Pottery Production and Social Complexity on the Chengdu Plain, Sichuan, China, 2500 to 800 BC

by

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Declaration

I certify that this thesis is my own research.
Materials published by other scholars are referred to in the text.

Po-yi Chiang

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Abstract

The goal of this research has been to examine potential changes in pottery production between 2500 and 800 BC on the Chengdu Plain of Sichuan, China, with a central focus on any relationships that might have existed between organization of pottery production and degree of social complexity. The evolutionary model of pottery production outlined by Rice (1981) is tested against archaeological data from the Chengdu Plain, covering pottery manufacturing technology and fabric composition, combined with a usage of metric indices to investigate degrees of standardization.

In this research, the most commonly accepted chronology for the Chengdu Plain between 2500 and 800 BC is first reviewed. Through an analysis of available radiocarbon dates, archaeological stratigraphies, and the contrasting distributions of the Sanxingdui and Shierqiao assemblages, I have suggested that the Baodun culture existed between 2500 and 2000 BC, and was succeeded in parallel by the Sanxingdui and Shierqiao cultures in the 2nd millennium BC.

This research also gives an introduction to significant sites on the plain and reviews past archaeological research. Problems with the relative and absolute dates of some sites are analysed. One of my conclusions is that the Bronze Age commenced on the Chengdu Plain between ca. 1100 and 950 BC, rather than during the earlier part of the 2nd millennium BC.

By synthesizing anthropological theories on the formations of social inequality and states, combined with an analysis of mortuary data and available protohistorical accounts, I propose an evolutionary model for the development of those societies that inhabited the prehistoric Chengdu Plain.

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Chapter 1

Research Background, Problem and Analytical Approach

1.1 Introduction

Pottery as a general artefact serves nearly all members of those societies that are accustomed to its usage. It was made in many geographic areas over long time spans (Barnett and Hoopes 1995; Kuzmin 2006, 2010; Rice 1999), and played a critical role in many social and economic contexts (Howard and Morris 1981; Kolb and Lackey 1988; Sinopoli 1991:83-160; van der Leeuw and Pritchard 1984). Because of its abundance and its diverse and nearly imperishable nature, once fired to a sufficient temperature, pottery is also one of the most important sources of information for archaeologists (Braun 1983:108; Matson 1995:108; Rye 1981:121-2).

Archaeologists have traditionally used pottery to elucidate aspects of the past, such as constructing chronologies, identifying style zones and boundaries, investigating exchange systems, and understanding craft technology. However, there remain great discrepancies in the research objectives and theoretical approaches adopted by Euro-American and Chinese archaeologists (Underhill 2002a), owing to their divergent backgrounds of academic thought. From this comparative theoretical perspective, this thesis studies the diachronic changes in the pottery made and used by the archaeological cultures of the Chengdu Plain in Sichuan, China, between 2500 and 800 BC.

1.2 Ceramic studies in Western archaeology

Based on Kolb (1989a:268-9), the beginning of an interest in studying pottery for its own sake in the West can possibly be traced back to the 16th century, when Capriano Piccolpasso reviewed the ceramic technology in use during the Italian Renaissance. More advanced and scientific studies on pottery were appearing by the mid to late 19th century, for instance, Alexandre Brougniart's work *Traité des arts céramiques*, Anatole Bamps' microscopic analyses of Peruvian ceramics, William H. Holmes' analyses of Chiriqui pottery manufacturing techniques and decoration in Colombia, and Erland Nordenskiold's petrographic thin section analyses of sherds from Mesa Verde in Colorado. Excluding Holmes, a geologist turned archaeologist, the others had no archaeological training.

With the rapid progress of archaeological fieldwork and research in the early 20th century, ceramic studies by Euro-American archaeologists increased in number. However, most early examples focused on reconstructing past pottery making methods and devising typological classifications in order to create relative archaeological chronologies (Kolb 1989a, b). In view of this situation, Shepard (1936:389; 1956:III-XIX) and Sayce (1933), according to the accounts by Bishop (1991) and Matson (1982:23), called for a better integration of ceramic technology within the larger behavioral context.

Aside from Shepard's own contribution on the integration of scientific analytical data with archaeological context (Morris 1974; Thompson 1991), ceramic archaeological theory also benefited greatly from research in the American Southwest. Here, Frederick R. Matson proposed his concept of 'ceramic ecology' in pottery analysis in 1961, intended to enhance the communication between archaeologists and ceramic technologists (Matson 1965:1-19; Borza 2008; Kolb 1988:1-37; Kramer 1985:78). Ceramic ecology may be considered as a facet of the more general concept of cultural ecology. It attempts to relate ceramic raw materials and manufacturing technology to the function of pottery within the specific cultural context.

According to Rice (1987:314),

> Ceramic ecology is a contextual approach to ceramic analysis that seeks to place technical data into both an ecological and sociocultural frame of reference by relating the technological properties of the local resources to the production and use of the ceramic products. Ceramic ecology, like general cultural ecology, begins with studying the ceramic environment – local resources used in pottery making – as well as with describing the ecological and climatological features that might impinge on potters.

This quotation not only summarises Matson's earlier thinking but also reflects his critique of the once-prevalent phenomenon of publishing descriptive accounts of technological pottery data isolated within archaeological reports (Kolb 1988, 1989b; Matson 1951, 1984; Rice 1987:328). He urged greater attention to the ethnographic literature related to pottery making and use, and to archaeologically-oriented ethnographic research design.

The impact of ceramic ecology was overshadowed by the surging popularity of ceramic ethnoarchaeology in the late 1960s and 1970s (Longacre 1991; M. Stark 2003), although a number of key publications during the 1980s by Rice (1984), van der Leeuw and Pritchard (1984), Kolb and Lackey (1988), and Kolb (1988, 1989), served to keep the field of ceramic ecology alive and well. Archaeologists realized that pottery was in effect a tool that contributed to the functioning of past societies (Braun 1983), and tended to pay less attention to typological classification and cultural-historical reconstruction for their own sakes, and more to past processes of pottery creation and use within the social context (van der Leeuw and Pritchard 1984).

Today, ceramic ethnoarchaeology along with new scientific methods for analysing sherds such as petrographic thin section analysis, firing temperature analysis, X-ray diffraction, X-ray fluorescence spectroscopy and neutron activation analysis (Rice 1987:371-446), have allowed archaeologists to build stronger inferences about locations of production, technological choices, vessel functions, and aspects of distribution and social organization (for example, D. Arnold 1985, 1991; P. Arnold 1991a, 2000; Costin 2000; Deal 1998; Hegmon 2000; Kramer 1985; Longacre 1991; Roux 2003; Skibo 1992; M. Stark 1991a, b, 1995, 2003; Underhill 2003). Nevertheless, culturally particularistic case studies, known as 'cautionary tales' (D. Arnold 1991:323), always exist and disturb straightforward analogies between the ethnographic record and archaeological contexts (D. Arnold 1991; Bowser 2000; Hegmon 2000). For example, a sharp change in pottery style need not be a result of a demographic shift or migration, but can also reflect commercialization and demand. Similarly, homogeneity in vessel shape need not imply specialized production, but may also reflect market preferences. Many processes of pottery production, distribution and consumption need to be comprehended in more complex ways.

1.3 The archaeological study of pottery in China

Modern archaeology in China commenced in the early 20th century (Chang Kwangchih 1986:12-21; Chen Xingcan 1997:15-22), and studies of pottery also became central foci of research. The academic development of archaeology in China has differed greatly from that of the West because, until recently, it has been fundamentally historiography-oriented (Chang Kwangchih 1981; Du Jinpeng 1996; Falkenhausen 1995:213-5; Olsen 1987; Su Bingqi 1991). Compliance with the Marxist paradigm was seen as necessary for a lengthy period of time, in order to create an abiding theoretical framework for cultural evolution. This tended to impede analytical research on ceramics (Chang Kwangchih 1981, 1992; Nelson 1995:4-7; Tong Enzheng 1995). In addition, the political uncertainty of the Sino-Japanese War between 1937 and 1945, the following civil war until 1949, and the Cultural Revolution from 1966 through 1976 also resulted in an unstable academic environment, making research progress difficult (Li Liu 2012:1-16).

Two research categories currently dominate the study of pottery in Chinese archaeology. They are typological study for chronological purposes, and studies of potential interaction between archaeological cultures based on pottery variability. Additional and important pottery studies include ethnoarchaeological observations of pottery manufacture by ethnic minorities in southwestern China, especially Yunnan, and today there are increasing instances of scientific analysis of sherd compositions and residues.

The typological study of pottery has a long history in Chinese archaeology. One of the earliest publications in English, Wu Jinding's (1938) *Prehistoric Pottery in China*, explicitly documented pottery excavated from Yangshao and Longshan contexts in terms of texture, surface decoration, wall thickness, mouth diameter, and details of the base or support. Wu's typological classification was integrated with site stratigraphies to enable a seriation of the archaeological finds. This Western-rooted method for relative dating of archaeological finds (Conkey and Hastorf 1990; Harris 1989:7-13; O'Brien and Lyman 2002:23-58; Plog 1980) was utilized extensively before the adoption of radiocarbon dating in China in 1965 (Institute of Archaeology, CASS 1983:306).

Today, typological classification of pottery remains the major goal for archaeological reports in China. In sites without ^{14}C datable materials, it still remains the best solution for cross-dating; for example, Bai Jiujiang and Zou

Houxi (2012) on the western Chongqing sequence; Gao Guangren and Shao Wangping (1981) on the chronology of Longshan *gui*-tripod vessels in northern China; Gao Tianlin (1996) and Su Bingqi ([1948]1984) on *li*-tripod vessels in the Yellow Valley; Song Zhimin (2005) and Sun Hua (1996) on the Chengdu Plain sequence; Su Bingqi (1965) on Banpo and Miaodigou pottery. Yu Weichao (1987) also gave a methodological introduction, and Yu Xiyun (2003) discussed cultural transformations using pottery typology.

However, the major drawback of typological relative dating, to be further discussed for the Chengdu Plain in Chapter 2 and 3, is that classifications by different archaeologists can be inconsistent and ambiguous, depending upon personal perceptions. This can be shown by examples from the Three Gorges region (that part of Yangzi valley connecting Hubei and Chongqing), where a series of salvage excavations have been conducted in the last 15 years by joint archaeological teams from a number of Chinese provinces (Chen Zhenyu and Wang Fengzhu 2003). Pottery vessels of similar morphology are given inconsistent names by archaeologists from different provincial backgrounds, and classifications often do not overlap coherently. A kind of vessel defined as a unity by one archaeologist can be separated into two or three subtypes by another. Moreover, the lack of pictorial illustration worsens the situation.

One of the major functions of pottery in Chinese archaeology is to assist the identification of archaeological cultures, social boundaries, and directions of social interaction (Li Boqian 2008). It has been used to study aspects of migration (Du Jinpeng 1995; Li Boqian 1983; Xiang Taochu 2005, Zhang Chi 2009), military conflict and acculturation (Luan Fengshi 1997; Wang Jin 1989; Yan Wenming 1990), and trade as well as other facets of cultural contact (An Jinhuai 1982; Jiao Tianlong 2007; Meng Huaping 2010; Ren Shinan 1989; Yu Mengzhou

2010). For instance, the early Central Plain-centric diffusion model of Chang Kwangchih (1963, 1977), the *quxi-leixing* (regional systems and local cultural series) model of Su Bingqi (1991, 1999:33-99; Su Bingqi and Yin Weizhang 1981), the more recent regional interaction sphere concept of Chang Kwangchih (1986:241-2), and Yan Wenming's (1987) idea of multiregional development all intrinsically assumed that social boundaries were defined by changes in pottery assemblages.

Sometimes, Chinese archaeologists have also correlated specific archaeological cultures, as defined in part by pottery styles, with certain proto-historic or early historic political or ethnic groups. For example, the Erlitou culture in Henan and Shanxi has been associated with the legendary Xia Dynasty (for example, Sun Hua 1980, Xiang Taochu 2011; Zou Heng 1980:95-182; but see Qin Xiaoli 2003; Xu Hong 2004, 2009; Xu Hong and Liu Li 2009). The Neolithic to Bronze-Iron Age archaeological cultures of southern and southwestern China have been associated with the *Yue*, *Pu* and *Qiang* peoples of the southern and southwestern *Yi* recorded in some historical accounts (Liu Hong 1996). Today, this approach remains popular in Chinese archaeology, and few Chinese archaeologists are familiar with Western ethnoarchaeological studies that claim that pottery stylistic patterning does not always correlate well with social boundaries (Bowser 2000; Gosselain 2000; Hegmon 1992: 522-4, 2000; M. Stark 1998; M. Stark *et al.* 2000, 2008; Sterner 1989). One important exception is Wang Ningsheng (2003), who has clearly pointed out the problem of past ethnic identification based on pottery typology in Chinese archaeology.

Questions of chronology, origin, provenance, and manufacturing technique are also of interest to Chinese archaeologists, and ethnoarchaeological observations and the application of various scientific methods have assisted in resolving some of these issues. A series of ethnoarchaeological pottery studies carried out since the 1950s have explicitly recorded the pottery industries of the Dai and Wa peoples in Yunnan, who speak Tai and Austroasiatic languages, as well as those of many Han populations. These studies have covered resource acquisition and preparation, vessel forming, finishing, drying, firing, organization of production and distribution, and time and seasonal scheduling (Cheng Zhuhai *et al.* 1986; JTDP 1977; Li Yangsong 1958, 1959; Wang Ningsheng 1989:190-210; Wang Yawen 2010; Yang Yuan 1986, 1987; Zhang Ji 1959). However, none have established an anthropology-based research framework for dealing with archaeologically excavated pottery. The ultimate goal of these studies was only to understand prehistoric pottery making techniques from present-day observations (Li Yangsong 1990).

Scientific analyses of archaeological pottery commenced in China as early as the 1960s (Zhou Ren *et al.* 1964). The now-discredited technique of thermoluminescence dating was introduced and applied in the late 1970s and early 1980s (Wang Weida 1979; Wang Weida and Zhou Zhixin 1983), although only a small number of microscopic and chemical analyses were conducted before 1990 (Li Jiazhi 1978; Yan Dongsheng and Zhang Fukang 1986:1). It was not until the release of the policy for Sino-foreign collaborative research in archaeology in 1990 (SACH 1992), which reopened the door to foreign experts (Li Liu 2012:19-20; Murowchick 1997; Underhill 2002a:21), that a variety of scientific methods were imported into China for sherd analysis. These included neutron activation analysis (NAA), X-ray diffraction (XRD), X-ray fluorescence analysis (XRF), energy-dispersive X-ray spectroscopy (EDX), electron probe micro analysis (EPMA-WDS), and inductively coupled plasma atomic emission spectroscopy (ICP-AES) (Chen Tiemei *et al.* 1998; Chen Yaocheng *et al.* 1999;

Cheng Xiaolin *et al.* 2009; Flad *et al.* 2005; Hung Lingyu *et al.* 2011; Liu Fangxin *et al.* 1993; Lu Xiaoke *et al.* 2012; Ma Qinglin and Li Xian 1991; Ma Qinglin *et al.* 2004; Min Ying *et al.* 2011; Wu Rui *et al.* 2005; Zhang Yi *et al.* 2012).

After 1990, scholarly exchange and collaborative projects between China and foreign countries increased rapidly. Some research by western scholars has been translated into Chinese; for example, Skibo and Deal (1995) on residue analysis; Matson on ceramic ecology (1965, translated by Huang Yang *et al.* 2012); Rice's *Pottery Analysis: A Source book* (contents selected, abbreviated and translated by Zhou Likun 2011) and her evolutionary model of pottery production (Rice 1981, translated by Guo Lusha and Chen Lizi 2014); Brown (1989, translated by Pan Yan and Chen Hong 2011) on the beginnings of pottery making from an economic perspective; and Roux (2003, translated by Fu Yongxu 2011) on quantifying ceramic standardization and production intensity. Additionally, some Chinese archaeologists (Dai Xiangming 2006, 2010; Sun Zhouyong 2008) are beginning to adapt to the influence of the Euro-American tradition, examining craft production by integrating perspectives in technology, ecology, economic organization, political economy and exchange (for Euro-American examples, see Brumfiel and Earle 1987; Clark and Parry 1990; Cobb 1996; Costin 1993, 2001; Costin and Wright 1998; Hruby and Flad 2007; Wailes 1996; Flad 2011; Stein and Blackman 1993).

Similar research has been pioneered in China by Underhill (1990, 1991, 1996, 2002b, c) on Longshan pottery, investigating how systems of pottery production evolved in relation to increasing cultural complexity, and how control of craft production of prestige goods contributed to elite social power and status consolidation. However, little attention was paid to such issues by Chinese archaeologists until Dai Xiangming (2006, 2010) and Sun Zhouyong's (2008) researches were published, even though Sun's focus was on jade *jue* earring production rather than pottery.

1.4 The research problem and procedures of analysis

The archaeological cultures located on the ancient Chengdu Plain between 2500 and 800 BC are termed the Baodun, the Sanxingdui and the Shierqiao. One conspicuous pottery change which occurred after the termination of the Baodun culture was the loss of its exquisite surface decoration. The high percentage of fine wares that dominated the Baodun repertoire also decreased during Sanxingdui and Shierqiao times, when coarse wares conversely dominated (Jiang Cheng and Li Mingbin 1998; Jiang Zhanghua *et al.* 2001, 2002; Li Boqian 1997; Song Zhimin 2002; Wang Yi and Sun Hua 1999; Wang Yi and Zhang Qing 1999; Sun Hua 2000:305-6). Based on my observations of archaeological collections of Sichuan pottery deposited in research institutions and museums, there might also have been a tendency towards increasing homogeneity in the sizes of specific vessel types.

In this thesis, the possible impetus behind these pottery changes is examined from the perspective of organizational change in production with increasing craft specialization. I examine potential changes in the modes of pottery production between 2500 and 800 BC on the Chengdu Plain, with a focus on the development of otherwise of specialized production over time, and relationships between the organization of pottery production and the degree of social complexity.

1.5 Chapter summaries and sources of data

In the following six chapters, chapter 2 firstly defines the geographical setting of the Chengdu Plain, in the Sichuan basin of China, as the spatial location of this research. It discusses available palaeoenvironmental data relevant for the late Holocene, and also examines the chronology for this region as constructed by Chinese archaeologists. One of my suggestions is that the Sanxingdui and the Shierqiao were partially contemporary rather than successive archaeological cultures. In addition, this chapter also suggests that the common pointed-based pottery vessels used as index fossils for the recognition of the Sanxingdui and Shierqiao cultures require a reassessment.

Chapter 3 inventories past excavations of archaeological sites dating between 2500 and 800 BC on the Chengdu Plain, and introduces the main sources of archaeological material used throughout this dissertation - settlements, burials and excavated artefacts. The aim of both chapters 2 and 3 is to construct an archaeological foundation for understanding the sociopolitical developments on the ancient Chengdu Plain that are discussed further in Chapter 4. Settlement data from the Sichuan Plain were found to be lacking sufficient detail to allow any strong conclusions about demography and social complexity, but chapter 4 formulates a model to explain sociopolitical development on the Chengdu Plain between 2500 and 800 BC using a synthesis of burial data and historical records, followed by an examination of anthropological theories on the formation of social inequality and states. This model suggests that the mode of subsistence and material culture production would have altered from a household-focused economy to one based more on economic specialization in order to meet increasing market demands consequent on sociopolitical consolidation and population increase.

Chapter 5 examines the prehistoric pottery industry of the Chengdu Plain in detail, approaching technological issues through petrographic thin sections of sherds, and measurements of vessels calculated from records of dimensions given in site reports. This analysis goes to the heart of the major research problem of this thesis, discussing issues connected with the development of craft specialization. The sherds used for thin-section petrography were provided by the Sanxingdui workstation and the Chengdu Municipal Institute of Cultural Relics and Archaeology. All are excavated finds with detailed recorded contexts. However, since the sample sizes made available to me in these institutions were quite small, the conclusions that follow should be considered as hypotheses guiding future studies.

In this thesis I review the Chinese language sources, including the collected reports published by the Chengdu Municipal Institute of Cultural Relics and Archaeology (CMICRA 2001, 2002, 2003, 2004, 2005a, 2006a, 2007a, 2008, 2009a, 2010, 2011, 2012, 2013); the Sichuan Provincial Institute of Cultural Relics and Archaeology (SPICRA 1998); and a number of independently published reports of important excavations including *Chengdu Shierqiao* (SPICRA and CMICRA 2009), *Jinsha taozhen* (CMICRA and SAMBU 2002), *Sanxingdui Sacrificial Pits* (SPCIRA 1999), and *Chenggu Baoshan* (CAMNU 2002). I also examine data published in three major Chinese archaeological journals: *Kaogu*, *Wenwu*, and *Kaogu xuebao*. As well as the above, I also refer to information contained in historical texts such as *Shuwang benji* (Basic Annals of the *Shu* Kings) and *Huayang guozhi* (The History of Huayang) (Liu Lin 1984). These sources refer to data relevant for the study of social change on the ancient Chengdu Plain, despite the mythological nature of some of the accounts.

Chapter 2

The environmental and chronological setting of the ancient Chengdu Plain

2.1 The environmental setting of the Chengdu Plain

Situated between latitudes 29.5° and 32°N, and between longitudes 103° and 104°E, the Chengdu Plain is a down-faulted basin that formed initially at the beginning of the Quaternary. The Min and upper Tuo rivers have been flowing through it and depositing alluvium since at least the middle Pleistocene (780-130 ka BP) (Fu Shun 2006:31; Qian Hong and Tang Rongchang 1997). The western boundary of the basin is formed by the Longmen and Qionglai ranges that form the eastern fringe of the Qinghai-Tibet Plateau and rise to around 1500 to 3000 m above sea level. The eastern edge of the plain is formed by the northeast to southwest oriented Longquan mountain range, the watershed between the Min and Tuo rivers, which rises to around 700 to 1000 m. In the northwestern portion of the plain, Dujiangyan city lies at 750 m above sea level, while Chengdu to the southeast lies at 500 m. Fifty km south of Chengdu City, the plain drops at a grade of 3° to 4° to 200 m above sea level (Li Jun *et al.* 2005).

Generally speaking, the physical boundaries of the Chengdu plain have two definitions. The greater one refers to the total area enclosed within the above mountain ranges and some low hills located in the south and the northwest of the Sichuan basin, between roughly Mianyang city in the north and Leshan city in the south. The more significant one for this thesis refers to the fan-shaped alluvial plain that measures around 7340 km^2 and includes the cities and counties around Chengdu City, including Guanghan, Pengzhou, Jintang, Deyang, Shifang, Pixian, Dujiangyan, Chongzhou, Dayi, Qionglai, Shuangliu, and Xinjin. In this thesis, the

Chengdu plain refers to the latter definition (Figure 2.1).

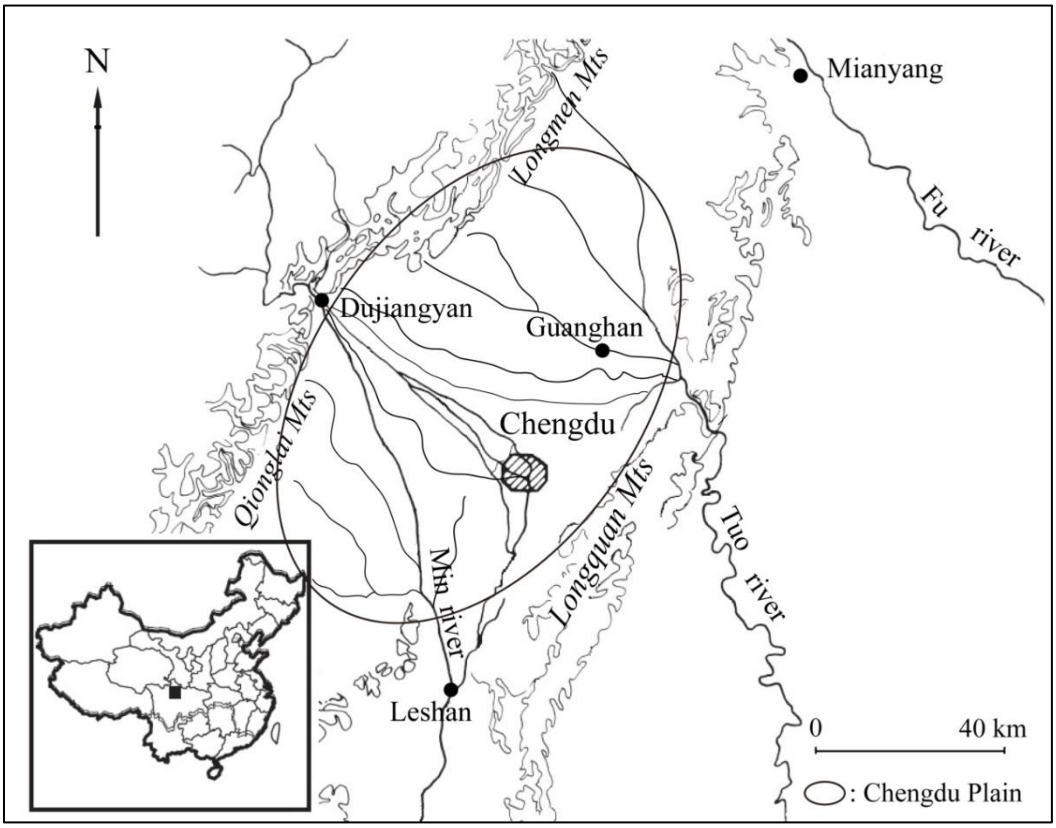


Figure 2.1: The geographic boundaries of the Chengdu Plain, which is drained by the tributaries of the Min and Tuo rivers (redrawn after Zhu Zhangyi *et al.* 2006, with modifications).

2.2 The Palaeoenvironments of the Chengdu Plain

The Chengdu Plain has a monsoon-influenced wet subtropical climate. The Qinling ranges to the north shield it from cold Siberian winds, and snow is rare. The annual mean temperature is 16-17℃, and annual precipitation averages 900-1300 mm. Rainy days average 300 days each year, with most rain falling in summer and autumn (SZX 1980:8-20).

However, the environment today need not reflect past conditions with precision, even though the palaeoclimate of the subcontinental area that comprises modern China has always been strongly affected by the Asian monsoon (Winkler and Wang 1993:249-54). Even so, throughout the Holocene, this monsoon has varied in intensity (An Zhisheng 2000; An Zhisheng *et al.* 2000). By 7000 BC, following the climatic amelioration after the last glacial maximum, temperatures had become 1-3°C warmer than present (Winkler and Wang 1993). The mid-Holocene climatic optimum then lasted between 6500 and 1000 BC (Shi Shaohua 1993; Shi *et al.* 1993), meaning that the earlier part of the time span covered in this thesis occurred in a period of relatively warm climate.

Climatic fluctuations in the Sichuan basin have been similar to those in East Asia generally (An Zhisheng *et al.* 2000; Liu Xingshi 1983, 2005; Shi Shaohua 1993), with a relatively temperate and arid period on record between 7500 and 5500 BC, a warmer and moister period between 5500 and 3000 BC, and then progressive cooling between 3000 and 700 BC (Li Jun *et al.* 2005).

Proxy data illuminating more precise details of the palaeoenvironment of the Chengdu Plain in the early Holocene remain scarce. Based on the Shierqiao spore and pollen record (SPICRA and CMICRA 2009:223-30), a large-scale early Holocene retreat of cold-resistant coniferous tree genera, such as *Pinus*, *Tsuga*, *Picea* and *Abies,* was matched by a spread of mesic fern genera such as *Hymenophyllum* and *Pteris,* as well as species of Polypodiaceae and *Polypodium*. The temperature during the early Holocene was slightly cooler than now, but a progressive warming trend after 5500 BC is attested by pollen cores from Ziyang city, Zizhong county, and another from Zigong city in the southern Sichuan basin, around 70-120 km southeast of Chengdu City (Figure 2.2).

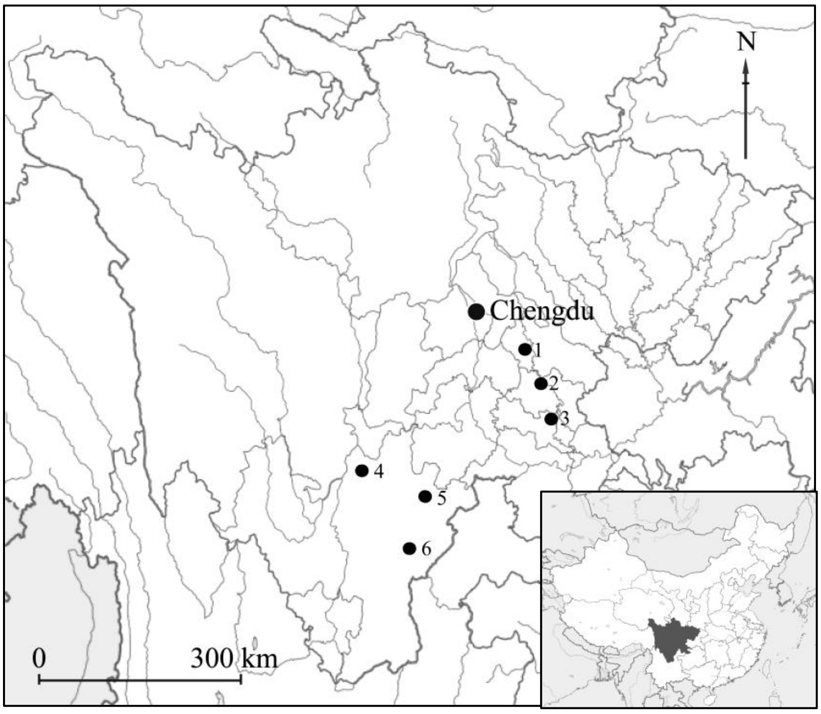


Figure 2.2: Locations of pollen cores: Ziyang (1), Zizhong (2), Zigong (3), Mianning (4), Leibo (5), Butuo (6).

Radiocarbon-dated between 5500 and 4740 BC, the Ziyang core contained subtropical plants, such as *Keteleeria*, *Castanea*, *Pterocarya*, palms, and tropical ferns. The annual mean temperature during this period is estimated to have been about 3℃ higher than now (Duan Wanti *et al.* 1981, cited in Winkler and Wang 1993). The cores from the other two river terrace sites in Zizhong and Zigong, dated between 4700 and 4400 BC, contain subtropical species dominated by Juglandaceae, Ginkgoaceae, and tropical ferns. These records also suggest an existence of subtropical broadleaf forest at this time (Duan Wanti *et al.* 1981, cited in Lan Yong 1993, Zhu Shiguang 1988).

Other data that identify palaeoclimatic oscillation in the early Holocene come from Lake Shayema in Mianning county in mountainous southwestern Sichuan, about 2400 m above sea level and 320 km southwest of Chengdu City (Figure 2.2). Although this site was in an area affected by both the Indian and the East Asian monsoons, the Shayema core indicates that southwestern Sichuan was warm and moist between 7100 and 5800 BC, and glacial era cold-tolerant genera such as *Abies, Betula* and deciduous oaks were progressively replaced by humid climate genera such as *Tsuga* and *Cunninghamia*. Also present by this time were evergreen oaks and other deciduous genera, including *Celtis, Fagus, Rhus, Euptelea, Liquidambar, Morus, Cercidiphyllum, Nyssa* and *Euonymus*.

The relative abundance of deciduous plants in the Shayema core suggests a warmer climate than now, with less seasonal precipitation. The pollen record from Shayema between 5800 and 2000 BC then suggests a transition from the previous warm and wet period into a pattern of strongly seasonal rainfall and a decreased range between summer and winter temperatures (Jarvis 1993; Liu Helin and Wang Deyin 1982, 1984). A similar change occurs in other parts of southwestern Sichuan (Tang Lingyu and Shen Caiming 2000), especially at Lake Yihai in Mianning county (Ai Nanshan 2002; Li Zhengji 1986), Lake Xiaohaizi in Leibo county (Liu Helin *et al.* 2004), and Lake Huolie in Butuo county (Liu Helin *et al.* 2003) (Figure 2.2).

A progressive warming trend between 8000 and 4000 BC can also be inferred from high-resolution pollen cores drilled in Guanghan. These indicate that broadleaf forests dominated by *Quercus* and evergreen broad-leaved trees were dominant on the Chengdu Plain by 4000 BC (Fu Shun 2002:12). However, by this time the climate was already starting to become drier. For instance, calculations of precipitation and air temperature from a pollen core drilled near the Jing river in Chengdu City suggest an annual precipitation of less than 800 mm prior to 2500 BC (Luo Lunde 1996). The formation of the Jiangbei conglomerate within the Sichuan basin between 5500 and 2500 BC, with its high calcium carbonate content, also suggests a high evaporation rate and growing aridity by this time because sedimentary gravels of this sort form only under conditions of low precipitation (Ai Nanshan 2002; Liu Xingshi 1998).

According to Luo Lunde (1996), annual precipitation after 2500 BC increased but the annual mean temperature between 2500 and 1000 BC dropped. The Guanghan core confirms a similar pattern (Fu Shun 2002:12), suggesting that the increasing precipitation apparently accelerated the formation of the Chengdu alluvial floodplain before 1700 BC (Fu Shun 2006:23-4). Clay mineral, organic, free iron oxide and organic carbon-isotope compositions of Jinsha soils suggest that the Chengdu Plain climate started to oscillate between cold/dry and warm/moist conditions after 2000 BC, with a cold and dry interval between 2000 and 1800 BC, a warmer and less dry interval between 1800 and 1450 BC, and then a warmer and wetter interval between 1450 and 1150 BC (Chen Bihui *et al.* 2003; Fu Shun 2006:61-2; Luo Hong *et al.* 2007; Luo Liping *et al.* 2007).

It remains unclear whether the cooling events that apparently occurred at circa 2500 and 2000 BC on the Chengdu Plain were related to the worldwide cooling events identified at roughly 3000 and 2000 BC (Bond *et al.* 1997; Perry and Hsu 2000), events which have been claimed by some to be associated with the collapse of a number of middle and late Neolithic cultures in China due to drought and flooding (Li Liu 2000; Lu 2007; Shi Chenxi *et al.* 2010; Shu Shaohua 1993; Wang Wei 2004; Wu Wenxiang and Liu Tungsheng 2001, 2004; Zhu Yan *et al.* 2001). However, no such impacts are visible on the Chengdu Plain until the termination of the Baodun culture at 2000 BC, a time at which there occurred an abandonment of several large walled settlements (see below).

Between 2000 and 1500 BC, Jinsha records suggest that the environment there consisted of marshland and intermittent streams with ephemeral channels. The flora largely included both evergreen and deciduous genera, such as *Pinus*, *Tsuga*, *Cyclobalanopsis*, *Quercus*, *Castanopsis*, *Ulmus* and *Betula*, accompanied by evergreen and deciduous shrubs such as *Michelia* and species of Oleaceae, Sapindaceae and Rutaceae. Non-arboreal pollen accounted for 60% of the total assemblage during this period, and increased to 75% around 1600-1400 BC. The transition from deciduous broadleaf forest to grassland and wetland was probably completed by 1200 BC (Luo Liping *et al.* 2008; Wen Xingyue *et al.* 2011). It thus becomes a major question whether these changes towards decreasing forest and increasing grassland reflect human impact and land clearance, autonomous climate change, or input from both sources.

The mid-Holocene optimum ended in the pollen records between 2000 and 1000 BC in different regions of China, and the climate apparently continued to become cooler and drier (Winkler and Wang 1993). A prolonged drought has been claimed for the Chengdu Plain between 1395 and 1305 BC, with an arid climate lasting until 1000 BC (Fu Shun 2006:62). However, botanists Yao Yifeng and colleagues (2005) estimate a mean annual temperature of 17.7-19.8℃ at 1000 BC, about 1.7 to 2.8℃ warmer than present. Mean annual precipitation at this time was 993.3-1113.3 mm, similar to the present. After 1000 BC, the mean annual temperature dropped to 15-16℃ (Luo Lunde 1996), and droughts became more frequent after 500 BC (Fu Shun 2006:29; Fu Shun *et al.* 2006; Liu Jian 2004:51; Luo Liping *et al.* 2007).

Environmental oscillations strongly affect population subsistence. At around 2500 BC, the moderate mean annual temperature of 17-19℃ and the increasing precipitation should have benefited the Baodun people in their practice of rice agriculture on the Chengdu alluvial floodplain (Fu Shun 2006:70) (see chapter 3). However, even by the time Baodun was starting, intensifying human activities must have had a corresponding reverse effect on natural vegetation due to the need for land clearance.

