zaoyang); 8. Bronze round *Hu* (Heshangling M2:27, Xichuan); 9. Bronze ladle (excavated from Qingyang Residential Quarter M1, Chengdu); 10. Bronze *Ding* (Qingdao M1:145, Mianzhu).

Imitation through modification of both vessel form and decorative motifs

This type refers to cases in which the main vessel form or decorative scheme derives from Chu state, while local features appear in certain aspects of both form and decoration. Such combined modification appeared in the early Warring States period and became particularly common in the middle and late Warring States period.

One example is the Bronze *Zun-Fou* from Qingdao M1:5 in Mianzhu. Its vessel body remains relatively close to that of the Bronze *Zun-Fou* from Wangshan WM2 in Jiangling, Chu state, and the circular whorl motifs on the belly are also a standard decorative motif of Chu-style bronze *Zun-Fou*. However, motifs such as bird-headed dragons, which were popular on imitations of this stage, appear on the lid and from the mouth rim to the shoulder (Wang 1987) (Fig. 5:1). As noted above, this represents a typical mismatch between decorative motifs and vessel form, and clearly constitutes a local imitation.

From the late Warring States period onward, the mouths of bronze *Zun-Fou* unearthed from tombs such as Feilong Village 06M2 in Pujiang and Tongxin Village 85M21A in Yingjing changed into square mouth with local characteristics (Chengdu Municipal Cultural Relics and Archaeology Work Team and Pujiang County Cultural Relics Management Office 2002; Sichuan Provincial Institute of Cultural Relics and Archaeology and Yingjing Yandao Ancient City Site Museum 1998) (Fig. 5:2–6). This differs from the round mouth commonly seen on bronze *Zun-Fou* in Chu state (Hubei Provincial Institute of Cultural Relics and Archaeology 1996). At the same time, copper-inlaid motifs such as

interlinked phoenix motifs and cloud motifs gradually replaced bird-headed dragon motifs and became the standard decoration of bronze *Zun-Fou* in Shu state. Since such motifs are not found in Chu state, the bronze *Zun-Fou* popular in Shu state from the late Warring States period onward should be understood as objects in which both vessel form and decorative motifs were locally modified.

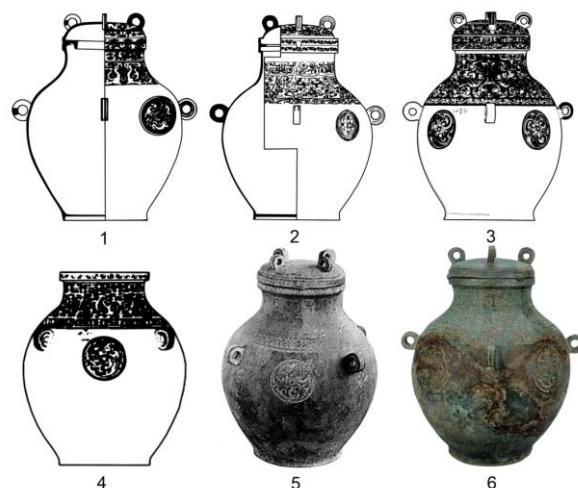


Fig. 5 Examples of bronze *Zun-Fou* produced through “imitation through modification of both vessel form and decorative motifs” unearthed in Shu and adjacent regions

1. Qingdao M1:5, Mianzhu; 2. Feilong Village 06M2:29, Pujiang; 3. Tongxin Village 85M21A:2, Yingjing; 4. Chengba 01873, Quxian; 5. Collected from Fuxi, Emei; 6. Xiaotianxi 74M1:23, Fuling

During the middle and late Spring and Autumn period, under the influence of Chu-style bronze ritual vessels, bronze-imitating pottery appeared in cemeteries such as Huanghe at Jinsha and Shuangyuan Village in Qingbaijiang. The main vessel types were *Zhan* and *Yu-Fou* (Fig. 6:1–4). These bronze-imitating pottery vessels all had prototypes to follow, but they also display local features in certain parts. There is no tradition of bronze-imitating pottery *Zhan* in Chu state, so this should be regarded as a distinctive feature of Shu state. The form and decoration of bronze-imitating pottery *Yu-Fou* in Shu state also differ significantly from comparable vessels in Chu state. In Chu state, bronze-imitating pottery *Yu-Fou* closely resemble their bronze prototypes, commonly with paired dragon-shaped handles and circular whorl motifs on the shoulder. By contrast, bronze-imitating pottery *Yu-Fou* in Shu state do not have paired dragon-shaped handles, and their bellies are often decorated with simple round disc-shaped bosses (Yang et al. 2017) (Fig. 6:5–7). Such bosses are also found on locally popular pottery vessels such as trumpet-mouthed jars and pan-mouthed jars, and clearly represent a local feature.

From the early Warring States period onward, the tradition of bronze-imitating pottery *Zhan* essentially disappeared in Shu state, while the tradition of bronze-imitating pottery *Yu-Fou* continued and remained broadly consistent in form with bronze *Yu-Fou* from Chu state. Since the early Warring States period, bronze-imitating pottery *Zun-Fou* were also commonly included in burials in Shu state. These can be divided into two major types: tall and slender forms, and short and stout forms. The tall and slender pottery *Zun-Fou* basically represent “overall imitations” (Fig. 6:8), and their forms are generally consistent with Chu-style bronze *Zun-Fou*. The short and stout pottery *Zun-Fou* are closer to bronze *Yu-Fou* in body form and decorative motifs (Fig. 6:9), but in terms of ears and lids they also display features of bronze *Zun-Fou*. They therefore combine characteristics of both bronze *Yu-Fou* and

bronze *Zun-Fou* (Fig. 6:10).