Research on the connections between adverse environmental change and the transitions from one archaeological culture to another on the Chengdu Plain is still preliminary. Natural disasters such as floods, droughts and river channel movements are implicated by some (Fu Shun 2006; Fu Shun *et al.* 2003, 2005, 2011; Guo Faming 1994; Liu Xingshi 1998, 2005; Luo Liping 2007), and earthquake-triggered lake water releases in the upper reaches of the Min and Tuo rivers by others (Fan Niannian *et al.* 2010; Wen Xingyue *et al.* 2012).

However, broader regional scale investigation remains indispensible, since these arguments so far are only based on ambiguous evidence from some of the large walled settlements (see chapter 3). For instance, a hypothesis that the destruction of eight Baodun walled settlements was caused by river channel migration and torrential rain was based simply on Liu Xingshi's (1998) identification of a flood deposit at Baodun, together with the identification of an ancient river channel passing through the Yufucun walled settlements. Similarly, the destruction of the Sanxingdui walled settlement has been ascribed to a mega-flood (Liu Xingshi 1998), identified from a 20 to 50 cm deep greyish black clean soil above the Sanxingdui cultural layer in Sanxingdui zone III (Lin Xiang 2001. However, this layer only indicates that Sanxingdui zone III was inundated at some point, but whether this affected the whole settlement remains unknown (Li Youcai 2004).

As another example, Fan Niannian *et al.* (2010) and Wen Xingyao *et al.* (2012) suggest that an earthquake-triggered landslide in the Longmen range dammed the Jian river (an upper tributary of the Tuo) at ca.1100 BC and temporarily rerouted the Jian to join the Min river. The suggestion is also that the reduced water supply in the Tuo river forced the Sanxingdui people to migrate from present-day Guanghan city to Jinsha in present-day Chengdu City in order to find resources for irrigation farming. The Sanxingdui walled settlement was then destroyed by a mega-flood when the dam burst and the Jian river rejoined the Tuo.

The effect of all these climatic and environmental changes on social developments on the Chengdu Plain is a topic of frequent debate and uncertainty. The only reasonable conclusion at this point is perhaps that a relatively warm and arid monsoon climate prevailed on the Chengdu Plain during the mid-Holocene. This climate gradually evolved toward less warmth but higher rainfall after 2500 BC, during and after the onset of the Baodun culture, but exactly how this impacted on the developing societies of the plain remains unclear, as does the important question of human impact versus natural climatic change.

2.3 The archaeological chronology

Based on pottery typology and site stratigraphies, most Chinese archaeologists accept three successive archaeological cultures on the Chengdu Plain between 2500 and 800 BC. These are termed successively Baodun, Sanxingdui, and Shierqiao. However, a small number of Chinese scholars propose the existence of an additional and transitional Yufucun culture dated between Baodun and Sanxingdui during the early 2nd millennium BC (Li Mingbin 2001, 2011; Song Zhimin 2006; Sun Hua and Su Rongyu 2003:119-20; Zhao Dianzeng and Li Mingbin 2004:149-62).

According to Li Mingbin (2011), this transitional Yufucun culture contained pottery of three successive styles, including Baodun phases 1 to 3, a Yufucun-specific style, and early Sanxingdui phase 2. The number of Yufucun sites as defined by Li is small. They are mostly distributed west and south of Chengdu, in Pixian county, Wenjiang and Gaoxinxi Districts in Chengdu City, and a small number have also been discovered in the borderland between Guanghan county and Chengdu. It is unfortunate that so far neither supporters nor critics (Jiang Zhanghua 2013) of Li's viewpoint provide clear and convincing illustrations of the pottery groups concerned. Because of the obscurity connected with the proposed Yufucun culture it is not considered further.

Past studies on the chronology of the prehistoric Chengdu Plain focus on the seriations proposed by Wang Youpeng *et al.* (1987) and Chen Xiandan (1989a). They both constructed a similar chronology in their successive publications by utilizing the Sanxingdui stratigraphy from the 1980-1986 excavations. The excavation record documented by Chen was the more detailed, and he divided the sequence into four phases in terms of the Chinese dynastic chronology. Phase 1 was the terminal Neolithic (ca. 2740-2070 BC); phase 2 was the transition between the legendary Xia and early Shang dynasties of the Central Plain of the Yellow River (ca. 2070-1600 BC); phase 3 was middle Shang; and phase 4 was late Shang to early Western Zhou (Chen Xiandan 1989a:218-9). The material culture of his phases 2 and 3 revealed little variation, and Chinese archaeologists now recognise both phases as part of the Sanxingdui culture. Chen's phase 1 corresponded to the Baodun culture, and thus differed greatly from the Sanxingdui culture (Jiang Zhanghua *et al.* 2002; Lin Xiang 2005; Sun Hua 2000:302-23; Wang Yi and Sun Hua 1999), as emphasized since by the increasing number of Baodun discoveries.

However, the question of whether Chen's phase 4 really corresponded to a late phase of the Sanxingdui culture as it is recognized today still remains widely debated (Jay Xu 2006; Jiang Zhanghua 1998a; Jiang Zhanghua *et al.* 2002; Li Boqian 1997; Song Zhimin 1990a, b, 1993, 2006, 2008:239-56, 2011; Sun Hua 1993a, 1996, 2000:138-78, 2001; Wang Yi and Zhang Qing 1999; Yu Mengzhou and Xia Wei 2011; Zhao Dianzeng 2005: 470-7; Zhao Dianzeng and Chen De'an 2005). Some Sanxingdui style pottery from the phase 3 deposits, such as small flat-based *guan* (Figure 2.3), ceramic ladles with bird-shaped handles with a hooked beak (Figure 2.4), tripodal *he* (Figure 2.5), high stemmed *dou* (Figure 2.6), and lids (Figure 2.7), all occur as well in phase 4. But phase 4 also yielded some new artefact forms, such as ∞-shaped handles on lids (Figure 2.8), pointed-based *zhan* (Figure 2.9), and pointed-based *bei* (Figure 2.10). The younger the deposit, the more common are these phase 4 artefact types.

Figure 2.3: Small flat-based *guan* from Sanxingdui phase 3.

Figure 2.4: Ceramic ladles with bird-shaped handles with a hooked beak from Sanxingdui phase 3.

Figure 2.5: Tripodal *he* vessels from Sanxingdui phase 3.

Figure 2.6: High stemmed *dou* from Sanxingdui phase 3.

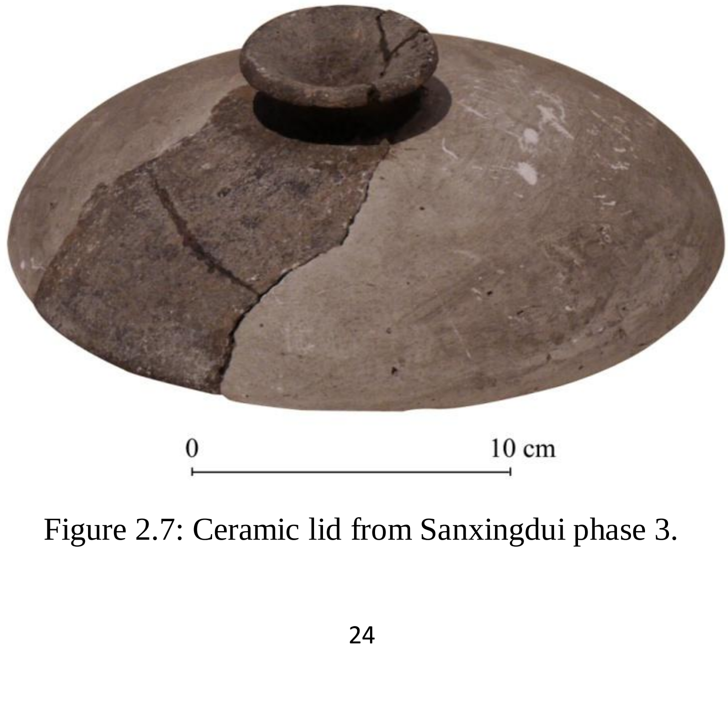


Figure 2.7: Ceramic lid from Sanxingdui phase 3.

Figure 2.8: ∞-shaped handles on lids from Sanxingdui phase 4.

Figure 2.9: Pointed-based *zhan* from Sanxingdui phase 4.

Figure 2.10: Pointed-based *bei* from Sanxingdui phase 4

Two perspectives exist on this debate over the separate existence of Sanxingdui phase 4. Some see it as an extension of the phase 3 Sanxingdui culture, regarding the new vessel forms as reflections of cultural contact with southern

Shaanxi and the upper reaches of the Han river in northwestern Hubei (CAMNU 2002:186; Chen Liang 1990; Li Boqian 1983, 1997; Song Zhimin 1998a, 2008: 264-6, 2011; Wei Jingwu 1993). This perspective would extend the upper date limit of the Sanxingdui culture from 1200 BC to around 800 BC, corresponding to the late Western Zhou or the early Spring and Autumn period of the dynastic chronology (Jay Xu 2006; Li Boqian 1997). A number of important phase 4 sites in or close to Chengdu City, such as Jinsha (CMICRA 2005b; Zhu Zhangyi *et al.* 2006), Shierqiao (SPICRA and CMICRA 2009), and the sites located in Gaoxinxi District in Chengdu City would, from this perspective, be classified as belonging to the Sanxingdui culture.

Opposed to the above perspective, others have categorized phase 4 as belonging to the Shierqiao culture, thus post-Sanxingdui, partially because of the appearance of the pointed-based pottery in large quantities (Jiang Zhanghua 1998a; Jiang Zhanghua and Li Mingbin 2002:168-83; Jiang Zhanghua *et al.* 2002; Song Zhimin 1990a, b; 2008:252-4, 2011; Sun Hua 1993a, 1996, 2000:49-67; Wang Yi and Zhan Qing 1999; Yu Mengzhou and Xia Wei 2011; Zhao Dianzeng 2005:470-86; Zhao Dianzeng and Chen De'an 2005; Zhao Dianzeng and Li Mingbin 2004:302-24). This school suggests that the pointed-based pottery arrived from western Hubei and eastern Sichuan, the so-called Xiajiang region (Bai Jiujiang and Li Dadi 2007:84; CAMNU 2002:186; Jiang Zhanghua 2004a, 2007; Jiang Zhanghua and Yan Jinsong 2003; Song Zhimin 1998a, 2008: 266-7, 2011).

This group thus regards Sanxingdui phase 4 as one of the earliest phases of the Shierqiao culture. Following this viewpoint, the Sanxingdui culture flourished between 2000 and 1200 BC, and Shierqiao proper commenced ca. 1200-1000 BC, during the late Shang and early Western Zhou. It terminated during the Spring and

Autumn period, around 800-700 BC, thus filling a previous hiatus between Sanxingdui and the historical Ba-Shu culture (Jiang Zhanghua *et al.* 2002; Song Zhimin 2008:245-52; Sun Hua 2000:68-88; Zhao Dianzeng 2005:537-600).

Chinese archaeologists who support the latter viewpoint treat the Shierqiao culture of phase 4 at Sanxingdui as the direct cultural successor of the Sanxingdui culture itself, partly because Sanxingdui style artefacts continued to be unearthed from Sanxingdui phase 4 layers and from other early Shierqiao sites (Jiang Zhanghua 1998a, 2004a, 2007; Jiang Zhanghua and Yan Jinsong 2003; Sun Hua 2000:86; Wang Yi and Zhang Qing 1999). At present, this viewpoint is the most widely accepted, but problems generated by radiocarbon dates, site distributions and site sequences over the Chengdu Plain undermine its absolute credibility, especially in light of the ongoing excavation program by Chengdu Municipal Institute of Cultural Relics and Archaeology.

2.4 Problems generated by the Shierqiao radiocarbon dates

The Chengdu Plain has produced very few radiocarbon-dated sites, and their paucity, as listed in table 2.1, has led some archaeologists to be uncritical about grasping at ^{14}C results in pursuit of a chronology (Figures 2.11, 2.12, and 2.13). The problem of whether or not Shierqiao was the direct successor of Sanxingdui is clearly raised by two ^{14}C dates from presumed early Shierqiao cultural deposits in the eponymous context itself - Shierqiao layer 13. These two dates, 2191-1696 BC (ZK-2132) on wood and 1927-1527 BC (BK-86095) on charcoal (OxCal 4.2. 95.4%) (CASS 1991:227), are too old to support the historical chronology outlined above. Some Chinese archaeologists suggest they are contextually incorrect and should be ignored (Jiang Zhanghua 1998a: 155; Jiang Zhanghua and Li Mingbin 2002:181; SPICRA and CMICRA 2009:131; Sun Hua 1996:136). If this is done, then the charcoal ^{14}C date ZK-1138, at 1123-808 BC (OxCal 4.2. 95.4%) from Sanxingdui site phase 4, stands as an indirect estimate for the date of early Shierqiao (CASS 1991:224).

Table 2.1: Radiocarbon dates from Chengdu Plain, Baodun to Shierqiao phases (CASS 1991, 1992, 1993; CMICRA *et al.* 2000:97; Liu Jian 2004:16-7; LRDABU 1996; Luo Liping 2007:12; Wang Yi 2006; Wen Xingyue *et al.* 2012; Zhou Zhiqing and Liu Yumao 2012) Calibration by OxCal 4.2. 95.4% using IntCal 13 (Reimer *et al.* 2013).

1. Baodun phase

Lab number and Sample Material	Site	Radiocarbon date (BP) $T_{1/2}$ = 5568	Calibrated date (BC)
GrA5726 Charcoal: wood	Baodun Collected within the earthen wall near Zhenwuguan	3965±60	2832-2286
GrA5717 Charcoal: wood	Baodun Gudunzi grave fill	3950±50	2576-2295
BK98009 Charcoal: bamboo	Gucheng House F5 fill	3905±85	2622-2137
BK98010 Charcoal: bamboo	Gucheng House F5 fill	3650±70	2273-1781
ZK-2346 Charcoal: wood	Bianduishan T204(5)	3960±250	3311-1765
ZK-2349 Charcoal: wood	Bianduishan T214(4)	3590±255	2848-1311
ZK-2330 Charcoal: wood	Sanxingdui T714EVIII	4540±135	3630-2911
ZK-2329 Charcoal: wood	Sanxingdui T711EIV-VII	3820±240	2905-1659
ZK-2328 Charcoal: wood	Sanxingdui T709CIV	4060±105	2891-2310
ZK-2104 Charcoal: wood-bamboo mixture	Sanxingdui 86GSIIIT1416(14):119	4050±85	2880-2349
BK-86046	Sanxingdui	4090±80	2877-2477

Charcoal: wood	86GSIIIT1416(14):182		
ZK-0973 Charcoal: wood	Sanxingdui 80GZAaT1(3)H	3960±100	2864-2147
BK-86045 Charcoal: wood	Sanxingdui 86GSIIIT1516(9):105	3880±80	2573-2136
BK-86047 Charcoal: wood-bamboo mixture	Sanxingdui 86GSIIIT1415(8B):69	3600±100	2275-1690

2. Sanxingdui phase

Lab number and Sample Material	Site	Radiocarbon date (BP) $T_{1/2} = 5568$	Calibrated date (BC)
BK-82058 Charcoal: wood	Sanxingdui T1(1)	3660±80	2287-1779
ZK-2326 Charcoal: wood	Sanxingdui 89GSHLT705(11)	3430±170	2271-1310
ZK-2327 Charcoal: wood	Sanxingdui 89GSHLT705(10)	3080±285	2135-591
ZK-2102 Charcoal: wood	Sanxingdui 86GSIIIT1516(8B):65	3510±80	2036-1630
ZK-2105 Charcoal: wood	Sanxingdui 86GSIIIT1414(9)H36(3):123	3500±75	2023-1641
ZK-2101 Charcoal: wood-bamboo mixture	Sanxingdui 86SIIIT1415(9)	3500±75	2023-1641
ZK-2103 Charcoal: wood-bamboo mixture	Sanxingdui 86SIIIT1415(11)	3450±80	1965-1534
ZK-1365 Charcoal: wood	Sanxingdui T(3)	3390±105	1946-1447
ZK-2496 Charcoal: wood	Sanxingdui T114(9)	3120±115	1639-1052
ZK-1138 Charcoal: wood	Sanxingdui T1(1)	2790±70	1123-808

3. Dates without clear stratigraphic contexts from Sanxingdui excavations in 1991

Lab number and Sample Material	Site	Radiocarbon date (BP) $T_{1/2} = 5568$	Calibrated date (BC)
ZK-2591 Charcoal: wood	Sanxingdui 91GSHTG2(4B):1	4760±130	3910-3105
BK-92085 Clay-charcoal mixture	Sanxingdui 91GSD77119(14)	4446±180	3634-2640
BK-92086 Clay-charcoal mixture	Sanxingdui 91GSDT7119(15)	4290±85	3322-2624
BK-92084 Wood	Sanxingdui 91GSDF7011(16)	4140±110	3012-2459
ZK-2592 Charcoal: wood	Sanxingdui 91GSHTG1H1	3970±115	2872-2151
ZK-2594 Charcoal: wood	Sanxingdui 91GSHTG1(5D)	3960±120	2872-2142
ZK-2694 Clay-charcoal mixture	Sanxingdui 91GSDT7124(6C)	3286±117	1884-1298
ZK-2693 Clay-charcoal mixture	Sanxingdui 91GSDT7020(6A)	3191±87	1665-1234
ZK-2695 Clay-charcoal mixture	Sanxingdui 91GSDT7124H9	2343±134	797-113

4. Dates without clear stratigraphic contexts from Jinsha excavations

Lab number and Sample Material	Site	Radiocarbon date (BP) $T_{1/2} = 5568$	Calibrated date (BC)
BK200171 Carbonized tree trunk	Jinsha ancient river channel of unknown stratigraphic context	2265±85	728-60
BA01205 Elephant molar	Jinsha unknown test pit	2930±70	1376-929
unknown lab number Charcoal: wood	Jinsha unknown	2685±40	909-798
Unknown lab number Charcoal: bamboo	Jinsha unknown	3030±40	1407-1131

Unknown lab number Unidentified animal bone	Jinsha unknown	3305±40	1684-1501
Unknown lab number Carbonized wood	Jinsha unknown	3390±40	1871-1560
unknown lab number Charcoal: wood	Jinsha unknown	3715±40	2275-1978
Unknown lab number Carbonized wood	Jinsha unknown	3830±40	2459-2148
BA05395 Charcoal: wood	Jinsha 2004CQJL27:51	2685±40	909-798
BA05400 Charcoal: bamboo	Jinsha 2004CQJIT7212(11)	3030±40	1407-1131
BA05401 Bone of unknown provenience	Jinsha 2004CQJH2318	3305±40	1684-1501
BA05406 Carbonized wood	Jinsha 2004CQJL58-4	3390±40	1871-1560
BA05411 Charcoal: wood	Jinsha 2004CQJIT7108(39)A	3715±40	2275-1978
BA05412 Carbonized wood	Jinsha 2004CQJIT6811(40)	3830±40	2459-2148

5. Shierqiao phase

Lab number and Sample Material	Site	Radiocarbon date (BP) $T_{1/2} = 5568$	Calibrated date (BC)
ZK-2132 Wood	Shierqiao II T40(13)	3580±80	2191-1696
BK-86095 Charcoal: wood	Shierqiao II T40(13)	3420±80	1927-1527
ZK-2133 Bamboo	Shierqiao II T64(10)	2400±105	797-212
BA111221 Carbonized rice	Zhonghai guoji Commune site 2 H26	3200±20	1505-1430
BA111222 Carbonized rice	Zhonghai guoji Commune site 2 H26	3205±25	1519-1426

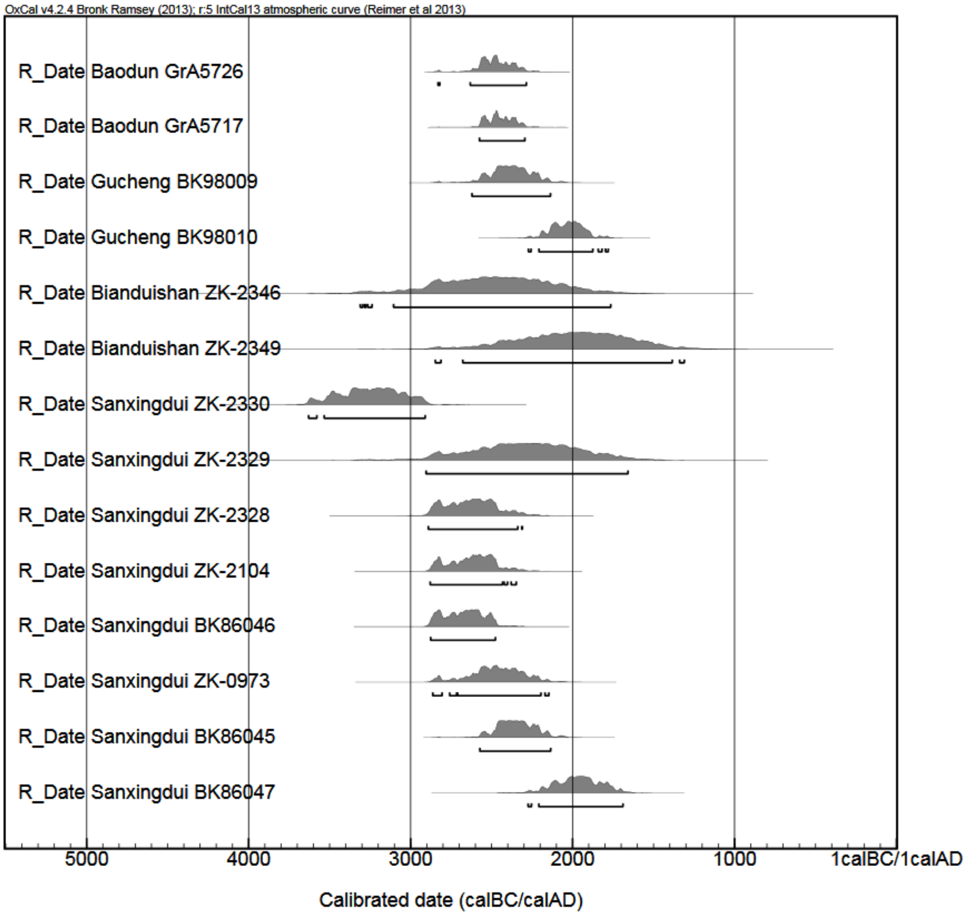


Figure 2.11: Probability distributions of the dates relating to the Baodun phase.

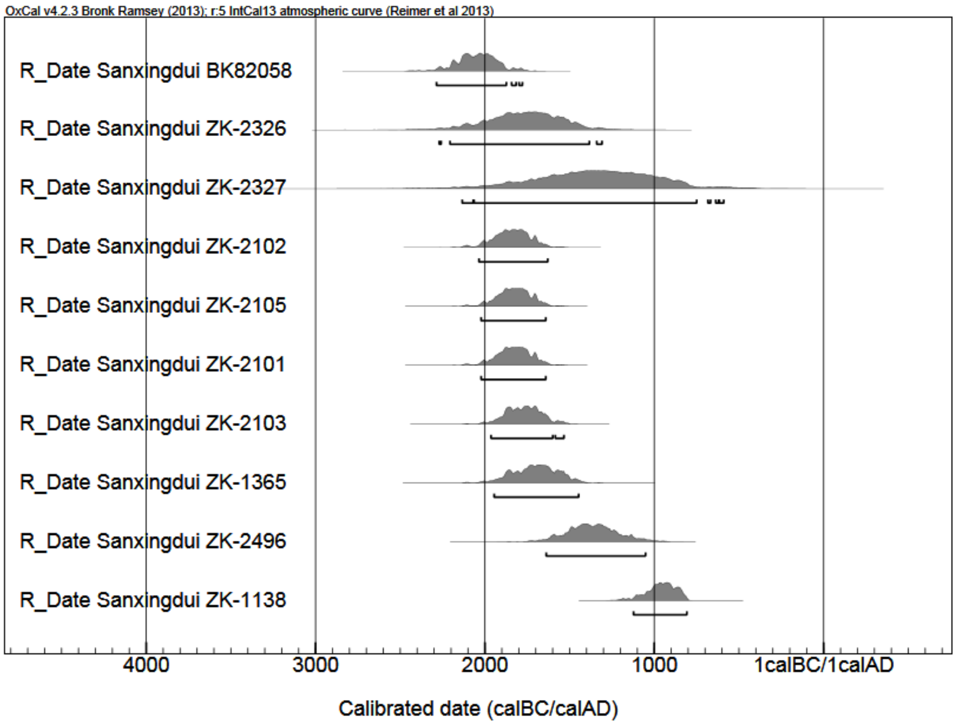


Figure 2.12: Probability distributions of the dates relating to the Sanxingdui phase.

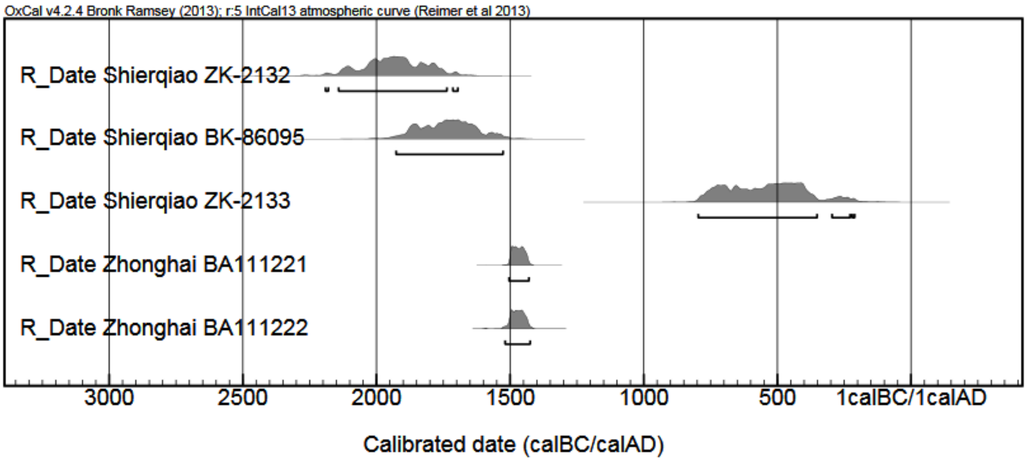


Figure 2.13: Probability distributions of the dates relating to the Shierqiao phase.

Apart from the two above-mentioned dates from Shierqiao itself, only 16 ^{14}C dates from Shierqiao contexts have been published. 14 are from unknown cultural layers at Jinsha. Unfortunately, their stratigraphic contexts remain unpublished (Table 2.1). Two dates for early Shierqiao, 1505-1430 BC and 1519-1426 BC on carbonized rice, are from artefact pit H26 at Zhonghai guoji Commune site 2 (Zhou Zhiqing and Liu Yumao 2012), a Shierqiao site located in western Chengdu City. Pits H26 and H25, the oldest Shierqiao cultural deposits in this site, were dug from layer 6, which lies on top of yellowish brown undisturbed soil. They have circular outlines about 8 to 9 m in diameter and contain a large quantity of carbonized plant remains and animal bones, and sherds dominated by small flat-based *guan*. Most of the artefacts unearthed from the pits are similar to those unearthed from Shierqiao layer 13. They lack the pointed-based pottery which occurs in the younger cultural layers of both sites, suggesting the date of Shierqiao layer 13 could be around 1500 BC.

2.5 The problems raised by site distributions and chronology

The distribution of the Sanxingdui culture on Chengdu Plain raises another problem, in that all known Sanxingdui sites are restricted to the Tuo Valley in the northern part of the plain. The locations include Guanghan county, Shifang city, Qingbaijiang, Xindu Districts in Chengdu City, and Jintang county. Shierqiao culture sites are more widely spread over the Min flood plain and the 160 km long piedmont of the Longmen and Qionglai ranges, including Pengzhou, Guanghan, and Ya'an cities (see Figures 2.1, 3.25, 3.26, 3.30 and 3.31). If these distributions and cultural attributions are correct, then the central and southern parts of Chengdu Plain were uninhabited during Sanxingdui times for around 800 years prior to the Shierqiao culture, a situation that seems very hard to accept.

This restricted pattern of Sanxingdui site distribution results not from any imbalance in the intensity of archaeological work south of Guanghan county, and salvage excavations during the past 15 to 20 years have been evenly distributed around Chengdu City. This problem needs to be resolved, and it cannot be explained by resort to environmental variations in productivity between the Min and Tuo valleys. Both valleys had been inhabited previously by the Baodun people around 500 years before the beginning of the Sanxingdui phase. Available studies of flora, fauna and geomorphology (CMICRA 2007b; Fu Shun 2006; Fu Shun *et al.* 2005; He Kunyu 2007a, b; Jiang Shibi 2003; Li Jun *et al.* 2005; Liu Jian 2004; Luo Liping 2007; Luo Liping *et al.* 2007; Wen Xingyue *et al.* 2011) reveal that the Min palaeoenvironment differed little from that of the Tuo. Both were moist lacustrine environments with abundant grassland and swamps drained by slow flowing streams.

One solution to this problem might come from a reconsideration of the Sanxingdui-Shierqiao seriation and chronology. If the Shierqiao culture can be dated earlier, thus overlapping with rather than replacing Sanxingdui, a solution might be found.

2.6 The date of the early Shierqiao

Chinese archaeologists have rejected the ^{14}C dates from Shierqiao layer 13 because both are considered too old. But if the dates from Zhonghai guoji Commune site 2, 1505-1430 BC and 1519-1426 BC on carbonized rice, are reliable, then the beginning of the Shierqiao culture would be much earlier than currently accepted. One of the problems here is that no single archaeological site on Chengdu Plain, except for Sanxingdui itself, contains successive Baodun, Sanxingdui and Shierqiao occupations. Furthermore, no Sanxingdui sites exist in the Min valley, where the most common archaeological deposits are Shierqiao, which lie either directly over Baodun deposits, or sometimes indirectly with a 10 to 30 cm stratigraphic gap in-between (Table 2.2).

This indicates that the Shierqiao culture, like Sanxingdui, descended directly from Baodun, thus rendering the Sanxingdui to Shierqiao succession observed at Sanxingdui itself as a special case. In other words, the Shierqiao culture might have been contemporary with Sanxingdui for some time, before ultimately replacing it at Sanxingdui. If so, Sanxingdui phase 4 cannot represent early Shierqiao, since it occurs above Sanxingdui phases 2 and 3, when Shierqiao was already in existence in nearby regions. Possibly, it represents an early phase of the middle Shierqiao.

Table 2.2: Chengdu Plain sites which include both Baodun and Shierqiao cultural deposits.

Sites	Stratification
Jinsha, Chengdu	
Xinghelu xiyanxian (Wang Lin and Zhou Zhiqing 2010)	10 to 25 cm of culturally sterile soil separates the Baodun and Shierqiao layers. Only a small number of sherds have been discovered from the Baodun layer.
Chunyu huajian (Chen Yunhong 2006a)	A Baodun layer does not occur beneath the Shierqiao, but a few Baodun sherds have been found.
Furongyuan south (Liu Jun *et al*. 2005)	A Baodun refuse pit occurs beneath Shierqiao layers.
Huangzhongcun gandao A yanxian (Zhou Zhiqing *et al*. 2005)	Shierqiao layers superpose Baodun.
Huangzhongcun gandao B yanxian (Zhou Zhiqing 2004)	A layer of loose yellowish sandy soil with few artefacts lies between the Baodun and Shierqiao layers.
Sanhe huayuan (Zhu Zhangyi and Liu Jun 2001)	A sparse Baodun assemblage occurs beneath the Shierqiao.
Wuhou District, Chengdu	
Minjiang xiaoqu (Li Mingbin and Wang Fang 2001)	No separate Baodun layer exists, but a number of Baodun refuse pits occur beneath the Shierqiao.
Jinniu District, Chengdu	
Commercial-residential building of Sichuan Ruyang Industrial Development (Zhou Zhiqing 2010)	No separate Baodun layer exists beneath the Shierqiao, but a few Baodun sherds have been discovered.
Zhonghai guoji Commune site 3 (Zhou Zhiqing and Liu Yumao 2007a)	Shierqiao layers superpose Baodun.
Qingbaijiang District, Chengdu	
Hongfengcun (Chen Yunhong *et al*. 2007)	Shierqiao layers superpose Baodun.
Gaoxinxi District, Chengdu	
Sichuan Fangyuan Zhongke (Zhou Zhiqing and Liu Yumao 2006a)	Shierqiao layers superpose Baodun.
Mofu Biotech (Zhou Zhiqing and Liu Yumao 2006b)	No separate Baodun layer exists beneath the Shierqiao, but a few Baodun sherds have

		been discovered.
	Xinjinxi Packing Factory (Zhou Zhiqing and Liu Yumao 2006c)	Shierqiao layers superpose Baodun.
	Datang Telecommunication Phase II (Zhou Zhiqing *et al.* 2005a)	No separate Baodun layer exists beneath the Shierqiao, but a few Baodun sherds have been discovered.
	Hangkonggang (Xie Tao *et al.* 2005a)	Shierqiao layers superpose Baodun.
	Huili Packing Factory (Zhou Zhiqing and Liu Yumao 2011)	Shierqiao layers superpose Baodun.
Xindu District, Chengdu		
	Chujiacun (Chen Yunhong *et al.* 2010)	A culturally sterile layer 11 to 35 cm thick separates the Baodun and Shierqiao layers.
	Taipingcun (Yi Li *et al.* 2012)	No separate Baodun layer exists beneath the Shierqiao, but a few Baodun sherds have been discovered.
Pixian		
	Institute of Internet Technology, Xihua University (Zhou Zhiqing *et al.* 2007)	No separate Baodun layer exists beneath the Shierqiao, but a few Baodun sherds have been discovered.
	Phases I and II of new campus in Southwest Jiaotong University (Xie Tao *et al.* 2005b)	Shierqiao layers superpose Baodun.
	Languang Green Drink phase II (Zhou Zhiqing *et al.* 2010)	No separate Baodun layer exists beneath the Shierqiao, but a few Baodun sherds have been discovered.
	Caojiaci (Yang Zhanfeng 2012a)	Shierqiao layers superpose Baodun.
Wenjiang		
	Tianxianglu (Yang Zhanfeng 2012b)	A culturally sterile 5 to 10 cm layer separates the Baodun and Shierqiao cultural layers.
	Fanjianian (Liu Yumao and Yang Zhanfeng 2012)	Terminal Shierqiao layers superpose culturally sparse Baodun.
	Yongfucun sanzu (Yang Zhanfeng 2012c)	Shierqiao layers superpose Baodun.
Xinjin		
	Baodun (He Kunyu *et al.* 2011a)	Shierqiao layers superpose Baodun.

According to the available site reports, early Shierqiao deposits occur in many sites (Table 2.3). Their relative chronology relies heavily on the pottery typology from layers 12 and 13 in the Shierqiao site itself (SPICRA and CMICRA 2009), and also from Lanyuan layers 6 and 7 (Zhou Zhiqing *et al*. 2003), and Sanhe huayuan layer 6 (Zhu Zhangyi and Liu Jun 2001). Most early Shierqiao sites are located in the western hemisphere of Chengdu City and contain not only pointed-based pottery of typical Shierqiao type, but also Sanxingdui style vessels such as small flat-based *guan*, high stemmed *dou*, and ceramic lids. A small number of Sanxingdui-type ceramic ladles with handles in the shape of a bird with a hooked beak, and a few tripodal *he*, have also been discovered in Shierqiao layers.

However, some of these sites show a sequence that contains Shierqiao-type pointed-based pottery stratified above layers that lack this form. They include Zhonghai guoji Commune site 2 in Chengdu City; the sites of Lanyuan, Renfang, Qiangyi Vehicle Trading and Jingpinfang in the Jinsha site cluster; the sites of Guoteng Phase II, Sichuan fangyuan zhongke, Xiqu guoji, Futong Optical-fiber Communication in Gaoxinxi District in Chengdu City; the sites of Languang Green Drink phase II, Caojiaci and Tiantaicun in Pixian county; the sites of Tianxianglu and Yongfucun sanzu in Wenjiang District in Chengdu City; and Chujiacun in Xindu District in Chengdu City.

Table 2.3: Archaeological sites reported to contain early Shierqiao deposits.

Sites		Layers
Jinsha, Chengdu		
	Lanyuan (Zhou Zhiqing *et al.* 2003)	7 to 5
	Sanhe huayuan (Zhu Zhangyi and Liu Jun 2001)	9 to 4
	Xinghelu xiyanxian (Wang Lin and Zhou Zhiqing 2010)	6 to 5

	Chunyu huajian (Chen Yunhong 2006a)	5
	Wanbo (Chen Yunhong *et al.* 2004)	6 to 5
	Longzui B yanxian (Zhou Zhiqing and Wu Nan 2010)	8
	Huangzhongcun gandao A yanxian (Zhou Zhiqing *et al.* 2005)	5
	Huangzhongcun gandao B yanxian (Zhou Zhiqing 2004)	5
	Qiangyi Vehicle Trading (Wang Lin and Jiang Ming 2009)	T3: 8 to 7 T2: 9 to 7
	Furongyuan south (Liu Jun *et al.* 2005)	5
	Shufeng Huayuancheng Phase II (Tang Fei *et al.* 2003)	4
	Renfang (Tang Fei *et al.* 2005)	6 to 4
	Jingpinfang of Langjiacun (Zhu Zhangyi *et al.* 2006)	7 to 6
Gaoxinxi District, Chengdu		
	Xiqu guoji (Zhou Zhiqing and Liu Yumao 2009)	5
	Futong Optical-fiber Communication (Zhou Zhiqing and Liu Yumao 2010a)	6 to 4
	Wan'an Pharmaceutical Packing Factory (Zhou Zhiqing *et al.* 2005b)	6
	Xinjinxi Packing Factory (Zhou Zhiqing and Liu Yumao 2006c)	5
	Sichuan Fangyuan Zhongke (Zhou Zhiqing and Liu Yumao 2006a)	4
	Guoteng Phase II (Liu Yumao *et al.* 2005)	4
	Datang Telecommunication Phase II (Zhou Zhiqing *et al.* 2005a)	6 to 5
Qingbaijiang District, Chengdu		
	Hongfengcun (Cheng Yunhong *et al.* 2007)	5
	Dafucun (Chen Yunhong *et al.* 2009)	6 to 5
Xindu District, Chengdu		
	Chujiacun (Chen Yunhong *et al.* 2010)	4
	Zhengyincun (Chen Yunhong and Liu Yumao 2003)	6 to 5
	Zhengyin xiaoqu construction site (Chen Yunhong and Wang Bo 2005)	6 to 5
	Taipingcun (Yi Li *et al.* 2012)	9 to 7
Qingyang District, Chengdu		
	Shierqiao (SPICRA and CMICRA 2009:18)	13 to 10
Jinniu District, Chengdu		
	Zhonghai guoji Commune sites 3 and 4 (Zhou Zhiqing and Liu Yumao 2007a, b)	4

	Zhonghai guoji Commune site 2 (Zhou Zhiqing and Liu Yumao 2012)	6 to 5
Pixian		
	Songjia heba (He Kunyu 2009)	5 to 4
	Institute of Internet Technology, Xihua University (Zhou Zhiqing *et al*. 2007)	4
	No.6 Academic building of the new campus, Xihua University (Zhou Zhiqing *et al*. 2006)	6
	Languang Green Drink phase II (Zhou Zhiqing *et al*. 2010)	5
	Caojiaci (Yang Zhanfeng 2012a)	H1 and H2
	Tiantaicun (Yang Zhanfeng 2012d)	7 to 6
Wenjiang		
	Yongfucun sanzu (Yang Zhanfeng 2012c)	4
	Tianxianglu (Yang Zhanfeng 2012b)	5
Dujiangyan		
	Shuzhuangtai (Suo Dehao *et al*. 2012)	3

Chinese archaeologists usually differentiate Shierqiao assemblages from Sanxingdui by the appearance of the above-mentioned pointed-based pottery, since this has never been discovered in any Sanxingdui phase 2 and 3 cultural deposits. If this criterion is adopted, the assemblages mentioned above that predate the appearance of the pointed-based pottery should be classified as Sanxingdui culture. However, Chinese archaeologists still classify them as early Shierqiao because they believe that their dates are close to those of the upper Shierqiao cultural layers which contained the flat-based *guan*, high stemmed *dou*, ceramic lids and pointed-based pottery. However, if these sites predate the pointed-based pottery, then using this form as an index fossil for the Shierqiao culture is not sufficient. The pointed-based pottery did not come into existence at the very beginning of the Shierqiao, so Sanxingdui phase 4, which has pointed-based pottery in large quantity, can hardly be early Shierqiao.

2.7 Conclusions

In this chapter I have defined the geographic scope of my research, summarized the effect of climate and environmental changes on social development, and challenged aspects of the most commonly adopted chronology for the Chengdu Plain between 2500 and 800 BC. Following an analysis of available radiocarbon dates, evidence of archaeological stratigraphy, and the contrasting distribution patterns of the Sanxingdui and Shierqiao assemblages, I suggest that the current chronology needs revision. Rather than a unilinear development, the Sanxingdui and Shierqiao cultures appear to have been contemporary, prior to the beginning of Sanxingdui phase 4, which was contemporary with late Shang and Western Zhou on the Central Plain.

Although the lower chronological boundary of the Shierqiao culture remains unknown owing to the rarity of ^{14}C dates, it should be noted that the excavation of the Shierqiao site itself was terminated in layer 13 owing to the need to protect a wooden structure that existed beneath. This implies that there were still unexcavated Shierqiao cultural layers below the level reached (Song Zhimin 1993; SPICRA and CMICRA 2009).

It is also suggested here that the pointed-based pottery is not an appropriate index fossil to define the Shierqiao culture as a whole, because this kind of vessel came into existence relatively late, around 1200 to 1100 BC. The connection between terminal Baodun and early Shierqiao is also not clear owing to the scarcity of early Shierqiao layers. Although Baodun and Shierqiao burials were generally supine, and details of house construction were similar (see chapter 3), their pottery types rarely show continuity. Future research on the potentially transitional Yufucun culture has some potential to solve this problem, given that the distributions of Yufucun and early Shierqiao sites overlap west of Chengdu.

Perhaps, the early Shierqiao sites without pointed-based pottery can be included in Li Mingbin's Yufucun complex.

In conclusion, it appears that there were three identifiable archaeological cultures on the prehistoric Chengdu Plain - Baodun, Sanxingdui, and Shierqiao. The Baodun culture existed between 2500 and 2000 BC, and was succeeded in parallel by the Sanxingdui and Shierqiao cultures, which flourished in separate regions during Sanxingdui phases 2 and 3, the former in the Tuo valley and the latter in the Min valley. Their connections with the preceding Baodun remain obscure. The presence of Sanxingdui style artefacts in Shierqiao sites also suggests contemporaneity.

During Sanxingdui phase 4, however, the cultural influence of Shierqiao reached the Tuo valley and began to dominate. Eventually, the Shierqiao culture survived longer than the Sanxingdui, into the early Spring and Autumn period with a termination around 800-700 BC. A graphical presentation of this chronological scheme is offered in Figure 2.14.

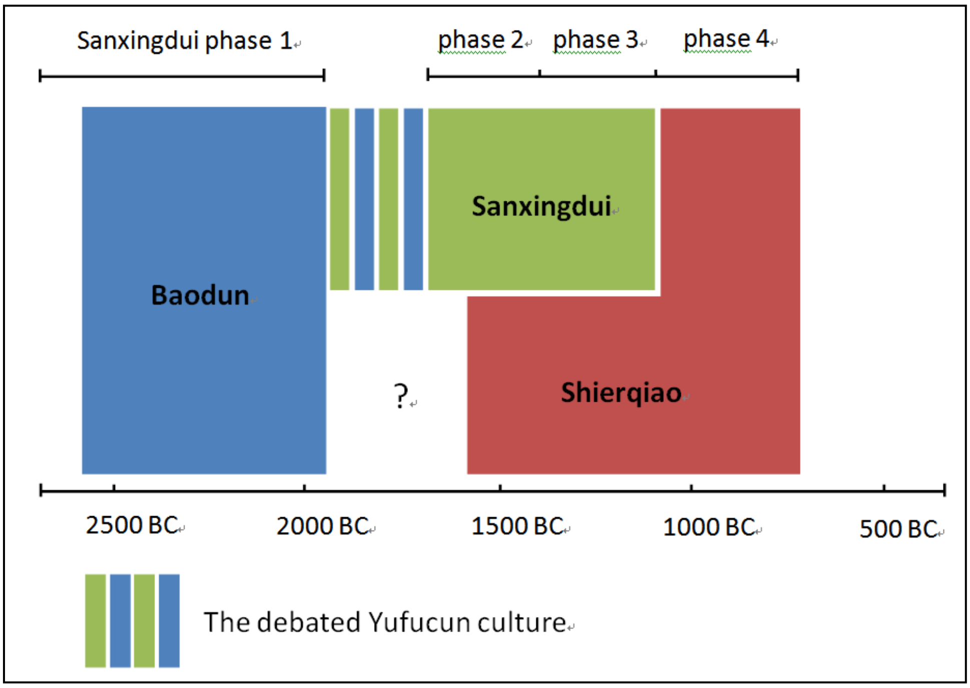


Figure 2.14: The author's revised chronology of the prehistoric Chengdu Plain.

Chapter 3
A review of past archaeological work concerning the Baodun, Sanxingdui and Shierqiao cultures on the Chengdu Plain

In the last 80 years a series of surface surveys and salvage excavations have been progressively carried out on the Chengdu Plain. The fast accumulating archaeological data offer valuable information to explore the past. On the basis of available site reports, this chapter provides an archaeological account of key discoveries on the Chengdu Plain dating between 2500 and 800 BC. It begins with a brief review of past archaeological research, and then gives an introduction to significant sites, following their chronological order. Disputes over the dates of some sites are also examined. The purpose of this chapter is to construct a foundation for the discussion in the following chapters, which will be focused on seeking evidence for increasing social complexity and on possible organizational changes in the pottery making industry in relation to social development.

3.1 A review of past archaeological research on the Chengdu Plain

Archaeological work on the Chengdu Plain commenced in 1933/34 with American scholar David C. Graham's excavation at Yueliangwan in Guanghan (Feng Hanji and Tong Enzheng 1979; Graham 1934; Lin Mingjun 1942; Zheng Dekun 1946:31; Zhou Shurong 2012). During most of the 20th century the research focus has been on the site of Sanxingdui, although there were also other scattered but significant discoveries, such as the Zhuwajie bronze hoards (Fan Guijie and Hu Changyu 1981; Wang Jiayou 1961) and the sites of Shuiguanyin (Deng Boqing 1959) in Xinfan township, Bianduishan (Zheng Ruokui and Ye

Maolin 1990) in Mianyang city, Yangzishan earthen mound (Yang Yourun 1957) in northern Chengdu City, and Shierqiao house remains in central Chengdu City (Li Zhaohe *et al.* 1987).

For most western scholars, the Sanxingdui artefacts from the two famous artefact pits (Chen De'an and Chen Xiandan 1987, 1989a; SPICRA 1999) form the major research focus (see Falkenhausen 2003 for a summary). Excepting the general introductions by Rawson (1996), Capon (2000), Sage (1992:16-25) and Treistman (1974:35-9), research has been focused on connections between the Central Plains Shang Dynasty, the middle reaches of the Yangzi River, and Sichuan basin (Bagley 1988, 1990, 1992; Ge and Linduff 1990; Rawson 1996:60-84). Also considered significant have been the possible origins of bronze metallurgy in Sichuan (Bagley 1992; Barnard 1990), the external connections of Sanxingdui (Falkenhausen 2006), and the social meanings of the artefacts (Rawson 1996:60-84; Wu Hung 1997).

Understanding of the archaeology of the prehistoric Chengdu Plain has greatly advanced since the last decade of the 20th century by virtue of a series of surveys and salvage excavations resulting from rapid urban construction. Examples include the sites at Jinsha (Jiang Zhanghua 2010; Zhu Zhangyi *et al.* 2002a, 2002b, 2006) and numerous sites around Chengdu City, especially in Pixian county (Flad *et al.* 2010; Horsley 2010; Li Shuicheng 2010). Recent research has included environmental studies in relation to social transformations on the prehistoric Chengdu Plain (e.g. Chen Bihui *et al.* 2003; Fu Shun 2006; Li Jun *et al.* 2005; Luo Liping 2007); the origins of farming there (d'Alpoim Guedes 2011; Jiang Ming *et al.* 2011a, b); metallurgical, metallographic and lead isotope analyses (e.g. Cui Jianfeng and Wu Xiaohong 2013; Jin Zhengyao *et al.*1995, 1998, 2004; Ma Jiangbo *et al.* 2012; Sun Shuyun *et al.* 2005; Xiang Fang *et al.*

2010; Xiao Lin *et al.* 2004; Zeng Zhongmao 1989, 1991); zooarchaeology (He Kunyu 2007a, b, 2011; Liu Jian 2004); forensic archaeology (Wei Dong and Zhu Hong 2008; Zhang Jun and Zhu Zhangyi 2006; Zhang Qing and d'Alpoim Guedes 2008); geological and geophysical analyses (Xiang Fang *et al.* 2008; Zhang Rubo 1999; Zheng Wenfeng *et al.* 2013); and the possible origins of the terminal Neolithic Baodun culture (Chen Jian 2007a; Huang Haode and Zhao Binfu 2004; Jiang Zhanghua 2002, 2004b).

In this chapter, key archaeological discoveries on the Chengdu Plain, as the main sources of material used throughout this thesis, are inventoried in chronological order. Although similar accounts have been published by Jiang Zhanghua *et al.* (2001), Wang Yi (2006), Zhao Dianzeng and Li Mingbin (2004), and Rowan Flad and Chen Bochan (2006), this introduction provides new dates and data through to mid 2013, and some additional data published in late 2013 and 2014 are also discussed.

3.2 Chengdu Plain in the 3rd millennium BC – the Baodun culture

Dated between 2500 and 2000 BC, the Baodun is so far the oldest Neolithic culture discovered on the Chengdu Plain. This of course is remarkably young compared to the middle and lower Yangzi, and to the Neolithic discoveries on the northern brink of the Sichuan basin, at sites such as Zhongzipu, Zhangjiapo and Lujiafen in Guangyuan county (Tang Zhigong 1997; Wang Renxiang 1991; Wang Renxiang and Ye Maolin 1993; Zheng Ruokui and Tang Zhigong 1992; Zheng Ruokui and Wang Renxiang 1991) (Figure 3.1). The name Bianduishan was applied to this archaeological culture in the past (He Zhiguo 1993; Sun Hua 1993a:23) because Bianduishan was the first discovered Neolithic site on the Chengdu Plain (PCSWM 1954). Bianduishan was replaced by Baodun as the eponymous site because Chinese archaeologists, after a survey in 1989 (Zheng Ruokui and Ye Maolin 1990), indicated that the material culture of Bianduishan was not really representative of the other Baodun sites discovered since the late 20th century, even though Bianduishan pottery does share some similarities with Baodun pottery. Furthermore, Bianduishan is actually quite distant from the core Baodun zone. Other sites on Chengdu Plain with pottery directly similar to Bianduishan include only Dashuidong (Hu Changyu *et al.* 2006), a limestone cave in Jiangyou city, about 40 to 45 km north of Bianduishan (Figure 3.1).

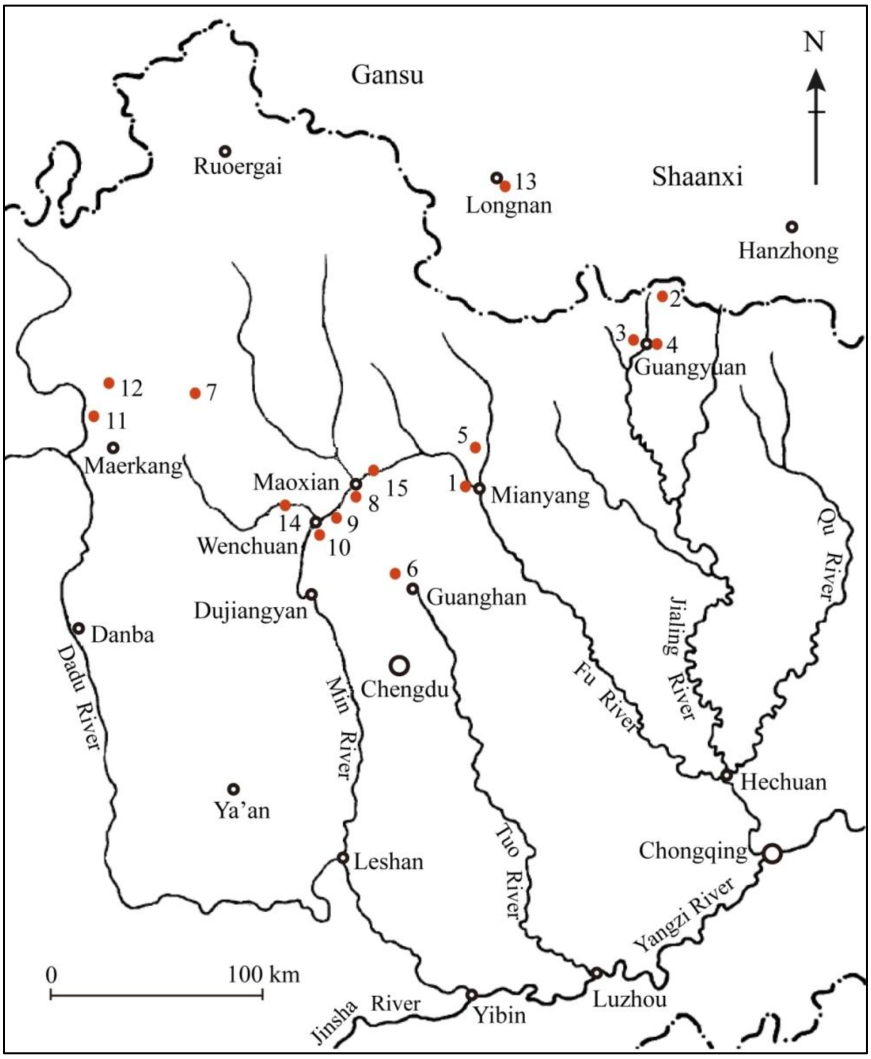


Figure 3.1: The distribution of sites in western and northern Sichuan: Bianduishan (1), Zhongzipu (2), Zhangjiapo (3), Lujiafen (4), Dashuidong (5), Guiyuanqiao (6), Guannaruo (7), Yingpanshan (8), Anxiang (9), Jiangweicheng (10), Haxiu (11), Konglongcun (12), Dalijiaping (13), Shawudu (14), Xiaguanzi (15).

The origin of the Baodun culture remains uncertain, and Neolithic sites older than Baodun have not so far been certainly recovered on the Chengdu Plain. In terms of recent and current opinions about Baodun origins, Yu Weichao (2008) suggests that the Baodun people were Shijiahe immigrants from Hubei, via eastern Sichuan, because of parallels between the Shijiahe greyish pottery and walled settlements and those of Baodun. Others suggest that the walls surrounding sites of the Baodun culture indicate interaction with the Middle Yangzi, where similar walled settlements have been found associated with rice farming. This has led several scholars to hypothesize that the arrival of the Baodun culture resulted from an expansion of rice agriculturalists into the region (Fuller and Qin 2009; Guedes 2011; Guedes *et al.* 2013; Rowan Flad and Chen Pochan 2006; Zhang Chi and Hung Hsiaochun 2008, 2010).

However, other Chinese archaeologists (Chen Jian 2007a; Chen Weidong and Wang Tianyou 2004; Huang Haode and Zhao Binfu 2004; Jiang Zhanghua 2004b, 2005; Xu Shueshu 1995) consider that Baodun might have originated in southern Gansu and northwestern Sichuan, possibly in the upper reaches of the Min river. This opinion is mainly inspired by the grey coarse sandy, fine sandy, and fine ware pottery from the site of Yingpanshan (Jiang Cheng *et al.* 2002), similar in fabric and colour to that of Baodun. Both assemblages are dominated by flat-based and ring-footed vessels, and some techniques of vessel forming and surface decoration show similarities, although the Baodun greyish white and greyish yellow fine wares do not occur at Yingpanshan. Nevertheless, some Chinese archaeologists believe that the Yingpanshan pottery provides a suitable prototype for Baodun (Huang Haode and Zhao Binfu 2004; Jiang Zhanghua 2004b, 2005).

Based on five calibrated radiocarbon dates (Table 3.1), Yingpanshan was evidently occupied about 300 to 500 years before Baodun. Recent discoveries at Guiyuanqiao in Shifang city (Figure 3.1) could provide a link between Yingpanshan and Baodun, since pre-Baodun (Guiyuanqiao phase 1) and Baodun (Guiyuanqiao phases 2 and 3) cultural deposits have been dated from charred seeds collected by systematic flotation. Phase 1 at Guiyuanqiao dates to 3100-2600 BC, phase 2 to 2600-2300 BC, and phase 3 to 2300-2100 BC (Wan Jiao and Lei Yu 2013a).

Table 3.1: Radiocarbon dates from Yingpanshan (CASS 2005; Chen Jian 2007b).

Lab number and Sample Material	Site	Radiocarbon date (BP) $T_{1/2}$ = 5568	Calibrated date (BC)
BA03208 Unknown material	Yingpanshan 2000SMYT l0H8	4390±60	3331-2896
BA03281 Unknown material	Yingpanshan 2000T12⑥	4170±60	2984-2581
ZK-3208 charcoal	Yingpanshan 2003SMYY1	4416±31	3319-2919
ZK-3210 charcoal	Yingpanshan 2003SMYH58	4274±31	3003-2778
ZK-3211 charcoal	Yingpanshan 2003SMYH26	4419±32	3322-2920

Calibration by OxCal 4.2. 95.4% using IntCal 13 (Reimer *et al.* 2013).

Details about Guiyuanqiao so far have only been published in one brief site report and one paper, which both contain very poor artefact descriptions and illustrations, so information about the scarce pre-Baodun cultural deposits in the Sichuan Basin remains insufficient (Wan Jiao and Lei Yu 2013a, b). According to these authors, the total of 1327 sherds excavated from Guiyuanqiao phase 1 pit H20 is dominated by coarse quartz-sand-tempered red wares with cord marking

(78.6%). No vessels could be reconstructed, but rim and base sherds suggest the presence of wide-lipped *guan* with flat bases and rims notched by sticks wrapped with fine cord (Figure 3.2). These vessels were constructed from slabs of clay that were flattened and then joined into the desired shape. Wall thicknesses usually exceed 1 cm. No evidence suggests kiln firing and the firing temperature remains unknown.

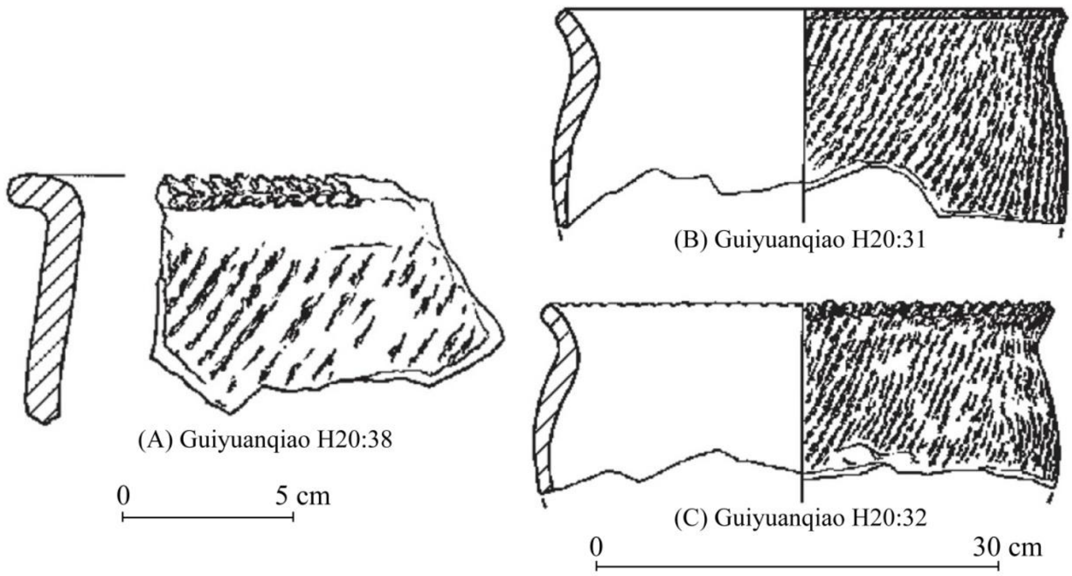


Figure 3.2: Wide-diameter *guan* with notched lips from Guiyuanqiao (redrawn after Wan Jiao and Lei Yu 2013a, with modifications).

The cultural connections between Guiyuanqiao, northwestern Sichuan and southern Gansu remain obscure, but flotation samples from Guiyuanqiao phase 1 ash pit H43 suggest that between 3100 and 2600 BC people subsisted heavily on broomcorn millet (*Panicum miliaceum*) and foxtail millet (*Setaria italica*), similar to their northern and northwestern counterparts (Wan Jiao and Lei Yu 2013b). Some Chinese archaeologists hold the opinion that the earliest Neolithic groups on the Chengdu Plain were southward immigrants from southern Gansu around 3500-3000 BC, via the Bailong valley, the Songpan grassland and the Min valley in northwestern Sichuan. This viewpoint also suggests that the pre-Baodun materials at Guiyuanqiao were brought in by immigrants (Chen Weidong and Wang Tianyou 2004; Jiang Zhanghua 2004b; Wan Jiao and Lei Yu 2013b; Zhang Qianglu 1998), perhaps agriculturalists descending from mountainous northwestern Sichuan (d'Alpoim Guedes 2011). However, the absence of painted pottery at Guiyuanqiao poses a problem, in that painted pottery was widespread in northwestern Sichuan and southern Gansu during the 4th and 3rd millennia BC.

Archaeological data that could support direct links between Gansu, northwestern Sichuan, and the Chengdu Plain thus remain insufficient. This is partly due to the poor quality of archaeological work in western Sichuan. For instance, two narrow-necked flask rim sherds with external flanges (Figure 3.3) from Guiyuanqiao phase 1 are similar to rims from the sites of Yingpanshan (Jiang Cheng *et al.* 2002), Guannaruo in Heishui county, Anxiang (Jiang Cheng *et al.* 2007) in Maoxian county, Jiangweicheng in Wenchuan county (Huang Jiaxiang 2006), Haxiu and Konglongcun in Maerkang county (Chen Jian and Chen Xuezhi 2007; Chen Jian and He Kunyu 2007), and Dalijiaping (ca. 3300-3100 BC) in southern Gansu (Zhang Qianglu and Wang Hui 2000) (see map, Figure 3.1). But they do not have clear stratigraphic contexts and dates.

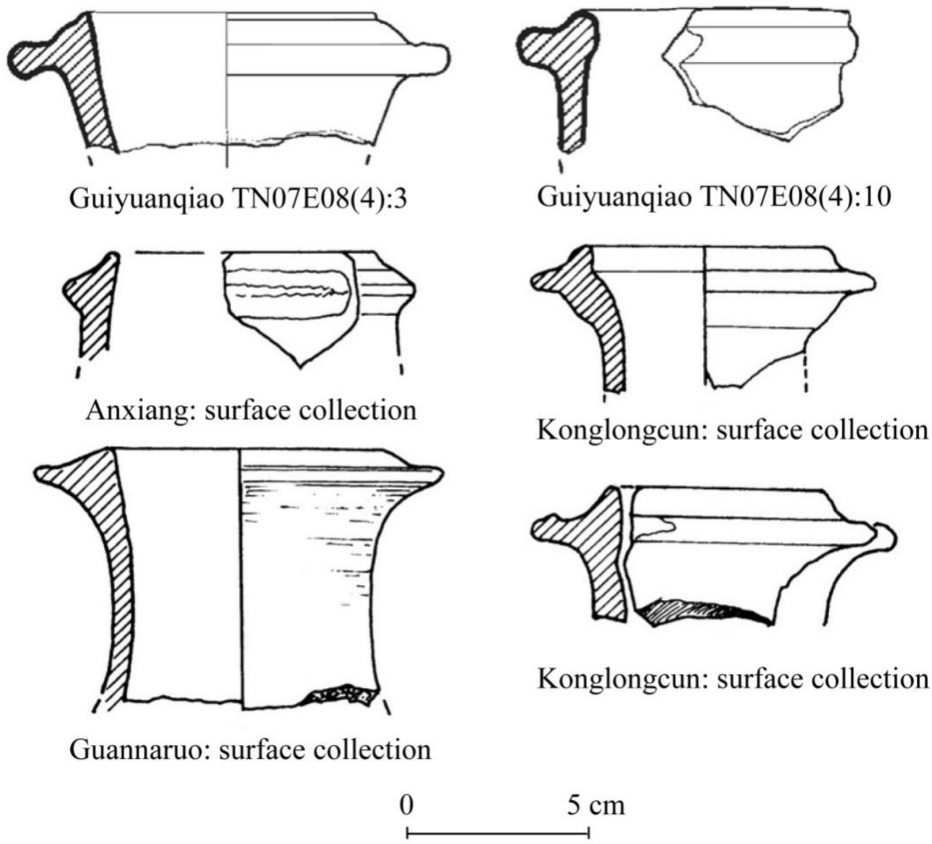


Figure 3.3: Narrow-necked flask rim sherds with external flanges from Guiyuanqiao, Anxiang, Konglongcun and Guannaruo (redrawn after Jiang Cheng *et al.* 2007, Wan Jiao and Lei Yu 2013b, with modifications).

To solve such problems, more archaeological work is required in the upper to middle reaches of the Fu valley and the piedmont zone of the Longmen-Qionglai ranges. Relevant sites here include Shawudu (Jiang Cheng *et al.* 2006, 2008a) and Xiaguanzi (Jiang Cheng *et al.* 2007, 2008b) in Maoxian county (Figure 3.1). The pottery of these two sites shows affinities with that from Bianduishan (Zheng Ruokui and Ye Maolin 1990) and Dashuidong (Hu Changyu *et al.* 2006) (Figure 3.1). However, it is unclear if such connections reflect actual population migration or simply cultural diffusion through the Min and Fu valleys (Chen Jian 2006; Cui Jianfeng *et al.* 2011; Hung Lingyu 2011:225; Hung Lingyu *et al.* 2011, but see Ren Ruibo *et al.* 2013), and this is a problem always with comparisons based only on pottery characteristics.

The notion that the ancestry of Baodun can be solely credited to cultural influences from the mountainous northwest also requires rethinking because archaeobotanical evidence for both millets and rice implies communications with other regions. Flotation samples from Guiyuanqiao and Baodun ash pits and cultural layers suggest a shift on the Chengdu Plain from broomcorn (*Panicum miliaceum*) and foxtail millet (*Setaria italica*) agriculture during Guiyuanqiao phase 1 (ca. 3100-2600 BC) into combined rice (*Oryza sativa japonica*) and foxtail millet production by the end of that phase (ca. 2600 BC). By the end of Guiyuanqiao phase 2, at ca. 2300 BC, rice cultivation was predominant (Wan Jiao and Lei Yu 2013b). Three potential routes for the spread of rice farming into the Chengdu Plain have been suggested: (1) through the upper Han river valley to the north of the Sichuan basin, via Danjiangkou city, Shiyan city, Yunxian county, Yunxi county, Ankang city and Hanzhong city, (2) through the Three Gorges of the Yangzi River in eastern Sichuan, and (3) through the foothills of northern Guizhou (d'Alpoim Guedes 2011; d'Alpoim Guedes *et al.* 2013; Zhang Chi and Hung Hsiaochun 2008, 2010) (Figure 3.4).

The immediate homeland of rice cultivation is universally believed to have been in the middle and lower Yangzi River (Bellwood 2011; Fuller 2011; Yan Wenming 1997, 1998, 2000; Zhao Zhijun 2010, 2011). The dispersal of rice and millet cultivating populations is often seen as pivotal in the population history of East and Southeast Asia, being linked to the establishment of sedentism and the spread of several major language families (Bellwood 2005a, b, 2006, 2008, 2009, 2013:135-6, 178-209; Bellwood and Oxenhem 2008; Fuller and Qin 2009; Lu 2005). Nevertheless, this population dispersal hypothesis based on rice farming from the middle Yangzi for the Chengdu Plain still needs further archaeobotanical support. Recent flotation analysis from Zhongba in Zhongxian county of Chongqing City (Figure 3.4) fails to corroborate a universal shift to rice since the main crops here between 2500 and 1750 BC continued to be broomcorn and foxtail millet, with a significant transition to rice occurring only after 1100 BC (Zhao and Flad 2013).

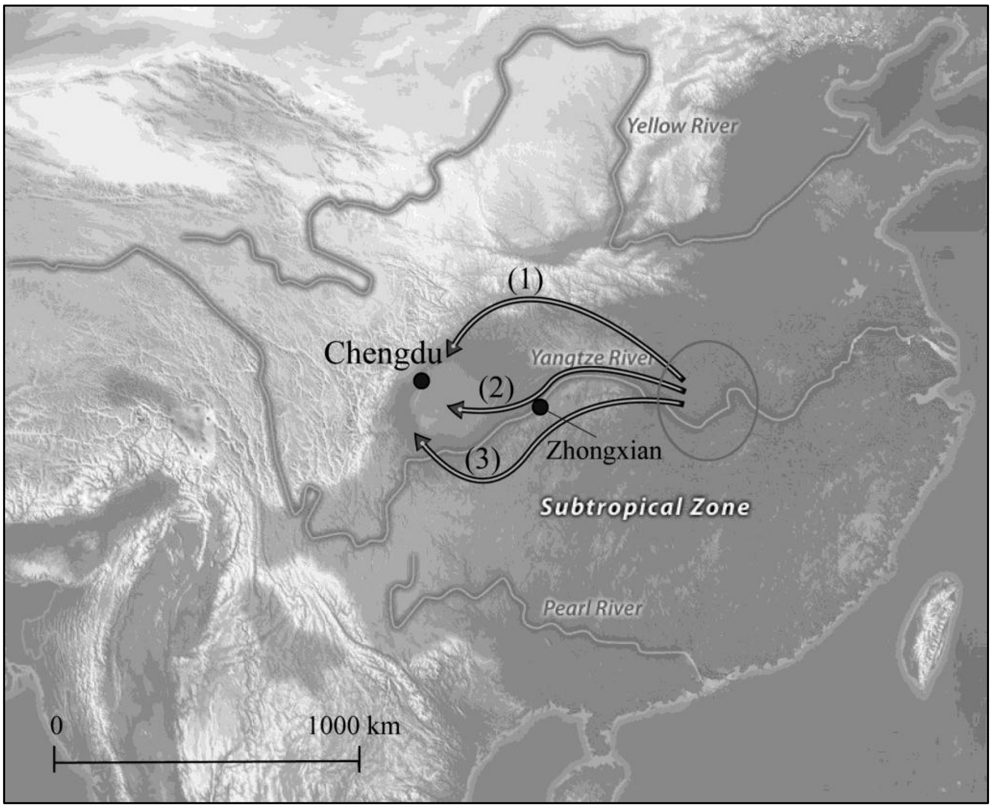


Figure 3.4: Three possible routes of rice farming dispersal into the Sichuan basin.

3.3 The walled settlements of the Baodun culture

The most significant excavated Baodun sites are the eight walled settlements of Baodun, Yufucun, Gucheng, Mangcheng, Shuanghe, Zizhucun, Yandian and Gaoshan (Figure 3.5). To date, only the Baodun excavations have been published in monograph form (CMICRA *et al.* 2000), and the other sites have only brief reports. Many questions remain unresolved concerning site functions, subsistence, settlement organisation and location, as well as relationships with the numerous unwalled settlements on the Chengdu Plain.

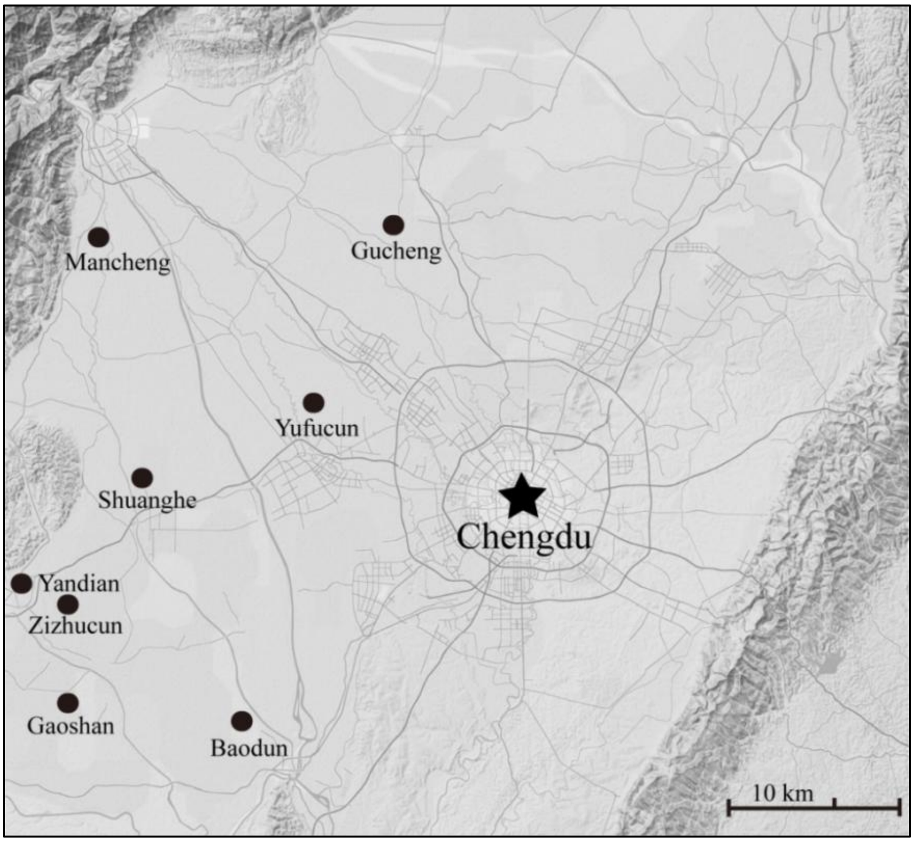


Figure 3.5: Distribution of the eight known Baodun walled settlements on the Chengdu Plain.