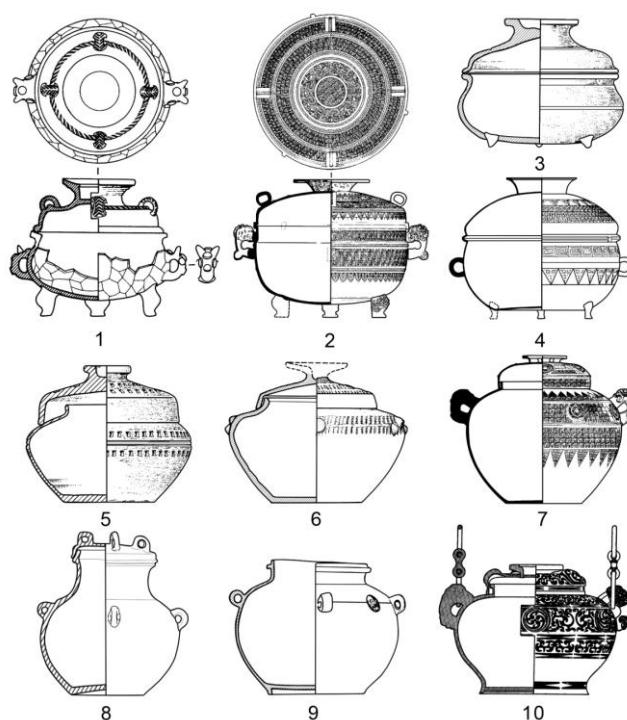


Fig. 6 Examples of Chu-style bronze-imitating pottery unearthed in Shu and their prototypes
1, 3. Pottery *Zhan* (Huanghe M600:1, Jinsha; Shuangyuan Village M293:13, Qingbaijiang); **2, 4.** Bronze *Zhan* (Yugang M279:6, Xiangyang; Huangtupo M31:4, Zhongxiang); **5, 6.** Pottery *Yu-Fou* (Shuangyuan Village M293:10, Qingbaijiang; Huanghe M577:4, Jinsha); **7, 10.** Bronze *Yu-Fou* (Bayilu M38:57, Nanyang; Leigudun M1:C189, Suizhou); **8, 9.** Pottery *Zun-Fou* (Chengguan M25:3, Shifang; Chengguan M2:4, Shifang)

On the basis of the currently available evidence, a new bronze production system gradually took shape in Shu state during the middle and late Spring and Autumn period. Compared with the local bronze production system of the Shang and Zhou periods, however, this new system shows a marked discontinuity in both style and technology. During the middle and late Spring and Autumn period, various types of Chu-style bronzes appeared in Shu state. At the same time, decorative motifs previously unseen in Shu state, such as *juanyun* motifs characteristic of the Central Plains and Chu during the Spring and Autumn period, also appeared on locally distinctive objects such as swords with scabbards. This indicates that the bronze production system in Shu from the Eastern Zhou onward was clearly influenced by external traditions, among which the influence of Chu culture was particularly prominent (Zeng and Li 2025).

By the early Warring States period, bronze vessels with local characteristics, such as *Fu*, *Fu-Zeng* and *mou*, had appeared in Shu state. At the same time, bronze vessels in non-local styles also show clear evidence of imitation, with imitations of Chu-style bronze vessels forming the dominant group. Both the production of local-style bronze vessels in Shu state and the imitation of non-local-style bronze vessels point to the late Spring and Autumn to early Warring States period as a key phase. Moreover, the production of bronze vessels with local characteristics appears to postdate that of non-vessel bronzes, a shift that was probably related to the sources of bronze-working technology.

Analysis of Material Circulation

Imitation and modification in form and decoration represent only the most visible manifestations of technological and cultural interaction. To clarify the formation of a new bronze production system in Shu and the deeper interactions between Shu and Chu, it is necessary to further trace the material foundation that supported this system: the sources of metal ores. Bronze production involved multiple stages, including mining, smelting, exchange, and transportation. Discussions of raw materials and technology can therefore move beyond the surface appearance of objects and reveal, at a more fundamental level, patterns of resource allocation and social interaction between regions.

Lead isotope ratio data show that most samples from the Chengdu Plain fall within the “common lead” category, with $^{206}\text{Pb}/^{204}\text{Pb}$ ratios mainly concentrated between 17.5 and 18.6. However, the lead isotope signatures vary across different periods. In the study of ore sources from different regions during the Eastern Zhou period, Zhang (2020) compiled lead isotope data from bronze objects across multiple regions, with a particular focus on the Han-Huai region. He proposed that the reference line $l_0: y = 1.0049x + 20.259$ ($^{208}\text{Pb}/^{204}\text{Pb}$ versus $^{206}\text{Pb}/^{204}\text{Pb}$) can be used to distinguish different types of metal ores.

Within this classificatory framework, bronzes from Shu dating from the mid-Spring and Autumn period to the early Warring States period mainly fall into lead types A and B. Most of their lead isotope ratios plot below the l_0 reference line, with only a few samples falling on or above it; type B lead is dominant (Fig. 7). This pattern suggests that the metal resources used in bronze production in the Chengdu Plain during this period were relatively stable, with type B lead occupying a dominant position within the regional metal resource system. In contrast, after the mid-Warring States period, lead isotope ratios in Shu bronzes gradually increased. The data represented by bronzes from Baishoulou show a relatively high degree of dispersion, and most samples plot above the l_0 reference line. In terms of lead use, the proportions of type A and type B lead gradually became more balanced. At the same time, alongside the continued use of type A and type B lead, type C_2 lead entered Shu after the mid-Warring States period and was gradually incorporated into the local bronze production system, indicating an increasing diversification of lead sources.

With regard to intra-regional resource circulation, the lead isotope ratios of objects excavated from Stone-cist Tomb No. 1 at Moutuo, located in the transitional zone between the western Sichuan Plateau and the Chengdu Plain, are consistent with those of most bronzes from Shuangyuan Village and Xinghelu in Chengdu. This pattern suggests that the Chengdu Plain and its surrounding areas shared broadly similar sources of raw materials, or at least closely related ore resources, and that a relatively stable network of material circulation and distribution may have existed within the region.

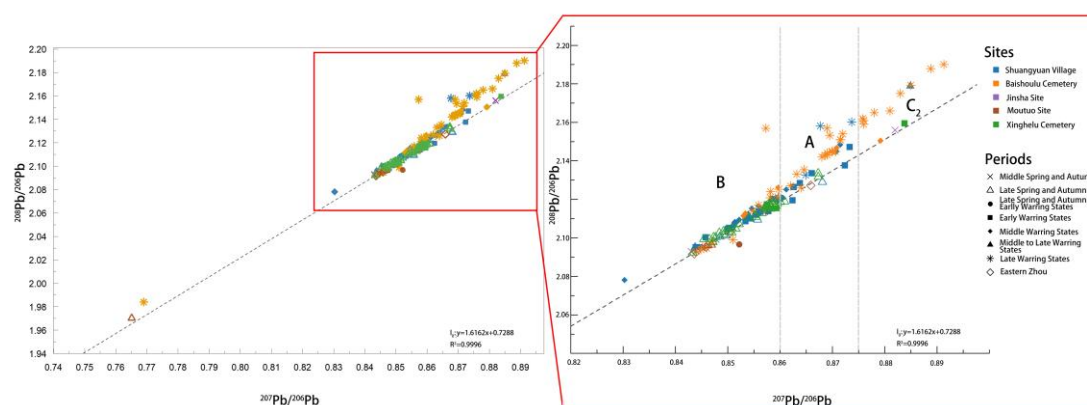


Fig. 7 Scatter plot of lead isotope ratios from the Chengdu Plain during the Eastern Zhou period

To clarify the sources and circulation of metal materials in the Chengdu Plain during the Eastern Zhou period, this study expands its scope beyond the lead isotope ratio data of bronze objects unearthed in the Chengdu Plain to include the contemporaneous Jiang-Huai region. From the perspectives of resource allocation and cultural interaction, it examines the patterns of interaction between Shu and Chu.

In his study of metal resource circulation in the Ba-Shu region from the late Western Zhou to the mid-Spring and Autumn period, Zhang (2020) argued that, during the early to middle Spring and Autumn period, the Chengdu Plain may have obtained metal resources from the middle Yangtze region either through resource allocation mediated by the Guanzhong political core or through interaction with the Xiajiang region. It is worth noting that, during the late Spring and Autumn to early Warring States period, when changes in ore sources had already occurred in the Jiang-Huai and Central Plains regions, the Chengdu Plain still continued to use type A and B lead, especially type B lead. The Chengdu Plain did not gradually begin to use type C2 lead until after the mid-Warring States period, showing a clear lag behind Chu and the Central Plains in the adoption of type C2 lead. Type C0 lead, moreover, was not widely used in Shu state.

In addition, a few samples with highly radiogenic lead signatures have been identified in the lead isotope ratio data from the Baishoulu cemetery in Chengdu and Stone-cist Tomb No. 1 at Moutuo. Highly radiogenic lead was prevalent in the Central Plains from the middle Shang period to Phase III of Yinxu. The occurrence of such data in sites dating to the Spring and Autumn and Warring States periods may indicate the recycling of pre-existing local metal materials through remelting. This phenomenon in the Chengdu Plain is not an isolated case. In his analyses of bronzes unearthed from the Jinsha site, Li suggested that highly radiogenic lead data dating from the late Shang-early Zhou to the early Spring and Autumn period at Jinsha may have resulted from the later remelting of earlier objects (Li et al. 2025; 2019). Taken together, these patterns indicate that the Chengdu Plain lagged noticeably behind contemporaneous Chu in terms of resource use as well as cultural and technological interaction.

Shu–Chu Relations from the Perspective of Material Circulation of Bronze Vessels

Since the late Western Zhou period, Shu had established eastward networks of resource exchange with the Xiajiang region, including the circulation of salt. At the same time, Chu influence also began to expand eastward into the Xiajiang region from the late Western Zhou to the early and middle Spring and Autumn period. Previous studies generally dated the appearance of Chu cultural elements in Shu to the middle and late Spring and Autumn period. However, recently published excavation materials from the Xinyicun site show that typical Chu cultural elements, such as Chu-style *Li* tripods, appeared in Shu no later than the early Spring and Autumn period (Chengdu Cultural Relics and Archaeology Institute 2020). The circulation of bronze vessels as prestige goods, together with that of metal raw materials, can to some extent reveal the substantive nature of cultural interaction between the two regions. On the basis of the currently available evidence, cultural interaction between Shu and Chu, as represented by bronze vessels, can be broadly divided into three stages.

The first stage spans the middle and late Spring and Autumn period to the early Warring States period. During this stage, the Chu-style ritual bronzes found in Shu were mainly imported objects from Chu, although a certain degree of imitation or modification had already begun to appear.

As noted above, the bronze *Ding* from Shuangyuan Village M15:14 and M46:42, which can be

identified as imported objects from Chu, differ to some extent in their lead isotope signatures from the *Dui* from Shuangyuan Village M84:20, which represents a locally produced imitation in the Chengdu Plain. Although the M15:14 and M46:42 *Ding* still used type A lead, which accounted for a relatively high proportion of lead sources in the Chengdu Plain during this period, their isotope ratios clearly deviate from the main distribution range of objects dated from the middle Spring and Autumn period to the early Warring States period. Instead, they show a higher degree of overlap with the cluster of type A lead used in bronze vessels unearthed from Chu contexts of the early Warring States period.

By contrast, the M84:20 *Dui* from Shuangyuan Village, which was clearly produced locally in imitation of the Chu style, clusters well with other local objects in terms of its lead isotope ratios (Fig. 8). The three Chu-style bronze *Zhan* from Stone-cist Tomb No. 1 at Moutuo and several other Chu-style vessels from the Shuangyuan Village cemetery display similar characteristics. This pattern indirectly confirms that, from the middle and late Spring and Autumn period to the early Warring States period, Chu cultural elements had already appeared extensively in Shu. However, the Shu people were not simply using “imported objects” from Chu; they had already begun to imitate or modify bronze objects locally.

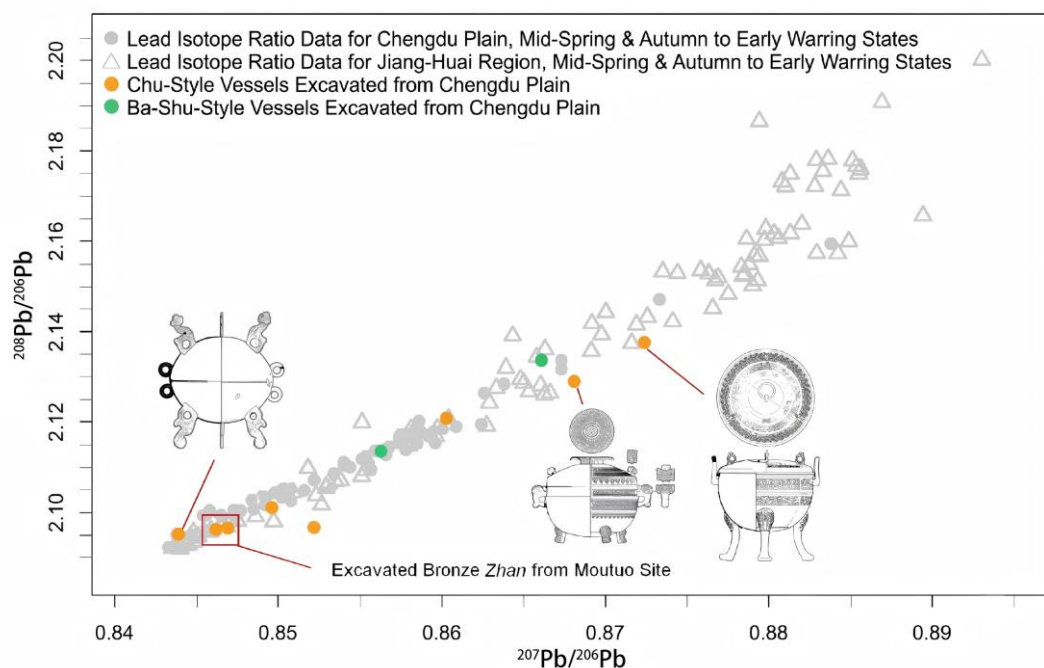


Fig. 8 Scatter plot of lead isotope ratios of bronze vessels excavated from the Chengdu Plain from the mid-Spring and Autumn period to the early Warring States period

The substantial appearance of Chu cultural elements in Shu during this stage should be understood against a specific historical background. Around the middle Spring and Autumn period, Chu actively expanded outward, and Chu culture, with its distinctive stylistic features, became increasingly pronounced. One important indicator of this development was the emergence of a group of bronze objects with clearly recognizable Chu characteristics. The appearance of bronze vessels with marked Chu-style features in Shu as early as the middle and late Spring and Autumn period should therefore be regarded as a result of Shu–Chu interaction.