The Baodun walled settlements have single or double ramparts constructed with layers of rammed earth or *hangtu* (Wang Yi 2006). At Baodun, Yufucun, and Gucheng, layers of earth were laid down and compressed. Today, the wall cross-sections remain trapezoidal, with an inner upright wall structure and outer slopes on both sides (Figure 3.6). At Baodun and Yufucun, the clay-rich soil was so tightly packed that even the imprints of the ramming tools could be detected, along with residues of sand and ash that were probably used to prevent the clay from sticking to the ramming tools (Jiang Zhanghua *et al.* 2001). At Gucheng, rocks and pebbles were utilized to protect erosion. Similarly, the *hangtu* earth of the Mangcheng walls was tightly compacted internally, while the outer wall surfaces were loosely constructed of rocks and pebbles. Ditches surround the earthen walls at Baodun, Mangcheng, Shuanghe and Zizhucun, perhaps initially dug as quarries for construction material.

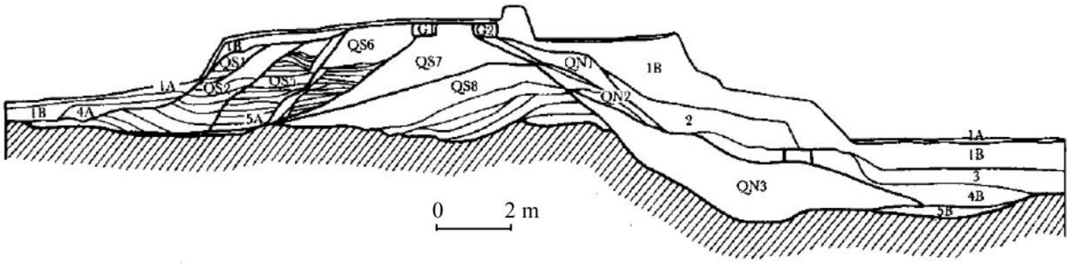


Figure 3.6: Section profile of the west wall of test trench T1 through the north wall of the Baodun walled settlement near Zhenwuguan (after Wang Yi 2006). The right side is inside the settlement and the layers depicted in the sloping elements are rammed earth (*hangtu*).

Baodun

Baodun is situated on the southwestern Chengdu Plain, about 470 m above sea level. The first survey was conducted in the 1950s, focused on a series of Han Dynasty brick tombs on top of the *hangtu* walls, which by that time were recognized as a man-made structure. Since later investigations in the 1980s failed to identify anything except for the *hangtu* walls predating the Han Dynasty, the walls were attributed to the Qin Dynasty or Warring States (CMICRA *et al.* 2000:1). However, two test trenches around the eastern corner were dug in 1995 (Wang Yi *et al.* 1997), followed by a larger scale excavation in 1996 (Jiang Zhanghua *et al.* 1998) that included additional wall sections and trenches in the central area of the site. After these two seasons of fieldwork, Baodun could be identified as a roughly rectangular enclosure of Neolithic Age, encompassing an area of about 600,000 m^2 (60 hectares). The maximum width of the inner wall today is 25 m and the maximum height 5 m.

In 2009, a second earthen enclosure was located outside the first one, except for the northeastern side around Jianglin. Constructed partly on top of a natural hill, this has a less regular shape than its rectangular predecessor and, different to the inner wall, is surrounded by a 10-15 m wide external ditch. The outer earthen wall encloses about 276 hectares (He Kunyu *et al.* 2011a) (Figure 3.7), making Baodun potentially the second largest Neolithic walled settlement in China, slightly smaller than the 4,250,000 m² walled settlement at Shimao, Shaanxi province (Sun Zhouyong *et al.* 2013), dated between the middle Longshan period and the beginning of the legendary Xia Dynasty, around 2000 BC.

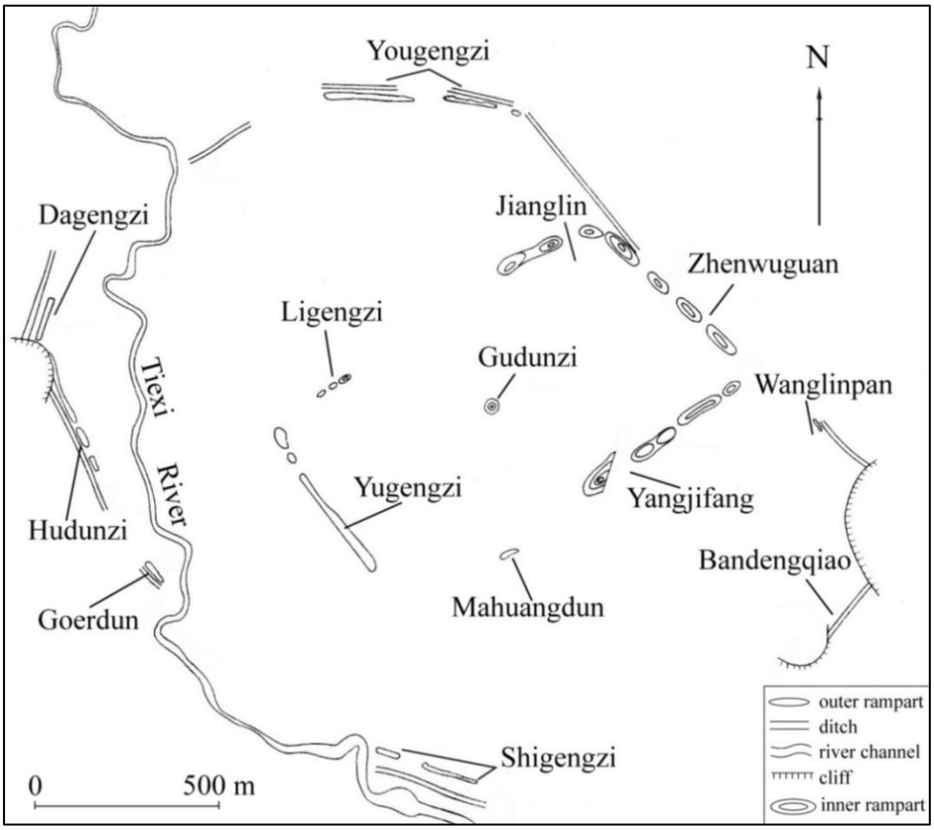


Figure 3.7: Plan of Baodun (redrawn after He Kunyu *et al.* 2011a, with modifications).

The stratigraphic evidence suggests that Baodun was a three-phase settlement – initially an unenclosed habitation, then the inner *hangtu* wall, and finally the outer *hangtu* wall. Test drillings within the inner enclosure suggest that Baodun cultural deposits are mostly preserved around Mahuangdun, Gudunzi and Jianglin, with the location about 100 m southwest of Gudunzi being perhaps the most densely settled zone (Figure 3.7). The Tiexi river changed its course in the mid 19th century and this might have destroyed much evidence (He Kunyu *et al.* 2011a).

The archaeological finds at Baodun have been reported by CMICRA *et al.* (2000:16), Jiang Zhanghua *et al.* (1998), and Wang Yi *et al.* (1997). Systematic flotation recently carried out at Baodun (d'Alpoim Guedes *et al.* 2013; Jiang Ming *et al.* 2011a) yielded 1430 carbonized seeds, including rice (*Oryza sativa*) (45%), foxtail millet (*Setaria italica*) (1.6%), Job's tears (*Coix.*sp) (1.3%), *Vicia sepium* (cf. *Vicia*) (4.1%), cowpea (*Vigna*) (1.5%), and seeds of non-domesticated species (46.5%), predominately sedges (*Fimbrystilis* cf. *bulbostylis*). The rice grains were found in Baodun phase 1 and 2 cultural layers. A high proportion (55%) of the spikelet bases are non-shattering, hence implying domestication (d'Alpoim Guedes 2011). In addition, the seeds of Cyperaceae species probably were associated with wet field rice agriculture (Jiang Ming *et al.* 2011a).

There are two radiocarbon dates from Baodun, 3322-2581 BC (OxCal 4.2. 95.4%) and 3086-2626 BC (OxCal 4.2. 95.4%), both on wood. The former sample (GrA5726) was collected inside one of the wall sections and the other (GrA5717) was from the fill of a grave.

Yufucun

The settlement with a single *hangtu* wall discovered at Yufucun in Wenjiang District in Chengdu City has an irregular shape, containing at least 5 corners. It encompasses an area of about 320,000 to 400,000 m². This enclosure was built atop a gentle slope around 560 m above sea level. Discovered in 1964, this site was excavated in 1996 and 1999. Test pits were widely distributed over the whole settlement, and the results suggest that the central and southeastern sections were residential, with the southern section used for burial and refuse disposal. The site was seriously disturbed during the Han and Song dynastic eras, and by modern clay mining for bricks (Jiang Cheng *et al.* 1998; Li Mingbin and Chen Yunhong 2001).

The cultural deposits at Yufucun were categorized into three phases based on pottery typology and the stratigraphic succession (Jiang Cheng and Li Mingbin 1998). The oldest phases, 1 and 2, have pottery in Baodun style with significant stylistic variability. The youngest phase 3 contains a Yufucun-specific set of pottery, a set with Sanxingdui affinities, and a set with Baodun affinities (see chapter 2). The mix of three sets of pottery vessels in the Yufucun phase 3 cultural layer suggests that this site was occupied until the transition between Baodun and Sanxingdui in the early 2nd millennium BC (Flad and Chen 2006).

Gucheng

Gucheng is located in Pixian county. This walled settlement has a single rectangular rampart, enclosing 304,000 m², with a possible gate in the southeastern corner. The orientation of the site is NW-SE, roughly parallel to the course of the Botiao river. Three seasons of excavation were conducted between 1996 and 1999 (Jiang Cheng and Yan Jinsong 1999; Yan Jinsong and Chen Yunhong 2001; Yan Jinsong *et al.* 2001), and an area excavated of more than 3000 m². The stratigraphic evidence suggests that Gucheng was a two-phase settlement, with an original unenclosed habitation later surrounded by a single *hangtu* wall.

Eleven wattle and daub (denoted F1-F12, excluding F4) and 2 stilt houses (F13 and F14) were excavated at Gucheng. House F5 was the most prominent because of its unique design and large size, encompassing about 550 m^2 (Figure 3.8). It was located quite centrally in the site, orientated roughly parallel to the settlement wall. The remains of house F5 include a 50 m long and 11 m wide rectangular outer foundation trench with 5 rectangular pebble platforms within set in a row 3-8 m apart, also a circular pebble structure measuring 65 cm in diameter in the eastern section, and two pebble accumulations outside. Each platform was surrounded by a 10-13 cm wide trench with dense postholes (Yan Jinsong *et al.* 2001). The function of house F5 remains unknown, but two radiocarbon dates were produced from it, of 2622-2137 cal. BC (OxCal 4.2. 95.4%) and 2273-1781 cal. BC (OxCal 4.2. 95.4%), both on bamboo charcoal (Wang Yi 2006).

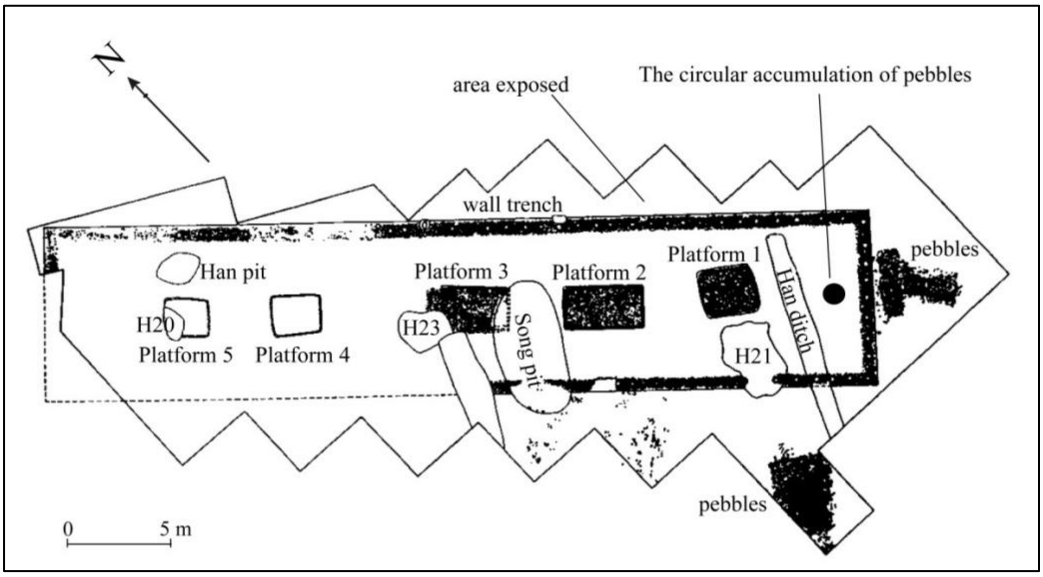


Figure 3.8: Plan of house F5 at Gucheng (redrawn after Wang Yi 2006, with modifications).

Mangcheng

Mangcheng in Dujiangyan city, discovered in 1989, is bivallate. The area enclosed by the inner rampart is 72,000 m^2, and the outer rampart encompasses 100,000 m^2. This site was excavated between 1996 and 1999 (Jiang Cheng *et al.* 2001; Wang Yi *et al.* 2001; Yan Jinsong *et al.* 1999). Oriented in a NNW-SSE direction, parallel to the Bojiang river to the east, the inner and outer ramparts are about 20 m apart. Both ramparts have an external ditch. Although a large portion of the eastern inner wall and the whole eastern outer wall have been destroyed, the excavation of test trench T36 confirmed their former existences.

The inner rampart was constructed of layers of densely rammed earth (*hangtu*), and the wall surface was faced with pebbles. The outer rampart of Mangcheng was stamped more loosely, although its surface was treated similarly. Stratigraphic evidence suggests that Mangcheng was a three-phase settlement, commencing as an unenclosed habitation, then being provided with its double *hangtu* walls, followed by a reconstruction of them on the same alignments.

Shuanghe

Similar to Mangcheng, Shuanghe also had bivallate ramparts about 20 m apart, encompassing 110,000 m^2. This site is located in Chongzhou, at a height of about 590 m above sea level. The adjacent Xi river runs parallel to the long side of the rampart. A season of excavation there in 1997 uncovered only 140 m^2, mostly around the center of the site. Therefore, it remains uncertain whether the ramparts were established during Baodun times (Jiang Cheng and Li Mingbin 2002).

Zizhucun, Yandian and Gaoshan

Zizhucun, Yandian and Gaoshan are reported, but as yet unexcavated, walled Baodun settlements. Their information below is largely from introductory papers (Jiang Zhanghua *et al.* 2001; Wang Yi 2006) and local newspaper reports.

Discovered in Chongzhou in 1997, the location of Zizhucun is close to Shuanghe. It has rectangular double ramparts 10 to 15 m apart, with more than 200,000 m^2 enclosed by the inner one. Located in Dayi county, Yandian and Gaoshan are also rectangular walled Baodun settlements. Information about Gaoshan is scarce, but according to newspapers Yandian has a single *hangtu* rampart enclosing 700 m by 500 m, or about 350,000 m^2. This rampart was evidently constructed after the site had been occupied for some time. Earthen structures discovered outside the enclosure are stated to include reservoirs and drainage systems.

Unwalled Baodun sites

Widely distributed on the Chengdu Plain, unwalled Baodun settlements outnumber the contemporary walled settlements (Figures 3.9, 3.10, and 3.11). The existence of wattle/daub and stilt houses, wells, refuse pits and graves suggest that these sites were mostly residential. Most have been exposed by salvage excavation, but exact sizes in the absence of defences are unknown.

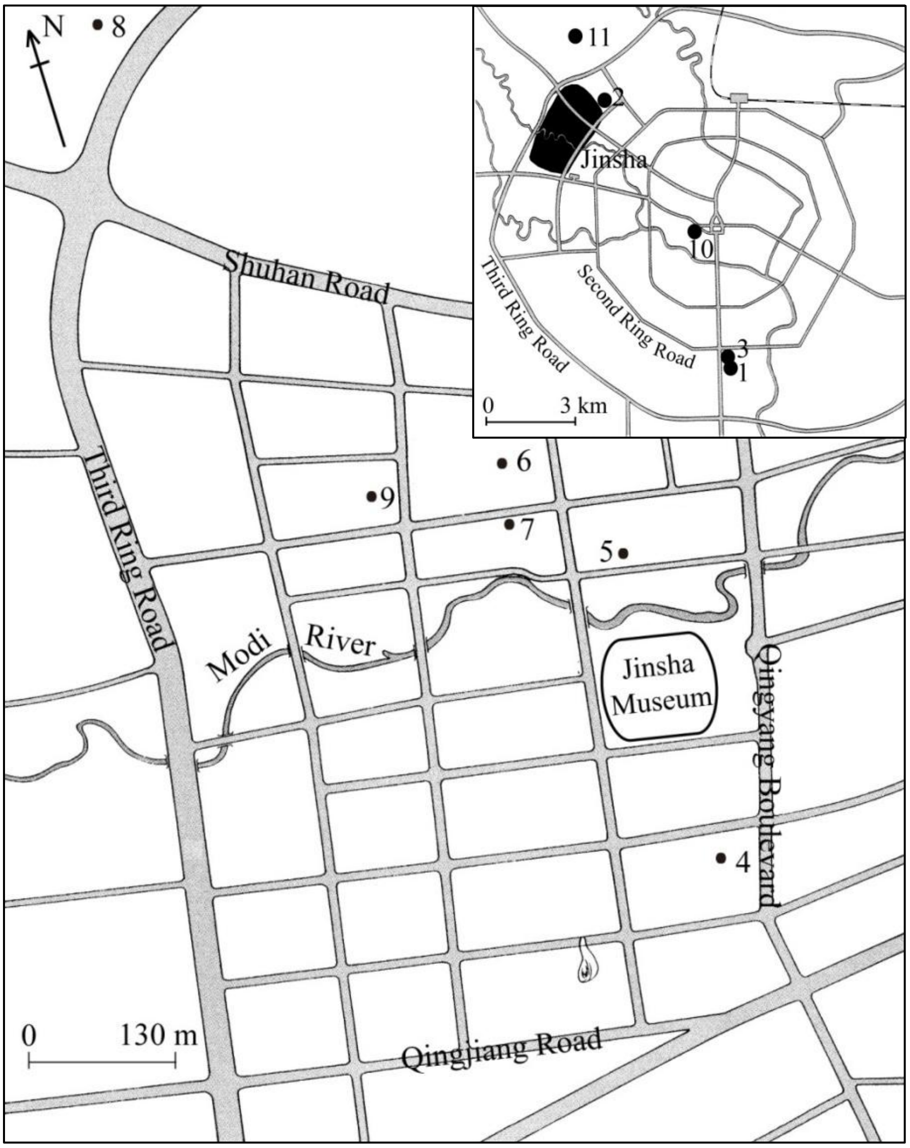


Figure 3.9: The distribution of unwalled Baodun settlements in Chengdu City: Shijiefang (1), Huachengcun (2), Minjiang xiaoqu (3), Zhixin Jinshayuan Phase I (4), Huangzhongcun gandao B yanxian (5), Furongyuan south (6), Huangzhongcun gandao A yanxian (7), Jingpinfang (8), Chunyu huajian (9), Fangchijie, (10), Qiangyi Vehicle Trading (11) (Chen Yunhong 2006a; Li Mingbin and Wang Fang 2001; Liu Jun *et al.* 2005; Liu Yumao and Rong Yuanda 2001; Wang Lin and Jiang Ming 2009; Xu Pengzhang 2003; Zhou Zhiqing 2004; Zhou Zhiqing and Tang Zhihong 2004; Zhou Zhiqing *et al.* 2005; Zhu Zhangyi 2001; Zhu Zhangyi *et al.* 2006). The main map in marked by the black zone in the inset.

Figure 3.10: The distribution of unwalled Baodun settlements west of Chengdu: Gewei Pharmacy Phase I (1), Hangkonggang (2), Sichuan Fangyuan Zhongke (3), Mofu Biotech (4), Xinjinxi Packing Factory (5), Xiqu guoji (6), Shunjiang xiaoqu Phase III (7), Huili Packing Factory (8), Zhonghai guoji Commune site 1 (9), Zhonghai guoji Commune site 3 (10), New campus phases I and II in Southwest Jiaotong University (11), Institute of Internet Technology, Xihua University (12), Laboratory Building of Qingshuihe Campus, UESTC (13) (Xie Tao *et al.* 2005a, b; Zhou Zhiqing and Liu Yumao 2006a, b, c, 2007a, 2008a, 2009, 2010, 2011; Zhou Zhiqing *et al.* 2005c, 2007). The location of Jinsha is also marked in Figure 3.9.

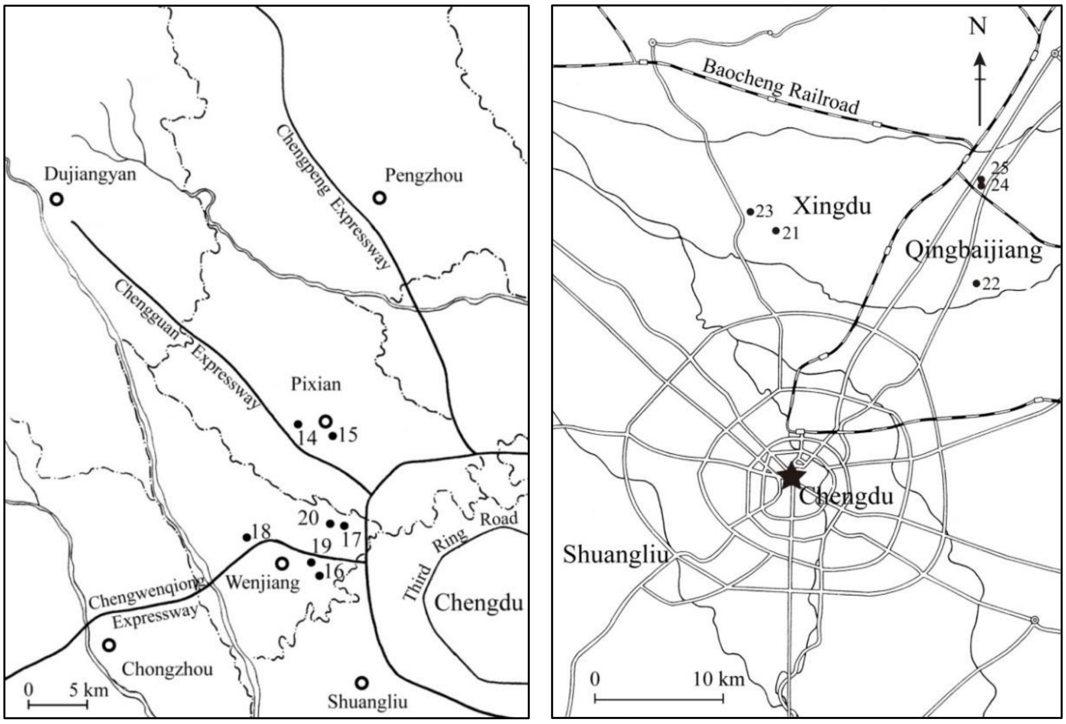


Figure 3.11: The distribution of unwalled Baodun settlements to the far west and north of Chengdu: Qingjiangcun (14), Caojiaci (15), Hongqiaocun (16), Xinzhuangcun (17), Tianxianglu (18), Fanjianian (19), Yongfucun sanzu (20), Zhongyi (21), Chujiacun (22), Taipingcun (23), Sanxingcun (24), Hongfencun (25) (Chen Yunhong 2006b; Chen Yunhong *et al.* 2007, 2009, 2010; Jiang Zhanghua and Yan Jinsong 2001; Liu Yumao and Yang Zhanfeng 2012; Liu Yumao *et al.* 2009; Yang Zhanfeng 2012a, b, c, e; Yi Li *et al.* 2012).

Baodun burial customs in the unwalled sites were similar to those in the walled sites. The deceased were mostly buried in rectangular pits within the residential areas, with very few grave goods. A small number of cemeteries were also discovered outside the residential areas. Children and adults alike were mostly buried supine, with a few flexed. According to a dental analysis of 13 adult skeletons from Shijiefang (Zhang Jun and Zhu Zhangyi 2006; Zhu Zhangyi 2001), both maxillary lateral incisors were sometimes extracted during life, and there was some evidence for dental caries (Table 3.2).

Table 3.2: Dental observations on 13 skeletons from Shijiefang.

Grave	Gender	Age	Lateral incisor evulsion	Health status
M1	female	30-35	no	dental caries
M3	male	around 25	yes	
M4	female	30-35	no	dental caries and abscess
M7	female	around 45	no	
M8	male	35-40	yes	dental caries and cyst
M9	unknown	adult	unknown	
M10	female	40-45	yes	ankylosing spondylitis
M11	possible male	around 35	unknown	
M12	female	16-18	no	dental caries
M13	possible female	teenager	no	
M14	unknown	15 or 16	no	
M16	male	15-17	yes	
M17	unknown	adult	unknown	

The Chengdu Plain has produced very few radiocarbon dates for Baodun sites, so the chronology relies heavily on stratigraphy and stylistic comparisons of artefacts, especially sets of pottery. This method, termed *leixingxue* in Chinese (Su Bingqi and Yin Weizhang 1982; Yu Weichao 1987:13-25; Zhang Zhongpei 1983; Zou Heng 1982), remains a doctrine still widely applied in Chinese archaeology.

To date, no clear statement with sufficient illustrations concerning the seriation of Baodun sites by *leixingxue* methods has been published, but most Sichuan archaeologists seem to have reached a consensus on dividing the Baodun culture into 4 phases, with phase 1 being the oldest and each phase lasting about 100 to 150 years. However, they have diverse opinions on the chronological order of the walled settlements (Table 3.3). As for the unwalled sites, local archaeologists consider the majority to date between late phase 3 and phase 4 of the Baodun sequence, excluding Caojiaci in Pixian county and Zhongyi in Xindu

District, Chengdu City, which are dated between late phase 2 and early phase 3 on the basis of pottery typology.

Based on their seriation, late phase 3 and phase 4 Baodun sites outnumber those of earlier phases, and they were densely distributed in central and western Chengdu City. Similar finds of late phase 3 and phase 4 artefacts were also excavated from the youngest Baodun cultural layers in the walled settlements of Gucheng and Yufucun (Jiang Zhanghua 2013). However, the ceramic seriation of Baodun sites on the Chengdu Plain is defective in that no thorough analysis of stylistic changes in Baodun phase 1 to 4 pottery based on stratigraphic evidence is available so far.

Table 3.3: Varying opinions on Baodun phase chronologies.

<table>
<tr><th colspan="3">Phase 1</th><th colspan="2">Phase 2</th><th colspan="3">Phase 3</th><th>Phase 4</th></tr>
<tr><td rowspan="2">(A)</td><td>early</td><td>late</td><td colspan="2" rowspan="2">Mangcheng</td><td>early</td><td>middle</td><td>late</td><td rowspan="2">Yufucun (3)</td></tr>
<tr><td>Baodun (1)</td><td>Baodun (2)</td><td>Yufucun (1)
Gucheng (1)</td><td>Yufucun (2)
Gucheng (2)</td><td>Gucheng (3)</td></tr>
<tr><td rowspan="2">(B)</td><td>early</td><td>late</td><td colspan="2" rowspan="2">Baodun (2)
Mangcheng (1)
Gucheng (1)</td><td colspan="3" rowspan="2">Mangcheng (2)
Gucheng (2)
Yufucun (2)</td><td rowspan="2">Yufucun (3)</td></tr>
<tr><td>Bianduishan</td><td>Baodun (1)
Yufucun (1)</td></tr>
<tr><td rowspan="2">(C)</td><td colspan="2" rowspan="2">Baodun (1)</td><td>early</td><td>late</td><td colspan="3" rowspan="2">Gucheng (1)</td><td rowspan="2">Yufucun (3)
Gucheng (2)</td></tr>
<tr><td>Yufucun (1&2)
Shuanghe (1)</td><td>Baodun (2&3)
Shuanghe (2)
Mangcheng
Zizhucun</td></tr>
</table>

(A): Jiang, Wang and Zhang 2001, 2002
(B): Wang Yi and Sun Hua 1999
(C): Zhao Dianzeng and Li Mingbin 2004:147-60
(*): phases of each walled site

3.4 Chengdu Plain in the 2nd millennium BC – the Sanxingdui culture

Named after the eponymous site in Guanghan city, the Sanxingdui archaeological culture flourished on the Chengdu Plain in the 2nd millennium BC. Fieldwork at that site between 1980 and 1986 established a basic framework for understanding the Sanxingdui sequence and its cultural definition (Chen Xiandan 1989a; Wang Youpeng *et al.* 1987). However, knowledge of the Sanxingdui culture still depends in an unbalanced way on the rich discoveries within and around the Sanxingdui walled settlement itself.

The origins of the Sanxingdui culture remain unknown (Chen Xiandan and Liu Jiasheng 2002). Most Chinese archaeologists considered it an intrusion by Erlitou immigrants from western Hubei via eastern Sichuan (Du Jinpeng 1995; Fan Yong 1993; Jiang Zhanghua 2002, 2007; Jiang Zhanghua and Yan Jinsong 2003; Li Boqian 1997; Xiang Taochu 2005; Yang Hua 1998). This is because some Sanxingdui artefacts have Erlitou affinities (Ao Tianzhao 2008, 2009; Du Jinpeng 1992, 1995; Falkenhausen 2006; Wang Qing 2004). However, this contention remains speculative since the artefacts exhibiting both Sanxingdui and Erlitou affinities along the potential routes of cultural diffusion, such as small flat-based *guan*, ceramic ladles with bird-shaped handles with a hooked beak, tripodal *he*, and high stemmed *dou* (Figures 2.3-2.6), are not radiocarbon-dated (Lin Chun 1984; Sun Zhibin 2007). However, those who support this idea consider these artefacts to be older than the similar artefacts excavated from the Chengdu Plain.

(a) Sanxingdui

Located about 10 km west of Guanghan and about 40 km northeast of Chengdu City, Sanxingdui can be regarded as either a single site or as a cluster of sites. The remains are spread along the southern bank of the Yazi river and both sides of the Mamu river (Figure 3.12). Scientific archaeological investigation began in Sanxingdui in 1980 and surface investigations and excavations have continued until now (Table 3.4).

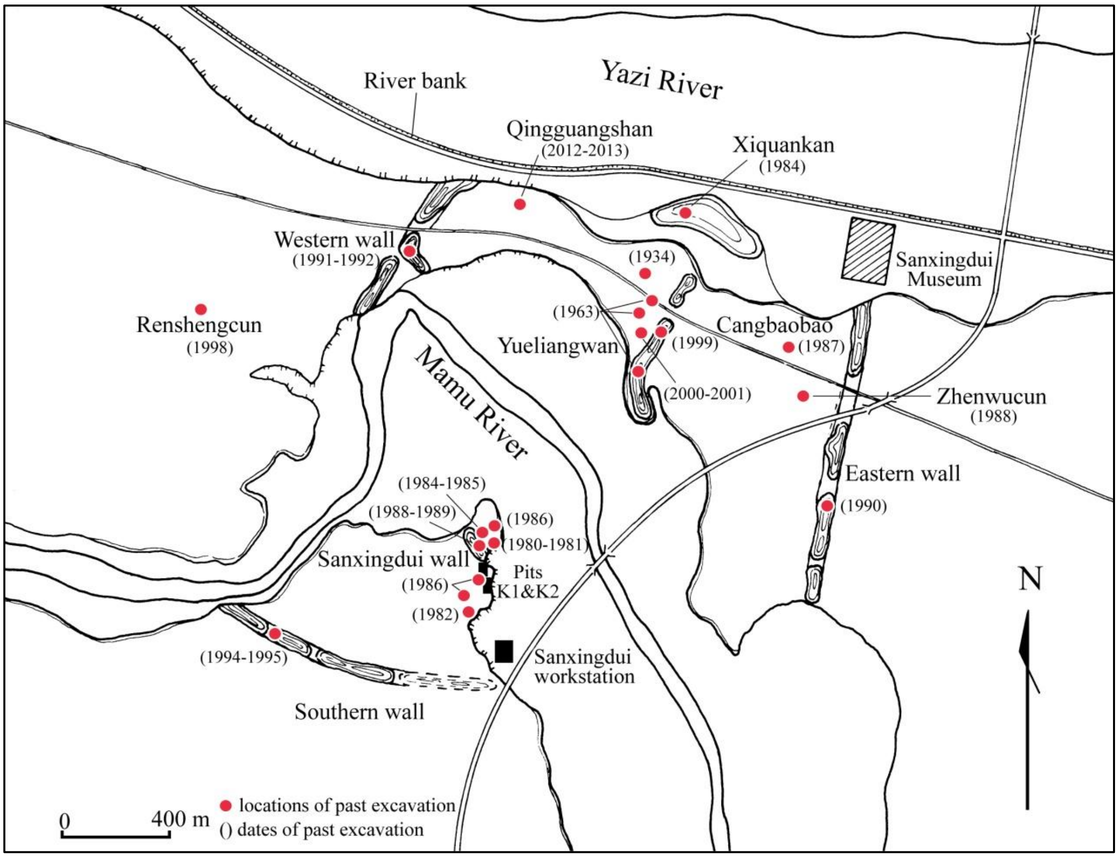


Figure 3.12: Map of Sanxingdui (redrawn from Jay Xu 2001a, with modifications).

Table 3.4: Archaeological contexts in and around Sanxingdui.

Date	Site locations	Events	Area of excavation
1929	Yueliangwan terrace	An unknown number of jade and lithic artefacts were discovered by Yan Daocheng during pond digging.	
1934	Yueliangwan terrace	More than 600 sherds, jades and lithic artefacts were discovered during David C. Graham's (1934) excavation on Yueliangwan terrace.	56 m²
1953	Yueliangwan terrace	A first surface survey was conducted by Feng Hanji.	