According to the *Zuo zhuan*, in the eighteenth year of Duke Ai, 477 BCE, “the Ba attacked Chu and besieged You” (Yang 1995). This event reflects the tense relations between Ba and Chu from the late

Spring and Autumn period to the early Warring States period. Although Chu was at one point disadvantaged in its wars against Wu at the end of the Spring and Autumn period, over the longer span from the middle and late Spring and Autumn period to the early Warring States period Chu generally accelerated its westward expansion and strengthened its control over the eastern Xiajiang region (Zhu 2010).

During this period, Shu and Qin repeatedly competed for control of Nanzheng, corresponding roughly to the present-day Hanzhong region. Given the political circumstances of the time, as well as the cultural connections between the Shu ruling elite and Chu (Xu 1981; Ren 1986)³, some form of alliance may have been reached between Shu and Chu (Zhou and Jiang 2020). This likely facilitated the absorption of Chu cultural elements and technical styles in Shu during this stage. Textual sources also record that the Shu ruling elite carried out a “ritual reform” modeled on Chu. A note to Zhang Heng’s biography in the *Hou Han shu*, citing the Shu Wang Benji, states: “From Emperor Kaiming down to the fifth generation, there was Kaiming Shang. He first abandoned the imperial title and again adopted the title of king” (Yang 1958). The *Huayang Guozhi*: Shu Zhi records: “In the ninth generation there was Emperor Kaiming. He first established ancestral temples; wine was called li, music was called jing, people favored red, and the emperor assumed the title of king” (Chang 1984). On the basis of the period in which Chu cultural elements became widespread in Shu and the genealogy of the Kaiming lineage, archaeologists generally date this “ritual reform” to the late Spring and Autumn to early Warring States period (Sun 2019). This chronology corresponds closely with the substantial appearance of Chu cultural elements in Shu state.

The second stage corresponds to the middle Warring States period. During this stage, imitations of Chu-style ritual bronzes found in Shu increased noticeably, while directly imported objects gradually declined; imitation and modification became more prominent. We suggest that this reflects the flourishing of local bronze imitation and casting, closely related to the gradual maturation of the bronze craft industry in Shu. Alloy composition analyses show that the non-local-style bronze vessels from the wooden-chamber tomb at Majia, Xindu, are characterized by high-tin and low-lead bronze compositions. This differs markedly from the high-tin and high-lead composition observed in local bronzes since the middle and late Spring and Autumn period. Judging from the alloy compositions of bronze vessels excavated from the tomb of Zeng Hou Yi, high-tin and low-lead bronze had already appeared in Zeng, Chu, and related regions by the early Warring States period and had become the dominant alloying pattern (Hubei Museum 1989). This suggests that the shift in alloy composition in Shu occurred slightly later than in Chu. At the same time, lead sources in Shu also changed significantly during the middle Warring States period. While type A and type B lead continued to be used, type C₂ lead began to appear; this type of lead had gradually become the main lead source in Chu since the late Spring and Autumn period. The increasing complexity of lead compositions in Shu reflects the growing demand for metal resources within the local bronze craft industry and indicates that channels for obtaining metal resources were becoming increasingly diversified.

Although the available data remain limited, the lead isotope ratios of Chu-style bronze vessels from

³ The origin of the Kaiming lineage is recorded in similar terms in texts such as the *Shu Wang Benji*, *Huayang guo zhi*, the *Shui jing zhu*, and the *Taiping yulan*. Although these accounts contain mythological exaggeration and fictional elements, they are not without plausible content. Scholars have investigated the origin of the Kaiming lineage in depth on the basis of both textual records and archaeological discoveries. The view that the lineage was of Chu origin is the most widely held; it is further argued that the Kaiming rulers actively introduced Chu culture, so that Shu came to be profoundly influenced by it. At the very least, it can be established that the Kaiming lineage maintained close connections with the Chu region, the Chu people, and the Chu state. See Xu (1981) and Ren (1986).

Shu nevertheless show characteristics similar to those of local objects (Fig. 9). This may suggest that these vessels were locally imitated and produced in Shu. In his study of bronze production in the Chengdu Plain during the Eastern Zhou period, Wang et al. (2024) noted that, after the middle Warring States period, the bronze craft industry of Shu culture showed marked independence from Chu in the use of lead sources for locally styled bronze vessels.

In addition, the decrease in Chu imports during this stage may also have been related to the fluctuating political situation between Shu and Chu, marked by alternating periods of conflict and rapprochement. During the middle Warring States period, Chu reached a phase of considerable strength. It not only expanded eastward and conquered Yue, but also extended its influence further west, as indicated by the discovery of typical Chu-style cemeteries at sites such as Yajiao in Zhong County. Shu, meanwhile, also entered a period of increasing political and military strength, and clearer textual records of warfare between Shu and Chu begin to appear.

The *Shiji*, in the “Hereditary House of Chu”, records that in the fourth year of King Su, 377 BCE, “Shu attacked Chu and seized Zifang. Chu then built Hanguan to defend against it” (Sima Qian 2005). Some earlier scholars argued that “Shu attacked Chu” may have been a textual error for “Ba attacked Chu”, while others suggested that it referred to “a major offensive jointly launched by Ba and Shu against Chu” (Tong 1998). In recent years, however, some scholars, drawing on the discoveries at Luojiaba in Xuanhan, have proposed that the sudden emergence of M33 in the early part of the middle Warring States period provides archaeological evidence for the two military actions recorded in the *Shiji*: Shu’s attack on Chu and its seizure of Nanzheng (Peng 2022; Bai 2023; Shi 2018)⁴. From the middle Warring States period onward, the Luojiaba cemetery shows unusual phenomena such as weapons inserted into human bones and damaged human remains, suggesting that some tomb occupants may have been soldiers who died in battle (Sichuan Provincial Institute of Cultural Relics and Archaeology et al. 2015). The wooden-chamber tomb at Majia in Xindu also yielded a relatively large number of Chu-style bronze weapons, including swords with guards and round tangs, crossbow triggers, tanged trilobed arrowheads, and tanged triangular arrowheads (Sichuan Provincial Museum and Xindu County Cultural Relics Management Office 1981). These differ markedly from locally styled bronze weapons and lack distinctive Ba-Shu symbols, suggesting that they may have been war booty acquired in conflicts with Chu.

This unstable political situation, alternating between warfare and accommodation, may have promoted cultural encounters to some extent, while also significantly affecting the circulation of finished objects and metal resources. The relative scarcity of directly imported objects in Shu may therefore have been one consequence of these conditions. Even so, channels for the movement of artisans and the circulation of metal resources between Shu and Chu were not cut off. This further suggests that networks of technological and material exchange among the various Eastern Zhou states were highly complex.

The third stage corresponds to the late Warring States period. With Qin’s conquest of Shu, Chu-style objects in Shu declined sharply. Among bronze vessels, only a few types, such as the zun-fou, continued to appear, and both their forms and decorative patterns underwent substantial changes. This seems to suggest that Qin’s conquest of Shu temporarily disrupted the deeper penetration of Chu

⁴ Some scholars hold that the Luojiaba cemetery may be associated with the Banshun Man population of Ba culture, and are cautious about regarding it as the remains of Shu people long isolated within Ba territory. Although the ethnic and political affiliation of the Luojiaba cemetery remains difficult to determine at present, the artefacts unearthed there combine Shu, Chu, and other styles; it is therefore reasonable to treat the cemetery as an important node linking the Chengdu Plain with the cultures of the middle Yangtze and the Central Plains. See, respectively, Peng (2022), Bai (2023), and Shi (2018).

culture into Shu. Both transmitted texts and archaeological discoveries confirm that Qin and Chu repeatedly contested the Xiajiang region during the early part of the late Warring States period. During this stage, exchanges between Shu and Chu were mainly associated with warfare, and the circulation channels for finished objects and raw materials may not have been smooth. This situation may have encouraged the independent local production of bronze vessels in Shu. At the same time, Qin's conquest of Shu may also have caused a rupture in the indigenous bronze craft industry of Shu, leading to the creation of new vessel types with local characteristics, such as bronze *Zun-Fou*. It was not until the later part of the late Warring States period, when Qin seized Chu's western territories and core areas such as Jiangling, that Chu cultural elements began to reappear in Shu (Chengdu Municipal Institute of Cultural Relics and Archaeology and Longquanyi District Cultural Relics Management Office 2000; Shuihudi Qin Tomb Bamboo Manuscripts Group 2001; Jiang 1991; Li 2006)⁵.

Wang Ruizhe and colleagues conducted a systematic study of nine locally styled bronze yue axes from Chengdu, dating from the middle Warring States period to the early Western Han (Wang et al. 2022a). Their results show that, before and after Qin's annexation of Shu state, the alloy composition, processing techniques, and casting technology of bronze yue axes all underwent changes. They argue that, under Qin's policy of "taking its wealth to enrich the people and repair arms" and within a relatively relaxed political and social environment, the pre-existing military organization of Shu weakened. As the demand for bronze yue axes and similar weapons declined, so too did the requirements for their mechanical performance and manufacturing techniques. This also indicates that Qin's annexation of Shu brought new changes to the bronze craft industry in Shu. Unfortunately, scientific analytical data for bronze objects from the Chengdu Plain during this stage remain lacking.

⁵ On migration into Shu following the Qin conquest, texts such as the *Shiji* and the *Han shu* record official resettlement, the migrants including former nobles of the six states and Qin convicts. The *Jingyun Stele* unearthed at the Jiuxianping site in Yunyang records that Jing Yunshu, magistrate of Quren in the Han commandery of Ba, was a descendant of Gaoyang and a former Chu noble who settled in Zitong after the early Han and became a prominent local family. The Shuihudi Qin slips likewise record convicts entering Shu: in one legal petition, a commoner requests that his own son be banished to a border county of Shu for life, never to leave the place of banishment. Beyond these transmitted and excavated textual records, archaeological discoveries also indicate large-scale migration following the Qin occupation of Jiangling. See Shuihudi Qin Tomb Bamboo Manuscripts Group (2001, p. 155), Jiang (1991), and Li M (2006).

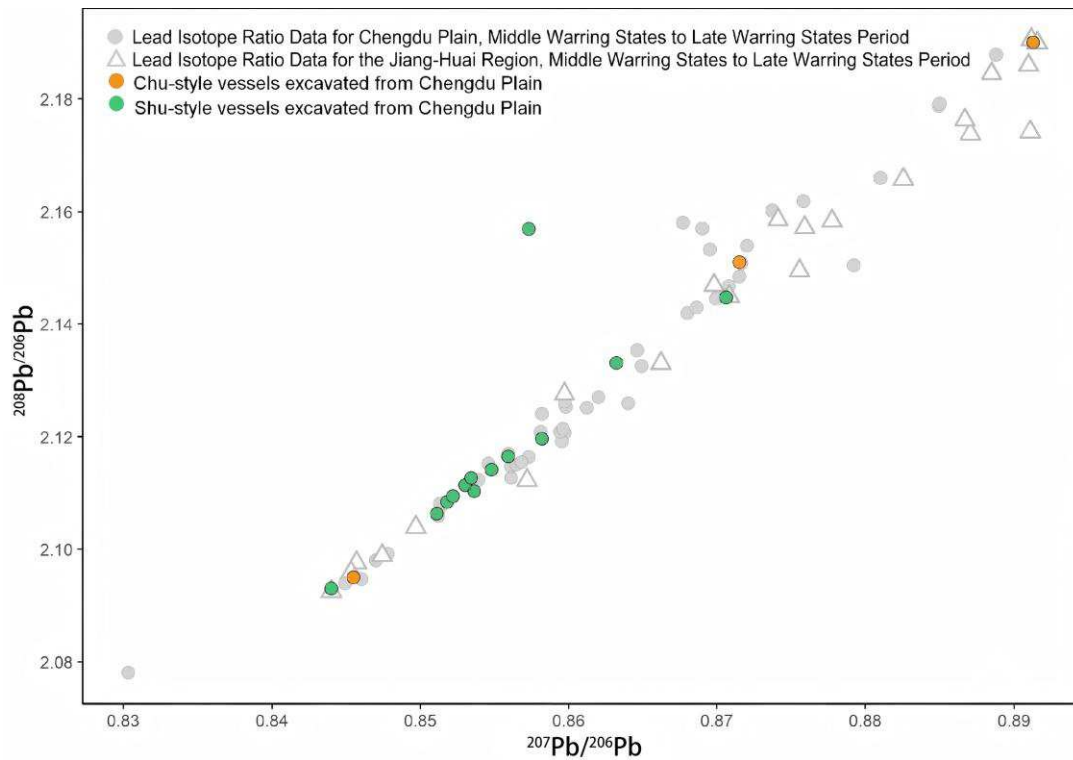


Fig. 9 Scatter plot of lead isotope ratios of bronze vessels from the Chengdu Plain from the middle to late Warring States period

Conclusion

By examining Chu-style bronze vessels unearthed in Shu state and comparing the material sources of bronze objects of different styles from Shu state and Chu state, this study identifies a clear chronological pattern in Shu–Chu cultural interaction. Chu culture had reached the Chengdu Plain, the core area of Shu state, no later than the early Spring and Autumn period, although interaction between the two regions remained relatively limited at that time. From the middle and late Spring and Autumn period onward, an exchange network centered on various types of bronze ritual vessels had taken shape between Shu state and Chu state. This network involved bronze-casting technology, metal resources, and related forms of material circulation. When considered alongside the geopolitical relations among Shu state, Chu state, Ba state, and other states, the evidence suggests that some form of political alliance may have existed between Shu and Chu during this period (Zhou and Jiang 2020).