1956	Yueliangwan terrace	Another surface survey was conducted by Wang Jiayou (Wang Jiayou and Jiang Dianchao 1958).	
1958	Yueliangwan terrace	A third survey was conducted by Sichuan Provincial Museum and the Department of History, Sichuan University (DHSU 1961).	
1963	Yueliangwan terrace and surroundings	Three sites were excavated by Ma Jixian (1993).	150 m^2
1964	Yueliangwan terrace	Jade artefacts were discovered in a rectangular pit.	
1974	Suozitian	More than 300 greenish-yellow jade artefacts were discovered in a rectangular pit covered with a stone slab.	
1976	Gaopian	One jade spearhead-shaped artefact, 2 jade axe-shaped artefacts and a bronze plaque with turquoise inlay were discovered (Ao Tianzhao 2006; Ao Tianzhao and Wang Youpeng 1980).	
1980 to 1981	North of Sanxingdui wall	Early phase Sanxingdui remains were discovered, including 18 house features, 3 pits, 4 graves, 110 jade artefacts, and more than 100,000 potsherds (Wang Youpeng *et al*. 1987).	1,225 m^2
1982	Southeast of Sanxingdui wall	Sanxingdui phase 4 remains were discovered, including a pottery kiln, animal bones, and an unknown number of pointed-based vessels.	100 m^2
1984	Xiquankan	A possible lithic *bi* disc workshop was discovered.	450 m^2
1984 to 1985	North of Sanxingdui wall	An excavation was conducted by the Sanxingdui archaeological team and the Department of History, Sichuan University (Chen Xiandan 1989a).	180 m^2
1985 to 1986	East and south of Sanxingdui wall	9 house features, including one with a 60 m^2 room constructed of wattle and daub, pottery vessels, and lithic tools were discovered.	1,325 m^2
1986	Southeast of Sanxingdui wall	Pit K1 was excavated in July (Chen De'an and Chen Xiandan 1987; SPICRA 1999). Pit K2 was excavated in August (Chen De'an	

		and Chen Xiandan 1989a; SPICRA 1999).	
1986 to 1988		A series of regional surveys were conducted in Guanghan, Shifang and Pengxian. Numerous small sites with Sanxingdui affinities were discovered (Chen De'an *et al*. 1993)	
1987	Cangbaobao	A rectangular pit containing jade artefacts, lithic tools and three bronze plaques with turquoise inlay was discovered (Chen De'an and Ao Tianzhao 1998).	
1988	Zhenwucun	Two bronze plaques with turquoise inlay and a set of jade chisels, lithic *bi* discs, rings and axes were discovered in a rectangular pit.	
1988 to 1989	Sanxingdui wall (mounds)	Sanxingdui phase 1 remains were found stratified beneath the Sanxingdui *hangtu* wall.	341.5 m^2
1990	Sanxingdui eastern wall	Evidence was discovered that the eastern wall contains a main inner wall structure and slopes on both sides.	1,075 m^2
1991 to 1992	Sanxingdui western wall	Similar evidence was found concerning the western wall.	837.5 m^2
1994 to 1995	Sanxingdui southern wall	The existence of the southern wall was demonstrated.	700 m^2
1998	Renshengcun	29 graves containing 5 pottery vessels and 61 jade artefacts were discovered. The jade artefacts were similar to those of the Liangzhu culture of the lower Yangzi valley. Most of the burials were associated with elephant tusks and other animal bones (Chen De'an and Lei Yu 2004).	900 m^2
1999	Yueliangwan terrace area	Evidence that the Yueliangwan structure was actually an earthen wall was identified. A house feature dated to Sanxingdui phase 1 was sealed beneath the wall.	500 m^2
2000 to 2001	Yueliangwan terrace	Excavation at Yanjia yuanzi yielded a large number of Sanxingdui phase 4 remains.	540 m^2

2011 to 2013		A series of regional surveys were conducted along the Yazi river (Ran Honglin and Lei Yu 2014)	
2012 to 2013	Qingguanshan	A burnt foundation was excavated at Qingguanshan. Remains of a possible northern wall at Qingguanshan and Cangbaobao were identified.	525 m^2

Sanxingdui is a trapezoidal settlement in plan that contains both inner and outer ramparts. The inner section includes the northern part of the western wall, together with the Yueliangwan and Sanxingdui walls, which were once considered to be natural mounds. Based on the pottery from dated deposits associated with the Yueliangwan, Sanxingdui and outer walls, the inner enclosure was constructed during Sanxingdui phase 2 and the outer during phase 3. The entire area enclosed by the eastern, western and southern walls, and the Yazi river to the north, is about 3.6 km^2, narrower in the north and wider in the south (Figure 3.12).

The older Yueliangwan wall (Figure 3.13) was built by a technique similar to that of the Baodun phase walls, in that 6 or 7 *hangtu* layers were founded on a natural elevation to make the core of the wall. Today, the walls have trapezoidal cross-sections with sloping sides. The younger walls, however, reveal a more sophisticated technique in that they have a vertical-sided central core of *hangtu* layers, with flanking and sloping earth layers added separately to either side. Sun-dried mud bricks sealed the top of the eastern and western walls (Jay Xu 2001a:28).

Figure 3.13: *Hangtu* layers within the Yueliangwan wall and the sloping outer face (photo by courtesy of Dong Jing).

The Sanxingdui walls perhaps once had a total length of 7,500 m, of which less than 3,500 m remains today. Surviving sections include the 1,093 m long eastern wall, the 495 m long western wall, the 1,140 m southern wall, the 650 m Yueliangwan wall, and the 40 m Sanxingdui wall which was originally around 260 m long (Lei Yu, pers. comm.). It is likely that the Mamu river also served as a natural barrier. It has long been speculated that the more than 400 m wide Yazi river formed a significant defence as well, but recent investigations along its southern bank have identified two man-made earthen structures, one 210 m long at Qingguanshan, the other 400 m long at Cangbaobao. Both might have been part of an original northern wall destroyed by river erosion (Dong Jing, pers. comm.; SPICRA 2014).

Similar to some Baodun walled settlements, ditches outside the *hangtu* walls have been discovered at Sanxingdui, including the Sanxingdui ditch 30 to 35 m wide and 2.4 m deep; the eastern ditch 20 to 25 m wide and 2.5 to 3 m deep; the western ditch 18 to 22 m wide and 2.6 m deep; the southern ditch 15 to 20 m wide and 2.7 m deep; and the Yueliangwan ditch 40 to 55 m wide and 3 m deep. All of these ditches apparently were connected directly with the Mamu or Yazi rivers. It is likely that Sanxingdui was originally a defended settlement with earthen walls and a complex water system.

Apart from the *hangtu* walls themselves, the major discoveries at Sanxingdui have occurred in the Yueliangwan, Xiquankan and Qingguanshan terraces, the Cangbaobao artefact pit, the Sanxingdui wall, and Sanxingdui artefact pits K1 and K2. Beyond the walled enclosures, a burial site at Renshengcun has also been excavated (Figure 3.12). The dates for these locations are derived primarily from typology and stratigraphy because no radiocarbon dates are available.

The Yueliangwan terrace

Yueliangwan, possibly an old river terrace fragment located quite centrally at Sanxingdui, was the core of investigation before 1980 owing to the rich discoveries made there. Scientific excavations at Yueliangwan began in 1963, when three locations were excavated by the Sichuan Provincial Council of Cultural Relics Management and the Department of History of Sichuan University (Ma Jixian 1993). Sites 1 and 2 were close together, about 200 to 250 m northwest of the Yueliangwan terrace, and site 3 was on Yueliangwan terrace (Figure 3.14). The excavation at site 3 was undertaken to see if the terrace was in fact a prehistoric man-made earthen mound, but the excavators only located part of an Eastern Han brick tomb on its top.

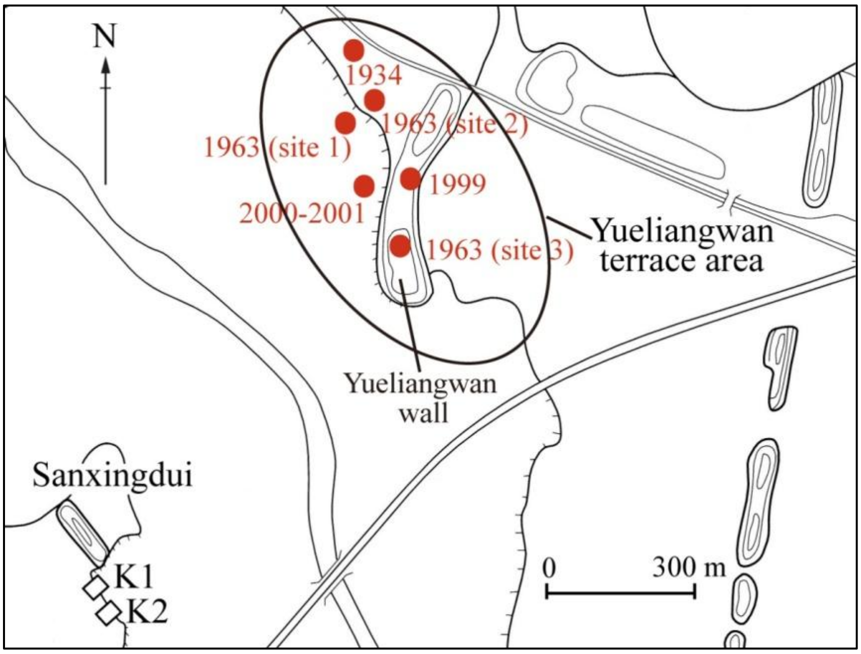


Figure 3.14: The locations of past excavations on the Yueliangwan terrace at Sanxingdui (redrawn after Jay Xu 2001a, with modifications).

The richest findings were excavated at site 1, which revealed 3 successive cultural layers, with prehistoric materials excavated from layers 2 and 3. Layer 2 (the younger) was further divided into two sub-layers based on soil colour, the upper being yellowish brown and the lower greyish brown. The artefacts from layer 3 below were categorized as Yueliangwan phase 1, and those from layer 2 as phase 2. According to Ma Jixian (1993), the morphological variation between the artefacts from the two sub-layers in layer 2 was conspicuous, but this was not recorded in the very beginning. Because the Yueliangwan phase 2 artefacts are different from those of Sanxingdui phases 2 and 3, but similar to those from Shierqiao layer 13, Song Zhimin (2011) dates them to the transition between Sanxingdui phases 3 and 4, and thus to the early Shierqiao phase.

After the excavation at Yueliangwan in 1963, the core zone of research was oriented southwards to Sanxingdui proper, and it was not until 1999 that the research focus turned back again to Yueliangwan, when the eastern fringe of the

Yueliangwan wall (Figure 3.14) revealed 14 cultural layers dated between Sanxingdui phases 1 and 4. The foundations of the Yueliangwan wall itself were located between layers 9 and 10. 50 house floors each encompassing between 14 and 37 m^2 of interior space, 108 pits and 9 graves were also identified.

In the following year, another excavation was carried out west of the terrace, uncovering layers belonging to Sanxingdui phases 2, 3 and 4, with ceramic roof tiles (Figure 3.15) and 8 circular or rectangular pits with intact pots, together with lithic *cong*, *bi* and *yuan*, associated with traces of burning. The roof tiles belong to Sanxingdui phase 2 and the pits to phase 4. Based on these discoveries, the excavators speculated that the Yueliangwan terrace was the site of a palace-like structure during Sanxingdui phase 2, after which it became used for ritual activities (personal communication from Dong Jing, Sanxingdui Museum).

Figure 3.15: A ceramic roof tile discovered in Yueliangwan terrace.

The Xiquankan terrace area

In the Xiquankan terrace area (Figure 3.12), an unrecorded number of house features, refuse pits and burnt surfaces, together with plentiful sherds, lithic raw materials, stone axes and adzes, finished and semi-finished lithic *bi* and *yazhang*, together with stone debitage, were excavated in 1984 (Chen Xiandan 1989a). Two stone kneeling human statuettes from here with their hands tied at the back (Figure 3.16) are smaller than but similar in design to statues from Fangchijie (Xu Pengzhang 2003) and Jinsha (Zhu Zhangyi *et al.* 2002b:166-81) in Chengdu City (Figure 3.17).

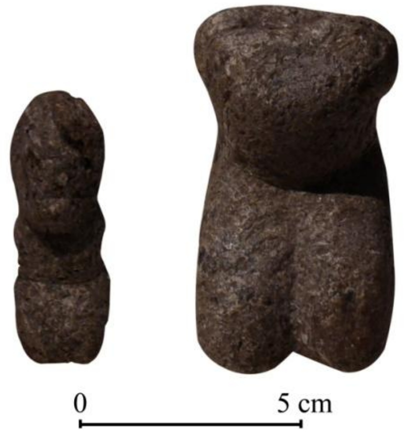


Figure 3.16: Two kneeling human stone statuettes from Xiquankan.

Figure 3.17: Kneeling stone statuettes with their hands tied at their backs from Fangchijie (left) and Jinsha (right).

The Sanxingdui location

Between 1980 and 1989, excavation was focused on the Sanxingdui location itself (Figure 3.18). Altogether, about 3000 m^2 in total have been excavated here. However, only the excavations between 1980 and 1981 have been published (Wang Youpeng *et al.* 1987). The results of excavations up to 1986 have been briefly summarized by Chen Xiandan (1989a), Zhao Dianzeng and Chen De'an (2001), but no publication pertaining to the Sanxingdui wall excavation in 1989 is publicly available. Remains dated to all four of the Sanxingdui phases have been discovered around the Sanxingdui location itself (Chen Xiandan 1989a). They include more than 40 house floors and 100 pits, largely distributed north and south of the Sanxingdui wall.

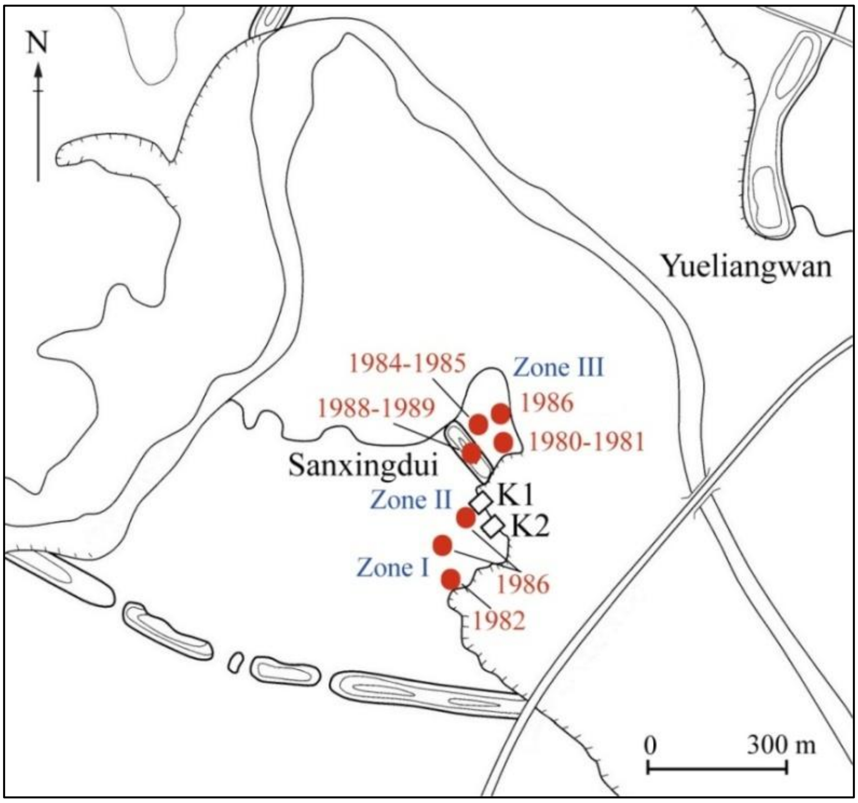


Figure 3.18: Past excavations at the Sanxingdui location proper (redrawn after Jay Xu 2001a, with modifications).

According to the site report of the 1980-1 excavations (Wang Youpeng *et al.* 1987), three of the houses defined by 20-30 cm diameter postholes are dated to Sanxingdui phase 1, including two circular houses (F16 and F18) and one rectangular (F17). F17 had larger postholes at the corners and intermediate points (Figure 3.19). F16 enclosed about 7 m², F17 12.25 m² and F18 10 m². No wall foundation trenches surrounded these houses and no other remains within the house enclosures were identified.

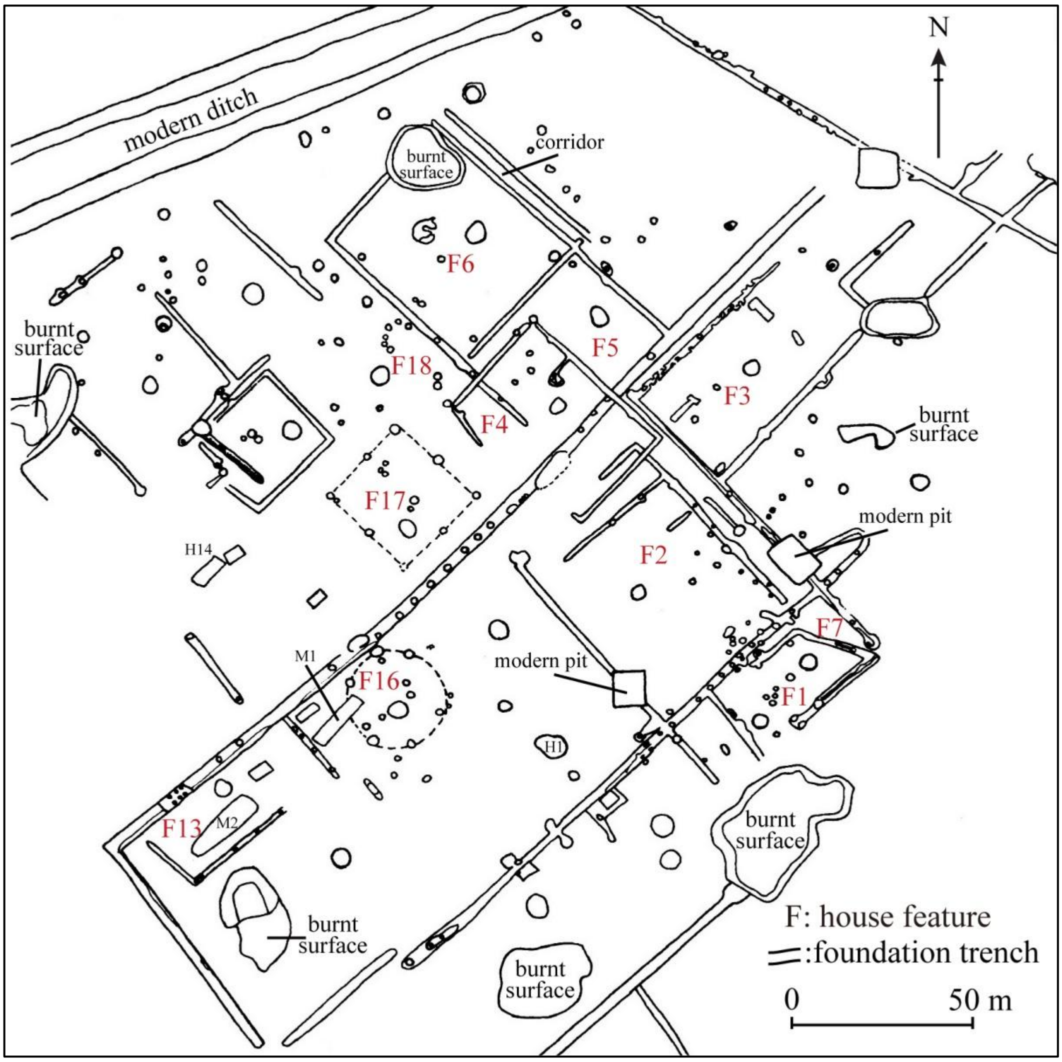


Figure 3.19: Plan of the Sanxingdui phase 1 and 2 houses discovered in Sanxingdui zone III in 1980-81 (redrawn from Wang Youpeng *et al.* 1987).

Fifteen Sanxingdui phase 2 houses were then constructed, defined by rectangular wall foundation trenches 15 to 30 cm wide and deep. Wood or bamboo posts were placed 50 to 100 cm apart within secondary trenches, about 5 to 10 cm wide and 10 cm deep, which were dug into the bottoms of the foundation trenches. These trenches were tightly filled up with soil and fragments of burnt daub. Gaps in the wall foundation trenches suggest doorways, and partition walls were also identified. In addition, a corridor, possibly covered, was discovered next to F6. These rectangular houses enclosed between 14 and 35 m^2, and only F14 exceeded 60 m^2. Some appeared to have been connected into complexes encompassing more than 200 m^2.

According to the excavator (Wang Youpeng *et al.* 1987), these houses belonged to two successive chronological groups, denoted A (F1-3 and F8-15) and B (F4-7), the latter being younger and better preserved. Both house groups were constructed directly on yellowish brown undisturbed soil, but the floors of the group B houses were each paved with a 3 cm thick layer of white clay. Burnt surfaces about 5 to 30 cm thick were common, containing sherds, animal bones and bamboo charcoal. A few impressions of sticks, grass stalks and bamboo were also discovered in the smooth floor surfaces.

The Qingguanshan terrace area

The most recent excavation at Sanxingdui was conducted in 2012 on the Qingguanshan terrace area. No official report has been published, but newspaper sources identify this terrace as a 55 by 15 m artificial earthen platform. Two parallel 50 m long rows of postholes (denoted F1 in Figure 3.20) were found on a foundation of three or four layers of burnt soil between layers of rammed earth (Lei Yu, pers. comm.). This structure supported 6 to 8 rooms aligned on opposite sides of a 5 m wide corridor, with each room being around 6 to 8 m long and 3 m wide. The postholes were rectangular and filled with burnt pebbles (Figure 3.21). Some lithic *bi* and elephant tusks were discovered near the walls. The function of F1 remains unknown, but suggestions include a warehouse, a ritual building, a palace-like structure, or a longhouse with family rooms.

Figure 3.20: An aerial view of Qingguanshan house F1 (The picture is extracted from newspaper sources reported by Sichuan Online on the 15th of January, 2013).

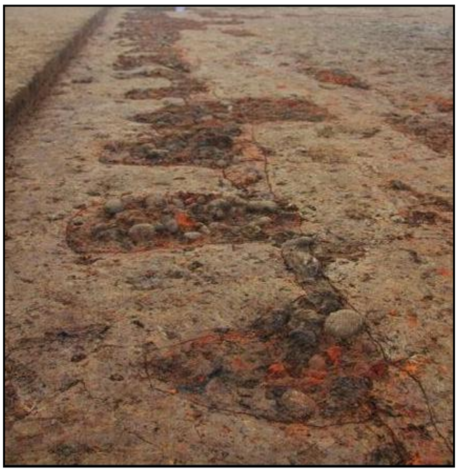


Figure 3.21: The postholes of Qingguanshan F1 were filled with burnt pebbles (The picture is extracted from newspaper sources reported by Sichuan Online on the 15th of January, 2013).

The Renshengcun cemetery

About 550 m west of the western wall, 29 graves (M1 to M29) were uncovered over an excavated area of 934 m² at Renshengcun in 1998 (Chen De'an and Lei Yu 2004) (Figure 3.22). According to Chen and Lei, these graves date between late Sanxingdui phase 1 and early Sanxingdui phase 2. Before excavation, M4 and M6 were destroyed during clay mining for bricks. All except M5 and M12 were oriented NE-SW. Only one superimposition was noted, of M26 over a corner of M2. All of the Renshengcun graves were rectangular, and their bottoms and sides had been rammed and smoothed. Some were deep - M16 at 1.8 m and M21 at 2.4 m. Some graves had side ledges in their walls next to the head or the feet, but none of these ledges had grave goods upon them. 4 of the larger graves had ramps (Figures 3.23). The human remains at Renshengcun were not well preserved, and some graves contained a layer of black or bluish black oily and sticky material, suggested by the excavators to result from decayed human flesh.

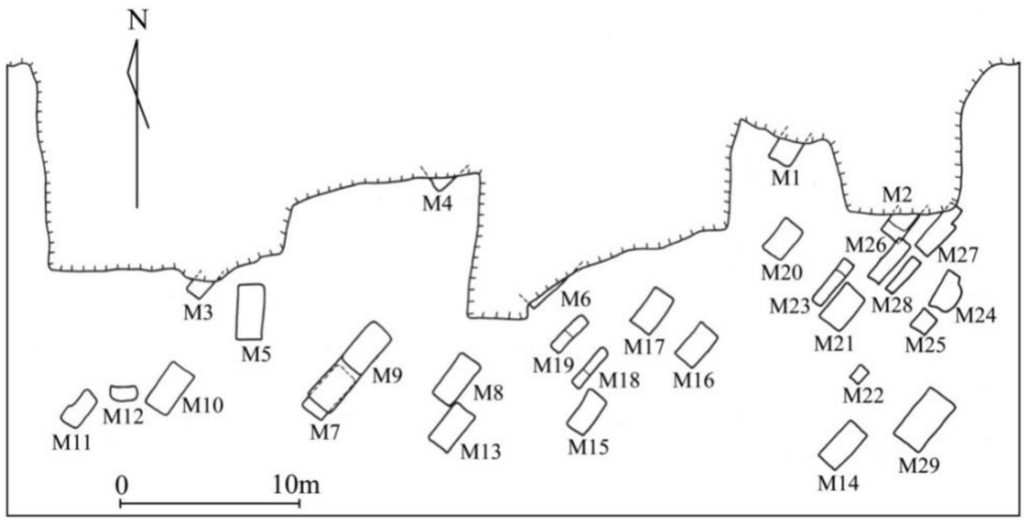


Figure 3.22: The Renshengcun cemetery (redrawn after Cheng Dean and Lei Yu 2004, with modifications).

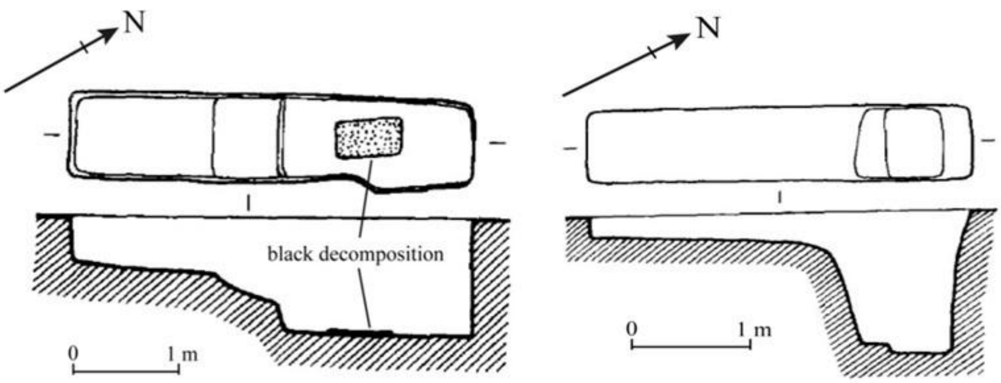


Figure 3.23: Renshengcun graves M23 (left) and M18 (right) (redrawn after Chen De’an and Lei Yu 2004).

Of the total of 29 graves, 21 had grave goods. However, the contents of each grave were not clearly documented in the site report. Most offerings were jade artefacts, such as discs shaped like snail shells, awls, *bi* discs, chisels, adzes and axes. The other grave goods included 5 pottery vessels, 37 globular basalt beads and 2 stone balls. According to unpublished data from the Chengdu University of Technology, these basalt beads were sourced to Emeishan, around 160 km southwest of Chengdu City.

The Cangbaobao terrace area

The most remarkable discoveries at Sanxingdui were the pits with ritually-deposited artefacts, and one of these was discovered at Cangbaobao. This yielded three rectangular bronze ornaments, two with openwork decoration (Figure 3.24), 10 jade artefacts and 24 other lithic artefacts. The jades include 8 ivory-coloured *yuan* rings, 1 greyish white chisel and 1 light green tube-shaped artefact. The other stone artefacts include 21 *bi* discs of varying diameter and 3 polished axes.

Figure 3.24: Three Cangbaobao rectangular bronze ornaments. The one in the middle has turquoise inlay (The left hand one is from SPICRA *et al.* 2009:284, and the others were photographed by the author in Sanxingdui Museum).

The Cangbaobao artefact pit was emptied by local workmen during clay mining in 1987 (Chen De'an and Ao Tianzhao 1998). No stratigraphic information was recorded, and it is not known if the pit was dug originally from below the 70 cm deep Sanxingdui phase 3 and 4 cultural layers. But eye-witness accounts describe a pit about 2×1 m which first became visible about 1 meter below the surface of the terrace and extended down into 40 cm of sterile basal deposit. As in the Yueliangwan pit uncovered in 1931 (Graham 1934) and that at Yanting in Miangyang (Zhao Dianzeng 1991; Zhao Zike 1991), all the artefacts placed within the Cangbaobao pit were along the side walls, associated with ash and burnt bone. A jade chisel was firstly uncovered about 65 cm below the surface. Other stone and jade artefacts which had been placed in orderly fashion by size were then discovered 20 cm below the chisel. In addition, quantities of cinnabar, ash and burnt bone were widely spread throughout the pit fill, with the cinnabar often on the surfaces of artefacts. Unfortunately, no further information about this pit or the discovery of the 3 bronzes was recorded.

Some Chinese archaeologists speculate that the Cangbaobao pit contents belong to early Sanxingdui phase 2, based on comparisons between the Cangbaobao bronze ornaments and three from Erlitou (Yang Guozhong 1984; Yang Guozhong and Zhang Guozhu 1986), where they date between Erlitou late phase 2 and phase 4 (ca. 1750 to 1500 BC according to Li Liu and Xu Hong 2007). However, the Cangbaobao bronze ornaments could be younger imitations or heirlooms (Yang Meili 2002:31-2, cited in Falkenhausen 2006:210). Given that the cultural layer above the pit dates to Sanxingdui phases 3 and 4, the pit contents at Cangbaobao thus have a *terminus ante quem* of middle Shang Dynasty on the Central Plain (ca. 1600-1400 BC).

Sanxingdui artefact pits K1 and K2

The most widely known and debated discovery at Sanxingdui has been that of artefact pits K1 and K2, both located in Sanxingdui zone II (Figure 3.18) and discovered in 1986 (Chen Xiandan 2007; SPICRA 1999). The artefacts, including bronzes, gold ornaments, jade and other stone artefacts, turquoise stones, elephant tusks and marine shells (*Cypraea tigris*, *Monetaria moneta*, and *Monetaria annulus*) (Zhang Shanxi and Chen Xiandan 1989), have been described in detail (e.g. Bagley 1988; Falkenhausen 2003; Jay Xu 2001a, b; Liu Yang and Capon 2000; SPICRA *et al.* 2009; Zhao Dianzeng 2005:227-378). Some of these artefacts were broken when placed into the pits; for instance, matching pieces of some broken jade items were distributed in different locations. All of the artefacts appear to have been burnt prior to interment (SPICRA 1999:22).

Much of the past debate about the contents of pits K1 and K2 has focused on their functions and dates (Jiang Zhanghua and Li Mingbin 2002:22-4). Explanations put forward include offerings for an as-yet-undiscovered rich grave, that the burials themselves were cremated, or that the pits were for hoards or storage. The breakage of the artefacts has also been attributed to destruction by an external or internal enemy (Barnard 1990; Jiang Zhanghua and Li Mingbin 2002:111; Sun Hua 1993b, 2007, 2013; Xu Chaolong 1992a; Yang Fan 2005), or to rituals connected with dynastic succession (Sun Hua 1993c). Shamanistic practices have also been invoked (Lin Xiang 1987), suggesting that once the sacred objects had outlived their usefulness or lost their power they would be ritually disposed of. Ideas connected with ritual have always been the most popular (Chen Xiandan 1989b, 1997; Chen Xiandan and Chen De'an 1987; Falkenhausen 2003:22; SPICRA 1999:440-2; Song Zhimin 1990a, 2008; Wang Jiayou and Li Fuhua 1993, Zhao Dianzeng 1993, but see Xu Chaolong 1992a, b; Zhang Xiaoma 1996).

Scholars also have diverse opinions on the dates of pits K1 and K2. The authors of the official report dated the K1 assemblage to the period between Yinxu (Anyang) late phase 1 and phase 2 (ca.1150-1100 BC), and K2 to the period between Yinxu late phase 2 and the phase 3-4 transition (ca. 1100-1050 BC). This chronology was based on the contents of the sealing deposits, especially the pottery from layers 6 and 5 above the two pits, as well as the chronology of Sanxingdui zone III and a general comparison with Shang bronzes and jade artefacts in Henan, Hubei and Shaanxi (SPICRA 1999:427-32). This chronology has been supported by Bagley (1988, 1992), Chen Xiandan (1997), and Sun Hua (1993a, b, c; 2000:157-61).

A different opinion holds that the pits were contemporary, rather than separated in date by 50-100 years, owing to their adjacent locations and identical orientations, as well as to similarities in the artefacts and their treatments before interment (Falkenhausen 2003:20-1; Hu Changyu and Cai Ge 1992). Stylistic considerations of the bronzes, jades and pottery vessels suggest to these authors a varied chronology commencing from middle to late Shang (ca. 1400-1100 BC) (Sun Hua 2007, 2013), running successively through late Shang (Bagley 1988; Gao Dalun and Li Yingfu 1994), late Shang to early Western Zhou (ca. 1100-900 BC) (Hu Changyu and Cai Ge 1992; Jiang Zhanghua 1991; Li Fuhua and Wang Jiayou 1991), late western Zhou (ca. 800 BC) (Song Zhimin 1990a), the Spring and Autumn period (771-476 BC) (Jiang Yuxiang 1993; Wang Yanfang *et al.* 1996; Xu Xueshu 1995) and finally even the Warring States period (476-221 BC) (Barnard 1990, but see Li Boqian 1996).

With regard to radiocarbon dating, there are three calibrated dates from pit K1: 2837-1117 BC and 1955-1510 BC on wood charcoal, and 2196-1429 BC on unidentified bone (Sun Hua 2000:161; Zhao Dianzeng and Chen De'an 2001:466). These dates have such huge error ranges as to be virtually useless for questions of refined chronology, and that of 1955-1510 BC clearly predates all other chronological estimates based on artefacts. Furthermore, any attempt to date K1 and K2 by their artefacts faces the problem that date of production need not equate with date of interment. The possibility that these artefacts were heirlooms or later imitations arises.

Scholars have also pointed out that the stratigraphic dating of pits K1 and K2 is problematic. According to the site report (SPICRA 1999), both K1 and K2 were dug into undisturbed soil. But K1 was sealed by layer 6 (light brownish yellow coloured soil), K2 by the younger layer 5 (light yellow coloured soil). Because the layer 6 that seals K1 was also sealed in turn by a layer 5 with a soil colour similar to that of the layer 5 that sealed K2, the authors of the site report inferred that K1 was the older of the two pits (SPICRA 1999:427). However, no equivalent to layer 6 exists around K2 at all, and the soil colours and pottery types of layers 6 and 5 above K1 are quite similar to each other (Chen De'an and Chen Xiandan 1987). Also, layer 6 only existed above the western section of K1 (Barnard 1990; Song Zhimin 1990a; Sun Hua 2000:181; Xu Xueshu 1995). Hence, there is no coherent stratigraphic evidence to imply that K1 is older than K2, even though certain stylistic comparisons of bronzes and jade artefacts could be used to support this viewpoint (CMIRCA 1999:428-32).

Excluding the possibility that the cultural deposits above K1 and K2 are *fengtu*, man-made earthen mounds to seal graves or ritual pits, the stratigraphic succession at Sanxingdui and the typology of the pottery provide additional clues to infer the older chronological limits for K1 and K2. According to Chen Xiandan (1989a), excavation at Sanxingdui zone II in 1986 revealed 8 layers above the undisturbed soil. Layers 1 to 3 at the top contained early modern cultural deposits and layers 4 to 8 were Sanxingdui phase 4 (Table 3.5). Although K1 and K2 were also located in zone II, the layers recorded above them in the site report (SPICRA 1999) were different from those recorded in the 1986 excavation. Layers 6 and 5 above K1 and K2 appear to be equivalent to layers 4 to 8 in the 1986 excavation, but the precise chronology remains obscure.

According to the K1/K2 report (SPICRA 1999:427), the pottery from layer 5 above K1 was similar to that from layer 4 in Sanxingdui zone III, excavated in 1984, and to that from layer 8 in zone III, excavated in 1986. Table 3.5 indicates that layers 6 and 5 above K1 and K2 possibly date to early Sanxingdui phase 4 (late Shang and Western Zhou on the Central Plain), and if this is correct then the youngest date limit for the digging and filling of the pits would be early

Sanxingdui phase 4, although the SPICRA report dated them to late Sanxingdui phase 3 (SPICRA 1999:427).

Table 3.5: The 1980-86 chronological seriation for Sanxingdui (Chen Xiandan 1989a).

	1980-1981	**1982**	**1984-1985**	**1986**		
Zone	III	I	III	I	II	III
Area excavated	1225 m^2	150 m^2	125 m^2	1325 m^2		
Early modern period	**(1)**	**(1)** **(2)**	**(1)**	**(1)** **(2)** **(3)**	**(1)** **(2)** **(3)**	**(1)** **(2)** **(3)**
Sanxingdui Phase 4		**(3)** **(4)** **(5)** **(6)**	**(2)** **(3)** **(4)** **(5)**	**(4)** **(5)** **(6)** **(7)** **(8)**	**(4)** **(5)** **(6)** **(7)** **(8)**	**(4)** **(5)** **(6)** **(7)** **(8)**
Sanxingdui Phase 3	**(2)**		**(6)**			**(9)** **(10)**
Sanxingdui Phase 2	**(3)**					**(11)** **(12)**
Sanxingdui Phase 1	**(4)** **(5)** **(6)** **(7)** **(8)**					**(13)** **(14)** **(15)** **(16)**

Layers are shown in brackets.