During the middle and late Warring States period, imported objects from Chu decreased among the bronzes found in Shu, while imitations increased markedly. This suggests that the forms of cultural interaction between Shu and Chu may have undergone an important transformation. Such a shift accords with the historical context of Shu–Chu warfare and Qin’s conquest of Shu state, indicating that changes in the political situation could affect the circulation of bronze vessels and their materials to some extent. More importantly, however, this transformation was also associated with the gradual maturation of Shu’s bronze craft industry, which underwent new changes under the successive influence of Chu state and Qin state. In this process, the intervention of Chu culture was an important factor in the reconstruction and gradual maturation of bronze production in Shu state during the Eastern Zhou period. The exchange between the two regions may also have

involved the movement of artisans.

In general, interaction between Shu and Chu was dynamic and complex, showing clear chronological variation. The bronze vessels unearthed in Shu indicate that Shu–Chu interaction was not merely a process of material transmission marked by the circulation of bronze objects and metal resources; to some extent, it also involved the transmission of technology, institutions, and ideas. Throughout this process, Chu cultural influence on Shu remained dominant for a long time. This dominance reflected the broader political, military, economic, and commercial relations between the two states. In response to external pressures, Shu continuously adjusted its strategies and gradually established a local system of bronze production. The imitation, modification, and innovation of bronze vessels in Shu were therefore a material expression of changing Shu–Chu relations.

Current understanding of Eastern Zhou bronze production in Shu remains limited. Future research should accumulate more systematic analytical data and take bronze craft production as an entry point for further exploring the dynamic relationships between Shu state, Chu state, and other regions in terms of technological interaction and metal-resource circulation. Such work can then be extended to deeper issues, including political conditions, military relations, and economic exchange, thereby providing new evidence for understanding the political landscape and social transformations of Southwest China from the late Western Zhou-early Eastern Zhou transition to the eve of Qin unification.

Statements and Declarations

Funding This work was supported by the Major Project of the Sichuan Provincial Social Science Foundation, ‘Comprehensive Study of Bronzes from the Sanxingdui and Jinsha Sites’ (Grant No. SCJJ25ZD05), and the 2025 Special Programme for Archaeological Research and Heritage Conservation at the Sanxingdui Site, ‘An Archaeological Study of the Cultural Functions of Composite Bronzes at Sanxingdui’ (Grant No. SXD2025-08).

Competing interests The authors declare no competing interests.

Author contributions Z. Y.: conceptualisation, writing—original draft, writing—review and editing, and funding acquisition. X. Z. (Xiaotian Zeng): data curation, formal analysis, writing—original draft, writing—review and editing, and translation. X. Z. (Xiaohan Zhang): investigation, writing—review and editing, and translation. All authors read and approved the final manuscript. G. Q.: methodology and validation. **Data availability** All data generated or analysed during this study are included in this article and its Supplementary Information files.

Ethics approval Not applicable.

Data availability The data analyzed in this study were compiled from previously published sources, which are cited in the Supplementary Material. The complete compiled dataset is

References

- Bai J (2023) Several orientations in the study of Ba-Shu bronze culture 巴蜀青铜文化研究中的几个取向问题. In: Yibin Museum (ed) *Twin blossoms: special exhibition on Ba-Shu bronze civilization* 花开并蒂——巴蜀青铜文明特展. Sichuan Fine Arts Publishing House 四川美术出版社, Chengdu
- Bai J(2025)Documents, Artifacts, and Civilization: Archaeological Explorations of Ba Culture 文献·文物·文明：巴文化考古探索. Science Press 科学出版社, Beijing,pp 611–640
- Bai Y (2016) On the method for inferring the provenance of archaeological remains based on style and distribution 论基于风格与分布的考古遗物产地推定法. *Kaogu* 考古 2016(9)
- Chang Q 常璩 (1984) Annotated Huayang Guozhi 华阳国志校注. Liu L 刘琳 (annot). Bashu Press 巴蜀书社, Chengdu
- Chang Q 常璩 (2010) Huayang Guozhi, vol 3, Shu Zhi 华阳国志卷三蜀志. Yan Q 严茜子 (ed and punctuated). Qilu Press 齐鲁书社, Jinan
- Chengdu Archaeological Team (1996) Brief report on the excavation and cleaning of a Warring States tomb at Huacheng Residential Quarter, Chengdu 成都化成小区战国墓发掘清理简报. *Chengdu Wenwu* 成都文物 1996(4)
- Chengdu Cultural Relics and Archaeology Institute (2020) Excavation report of the Xinyicun site 新一村遗址发掘报告. Shanghai Classics Publishing House 上海古籍出版社, Shanghai
- Chengdu Cultural Relics and Archaeology Institute (2023) Excavation report of the Eastern Zhou boat-coffin tombs at Shuangyuan Village, Chengdu, Sichuan 四川成都双元村东周船棺墓发掘报告. *Acta Archaeol Sin* 考古学报 2023(2)
- Chengdu Municipal Institute of Cultural Relics and Archaeology (2002a) Excavation report of the boat-coffin and log-coffin burials at Shangye Street, Chengdu 成都市商业街船棺、独木棺墓葬发掘报告. In: *Chengdu archaeological discoveries 2000* 成都考古发现（2000）. Science Press 科学出版社, Beijing, pp 78–136
- Chengdu Municipal Institute of Cultural Relics and Archaeology (2002b) Brief report on the excavation of Warring States pit tombs at Shiren Residential Quarter in the western suburbs of Chengdu 成都西郊石人小区战国土坑墓发掘简报. *Wenwu* 文物 2002(4)
- Chengdu Municipal Institute of Cultural Relics and Archaeology (2004) Brief excavation report of the Xinyicun locality at the Shi'erqiao site, Chengdu 成都十二桥遗址新一村发掘简报. In: *Chengdu archaeological discoveries 2002* 成都考古发现（2002）. Science Press 科学出版社, Beijing, pp 172–208
- Chengdu Municipal Institute of Cultural Relics and Archaeology (2009) Boat-coffin burials at Shangye Street, Chengdu 成都商业街船棺葬. Cultural Relics Press 文物出版社, Beijing
- Chengdu Municipal Institute of Cultural Relics and Archaeology (2013) Ancient burials at Yanjinggou, Feilong Village, Pujiang County 蒲江县飞龙村盐井沟古墓葬. In: *Chengdu archaeological discoveries 2011* 成都考古发现（2011）. Science Press 科学出版社, Beijing, pp 338–372
- Chengdu Municipal Institute of Cultural Relics and Archaeology, Longquanyi District Cultural Relics Management Office (2000) Brief report on the excavation of wooden-chamber tombs

- along the North Trunk Road in Longquanyi District, Chengdu 成都龙泉驿区北干道木椁墓群发掘简报. *Wenwu* 文物 2000(8)
- Chengdu Municipal Cultural Relics Management Office (1989) A Warring States tomb at Qingyang Residential Quarter, Sandongqiao, Chengdu 成都三洞桥青羊小区战国墓. *Wenwu* 文物 1989(5)
- Chengdu Municipal Cultural Relics and Archaeology Work Team (1997) Brief report on the cleaning of Warring States tombs at Jinsha Lane, Chengdu 成都市金沙巷战国墓清理简报. *Wenwu* 文物 1997(3)
- Chengdu Municipal Cultural Relics and Archaeology Work Team, Pujiang County Cultural Relics Management Office (2002) Brief excavation report of boat-coffin tombs in Pujiang County, Chengdu 成都市蒲江县船棺墓发掘简报. *Wenwu* 文物 2002(4)
- Emei Cultural Relics Management Office, Institute for the History of Natural Science (1986) Scientific analysis of Warring States bronzes from Emei County, Sichuan 四川峨眉县战国青铜器的科学分析. *Kaogu* 考古 1986(11)
- He K (1987) Scientific analysis of some Sichuan bronzes 部分四川青铜器的科学分析. *Sichuan Wenwu* 四川文物 1987(4)
- Huang S (2006) On the influence of Chu culture on Late Shu culture 试论楚文化对晚期蜀文化的影响. *Jiangnan Archaeol* 江汉考古 2006(2)
- Huang S (2007) Studies on Shu culture 蜀文化研究. Central China Normal University Press 华中师范大学出版社, Wuhan
- Hubei Provincial Institute of Cultural Relics and Archaeology (1996) Chu tombs at Wangshan and Shazhong, Jiangling 江陵望山沙冢楚墓. Cultural Relics Press 文物出版社, Beijing
- Hubei Provincial Museum (1989) Tomb of Marquis Yi of Zeng 曾侯乙墓. Cultural Relics Press 文物出版社, Beijing
- Jiang Z (1991) A study of migrant tombs in the Ba-Shu region 巴蜀地区的移民墓研究. *Sichuan Wenwu* 四川文物 1991(1)
- Jingzhou Museum, Zhongxiang Museum (2009) Excavation report of Eastern Zhou and Qin tombs at Huangtupo, Zhongxiang, Hubei 湖北钟祥黄土坡东周秦代墓发掘报告. *Acta Archaeol Sin* 考古学报 2009(2)
- Li H (2020) Fighting and burial: the production of bronze weapons in the Shu state based on a case study of Xinghelu cemetery, Chengdu, China. *Herit Sci*
- Li H, Cui J, Chen J et al (2025) Study on the copper production system in the Chengdu Plain during the pre-Qin period 成都平原先秦时期铜器生产体系研究. *Kaoguxue Jikan* 考古学集刊 2025(1):155–184
- Li H, Cui J, Zhou Z et al (2018) Production of bronze weapons from Eastern Zhou tombs at the Xinghelu locality of the Jinsha site, Chengdu 成都金沙遗址星河路地点东周墓葬铜兵器的生产问题. *Kaogu* 考古 2018(7). Accessed 17 March 2026
- Li H, Cui J, Zhou Z et al (2019) Study on the production of bronzes unearthed from the “ritual area” of the Jinsha site 金沙遗址“祭祀区”出土铜器的生产问题研究. *Bianjiang Kaogu Yanjiu* 边疆考古研究 2019(1):335–348
- Li H, Gong Y, Cui J et al (2021) Imports or imitations?: scientific and typological analysis of the bronze artefacts at the Moutuo archaeological site, Sichuan, China. *Archaeometry* 63(5):975–990
- Li H, Zuo Z, Cui J et al (2020a) Bronze production in the ancient Chengdu Plains: a diachronic

- metallurgical perspective on a separate cultural region. *J Cult Herit* 43:26–36
- Li H, Zuo Z, Cui J et al (2020b) Copper alloy production in the Warring States period (475-221 BCE) of the Shu state: a metallurgical study on copper alloy objects of the Baishoulv cemetery in Chengdu, China. *Herit Sci* 8:67
- Li M (2006) On Qin tombs in the Sichuan Basin 论四川盆地的秦人墓. *Nanfang Wenwu* 南方文物 2006(3)
- Mao County Qiang Museum, Chengdu Municipal Institute of Cultural Relics and Archaeology, Aba Tibetan and Qiang Autonomous Prefecture Cultural Relics Management Office (2012) Stone-cist Tomb No. 1 at Moutuo, Mao County 茂县牟托一号石棺墓. Cultural Relics Press 文物出版社, Beijing
- Peng S (2022) A re-examination of the Luojiaba cemetery in Xuanhan 宣汉罗家坝墓地再研究. *Sichuan Wenwu* 四川文物 2022(1)
- Peng S (2024) An archaeological perspective on Ba history: focusing on cultural similarities and differences between Ba and Shu from the Warring States period to Qin 巴史的考古学观察——以战国至秦巴与蜀的文化异同为中心. Dissertation, Peking University
- Ren N (1986) New explorations in the ancient history of Sichuan 四川上古史新探. Sichuan People's Publishing House 四川人民出版社, Chengdu
- Shi J (2018) The Luojiaba burials and Eastern Zhou culture in the Chengdu Plain 罗家坝墓葬与成都平原东周时期的文化. *Sichuan Wenwu* 四川文物 2018(3)
- Sichuan Provincial Institute of Cultural Relics and Archaeology, Yingjing Yandao Ancient City Site Museum (1998) Excavation report of Ba-Shu boat-coffin burials at Tongxin Village, Yingjing 荣经同心村巴蜀船棺葬发掘报告. In: Sichuan archaeological report collection 四川考古报告集. Cultural Relics Press 文物出版社, Beijing, pp 212-280
- Sichuan Provincial Institute of Cultural Relics and Archaeology et al (2015) Luojiaba, Xuanhan 宣汉罗家坝. Cultural Relics Press 文物出版社, Beijing
- Sichuan Provincial Museum (1976) Excavation of Tomb No. 10 at Baihuatan Middle School, Chengdu 成都百花潭中学十号墓发掘记. *Wenwu* 文物 1976(3)
- Sichuan Provincial Museum, Xindu County Cultural Relics Management Office (1981) A Warring States wooden-chamber tomb at Xindu, Sichuan 四川新都战国木椁墓. *Wenwu* 文物 1981(6)
- Sima Q 司马迁 (2005) *Shiji*, vol 40, Hereditary House of Chu 史记卷四十楚世家第十. Zhonghua Book Company 中华书局, Beijing
- Song Z (2004) Problems in the archaeological study of pre-Qin Sichuan 四川先秦时期考古研究的问题. In: Collected archaeological papers of Song Zhimin 宋治民考古文集. Science Press 科学出版社, Beijing, pp 320-326
- Shuihudi Qin Tomb Bamboo Manuscripts Group (2001) Shuihudi Qin tomb bamboo manuscripts 睡虎地秦墓竹简. Cultural Relics Press 文物出版社, Beijing
- Sun H (2019) Chengdu city in the Warring States period: with a discussion of the planning tradition of the Shu capital 战国时期的成都城——兼谈蜀国都城规划传统. In: Ancient Civilizations 古代文明, vol 13. Shanghai Classics Publishing House 上海古籍出版社, Shanghai, pp 229-256
- Sun S, Li X et al (2008) Study on tin-plating techniques on the surface of Chinese bronzes 中国青铜器表面镀锡技术研究. *Sci Conserv Archaeol* 文物保护与考古科学 20
- Tong E (1998) Ancient Ba and Shu 古代的巴蜀. Chongqing Publishing House 重庆出版社,