The above review suggests that K1 and K2 date to Sanxingdui phase 4, the Shierqiao phase, because no Sanxingdui phase 3 layers were identified in zone II at all (Song Zhimin 1990a). Also, the existence of pointed-based pottery of Shierqiao type in K1 provides circumstantial evidence to bolster this speculation. Unfortunately, the pottery in layers 6 and 5 above both pits is too fragmentary for precise dating (SPICRA 1999:16). In addition, layer 5 above K1 also yielded two pointed-based *zhan* sherds, this being a vessel type that postdates Sanxingdui phase 4 and which may be Western Zhou. Because layer 5 contains such mixed cultural material it would be improper to date it as early as Sanxingdui phase 4

In effect, the formation processes of layers 6 and 5 will be critical to the relative dating of the pits, because both layers are of alluvial origin from the Mamu river. As noted by Barnard (1990), both layers could contain redeposited materials, and as such any date based on the stratigraphy above both pits could be invalid.

(b) Other Sanxingdui sites on the Chengdu Plain

Except for Sanxingdui itself, few other Sanxingdui sites have been discovered on the Chengdu Plain. Between 1986 and 1990, surveys were carried out in Xindu, Pengxian (now Pengzhou), Guanghan and Shifang (Chen De'an *et al.*1993). In the Shiting, Mianyuan, Mamu and Yazi valleys, 13 sites dated between Sanxingdui phases 2 and 4 have been identified (Figure 3.25), but only Yanduizi has been excavated (Yu Chun and Jin Guolin 2005).

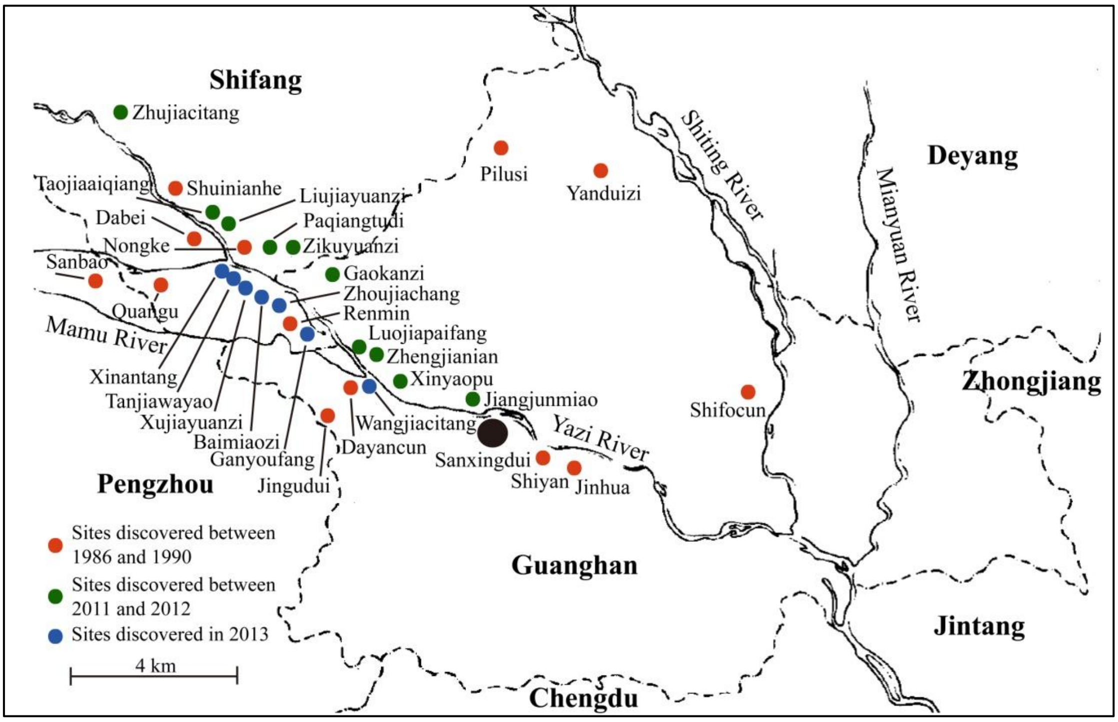


Figure 3.25: Possible Sanxingdui sites in Guanghan and Shifang counties.

Located 10 to 15 km north of Sanxingdui, Yanduizi lies on a low hill in northern Guanghan county. It contains 3 seriously disturbed layers, within which the possible Sanxingdui remains came mostly from 16 pits and 3 ditches. Small flat-based *guan* and high-stemmed *dou*, similar to those at Sanxingdui, were the most common forms. Yanduizi pottery is largely sandy plain with black slip. A small number of flaked basalt tools and ground stone tools were also excavated. Owing to the limited extent of excavation, neither the site size nor the chronological relationships between Yanduizi and Sanxingdui are clear.

A series of surveys were conducted along the Yazi river between 2011 and 2013 (Ran Honglin and Lei Yu 2014). This yielded 16 sites dating between late Shang and Western Zhou (Figure 3.25), but none have been excavated. It is evident that there are many small Sanxingdui sites along the Yazi valley to the northwest of Sanxingdui, and they appear to become denser as Sanxingdui is approached, suggesting the existence of satellite settlements around the Sanxingdui walled enclosure.

Away from Guanghan and Shifang, some sites allegedly dated to the Sanxingdui culture have been discovered between Chengdu and Guanghan, including Hetaocun in Chengdu (Li Mingbin 2003a), Qingjiangcun (Jiang Zhanghua and Yan Jinsong 2001) in Pixian, and Zhengyin xiaoqu (Chen Yunhong and Wang Bo 2005) and Guilinxiang in Xindu (Yan Jinsong and Chen Yunhong 1997). However, the available information does not allow the assemblages from these sites to be differentiated from those of the early Shierqiao phase. The best sites include 'Zone A of Jinhai'an Phase II' in Jintang (Liu Yumao and Liu Shouqiang 2009) and Sanxingcun in Qingbaijiang District of Chengdu (Chen Yunhong 2006b) (Figure 3.26). 'Zone A of Jinhai'an Phase II' is dated by its pottery to between Sanxingdui phases 2 and 3, and Sanxingcun to between phases

1 and 2.

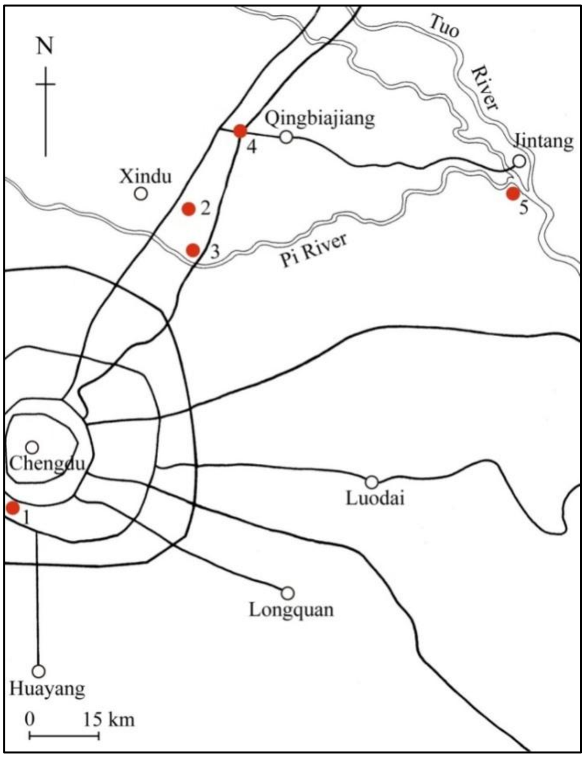
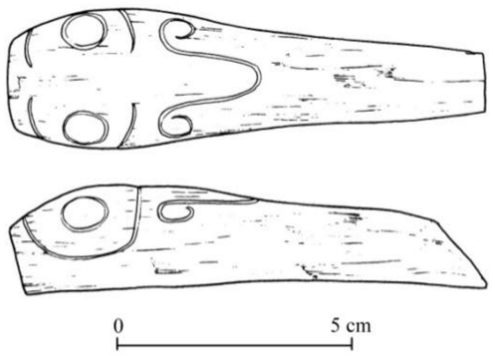
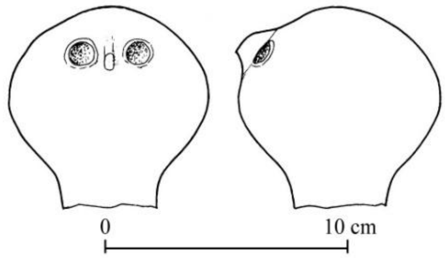


Figure 3.26: Distribution of sites believed to be of Sanxingdui date in and northeast of Chengdu: Hetaocun (1), Zhengyin xiaoqu (2), Guilinxiang (3), Sanxingcun (4), Zone A of Jinhai'an Phase II (5).

'Zone A of Jinhai'an Phase II' is the easternmost Sanxingdui site on the Chengdu Plain. The excavated area of 3000 m^2 is situated at the junction of the Pi, Qingbai and Tuo rivers. Sanxingdui remains were uncovered mostly from layer 5 and the pottery is similar to that of Sanxingdui phases 2 and 3 at Sanxingdui. At Sanxingcun, Sanxingdui materials were identified in layers 4 and 3. Layer 4 has both Baodun and Sanxingdui style vessels, whereas layer 3 has mainly Sanxingdui types. Remarkable finds from Sanxingcun include a 11.8 cm long bird's-head shaped wooden artefact (Figure 3.27) and a 9.5 cm high owl's-head shaped pottery figurine (Figure 3.28), both paralleled by the bird-shaped handles with hooked beaks and two owl's-head pottery figurines from Sanxingdui (Figure 3.29).





Figures 3.27 and 3.28: A bird's-head shaped wooden artefact (left) and an owl's-head shaped pottery figurine from Sanxingcun (right) (Chen Yunhong 2006b).

Figure 3.29: Two owl's-head shaped pottery figurines from Sanxingdui.

(c) Early Shierqiao sites around Chengdu

Early Shierqiao deposits exist in a small number of sites in Chengdu City and to its west and north (Table 3.6) (Figure 3.30), including Qiangyi Vehicle Trading and Jingpinfang. Pit H26 in Zhonghai guoji Commune site 2, with typical early Shierqiao artefacts, yielded two radiocarbon dates on charred rice of 1505-1430 BC and 1519-1426 BC. Both dates suggest that early Shierqiao was contemporary with Sanxingdui, rather than later in time.

Table 3.6: Archaeological sites reported to contain early Shierqiao deposits.

Sites		Layer(s)
Jinsha, Chengdu City		
	Lanyuan (Zhou Zhiqing *et al.* 2003)	7
	Qiangyi Vehicle Trading (Wang Lin and Jiang Ming 2009)	T3: 8 to 7 T2: 9 to 7
	Renfang (Tang Fei *et al.* 2005)	6 to 5
	Jingpinfang (Zhu Zhangyi *et al.* 2006)	7 to 6
Gaoxinxi District, Chengdu		
	Xiqu guoji (Zhou Zhiqing and Liu Yumao 2009)	5
	Futong Optical-fiber Communication (Zhou Zhiqing and Liu Yumao 2010a)	6
	Sichuan Fangyuan Zhongke (Zhou Zhiqing and Liu Yumao 2006a)	4
	Guoteng Phase II (Liu Yumao *et al.* 2005)	4
Xindu District, Chengdu City		
	Chujiacun (Chen Yunhong *et al.* 2010)	4
Jinniu District, Chengdu City		
	Zhonghai guoji Commune site 2 (Zhou Zhiqing and Liu Yumao 2012)	H25 and H26
Pixian		
	Languang Green Drink phase II (Zhou Zhiqing *et al.* 2010)	5
	Caojiaci (Yang Zhanfeng 2012a)	H1 and H2
	Tiantaicun (Yang Zhanfeng 2012d)	7
Wenjiang		
	Yongfucun sanzu (Yang Zhanfeng 2012c)	4
	Tianxianglu (Yang Zhanfeng 2012b)	5

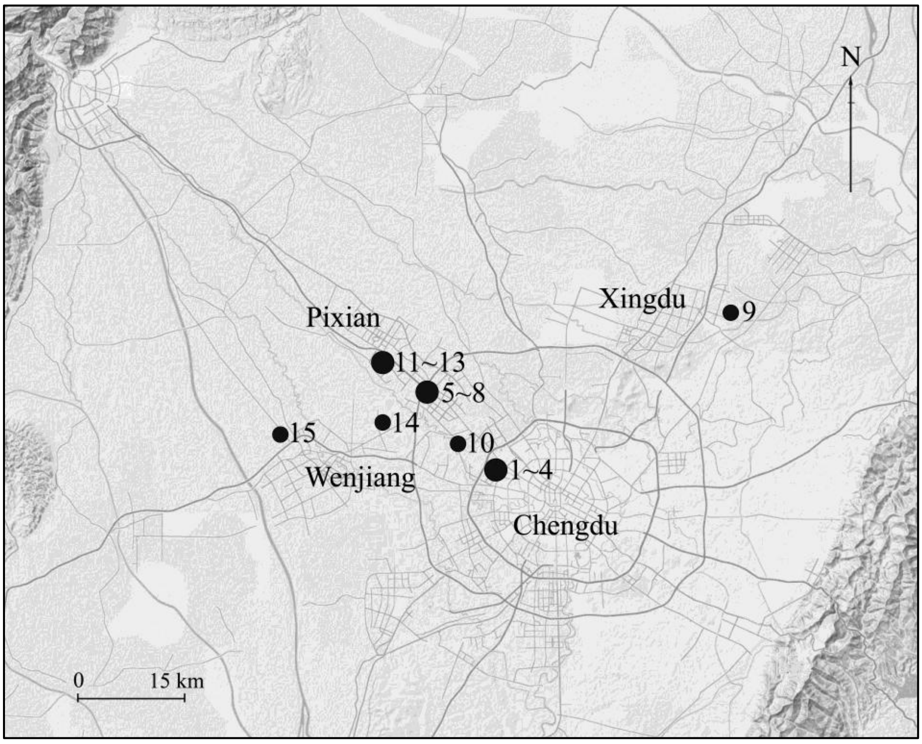


Figure 3.30: Archaeological sites reported to contain early Shierqiao deposits: Lanyuan, Qiangyi Vehicle Trading, Renfang, Jingpinfang (1)-(4), Xiqu guoji, Futong Optical-fiber Communication, Sichuan Fangyuan Zhongke, Guoteng Phase II (5)-(8), Chujiacun (9), Zhonghai guoji Commune site 2 (10), Languang Green Drink phase II, Caojiaci, Tiantaicun (11)-(13), Yongfucun sanzu (14), Tianxianglu (15).

Cultural layers about 20 to 40 cm thick exist in these sites, which generally contain poorly preserved sherds in large quantities in pits, together with pebbles and accumulations of ash. As discussed at the end of chapter 2, their material culture is similar to that of the much-debated Yufucun culture, which also had connections with Sanxingdui. To date, only one early Shierqiao grave exists, at Chujiacun. This was a poorly preserved supine inhumation in a rectangular pit with no container. Remains of houses are scarce, but houses F61 and F62 at Jingpinfang had postholes within wall foundation trenches, like Baodun culture houses.

3.5 Chengdu Plain between 1000 and 800 BC – the Shierqiao culture

The Shierqiao culture continued on the Chengdu Plain after the Sanxingdui culture faded from archaeological visibility by the beginning of Sanxingdui phase 4. Shierqiao sites are widely distributed on the whole plain, with expansion into the middle and lower reaches of the Qingyi and Dadu valleys along the eastern fringe of the Qinghai-Tibet Plateau. Sites there, such as Shaxi (Chen De'an and Cao Jun 2007; Lei Yu 1990), Maipingcun, Majiashan (Chen Jian *et al.* 2003, 2006; Guo Fu *et al.* 2012), and Sanxing (Chen Weidong and Zhou Kehua 2008) have also yielded pointed-based pottery similar to that on the Chengdu Plain. However, very few of these Shierqiao sites have been radiocarbon-dated and chronology still relies heavily on typology and stratigraphy.

Shierqiao and Xinyicun

Shierqiao is located quite centrally in Chengdu City, about 3.5 km southeast of the Jinsha site cluster (Figure 3.31). This waterlogged site was discovered in 1985 during basement construction, and excavated between 1986 and 1988 (SPICRA and CMICRA 2009). In 1995, an extension to the site was discovered about 100 m east of Shierqiao at Xinyicun (Jiang Zhanghua *et al.* 2004). The excavation at Shierqiao ceased in layer 13, the lowest cultural layer discovered at that time, in order to conserve two large wooden pile structures that were possibly destroyed by a flood (SPICRA and CMICRA 2009:19-37). Hence, the lower layers were left unexcavated. Shierqiao cultural deposits here include layers 5 and 6 in unit T25 of zone I, and layers 10-13 in zones I and II (Figure 3.32). Layers 5 to 9 in zones I and II date between the terminal Warring States period (or Qin Dynasty) and the Western Han Dynasty (ca. 250-150 BC).

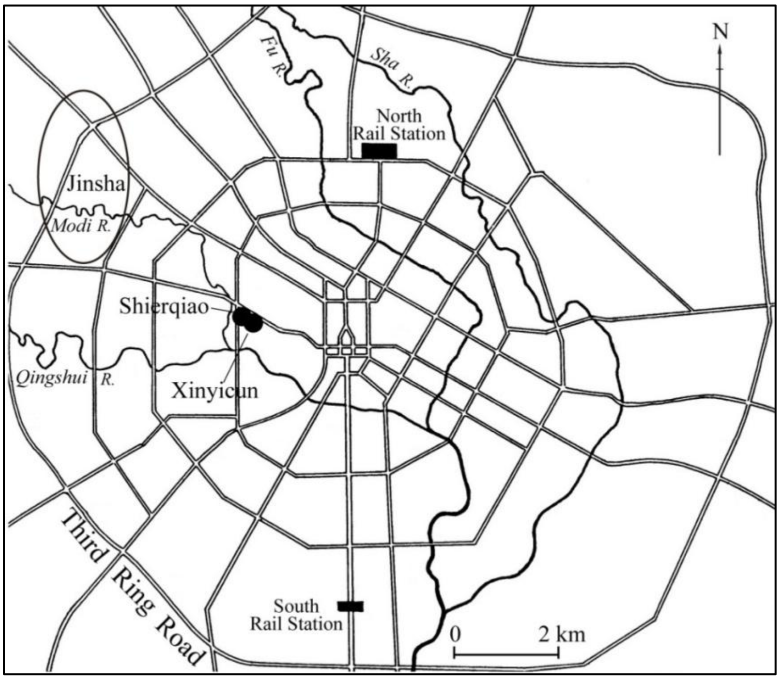


Figure 3.31: The locations of Shierqiao and Xinyicun in Chengdu City.

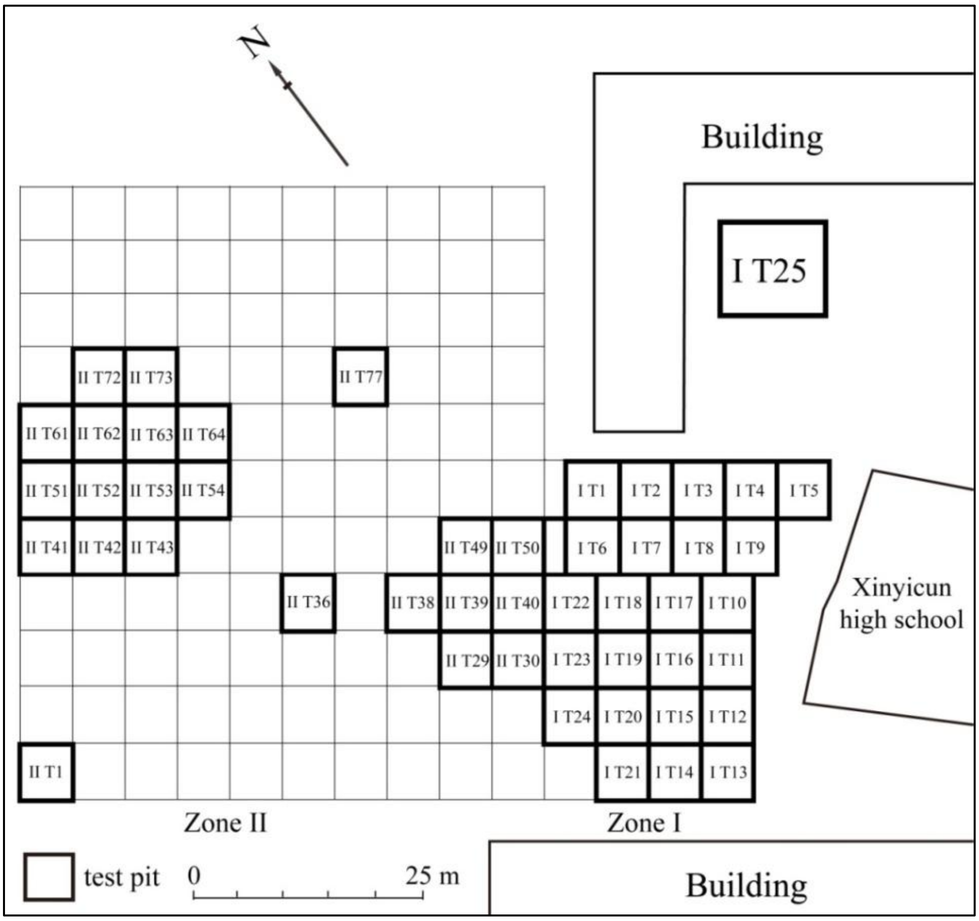


Figure 3.32: Plan of Shierqiao excavation (redrawn from SPICRA and CMICRA 2009:6, with modifications).

At Xinyicun, layers 6-9 predated the Warring States period. Layer 9 yielded few artefacts, but layers 7 and 8 have pottery very similar to that from layers 10 and 11 in Shierqiao. Based on the pottery recovered from Shierqiao and Xinyicun, a likely seriation of cultural layers is illustrated in figure 3.33.

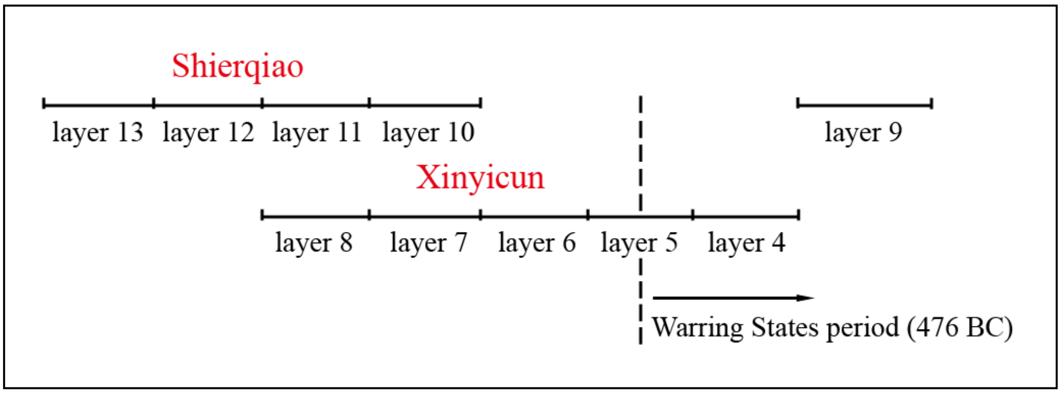


Figure 3.33: Suggested chronological seriation of the Shierqiao and Xinyicun layers.

Most specific Sanxingdui style artefacts, such as the bird-shaped handles with hooked beaks and the tripodal *he* pottery vessels, had disappeared prior to Shierqiao layer 11. The only Shierqiao vessel type that continued throughout the Warring States period was the pointed-based *zhan*, pottery bowls 5 to 15 cm high with maximum diameters between 15 and 25 cm (Song Zhimin 1998a, 2005) (see the metrical analysis of *zhan* in chapter 5).

Chinese scholars have reached no consensus on the dates of early Shierqiao and Xinyicun, as summarized in table 3.7. Their dating is based heavily on pottery typology and stratigraphic succession rather than absolute dates, but the common reliance on stylistic comparison of the pointed-based pottery with that from Sanxingdui pit K1 is not really helpful because of the chronological uncertainty also associated with the latter, with dates from late Shang to early Western Zhou being possible.

Table 3.7: Summary of the opinions of Chinese archaeologists on the chronologies of early Shierqiao and Xinyicun cultural layers.

<table>
<tr><th></th><th colspan="10">Layers and the corresponding dates</th></tr>
<tr><td>(A)</td><td colspan="2">SQ ⑬-⑫
1250-1100 BC</td><td colspan="4">SQ ⑪-⑩
1100-1050 BC</td><td colspan="2">XYC⑧
850-750 BC</td><td>XYC ⑦
750-650 BC</td><td>XYC ⑥
650-550 BC</td></tr>
<tr><td>(B)</td><td>SQ ⑬
1200-1150 BC</td><td colspan="2">SQ ⑫-⑪
1150-1100 BC</td><td colspan="3">SQ ⑩
700-400 BC</td><td colspan="4"></td></tr>
<tr><td>(C)</td><td>SQ ⑬
1100-1050 BC</td><td colspan="2">SQ ⑫
1050-1000 BC</td><td colspan="3">SQ ⑪-⑩
1050-950 BC</td><td colspan="2">XYC ⑧
850-750 BC</td><td colspan="2">XYC ⑦-⑥
750-650 BC</td></tr>
<tr><td>(D)</td><td colspan="5">SQ ⑬-⑩
850-750 BC</td><td colspan="5">XYC ⑧-⑥
750-450 BC</td></tr>
<tr><td>(E)</td><td colspan="2">SQ ⑬-⑫
1250-950 BC</td><td colspan="4">SQ ⑪-⑩
850-700 BC</td><td colspan="4">XYC ⑧-⑥
750-450 BC</td></tr>
<tr><td>(F)</td><td colspan="2">SQ ⑬-⑫
1100-1000 BC</td><td colspan="2">SQ ⑪
1050-950 BC</td><td colspan="3">XYC ⑧
850-750 BC</td><td colspan="3">XYC ⑦-⑥ and SQ ⑩
750-650 BC</td></tr>
</table>

SQ: Shierqiao XYC: Xinyicun ⊛: layer

(A) Original site reports (Jiang Zhanghua *et al.* 2004; SPICRA and CMICRA 2009).
(B) Sun Hua 1996.
(C) Jiang Zhanghua and Li Mingbin 2002:183.
(D) Song Zhimin 1990b; 2005, 2006.
(E) Zhao Dianzeng and Li Mingbin 2004:317.
(F) Zhao Dianzeng 2005:480-2.

The site of Shierqiao has only three radiocarbon dates. As discussed in chapter 2, it is possible that the two dates from layer 13, 2191-1696 BC (ZK-2132) on wood and 1927-1527 BC (BK-86095) on charcoal (OxCal 4.2. 95.4%) (CASS 1991:227), are somewhat too early for the context and possibly on old wood. However, another date on bamboo charcoal from Shierqiao layer 10, 797-212 BC (ZK-2133), despite having received little attention from Chinese archaeologists, is far more acceptable since bamboos have relatively short life cycles (Farrelly

1984:140-2). If this date is contextually correct, the lower date limit for Shierqiao layer 10 could be late Western Zhou (ca. 800 BC), and the upper could be Spring and Autumn period (commencing 770 BC). Xinyicun layers 6 and 5 have no radiocarbon dates, but bronzes from grave M1 dug from layer 5 are similar to those discovered with early and middle Warring States (ca. 450-350 BC) burials in and around Chengdu City (Figure 3.34). Hence, the upper date of Xinyicun layer 5 could be 450 BC.

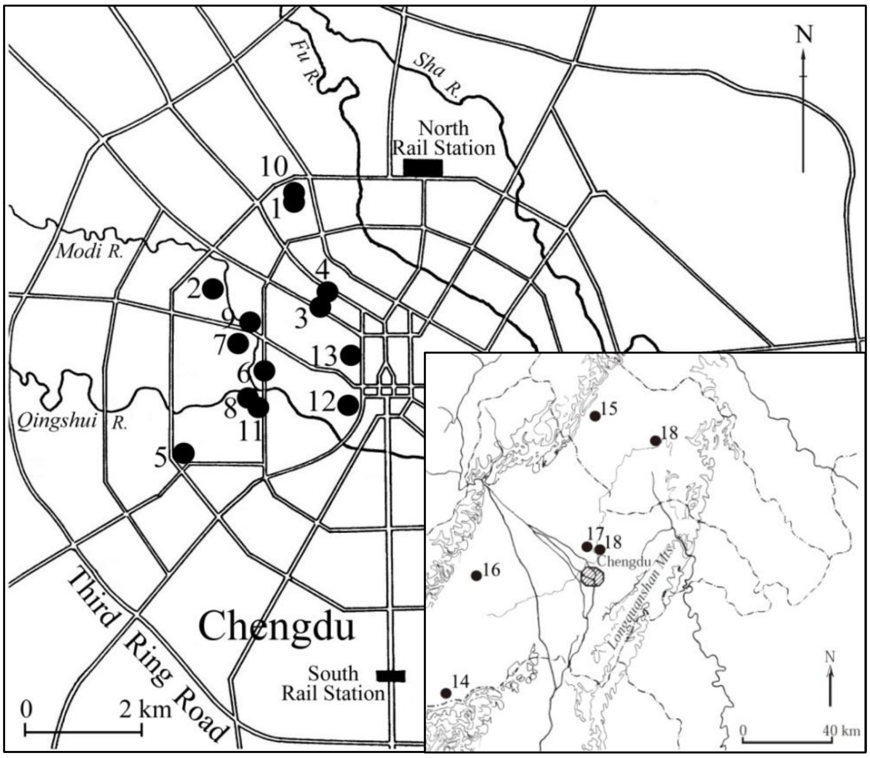


Figure 3.34: Distribution of early to middle Warring States burial sites in and around Chengdu City: Guangrong xiaoqu (1), Shiren xiaoqu (2), Qingyang xiaoqu (3), Chengdu Institute of mechanic and telecommunication industry (4), Shengdeng commune (5), Qingyanggong (6), Sichuan Provincial Institute of Water conservancy (7), Luojianian (8), Chengdu University of Chinese Medicine (9), Jinshaxiang (10), Baihuatan (11), Wenmiao xijie (12), Shangyejie (13), Pujiang (14), Qingdao (15), Wulong (16), Taiping commune (17), Chengguan (18), Majia (19) (Chen Xianshuang 1983, 1985; CMICRA 2009b; Lei Yuhua 1997; Lei Yuhua and Zhu Zhangyi 1998; Li Fuhua *et al.* 1981; Luo Kaiyu and Zhou Ertai 1993; SPICRA *et al.* 2006; SPM 1976; SPM and Wang Youpeng 1987; Xu Pengzhang 1989; Yan Jinsong 2005; Zhang Caijun 1982; Zhang Xiaoma 1985;

Zhang Xiaoma and Jiang Zhanghua 1992; Zhao Dianzeng and Hu Changyu 1985; Zhao Dianzeng and Hu Liang 1985; Zhu Zhangyi 2000, 2002).

A *terminus post quem* for Shierqiao layer 13 can be inferred in part from the dated contents of pit H26 in Zhonghai guoji Commune site 2 (Zhou Zhiqing and Liu Yumao 2012), and from layer 3 in the site of Shaxi (Lei Yu 1990). The first site is located 5 km northwest of Shierqiao, and Shaxi is on a terrace of the middle Qingyi river in Ya'an, 160 km southwest of Chengdu. H26 has two ^{14}C dates on charred rice of 1505-1430 BC and 1519-1426 BC, and one of 1423-1047 BC on charcoal (OxCal 4.2. 95.4%) (CASS 1991:228). Since no pointed-based pottery was found in either site, the date of Shierqiao layer 13 should be younger than these three dates.

Another way to estimate the date of Shierqiao stratum 13 is from the pointed-based pottery (K1:320) found in Sanxingdui pit K1 (SPICRA 1999:145-8), because similar items (I T2⑬:4 and I T12⑫:3) were found in Shierqiao layers 13 and 12 (SPICRA and CMICRA 2009:79) (Figure 3.35). Given that Sanxingdui pit K1 does not predate Sanxingdui phase 4 (dated late Shang to early Western Zhou), the date of Shierqiao layer 13 should be terminal Shang or later, i.e. later than 1100 BC.

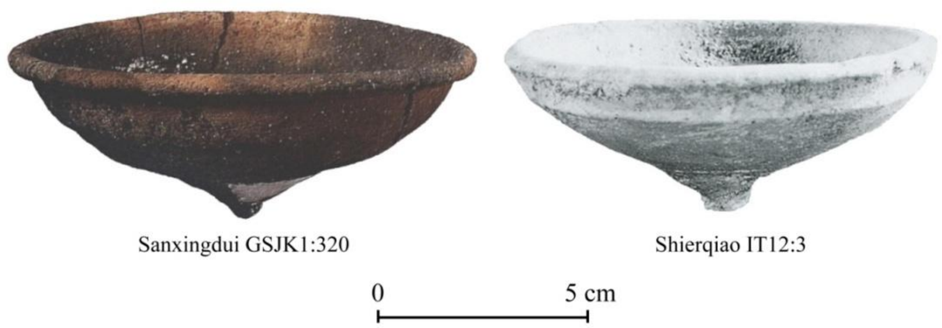


Figure 3.35: Similar pointed-based *zhan* from Sanxingdui pit K1 and Shierqiao layer 12 (from SPICRA *et al.* 2009:373 and SPICRA and CMICRA 2009: plate 17, with modifications).

The Jinsha site cluster

The Jinsha site cluster includes a number of Shierqiao occupations distributed over an area of 5 km^2 enclosed by Shuhan Road to the north, Qingyang Road to the east, Third Ring Road to the west, and Qingjiang Road to the south (Figure 3.36). Located about 5 km west of the center of Chengdu, the existence of this cluster was recognized accidently during road construction only in 2001 (CMICRA 2005b:4), even though one location had been exposed at Huangzhong xiaoqu in 1995 (Zhu Zhangyi *et al.* 2002a, 2006). However, after these initial test excavations at Huangzhong xiaoqu, and also at Sanhe huayuan (Zhu Zhangyi and Liu Jun 2001) and Jindu huayuan, the Jinsha cluster was only considered to be a not-unusual site cluster with late Shang to Western Zhou period remains. The true importance of Jinsha was recognized later through the discovery of bronze, jade and gold artefacts at the site of Meiyuan Northeast (Wang Fang *et al.* 2004), some similar to specimens from Sanxingdui pits K1 and K2. It is unfortunate that these discoveries were not archaeologically excavated, but unearthed by mechanical excavators.

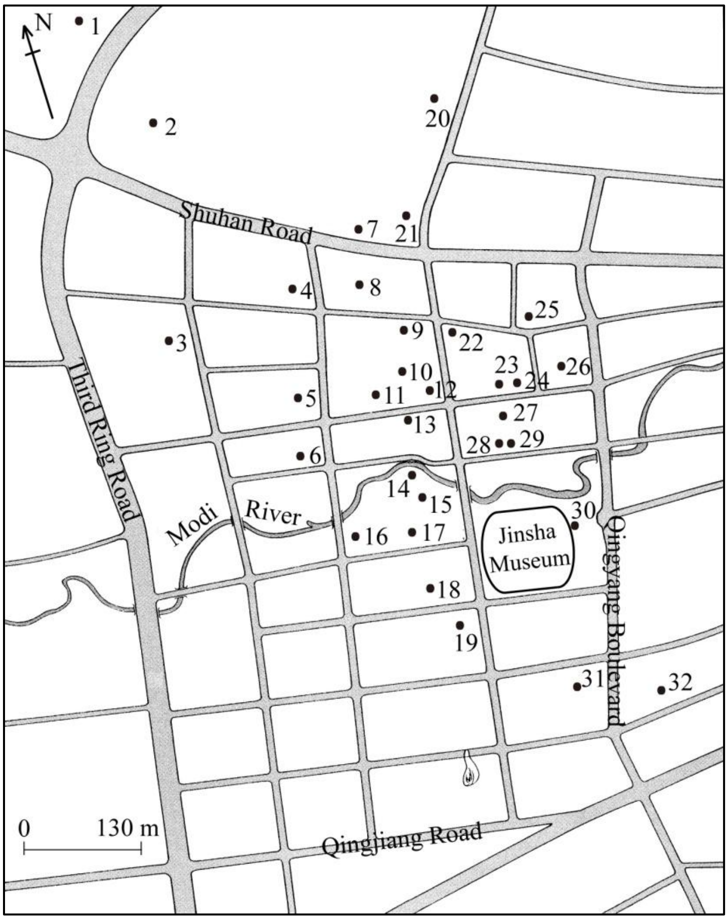


Figure 3.36: The Jinsha site cluster: Jingpinfang (1), Jiazaihuilang (2), Longzui B yanxian (3), Yudu huayuan (4), Chunyu huajian (5), Wanbo (6), Xicheng tianxia (7), Jindu huayuan (8), Furongyuan north (9), Furongyuan south (10), Guoji huayuan (11), Bureau of communication, Jinniu District (12), Huangzhongcun gandao A yanxian (13), Shufeng Huayuancheng Phase II (14), Yansha tingyuan (15), Yongjinwan (16), Renfang (17), Lanyuan (18), Hanlong (19), Jin'gangwan (20), Yangxixian zonghelou (21), Xinghelu xiyanxian (22), Gangzheng (23), Locus C of Site no. 5 (24), Sanhe huayuan (25), Huangzhong xiaoqu (26), Jinyu (27), Huangzhongcun gandao B yanxian (28), Jiangwang fudi (29), Meiyuan Northeast (30), Zhixin jinshayuan (31), Qili huayuan (32).

The Jinsha site cluster has produced very few ^{14}C dates and their stratigraphic contexts are not published. The chronological seriation of the Jinsha sites thus relies on the typology of the pottery from Shierqiao and Xinyicun. Based on the typological assumption that adjacent sites of roughly the same date should have pottery of similar style, the Jinsha site cluster can be divided into four successive phases, with the oldest predating Shierqiao layers 13 and 12, and the other three running parallel to early Shierqiao and Xinyicun (Figure 3.37).

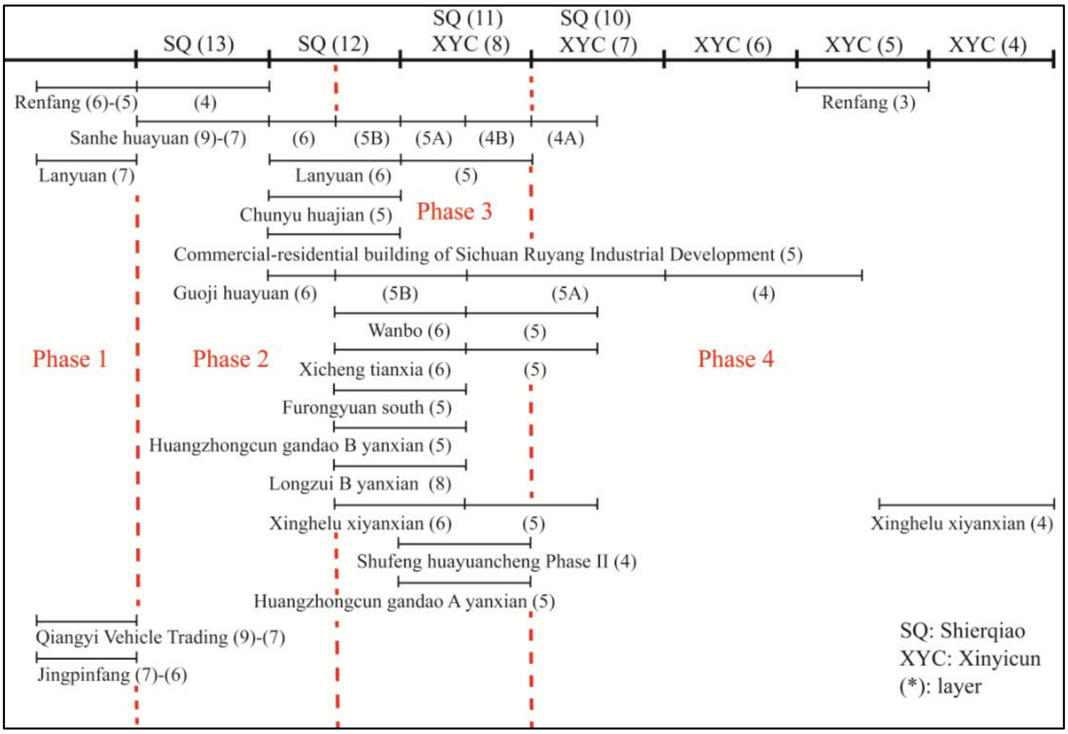


Figure 3.37: A stratigraphic seriation of the Jinsha site cluster.

The oldest sites, here placed in Phase 1, include Qiangyi Vehicle Trading layers 9 to 7 (Wang Lin and Jiang Ming 2009), Jingpinfang layers 7 and 6 (Zhu Zhangyi *et al.* 2006), Lanyuan layer 7 (Zhou Zhiqing *et al.* 2003), and Renfang layers 6 and 5 (Tang Fei *et al.* 2005). The first two sites are located close together, northwest of the Third Ring road and about 1 to 2 km from the Jinsha core zone (Figure 3.36). The types of pottery unearthed there are similar to some from Shierqiao layer 13, but there is no pointed-based pottery and such forms only appear in higher layers, such as Lanyuan layer 5 and Renfang layer 4.

The earliest Shierqiao cultural deposits in the Qiangyi Vehicle Trading site and Jingpinfang are generally 35 to 50 cm thick, about 15 cm thicker than at

Lanyuan and Renfang. According to the site reports, it appears that the area northwest of the Jinsha core zone, where most Jinsha sites are distributed in figure 3.36, was a major region of human occupation. The density of early Shierqiao finds here is greater than at Lanyuan and Renfang.

The cultural materials in the Jinsha site cluster which are similar to those from Shierqiao layers 13 and early 12 are placed in Phase 2, which includes Renfang layer 4, Sanhe huayuan layers 9 to 6 (Zhu Zhangyi and Liu Jun 2001), Lanyuan lower layer 6 (Zhou Zhiqing *et al.* 2003), Chunyu huajian lower layer 5 (Chen Yunhong 2006a), Commercial-residential building of Sichuan Ruyang Industrial Development layer 5 (Zhou Zhiqing 2010), and Guoji huayuan layer 6 (Zhou Zhiqing *et al.* 2006). Of these sites, the first two probably slightly predate the others and correspond with Shierqiao layer 13. Relatively little pottery was unearthed at Renfang and Sanhe huayuan during this period, but a greater density occurred contemporary with the beginning of Shierqiao layer 12 and continued until the termination of Shierqiao layer 11 (Xinyicun layer 8). At Lanyuan, 461 pits, including some with many pottery vessels, more than 100 graves, 17 house features and 3 pottery kilns were excavated over 12,800 m^2 in layers 6 and 5 (Zhou Zhiqing *et al.* 2003). At Sanhe huayuan, five large rectangular house plans (F5-F9) covering a total area of about 1000 m^2 and four adjacent smaller ones (F1-F4) were also excavated under layers 5A and 4B respectively (CMICRA 2005b:5). House F6 had at least five rooms and measured around 8 m in width and over 54.8 m in length.

Prosperity at Jinsha peaked during Phase 3, contemporary with Shierqiao layers 12 and 11. Aside from the conspicuous activity at Lanyuan and Sanhe huayuan mentioned above, other evidence of intense human activity has been identified in Chunyu huajian upper layer 5 (Chen Yunhong 2006a), Guoji huayuan layer 5B (Zhou Zhiqing *et al.* 2006), Wanbo layer 6 (Chen Yunhong *et al.* 2004), Xicheng tianxia layer 6 (Chen Yunhong *et al.* 2007), Furongyuan south layer 5 (Liu Jun *et al.* 2005), Huangzhongcun Gaodao B yanxian layer 5 (Zhou Zhiqing 2004), Longzui B yanxian layer 8 (Zhou Zhiqing and Wu Nan 2010), Xinhelu xiyanxian layer 6 (Wang Lin and Zhou Zhiqing 2010), Shufeng Huayuancheng Phase II layer 4 (Tang Fei *et al.* 2003), and Huangzhongcun gandao A yanxian layer 5 (Zhou Zhiqing *et al.* 2005). At Furongyuan south, 23 small house features, a well, 176 pits and 25 other trenches were excavated. Huangzhongcun Gaodao B yanxian produced 17 pits, 2 kilns and one burial. Wanbo commenced as a burial site with 56 supine burials with folded arms, generally with few to no grave goods, and then was reoccupied as a residential area. Another burial site, Shufeng Huayuancheng Phase II, had 15 square or rectangular graves with little spatial overlap, mostly again supine with arms folded atop chests. Graves M22, M23, M24, M27, M37, and M38 were secondary or disturbed inhumations.

Phase 4 sites include Renfang layer 3 (Tang Fei *et al.* 2005), Sanhe huayuan layer 4A (Zhu Zhangyi and Liu Jun 2001), Guoji huayuan layer 4 and upper 5A (Zhou Zhiqing *et al.* 2006), Wanbo and Xichen tianxia upper layer 5 (Chen Yunhong *et al.* 2004, 2007), and Xinhelu xiyanxian upper layers 5 and 4 (Wang Lin and Zhou Zhiqing 2010). These sites mark the end of occupation at Jinsha. At the beginning of this phase, the number of sites at Jinsha decreased sharply. Jinsha itself no longer existed as a nucleated habitation. Only the 10 to 15 cm deep layer 4A at Sanhe huayuan has yielded a few coarse sandy sherds and refuse pits. However, many cemeteries of this phase have been excavated at Guojihuayuan, Wanbo and Xinhelu xiyanxian, and reveal a progressive transformation in mortuary practice. The 24 graves excavated in Xinhelu xiyanxian upper layer 5 and those excavated below Wanbo layers 6 and 5 have rectangular pits without coffins, additional mortuary structures, such as ledges, and few to no grave goods. However, mortuary practices altered at Jinsha during the transition between Shierqiao layers 11 and 10, in that graves M470 and M182 at Wanbo contained hollow log coffins, lying below the supine remains (Figure 3.38). Another change occurred with the full log coffins used in Guoji huayuan layer 4 (Figure 3.39). It is possible that these were prototypes for the Warring States coffins discovered below Xinhelu xiyanxian layer 4 (Figure 3.40) and at Shangyejie in Chengdu (Figure 3.41) (CMICRA 2009).

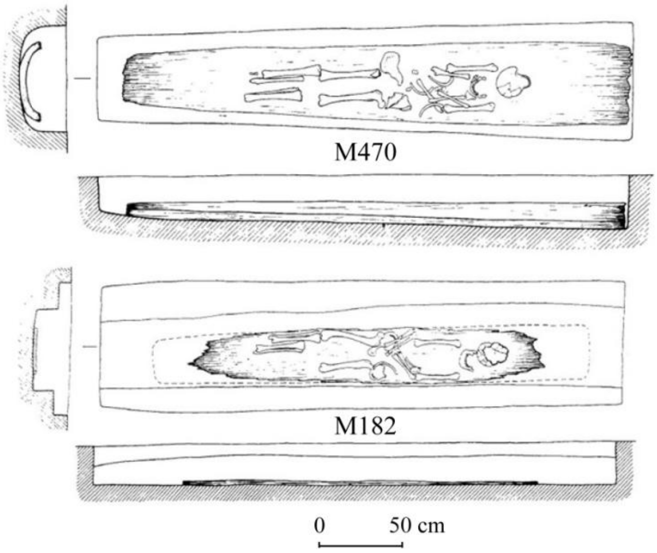


Figure 3.38: Log coffin burials M470 and M182 at Wanbo (Chen Yunhong *et al.* 2004).

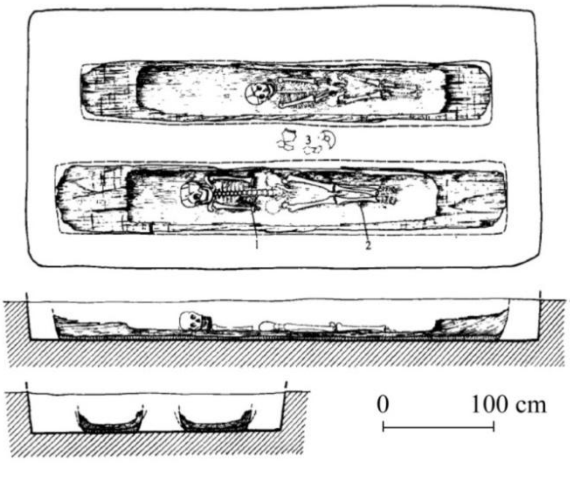


Figure 3.39: Log coffin burial M917 at Guoji huayuan (Zhou Zhiqing *et al.* 2006).

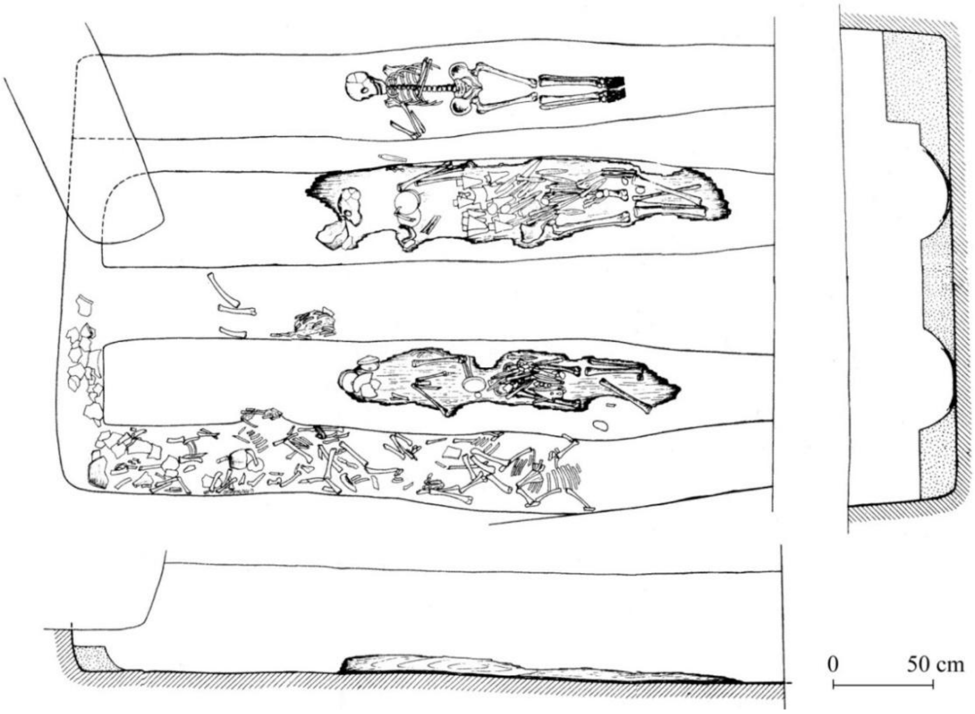


Figure 3.40: Log coffin burial M2725 at Xinhelu xiyanxian (Wang Lin and Zhou Zhiqing 2010).

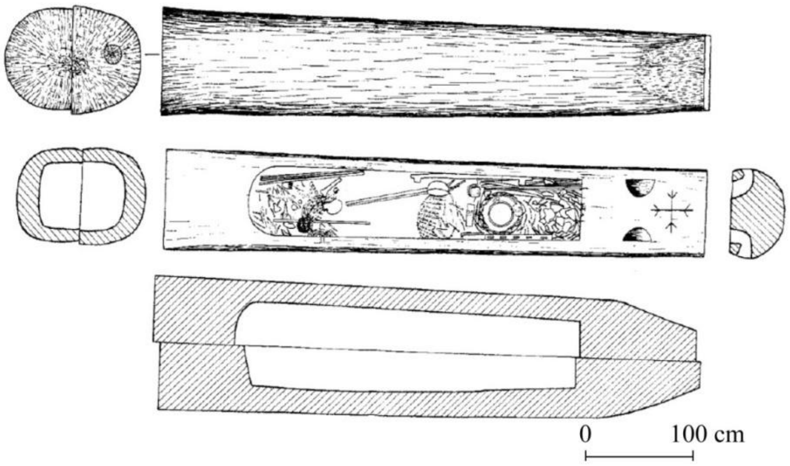


Figure 3.41: Log coffin burial M8 at Shangyejie (Jiang Cheng *et al.* 2002).

A most significant discovery in the Jinsha site cluster comes from Meiyuan Northeast (Wang Fang *et al.* 2004), including a number of exquisite gold foil ornaments, small bronzes, jades, cinnabar decorated carved stonework, and turtle plastrons with round drilled indentations (CMICRA 2005b; CMICRA and SAMBU 2002) which resemble certain artefacts from Sanxingdui pits K1 and K2.

It is unfortunate that these artefacts were unearthed by mechanical excavators since their stratigraphic context has been lost, but they appear to have come from at least 10 cultural layers. Similar items excavated from other Jinsha sites, including a jade adze, chisel and *yazhang* forked blade from Lanyuan graves M33, M61 and M64; a jade *yazhang* from Guoji huayuan grave M825; jade chisels, *yazhang* and *yuan* from Wanbo layers 7 and 6 and bronze *bi* bangles from Xinhelu xiyanxian grave M2727, also date between Western Zhou (Shierqiao layer 12) and the Warring States period (Xinyicun layer 4). However, they do not clarify the dates of the artefacts listed above from Meiyuan Northeast, even though some Chinese archaeologists relate them to Shierqiao layers 12 and 11 (Zhu Zhangyi *et al.* 2002a).

Further salvage excavation at Meiyuan Northeast has uncovered a pit (K1) with many elephant tusks and a number of jade and bronze pieces, together with a possible jade workshop for *bi* and *yazhang* encompassing around 300 m^2, and another 300 m^2 area with an accumulation of cut wild boar tusks, deer antlers and elephant tusks, as well as pottery and decorated stone sculptures. According to the brief report (Zhu Zhangyi *et al.* 2002a), pit K1 was cut from layer 8, the layer contemporary with Shierqiao layer 12, and a large quantity of gold, bronze, jade, stone, and ivory artefacts were excavated in layer 8.

Systematic flotation was carried out at Locus C in Jinsha Site 5. 15 soil samples from 14 pits yielded 0.848g of charcoal and 298 carbonized seeds, including 201 rice grains (*Oryza sativa*), 58 foxtail millet grains (*Setaria italica*), 3 shiso grains (*Perilla frutescens*), and one soybean (*Glycine soja*). Possibly non-domesticated seeds of other grasses in the genera *Panicum*, *Echinochloa*, *Setaria* and *Panicoideae* (Jiang Ming *et al.* 2011b) could have been crop weeds. In addition, 32 spikelet bases of a non-shattering type of rice were also recovered, suggesting that it was domesticated.

Sites northwest of Chengdu

A few Shierqiao sites have been excavated between Pixian and the Jinsha site cluster along the Qingshui, Modi and Jin rivers (Figure 3.42), with the greatest aggregation of sites occurring in Gaoxinxi District. Compared to Jinsha, Shierqiao remains from these sites are badly preserved and less abundant. The most common discoveries are pits and trenches with sherds and ground stone tools. Rectangular wattle and daub house features, burials and kilns, similar to those from Jinsha, were also excavated in the sites of Zhonghai guoji Commune site 2 (Zhou Zhiqing and Liu Yumao 2012), Lijia yuanzi (Yi Li *et al.* 2011), Songjia heba (He Kunyu 2009), Datang Telecommunication Phase II (Zhou Zhiqing 2005a), and Putian Cable Corporation (Zhou Zhiqing and Liu Yumao 2008b). Guoteng Phase II (Liu Yumao *et al.* 2005) and Hangkonggang (Xie Tao *et al.* 2005a) have very poor preservation.

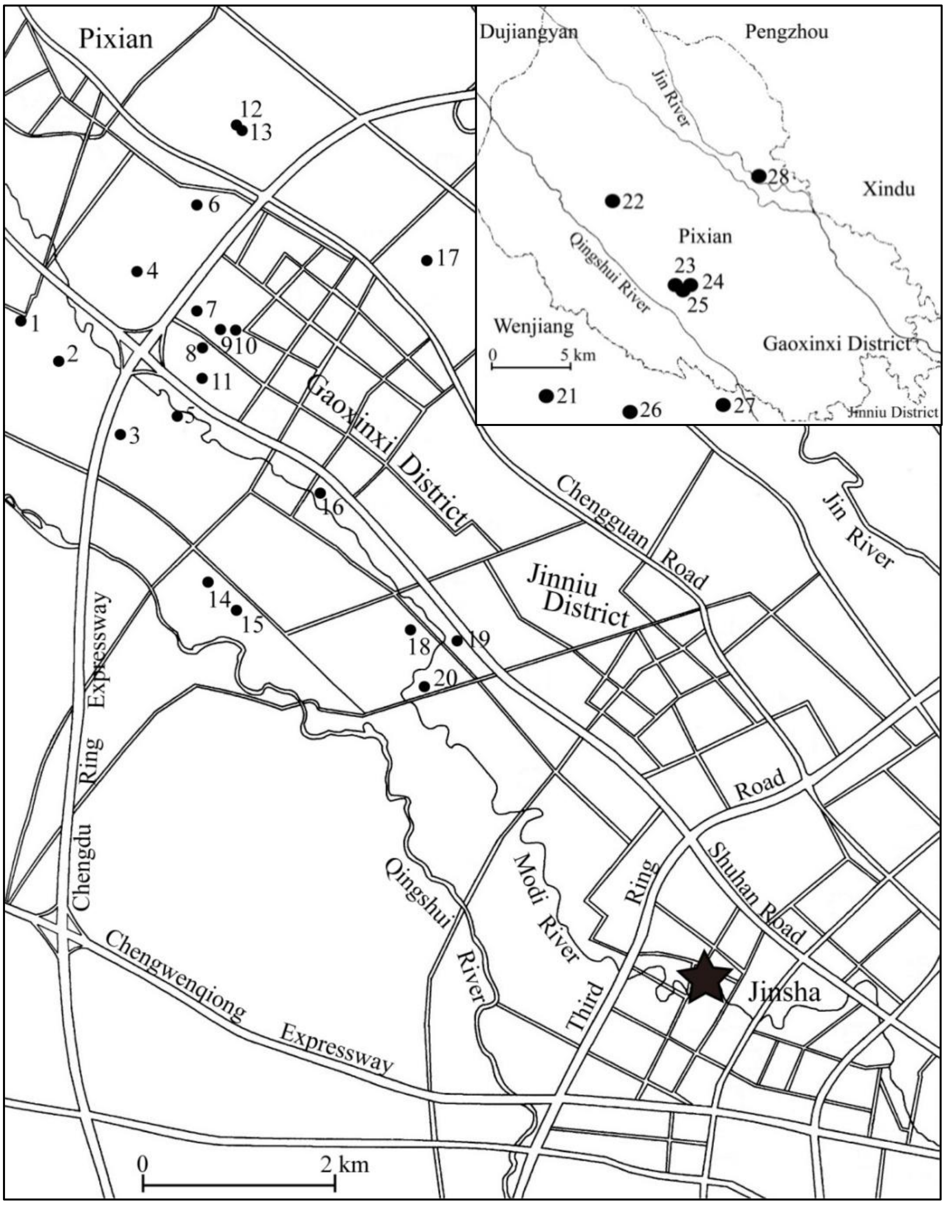


Figure 3.42: Distribution of Shierqiao sites along the Qingshui and Modi rivers: Shunjiang xiaoqu Phase II (1), Qingshuihe campus administration building, UESTC (2), Mofu Biotech (3), Hangkonggang (4), Guoteng Phase II (5), Futong Optical-fiber Communication (6), Wan'an Pharmaceutical Packing Factory (7), Weipo Production of Yaguang Investment (8), Xinjinxi Packing Factory (9), Sichuan Fangyuan Zhongke (10), Datang Telecommunication Phase II (11), No.6 Academic building of the new campus, Xihua University (12), Institute of Internet Technology, Xihua University (13), Huili Packing Factory (14), Putian Cable Corporation (15), Xiqu guoji (16), New campus phases I and II in Southwest Jiaotong University (17), Zhonghai guoji Commune site 4 (18), Zhonghai guoji Commune site 2 (19), Zhonghai guoji Commune site 3 (20), Tianxianglu (21), Lijia Yuanzi (22), Languang Green Drink phase II (23), Tiantaicun (24), Caojiaci (25), Fanjianian (26), Yongfucun sanzu (27), Songjia heba (28).

As at Jinsha, the chronological seriation of the sites northwest of Chengdu also depends on typological comparisons with the pottery from Shierqiao and Xinyicun. Among the four successive phases that can be recognized, Phase 1 predates Shierqiao layer 13 and the others run parallel with early Shierqiao and Xinyicun, with Phase 2 being contemporary with Shierqiao layer 13 and the early period of layer 12, Phase 3 with Shierqiao layers 12 and 11, and Phase 4 with Shierqiao upper layer 10 and Xinyicun lower layer 6 (Figure 3.43).

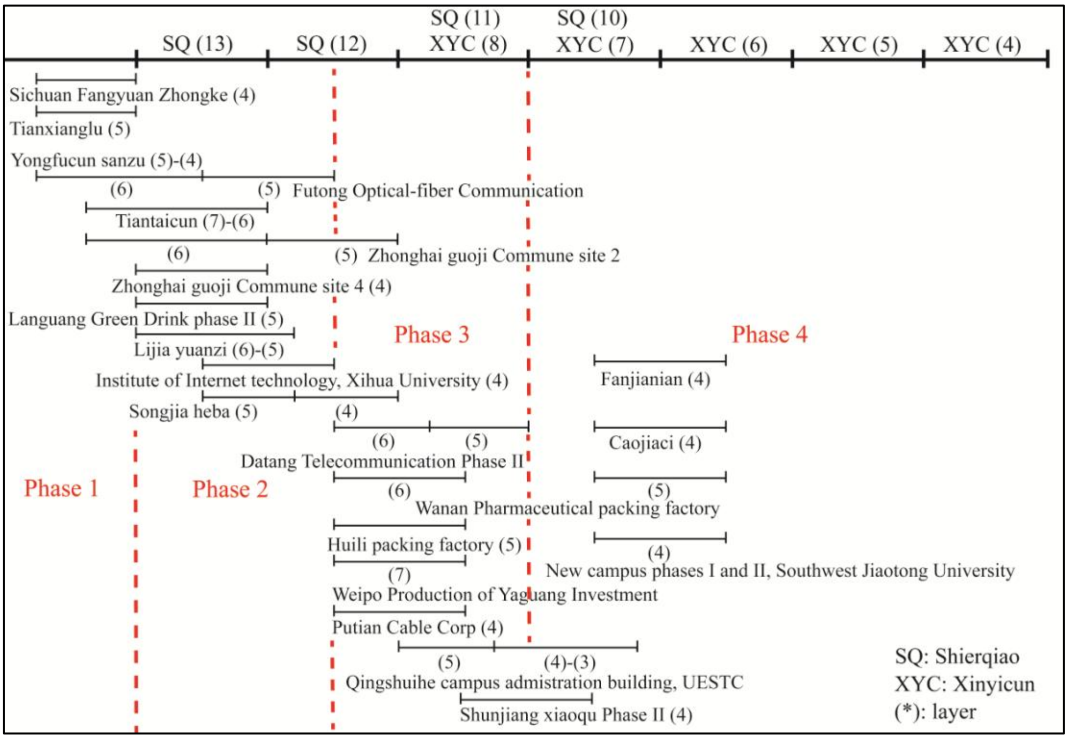


Figure 3.43: The stratigraphic succession of the sites northwest of Chengdu.

It appears that this region northwest of Chengdu was sparsely inhabited in Phase 1, since there are only 4 sites: Sichuan Fangyuan Zhongke layer 4 (Zhou Zhiqing and Liu Yumao 2006a), Tianxianglu layer 5 (Yang Zhanfeng 2012b), Yongfucun sanzu layers 5 and 4 (Yang Zhanfeng 2012c), and Futong Optical-fiber Communication layer 6 (Zhou Zhiqing and Liu Yumao 2010a). Except for 3 pits at Sichuan Fangyuan Zhongke and Tianxianglu, most of these sites have produced only sherds. During the following periods, the number of Shierqiao sites gradually increased, and prosperity peaked contemporary with Shierqiao layers 12 and 11, after which there was a sharp decline parallel to Xinyicun layers 7 and 6. A similar trajectory of site numbers through time also occurred at Jinsha.

The Zhuwajie bronze hoards and Qinglongcun

Two hoards of bronzes accidentally discovered by workers in 1959 and 1980 at Zhuwajie in Pengzhou are controversially dated to the Shierqiao phase. Located within 25 m of each other, each consisted of a large burial jar of coarse sandy pottery with late Shang to early Western Zhou style bronzes within. Unlike the artefacts within Sanxingdui pits K1 and K2, the Zhuwajie bronzes had not been burned or rendered unusable. Instead, they are convincingly seen as artefacts interred for later retrieval (Falkenhausen 2001).

The Hoard 1 burial jar contained 8 bronze vessels (5 *lei*, 1 *zun*, and 2 *zhi*) (Figures 3.44 and 3.45) and 13 bronze weapons (8 *ge*, 2 *yue* axes, 1 spearhead, 1 *jin* and 1 *ji*). It had possibly been buried in a pit over 2 m deep backfilled with fine yellow sand. The flat-based burial jar was of greyish black clay with cord-marking applied to the brownish red exterior surface. Its maximum diameter at a height of 44 cm is 76 cm, but the upper part of the vessel was lost before archaeologists reached the site. Therefore, the shape of the orifice and the total height are unknown, but the mouth must have been big enough to accommodate a 50 cm diameter bronze vessel, unless they cut off the top and then placed it back on again, as with some large burial jars in Southeast Asia (P. Bellwood, pers. comm.). Because all the artefacts had been removed by the workers the original arrangement of the bronzes within the jar was unclear (Feng Hanji 1980; Wang Jiayou 1961).

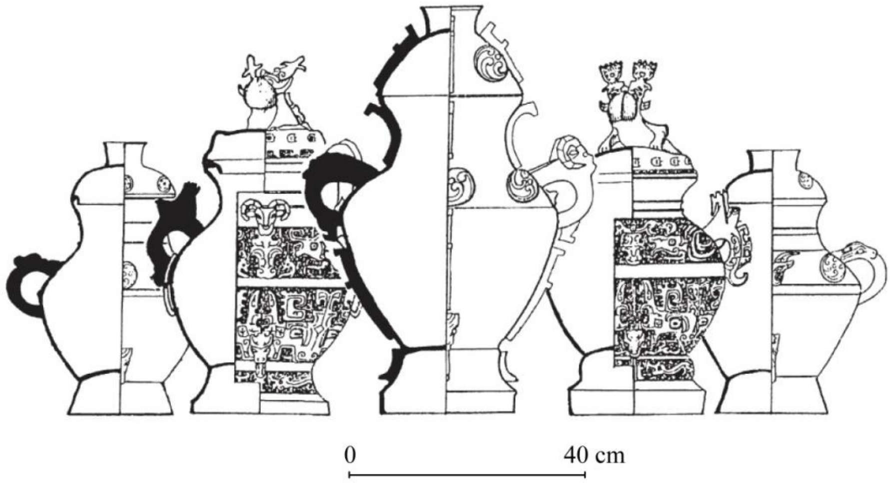


Figure 3.44: 5 bronze *lei* from Zhuwajie hoard 1 (after Sun Hua 2006, with modifications).

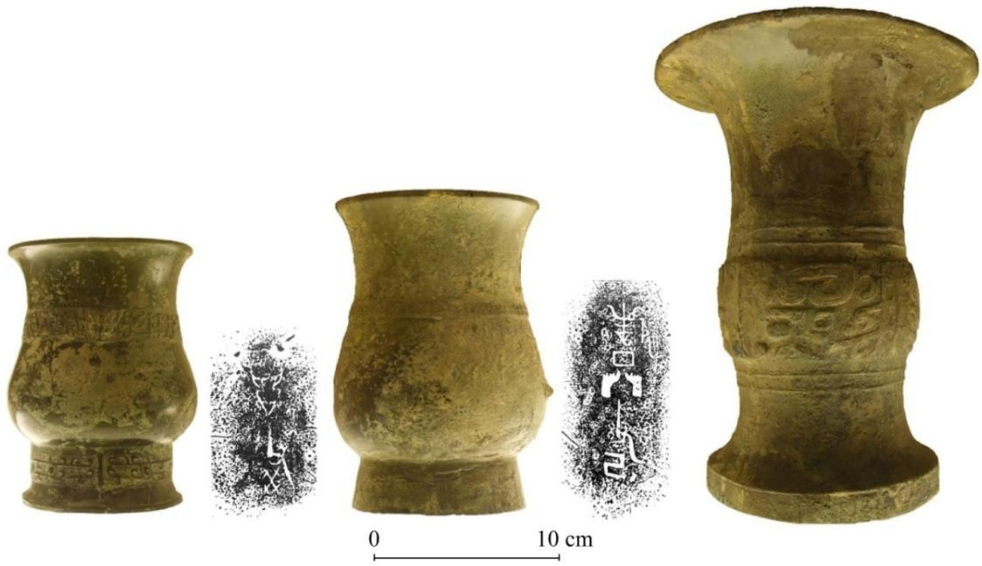


Figure 3.45: Two bronze *zhi* vessels with basal inscriptions reading '*tanfugui*' (left) and '*muzhengfuji*' (middle), and a bronze *zun* (right) from Zhuwajie hoard 1. (Basal inscriptions from Falkenhausen 2001, and photographs by the author in Sichuan Provincial Museum).

The Hoard 2 burial jar contained 4 bronze *lei* vessels (Figure 3.46), and 15 bronze weapons (10 *ge*, 2 *ji* and 3 *yue* axes). It had been placed in a 3 to 4 m long trench over 2.5 m deep. The bronze vessels were firstly packed inside the urn in order of size, and then the weapons were placed inside the bronze vessels. The flat-based jar is greyish brown and has geometric paddle impressions on its upper body. Its orifice is restricted, around 75 cm in diameter, and the maximum diameter of the body is 85 cm. Although broken, the vessel height is estimated to have been 120 cm (Fan Guijie and Hu Changyu 1981).

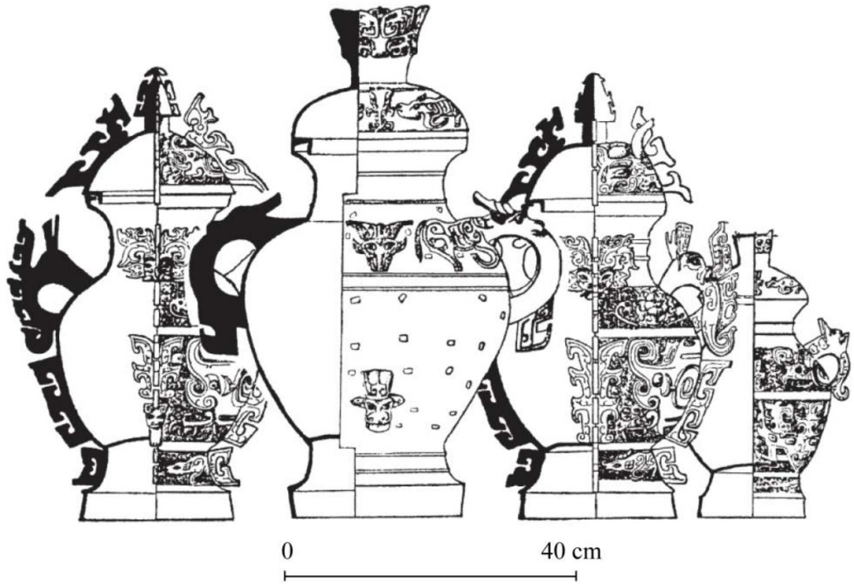


Figure 3.46: 4 bronze *lei* from Zhuwajie hoard 2 (after Sun Hua 2006, with modifications).

Two hundred meters away from these two hoards, a Shierqiao site called Qinglongcun was excavated over an area of 200 m^2 between 1987 and 1988 (Jiang Cheng *et al.* 2007). Qinglongcun contained 5 cultural layers, and the Shierqiao deposits were in layers 5 and 4, with the latter around 180 to 200 cm thick. Beneath the much thinner layer 5 was undisturbed soil. The Shierqiao remains at Qinglongcun include a pit buried in layer 5, much evidence for burning in layer 4 and large quantities of coarse sandy plainware similar to that in Shierqiao layers 11 and 10 and Xinyicun layers 8 and 7. Traces of wattle and daub walls were also identified. The connection between Qinglongcun and the two Zhuwajie hoards is unclear, but the rhomboid impressions on the Qinglongcun sherds and the burial jar of Zhuwajie hoard 2 show enough resemblances (Figure 3.47) to suggest that the Zhuwajie bronze hoards belong to the Shierqiao phase.

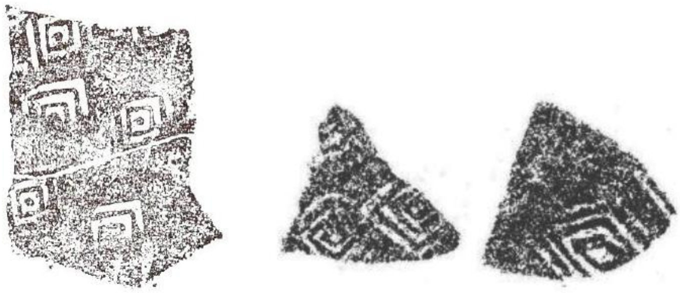


Figure 3.47: Similar rhomboid paddle-impressions on Zhuwajie (left) and Qinglongcun (center and right) sherds.