Chongqing

- Wang J (1991) A preliminary discussion of Zhou-period Ba-Shu bronzes found in the Yichang area 宜昌地区所见周代巴蜀铜器刍议. *Jiangnan Archaeol 江汉考古* 1991(1)
- Wang L (2003) Explorations of early Chu culture 早期楚文化探索. *Jiangnan Archaeol 江汉考古* 2003(3)
- Wang R, Wang N, Li P et al (2022) An archaeometallurgical interpretation of Qin's annexation of Shu: a case study of bronze Yanhebao yue axes unearthed in Chengdu 秦并蜀的铜冶金考古解读：以成都出土烟荷包钺为例. *Chin J Hist Sci Technol 中国科技史杂志* 2022(4)
- Wang R 王仁湘 (2018) Ancient Shu cicada worship and its origins: starting from the insect-patterned jade plaque unearthed at the Jinsha site 古蜀蝉崇拜及其渊源——从金沙遗址出土昆虫纹玉饰牌说起. In: Chengdu Jinsha Site Museum, Chengdu Cultural Relics and Archaeology Institute, Institute of Archaeology, Chinese Academy of Social Sciences (eds) *Proceedings of the International Symposium on Jade Culture in the Xia and Shang Periods 夏商时期玉文化国际学术研讨会论文集*. Science Press 科学出版社, Beijing, pp 279–294
- Wang X, Yang Y, Wang T et al (2022) Subdivision of culture and resources: raw material transformation and cultural exchange reflected by bronze poleaxes from the Warring States sites in the Chengdu Plain. *Archaeol Anthropol Sci* 14(7):121
- Wang X, Yang Y, Wang T et al (2024) A feast: indigenous production and interregional exchange reflected by the bronze vessels unearthed from Shuangyuan Village Cemetery in southwestern China. *Archaeometry* 66(2):352–367
- Wang X, Yang Y, Wang T et al (2025) Typology and lead source diversity of late Shu bronze jin from Shuangyuan Village cemetery. *npj Herit Sci* 13(1):641
- Wang Y (1987) Boat-coffin burials in Mianzhu County, Sichuan 四川绵竹县船棺葬. *Wenwu 文物* 1987(10)
- Xiangyang Municipal Institute of Cultural Relics and Archaeology (2011) *Chu tombs at Yugang 余岗楚墓*. Science Press 科学出版社, Beijing
- Xu Z (1981) *On Ba-Shu culture 论巴蜀文化*. Sichuan People's Publishing House 四川人民出版社, Chengdu
- Yang B (1995) *Annotated Chunqiu Zuozhuan 春秋左传注*. Zhonghua Book Company 中华书局, Beijing
- Yang Q (1993) A preliminary analysis of Ba-Shu cultural elements in the Jing-Chu region 荆楚地区巴蜀文化因素的初步分析. In: Sanxingdui and Ba-Shu culture 三星堆与巴蜀文化. Bashu Press 巴蜀书社, Chengdu, pp 233–242
- Yang X 杨雄 (1958) *Shu Wang Benji 蜀王本纪*. In: Yan K 严可均 (ed) *Quan Shanggu Sandai Qin Han Sanguo Liuchao Wen 全上古三代秦汉三国六朝文*. Zhonghua Book Company 中华书局, Beijing, p 413
- Yang Z, Zuo Z, Chen Y (2017) The dating of tombs beneath layer 2 at the Huanghe locality of the Jinsha site, Chengdu, and related issues 成都金沙遗址“黄河”地点二层下墓葬年代及相关问题. *Sichuan Wenwu 四川文物* 2017(4)
- Zeng Y, Li Y (2025) Bronze sword sheaths unearthed from the Eastern Zhou cemetery at Shuangyuan Village, Chengdu, and related issues 成都市双元村东周墓地出土青铜剑鞘及相关问题. *Kaogu 考古* 2025(10)
- Zeng Z (1987) Phosphorus: a distinctive alloy component in Ba-Shu bronze weapons 磷——巴

- 蜀式青铜兵器中特有的合金成分. *Sichuan Wenwu* 四川文物 1987(4)
- Zeng Z (1992) Compositional analysis of unearthed Ba-Shu bronzes 出土的巴蜀青铜器的成分分析. *Sichuan Wenwu* 四川文物 1992(3)
- Zeng Z (1993) Casting techniques of tiger-stripe patterns on Ba-Shu bronze swords 巴蜀式青铜剑虎斑纹的铸造工艺. *Sichuan Wenwu* 四川文物 1993(5)
- Zhang J (2020) Research on resources and technology of Eastern Zhou bronzes: focusing on the Han-Huai region 东周青铜器的资源与技术研究——以汉淮地区为中心. Dissertation, Peking University
- Zhou L (2021) A study of Eastern Zhou bronzes from the Chengdu Plain 成都平原东周青铜器研究. Dissertation, Sichuan University
- Zhou L, Jiang Z (2020) On the archaeological culture of the Chengdu Plain during the Spring and Autumn period 试论成都平原春秋时期考古学文化. *Kaogu* 考古 2020(2)
- Zhu P (2010) The westward spread of Chu culture: an archaeological perspective on Chu's management of the west 楚文化的西渐——楚国经营西部的考古学观察. Bashu Press 巴蜀书社, Chengdu

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [SupplementaryMaterial.xlsx](#)
- [Coordinate.docx](#)