The details of the Zhuwajie hoards were published in two concise early reports (Fan Guijie and Hu Changyu 1981; Wang Jiayou 1961), and the bronzes were later analysed comparatively by Falkenhausen (2001) and Sun Hua (2006) in terms of their origins, dates of manufacture and forms of interment. However, no consensus has been reached on these questions.

As the Zhuwajie bronzes are similar to Shang and Zhou bronzes on the Central Plains, their origins have raised much speculation. Hayashi (1984:292-3) believed they were imports from the Western Zhou core area because the Zhuwajie bronzes showed no connection with the local material culture of the Chengdu Plain. This perspective is similar to that of Wang Jiayou (1961), who believed that, except for the *yue* axes of Hoard 1 which are in a local style, all the other Hoard 1 bronzes were imports. Feng Hanji (1980) held a slightly different opinion, contending that although some bronzes were local imitations, the *zun* with a *tao-tie* animal design on its body and the two *zhi* vessels with basal inscriptions reading '*tanfugui*' and '*muzhengfuji*' respectively were Shang imports.

To date, aside from historical inscriptions (Xu Zhongshu 1962), bronze vessels with inscriptions containing the characters *tan* and *muzheng* have also been recovered from grave M13 at Zhuyuangou in Baoji county (Lu Liancheng and Hu Zhisheng 1988:66) and grave M1 at Weijiazhuang in Longxian county (Song Zhimin 1991), southern Shaanxi. These vessels consist of an early Western Zhou bronze *jue* with the characters '*tanfugui'* and a bronze *zun* vessel with '*muzheng*'. Feng's observations are confirmed by Xu Zhongshu's (1962) historiographical research on bronze inscriptions. Xu and Falkenhausen (2001) concluded that the inscribed Zhuwajie *zhi* vessels probably once belonged to members of the *tan* and *muzheng* lineages in northern China during the late Shang Dynasty, and were later imported into Sichuan. However, this idea was doubted by Sun Hua (2002:143) who argued that the two *zhi* vessels with inscriptions were products of the early Western Zhou, mainly on the basis of stylistic comparison. However, Sun agreed that both vessels were imports from northern China.

Whether these 9 bronze *lei* vessels in the two Zhuwajie hoards were actually imports is still an issue of debate. Li Xueqin (1996) believed that two of them (Nos. 4 and 8) could have been imports, the rest local products. However, Rawson (1990:30) considered all to be local imitations of middle Yangzi bronzes, focusing on the flamboyant designs of the Zhuwajie *lei*, especially the animal motifs and jagged flanges. Falkenhausen (2001) and Sun Hua (2002), on the contrary, have both favoured origins in Zhou territory, possibly from workshops in southern Henan or Shaanxi, especially the Hanzhong basin. No such bronze vessels of this Western Zhou style have been excavated in the Three Gorges and Xiajiang regions (Yangzi valley east of present-day Chongqing) (Chen Liang 1990; CTGPC and SACH 2009:72-128; Liu Shier and Zhao Congcang 1993; Song Zhimin 2007; Wang Weilin and Sun Bingjun 1989; Wei Jingwu 1993; Zhao Congcang 1994).

To summarise current opinions (Sun Hua 2006), the most likely dates for the manufacture and interment of the bronzes in the two Zhuwajie hoards range from early Western Zhou, through early to middle Western Zhou, and into the transition into the Spring and Autumn period. Specifically, most scholars believe the bronzes with the inscriptions were produced in the late Shang (but see Hayashi 1984). However, there is no evidence to suggest the hoards were buried right after production of the bronzes, so there could be quite a time gap between date of manufacture and date of burial.

The geometric paddled impressions on the jar of hoard no. 2 (Figure 3.47) are similar to those discovered on some Shierqiao and Xinyicun vessels, especially from Shierqiao layers 11 and 10 and Xinyicun layers 8 and 7 (Jiang Zhanghua 1998b). Therefore, if the bronzes were interred immediately after being placed into the urns, the date of interment of both hoards should be late Western Zhou or Spring and Autumn period (Li Mingbin 2002).

Shaxi

Shaxi is discussed here because the finds, especially the pottery, resemble to some degree those from Shierqiao layers 13 and 12, and this site may represent an exploitation of marginal lands (see chapter 4). The location of Shaxi is not within the geographic definition of the Chengdu Plain used in this thesis, and lies at the southwestern margin of the Sichuan basin around 160 km southwest of Chengdu. The Shaxi site is located on a natural terrace along the northern bank of the Qinggyi river, and covers about 30,000 m^2. Before excavation, a small number of stone and bone tools were accidentally collected between 1954 and 1955 by local people (Wei Dayi 1958). To date, three seasons of excavation in the eastern, western and northern portions of the site, in 1985, 1986 and 2005 (Chen De'an and Zeng Jun 2007; Lei Yu 1990), have exposed an area of 262 m^2. The Shierqiao cultural deposit is in Shaxi layers 4 and 3, on top of clean river sand.

Shaxi is very rich in stone tools. According to the site reports (Chen De'an and Zeng Jun 2007; Lei Yu 1990), people quarried or collected various igneous (diabase, gabbro, diorite, andesite, basalt, rhyolite, porphyrite, and tuff), sedimentary (siliceous rocks, sandstone and flint), and metamorphic rocks (quartzite and phyllite), all native to mountainous western Sichuan. 288 stone tools were excavated at Shaxi, 97% flaked, retouched and unpolished and 3% ground. The former include shouldered and unshouldered axes, shouldered hoes, unidirectional and multidirectional cores in various shapes, various cutting tools and scrapers, and hammerstones. The ground stone tools are fully polished axes and flat arrowheads.

The Shaxi shouldered axes and hoes were produced from flakes detached from river pebbles and cobbles. Their surface was not polished. Sizes vary, but length are generally less than 25 cm, widths 15 cm and thicknesses 4 cm. Ventral surfaces are usually smooth from negative flake removal, and dorsal surfaces still have cortexed and smooth pebble exteriors (Figure 3.48).

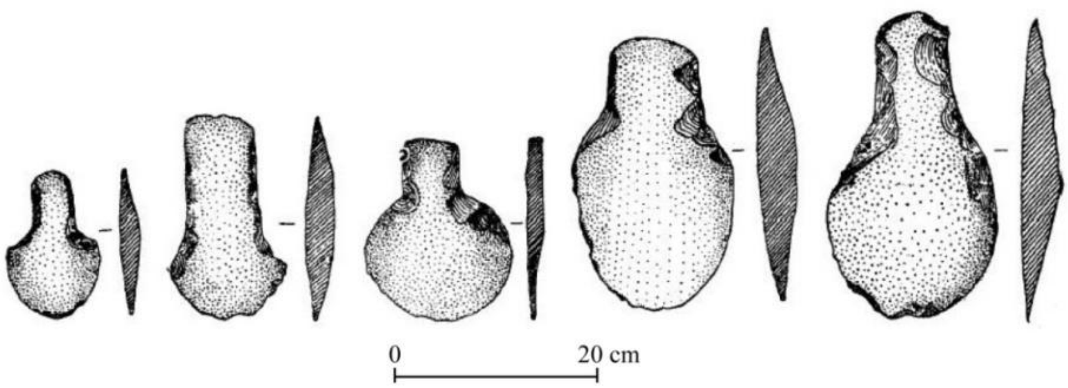


Figure 3.48: Shouldered stone axes and hoes from Shaxi.

Shouldered stone tools are a major component of some of the archaeological cultures of southern and southwestern China (Lin Huixiang 1958; Fu Xianguo 1988; Wang Haiping 1987, 1998 [1995]; Wang Renxiang 1987), but they are not common in or around the Sichuan basin. They do occur along the middle and lower reaches of the Qingyi valley (Li Bingzhong and He Wei 1994; Wu Jia'an 1988) and in Manghuai county in Yunnan. Tanged stone axes like these were also widely produced by Neolithic to Bronze groups in the upper and middle reaches of the Longchuan (a tributary of the Irrawaddy), Nu (the Salween) and Lancang (the Mekong) rivers in western Yunnan (Figure 3.49) (Chen Na 2010; Zhang Xingyong 1992).

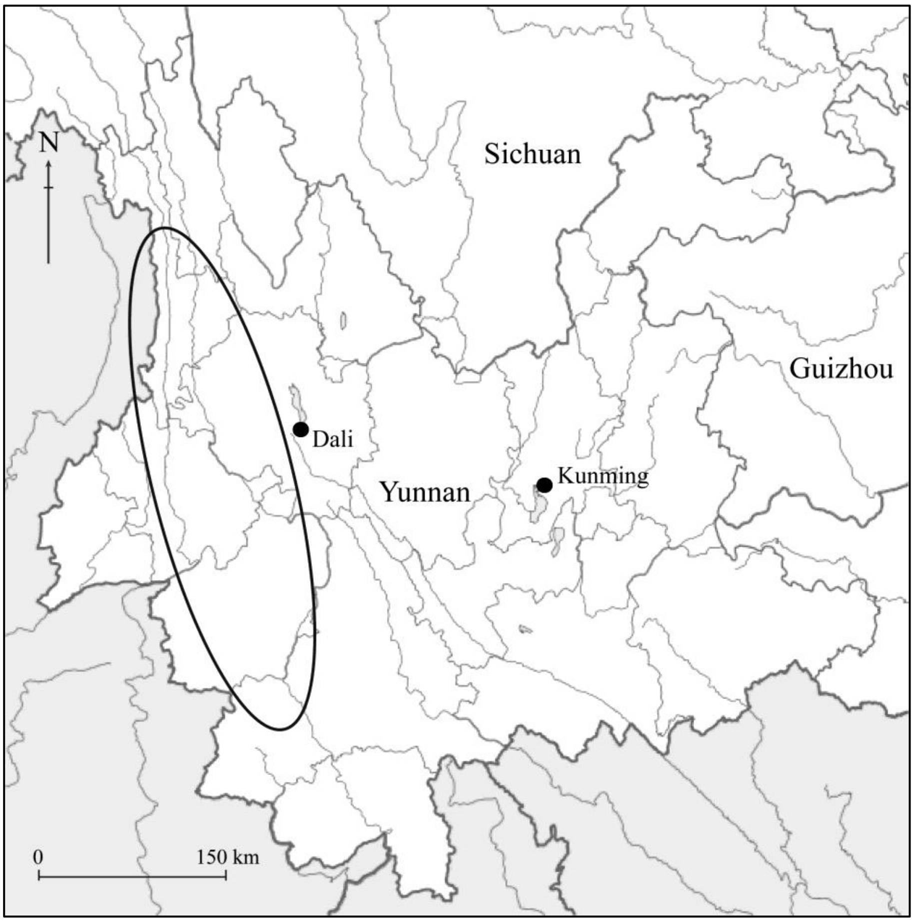


Figure 3.49: Regions in Yunnan where tanged stone axes like those of Shaxi occur.

3.6 Summary and Discussion

The above account of key archaeological discoveries records a long-term evolutionary process on the Chengdu Plain between 2500 and 800 BC. Although the settlement data accumulated in the past 80 years are abundant, the lack of radiocarbon dates and the limited nature of many excavations impede comprehension of social structure and development in more detail. Some analytical results, such as the seriation of the Jinsha sites and the chronology of the Baodun settlements, are inferential rather than conclusive, and some fieldwork, such as the excavation in the Qingguanshan area of Sanxingdui, are not officially reported.

Nevertheless, some inferences about the development of basic social forms, from simple to complex, can be based on settlement patterns, associated demographic inferences (Table 3.8), and the increasing variability and diversity of excavated artefacts. These inferences are discussed in the following chapters.

Table 3.8 Excavated site numbers on the Chengdu Plain from site reports published during the last 80 years.

Region	ca. 2500-2000 BC	ca. 2000-1200 BC	ca. 1200-600 BC
Min valley	37 Baodun sites, including 8 large walled settlements.	3 Sanxingdui sites and 16 early Shierqiao sites.	48 Shierqiao sites.
Tuo valley	9 Baodun sites.	8 Sanxingdui sites, including the Sanxingdui settlement complex.	10 Shierqiao sites
Total	46 sites	27 sites	58 sites
note	1. The relative scarcity of sites along the Tuo valley reflects limited fieldwork. 2. To date no Shierqiao walled settlement site has been discovered.		

Unfortunately, the social landscape of the Chengdu Plain predating 2500 BC remains obscure owing to the scarcity of archaeological sites. The following Baodun phase may have witnessed the formation of an incipient complex society on the Chengdu Plain, characterized by a few large walled settlements surrounded by numbers of small villages, forming at least a two-tiered settlement hierarchy. The origins of the Baodun culture remain unknown, but archaeological evidence so far points to both northwestern Sichuan and the middle Yangzi, possibly reflecting immigration of farming populations. Baodun people initially subsisted on combined rice (*Oryza sativa japonica*) and foxtail millet (*Setaria italica*) production, and then predominately on rice after 2300 BC. The abandonment of their walled settlements and the replacement of Baodun by Sanxingdui style pottery around 2000 BC signified the termination of the Baodun culture, but to date no comprehensive research has been carried out on the nature of this cultural boundary.

Two archaeological cultures have been identified on the Chengdu Plain in the 2nd millennium BC, the Sanxingdui along the Tuo river and the Shierqiao along the Min river. The former was focused on the Sanxingdui walled settlement itself, which was far larger in scale and more complex in defence structure than any of the Baodun enclosed sites. But knowledge of the Sanxingdui culture still depends in an unbalanced way on the rich discoveries within and around the Sanxingdui walled settlement. Similarly, knowledge about early Shierqiao is still limited owing to the scarcity of sites.

It has long been alleged that the Bronze Age commenced on the Chengdu Plain during the 2nd millennium BC, mainly on the basis of surface collections (Ao Tianzhao 2008, 2009) and the bronzes excavated from the hoard pits at Cangbaobao, Shiguci, and Zhenwucun, together with the large quantity of bronzes from pits K1 and K2 at Sanxingdui. In addition, a few small pieces of bronze, malachite and bronze slag were found in Yueliangwan site 1 layer 2 (Ao Tianzhao and Wang Youpeng 1980; Chen De'an and Ao Tianzhao 1998; Ma Jixian 1993). However, the dates for all these occurrences are inconclusive.

On the other hand, a dagger, five arrowheads and four chisels from Shierqiao layer 12 (SPICRA and CMICRA 2009:116-8) appear to predate 950 BC. Likewise, Shierqiao phase bronzes from other sites include one *zun* vessel from Minjiang xiaoqu pit H65 (Li Mingbin and Wang Fang 2001), one *jin* from Lanyuan grave M61, two *yue* axes and two axes from Lanyuan grave M33 (Zhou Zhiqing *et al.* 2003), one spearhead from Zhihuijie layer 5B (Luo Erhu and Xu Pengzhang 1987), one dagger from Sanhe huayuan grave M12 (Zhu Zhangyi and Liu Jun 2001), one fragment from Xinghelu xiyanxian grave M2731 (Wang Lin and Zhou Zhiqing 2010), one arrowhead from Wan'an Pharmaceutical Packing Factory pit H4, and one fragment from Qiangyi Vehicle Trading layer 6 (Wang Lin and Jiang Ming 2009). Other finds include three *ge*, one *yue* axe, one axe, one spearhead and one knife from Shuiguanyin grave M1; and three *ge*, one *yue* axe, one knife, one spearhead and fifteen fragments from Shuiguanyin grave M2 (Deng Boqing 1959).

Among the above, the oldest specimens come from Shierqiao layer 12, Minjiang xiaoqu pit H65 and Lanyuan grave M61, probably dated between terminal Shang and early Western Zhou (ca. 1100-950 BC). The other specimens are dated between 950 BC and 800 BC. The Sanxingdui culture had terminated by the late Shang, around 1100 BC, and hence there is no reason to conclude that the Sanxingdui culture proper was a Bronze Age culture.

The Shierqiao culture flourished on the Chengdu Plain in the first half of the 1st millennium BC, and seems to correlate with the Early Bronze Age in the region. The archaeological data of the Shierqiao culture are more abundant than those of the Baodun and Sanxingdui cultures, and the distribution of Shierqiao sites suggests that its influence reached the southwestern edge of the Sichuan basin. On account of the bronzes from Zhuwajie hoards 1 and 2, regional interaction between the Chengdu Plain, northern China, eastern Sichuan, and the middle Yangzi has also been speculated upon. As shown from the Jinsha site cluster and the many sites northwest of Chengdu City, the prosperity and demographic impact of the Shierqiao culture peaked around 900 BC, and finally faded during the transition between the Western Zhou and Spring and Autumn periods (ca. 800-700 BC).

Chapter 4

Social Complexity on the Chengdu Plain between 2500 and 800 BC

Archaeologists usually employ a concept of sociocultural complexity when discussing the scale, degree of sophistication and level of organization of past human societies. From the archaeological record, increases in complexity can be identified through increases in the quantities, qualities, varieties, and levels of specialized production of material goods. Through well-designed analyses of artefacts, information about long-term changes in social complexity, often inaccessible through site layouts and distributions alone, can be recovered.

The archaeological data accumulated during the last 80 years on the Chengdu Plain offer a record of progressive development of material wealth that can enable a systematic study of social development (Shi Jinsong 2005). This thesis evaluates those potential changes in social complexity that date between the Baodun and Shierqiao phases (2500 to 800 BC) on the basis of available archaeological sources. In this chapter, an evolutionary model accounting for the growth of social complexity on the Chengdu Plain is proposed.

4.1 Social complexity

The concept of social complexity was not created initially by archaeologists. Instead, it was borrowed during the 1970s from neo-evolutionary anthropologists who had given this term new life beyond its roots in mid 19th century sociology (Morris 2009; Rowlands 1989). The definition of social complexity varies with scholars from diverse disciplines (see Adams 2001:355; Rothman 2004; Smith 1993; Trigger 1998:10; Wenke and Olszewski 2007:292; Yoffee 2004:17), but the key concept of differentiation between social segments that underpins it can be examined from two dimensions. Horizontal differentiation (heterogeneity) refers to functional specialization between segments of equivalent rank in a social system. Vertical differentiation refers to hierarchy and inequality between organizational components, such as kin units and lineages (Blanton *et al.* 1981:21-2). These two axes are not necessarily correlated (McGuire 1983:101-2).

In this thesis, the concept of social complexity, based on Tainter (1988:23) and Railey and Reycraft (2008), is used in reference to the number of members in a society, the number and distinctiveness of its classes and specialist groups, and the social mechanisms used to maintain stability, reduce dissent and encourage growth. Augmentation of any of these dimensions, such as population number and density, number of formalized leadership positions, or territorial extent via conquest, can increase the complexity of a society.

Studies of social complexity in the last 50 years have frequently been tied to theories of social evolution (Marcus 2008). Many scholars have studied the formation of intermediate (chiefdom) societies and stratified states through analyses of archaeological and ethnoarchaeological data, focusing on questions of how and why the complexity evolved (for example, see J. Arnold 1996; Boehm 1993; Carneiro 1970, 1981; Cohen and Service 1978; Earle 1987a, 1991, 1997; Feinman and Marcus 1998; Flannery 1972; Flannery and Marcus 2012; Fried 1974; Haas 1982; Johnson and Earle 2000; Jones and Kautz 1981; Leblanc 2006; Li Liu and Xingcan Chen 2003; Morris 2009; Stanish 2004; Wenke and Olszewski 2007:279-323; and Wright 1977). Reacting to criticism of what are sometimes perceived to be unilineal evolutionary schemes proposed by some anthropologists (for example, those of Service 1962 and Fried 1967), a number of archaeologists have moved towards a more processual approach that focuses on the growth of organizational variability itself (J. Arnold 1996; Stein 2001; Feinman and Neitzel 1984; O'Shea and Barker 1996; Tainter 1978; Yoffee 1993). These approaches examine varied social and organizational phenomena such as production, exchange, specialization, demography, ideology, social conflict and collapse (Manzanilla 2001; Stein 2001; for discussions of social collapse and resilience, see the general overviews and edited collections by Diamond 2005; Railey and Reycraft 2008; Springs 2007; Tainter 1988; Yoffee and Cowgill 1988). Studies on social collapse, especially focusing on concepts of social maladjustment and subsistence stress (Fisher *et al.* 2011; Li Liu 2000; McAnany and Yoffee 2010; Redman 2005; Schwartz and Nichols 2006), have also prompted some scholars to reflect on increasing environmental degradation in the 21st century, and its possible alleviation.

4.2 Social Complexity on the Chengdu Plain

Any study of social complexity on the Chengdu Plain must also touch on some of the above issues. This chapter focuses on potential increases in social complexity as witnessed through archaeological material culture, especially burials. The following chapters discuss indicators of increasing population size and craft specialization (e.g. Childe 1950; Maisels 1999; Naroll and Cohen 1970:854-70; Trigger 2003).

Settlement patterns, as one of the most common archaeological sources used to identify changes in social complexity, are too poorly recorded on the Chengdu Plain to allow much informative discussion. This is indeed unfortunate, because housing and settlement hierarchies are frequently tied to the number of decision-making levels in a society (Cordy 1985; Earle 1987a; Earle 1991; Peebles and Kus 1977; Wright 1977; Wright and Johnson 1975). In China, successful analyses of settlement patterns have been undertaken on the Central Plain of the Yellow River, in Shandong, Chifeng and Liaoning (Li Liu 1996a, 2004; Li Liu and Xingcan Chen 2003; Shelach 1998, 1999; Underhill *et al.* 2008; Xiaolin Ma 2005), mostly by western archaeologists or by Chinese archaeologists trained in the west.

However, settlement pattern research on the prehistoric Chengdu Plain has been very rare. This is partly because the numerous salvage excavations that have characterized Chengdu Plain archaeology have never exposed whole settlements. Because of this, I rely instead later in this chapter on mortuary data to evaluate potential changes in Chengdu Plain social stratification through time. First of all, however, I review the early historical sources that relate to the societies of the Chengdu Plain towards the end of the time span covered in this thesis.

4.3 Textual sources on the Chengdu Plain during the first millennium BC

The Baodun, Sanxingdui, and Shierqiao cultures belonged to non-lliterate populations, and hence no indigenous textual sources are available that relate directly to them. However, ancient texts in the region began to be compiled soon after the termination of the Shierqiao culture between 800 and 600 BC. Most of them relate to the Shu polity, established on the Chengdu Plain during the Warring States period (476-221 BC). It is possible that this polity was a development from its Shierqiao predecessor.

According to the *Huayang guozhi* (*History of Huayang*), a historical record relevant mainly for southern Shaanxi, Sichuan, Yunnan and Guizhou that was compiled by Chang Qu, a native of the southwest China who lived early in the 4^{th} century AD, Shu was established by rulers termed *Kaiming* who established a capital at Pi (location uncertain, but probably in present-day Shuangliu county, Sichuan). During the reign of the ninth ruler of the Kaiming dynasty, the capital of Shu was shifted to Chengdu (present-day Chengdu City). Since the first Kaiming, the territorial expansion of Shu had been progressively accomplished through warfare with its neighbours (Liu Lin 1984:185-6), a process that probably continued until around 350 BC. These neighbours included other polities termed Ba to the east, Yue to the south, and Qin to the north.

The social organizations of Ba and Yue are unknown. They were probably tribally-organized societies rather than united political state-level entities such as the Qin kingdom. Shu is stated to have been rich in jade, gold, silver, copper, iron, lead, tin, cinnabar, silk and other fabrics, lacquer, hemp, and animals such as the yak, rhinoceros and elephant. The Shu people traded these resources for servants from Dian, Liao, Cong and Bo (Liu Lin 1984:175), all perhaps neighbouring societies located to the west and south.

Other accounts of Shu come from its literate neighbours, the Qin and Chu Warring States, which occasionally had contacts with Shu through diplomatic and military channels (Xu Zhongshu and Tang Jiahong 1981; Zheng Dekun 2004:24 [1946]). According to the *Huayang guozhi*, Shu invaded Qin at a place called Yong (in present-day southern Fengxiang county, Shaanxi) during the reign of the second Kaiming (date uncertain) (Liu Lin 1984:185). The *Shiji* (*Records of the Historian*) also states that Shu paid fabrics as tribute to Qin in 474 BC (ZHBC 1959:199). In 387 BC, Qin attacked Shu and seized Nanzheng, the borderland region between present-day southern Shaanxi and northern Sichuan (ZHBC 1959:200). Ten years later (377 BC), Shu attacked the state of Chu and seized Zifang (in present-day Songzi county, Hubei). Chu then established a fortress in response at Hanguan in present-day Fengjie county, Chongqing (ZHBC 1959:1720).

In 337 BC, Shu sent envoys to Qin to celebrate the accession of the Qin ruler Huiwen. However, a few years later, in 316 BC, Shu was finally conquered by a Qin army led by general Sima Cuo (ZHSJ 1959:207). According to the *Huayang guozhi*, the twelfth Kaiming fled to Wuyang, northeast of present-day Pengshan county, Sichuan, where he was killed by a Qin army (Liu Lin 1984:192). In 314 BC, King Huiwen of Qin appointed his son Tongguo as Marquis of Shu, and Chen Zhuang was appointed as Chief Minister. In addition, Zhang Ruo was appointed as the Governor of Shu. During this period, the resistance of the Shu people was still intense, hence the Qin resettled ten thousand Qin families within Shu territory to keep the region under control.

From this time onwards, Shu passes from history as an independent polity. In 288 BC, King Huiwen appointed Zhang Yi and Zhang Ruo to construct three walled cities on the Chengdu Plain, including Chengdu itself, Pi and Linqiong. Chengdu was the largest, with a circumference of 12 *li* (Liu Lin 1984:194-5). In 256 BC, the Dujiangyan irrigation system for water conservancy and flood control of the Min river was constructed by Li Bing, the Governor of Shu (Liu Lin 1984:201-6). This irrigation system included a diversion dam (Yuzui) which divided the Min river into inner and outer channels, a flood spillway (Feishayan) from the inner into the outer channel; and intake works (Baopingkou) which controlled the flow in the inner river. Today, this system still has a vital role in the economic, social, ecological and environmental affairs of the Chengdu Plain (Li Keke and Xu Zhifang 2006).

It remains difficult to determine the precise sociopolitical structure of the Shu polity before the Qin conquest from existing sources. There are no records of population size, degree of social stratification, or the mechanisms behind decision making. Moreover, Warring States archaeological resources on the Chengdu Plain are dominated by mortuary rather than settlement data (Jiang Zhanghua 2008; Li Mingbin 1999). It is clear that Shu was considered a peripheral group (Liu Lin 1984:176) compared to the class-based societies of the Central Plain (Shen Changyun and Yang Shanqun 2007:109-16; Yang Kuan 1997:216-78), hence it possibly was not a centrally-organized and stratified state, but rather a chiefdom-level polity in Earle's (1991:1) definition. This implies the existence of a decision-making hierarchy founded on social ranking.

An ancient text termed *Shangshu*, which was compiled before the Spring and Autumn period (770-476 BC), records that the early Shu people participated in a military operation led by the Zhou ruler Wu, who attacked and destroyed the Shang state in 1046 BC. Some scholars also claim to recognise a character for Shu carved on oracle bones dating to late Shang and Western Zhou (Lin Xiang 1985, 1989; Rao Zongyi 1995; Sage 1992:28-34). However, the connection between this earlier Shu and the Warring States Shu remains obscure. Suggestions for the location of the earlier Shu include the Sichuan basin (Tang Lan 1939, cited in Duan Yu 2009a), the Chengdu Plain (Duan Yu 2009a; Tong Enzheng 2004a:44-54 [1998]), the Central Plains (Du Yong 2006), Sichuan or southern Shaanxi (Dong Zuobin 1942), southern Shaanxi (Gu Jiegang 1962, cited in Yang Xizhang 1986; Li Boqian 1983), western Shanxi (Kunio 2006:729-30 [1953]), western Shandong (Hu Houxuan 1945, cited in Duan Yu 2009a), and the region northwest of Shang territory (Guo Morou 1983; Chen Mengjia 1956, cited in Duan Yu 2009a). To date, no consensus has been reached.

Other information about the Shu and their origins comes from the *Huayang guozhi* and *Shuwang benji* (Basic Annals of the Shu Kings). The *Shuwang benji* was possibly compiled by Yang Xiong (53 BC-AD 18) or Qiao Zhou (AD 200-270), with the latter more plausible (Xu Zhongshu 1998:1319-28 [1979]).

However, the original manuscript of the *Shuwang benji* has been lost, and fragments are only preserved in later historical sources (Li Shaoming 1993; Sun Hua 1990a, b; Tong Enzheng 2004a:44-54 [1998]). These records suggest that four successive dominant lineages termed Cancong, Baiguan, Yufu and Duyu provided rulers before the commencement of the Warring States Kaiming dynasty (Zheng Dekun 2004:20-2 [1946]). The *Shuwang benji* also states that the early Shu population was sparse during the Cancong, Baiguan, and Yufu dynasties, and that it was not until Yufu that they practiced systematic farming. During the Duyu reign, farming was further intensified and territory dramatically expanded (Liu Lin 1984:182). A serious flood occurred at the end of the Duyu reign, but the ruler was not able to control the damage. He was replaced by his chief minister, Bieling, who became the first Kaiming ruler of Shu. Lubao, the son of Bieling, later became the second Kaiming (Liu Lin 1984:185).

With regard to the political transition between the Duyu and Kaiming ruling lineages, the author of the ancient text *Shiji zhengyi* (The annotation of *Shiji*), Zhang Shoujie, writing around the 7th century AD, suggested that inter-community conflict within the middle and late Spring and Autumn period (ca. 650-500 BC) forced some of the Shu population to migrate to Yao and Sui (locations unknown, but probably in present-day southwestern Sichuan and northern Yunnan) (cited in Tong Enzheng 2004b:397 [1998]).

One of the difficulties in examining first millennium BC social development from historical accounts is the vagueness of the chronology. Some scholars have tried to link these mythical accounts with dated archaeological finds on the Chengdu Plain by estimating reign lengths, but this is highly speculative (Duan Yu 1999; Peng Bangben 2002; Zhao Dianzeng 2005). Duan Yu (1999:18-22) suggests that the four early Shu polities listed in the *Shuwang benji* were established by different ethnic groups and overlapped in date, whereas Peng Bangben (2002) suggests that they were successive. However, the *Shuwang benji* still seems to refer to growth of population and intensification of food production, as well as to the existence of decision-making echelons who were able to mobilize people for flood control and war prior to the Warring States period.

4.4 The rise of complex societies on the Chengdu Plain - a theoretical review

The reasons suggested by anthropologists and archaeologists for increases in social complexity and the formation of centralised political organizations in ancient contexts are diverse. Some emphasize population growth and population pressure on resources as significant causal factors (Boserup 1965; Chang Kwangchih 2004 [1990]; Cohen 1981; Friesen 1999; Harner 1970). Others highlight the agricultural intensification process itself (Hayden 1996; Kealhofer and Grave 2008; Schurr and Schoeninger 1995; Wittfogel 1957). Still others focus on control of regional exchange networks (Feinman and Nicholas 2004), ritual practices (Chang Kwangchih 1983), and warfare leading to an incorporation of small groups into larger ones (Carneiro 1970; LeBlanc 2006; Underhill 2006; Webster 1975). All of these mechanisms of course overlap in their functions to some degree, and no single one can explain everything because of the inherent variation in socio-environmental condition and cultural dynamics (Service 1975: 266-89; Wenke and Olszewski 2007:299-309; Wright and Johnson 1975).

In China, most research on the initial rise of complex societies has until recently focused on the Longshan phase (ca. 3000-1800 BC) of the eastern Loess Plateau and the Central Plains, especially in Henan and Shanxi, where the earliest protohistorically documented states developed. Because archaeology in China is regarded as a historiographical discipline (Li Liu 2004:1-10; Olsen 1987), much research has involved the identification of antecedents for the Xia, Shang, and Western Zhou Dynasties (Pearson and Underhill 1987). However, several scholars have also proposed a Longshan evolutionary model emphasizing interaction between chiefdoms (Chang Kwangchih 1986; Gao Jiangtao 2009; Li Liu 1996a, 2000, 2004:251; 2012; Underhill 2006). Some have also focused on the impact of environmental change on the development of initial complex society (Wang Wei 2004; Xia Zhengkai 2009; Xu Zhuoyun 1999).

Compared to this abundant research in central China, the initial rise of complex societies on the Chengdu Plain has so far received little interest. In the early days, research was usually tied to Morgan-Engels theory (Dong Qixiang 1991; Feng Hanji 1987; Song Zhimin 1998b:140-54; Tong Enzheng 2004a:49-52, 2004c:247-75) and Service's (1962) evolutionary model (Duan Yu 1999, 2006; Peng Bangben 2004; Shen Changyun 2008). For instance, Duan Yu (1999:158-72, 2006) and Shen Changyun (2008) have proposed internal conflict, political consolidation and improvement of flood control and irrigation as the major causative factors behind the rise of complex societies on the Chengdu Plain.

The major sources that can be utilized for the Chengdu Plain include the protohistorical records discussed above, and archaeological evidence for status hierarchy, economic specialization, and urbanism (as discussed by Duan Yu 2009b; Duan Yu and Zou Yiqing 2009; Huang Jianhua 2002:74-90; Mao Xi 2008; Zhao Dianzeng 2005; Zhu Zhangyi 1991). Any comprehensive evolutionary model of the rise of complex society on the Chengdu Plain must synthesize well-structured anthropological theories, archaeological evidence, protohistorical records and relevant palaeoenvironmental data.

In this thesis, the proposed explanatory account of the rise of complex society on the Chengdu Plain between 2500 and 800 BC is established principally on the anthropological theories of Stanish (2004) and LeBlanc (2006). These scholars have examined the evolution of ranking and explain sociopolitical consolidation from microscopic and macroscopic perspectives respectively. By adopting evolutionary game theory, Stanish (2004) argues that social ranking originated from the pursuit of a production surplus through a more efficient organization of labour. He assumes that the vast majority of people would be 'conditional cooperators', who would not make optimal economic choices in all circumstances. The majority would cooperate with leaders to maximize production, and would voluntarily give up their autonomy in such a pursuit. A small group of leaders would coordinate this organizational change in production, one goal of which would be to overcome the limits within household economies. These leaders would also be active redistributors of any production surplus. Any failure by recipients to reciprocate such redistribution would lead to ritual or physical sanctions.

The model proposed by LeBlanc (2006) is built on Carneiro's (1970, 1981) circumscription theory for the origins of the state. He argues in favour of chronic warfare among competing social groups in socially circumscribed territories, such that consolidation of regional polities by conquest would result in a more complex society. LeBlanc's model links conquest and consolidation with the existence of productive but uninhabited buffer zones, which would be occupied by successful expanding polities and returned into production. Concomitant increases in the carrying capacity of such productive land would have allowed new levels of population density and social complexity to become established.

LeBlanc did not explicitly consider the initial rise of social ranking, but he suggested that it was usually war leaders or those who managed regional alliances who became the elites. To maintain their status, elites would customarily devise a variety of status behaviours involving dress, body ornaments, burial practices, house types and ceremonies in order to legitimize and institutionalize their social rank. Rules of lineage inheritance would follow. For LeBlanc, the most important reason for non-elites to acquiesce is that they would welcome the protection and economic benefit derived from the neutralisation of former enemies. LeBlanc did not neglect the oscillation of land carrying capacity that would be caused by environmental change and human over-exploitation of resources, and he contended that in some cases the timing of climate shifts could have assisted or impeded emerging elites who wished to legitimize their social status.

4.5 An evolutionary model for the rise of complex society on the prehistoric Chengdu Plain

Based on the archaeological data summarized in chapter 3, we know that the earliest Neolithic occupants arrived on the Chengdu Plain around 3100-2600 BC (Guiyuanqiao phase 1). These first settlers were possibly immigrant farmers practicing a combination of broomcorn (*Panicum miliaceum*) and foxtail millet (*Setaria italica*) cultivation. The palaeoenvironment of the plain was then affected by a recession of the East Asian monsoon, leading to wetter and cooler conditions by around 2500 BC. These allowed a transition to a combined system of rice (*Oryza sativa japonica*) and foxtail millet subsistence.

There are many archaeological observations which suggest that population increase consequent on the development of agriculture could sometimes have been very rapid (Bellwood 2005a:14-9; Barker 2006:399-400), especially amongst populations who depended more on food production than on hunting and gathering (Bellwood 2009). When settlers moved into frontier regions where pre-existing populations either did not exist or were small, villages were likely to fission with growth, as long as land was available. In the current state of knowledge, dramatic population growth might thus have occurred on the Chengdu Plain between 2500 and 2000 BC since Baodun sites greatly outnumber any pre-Baodun sites. It is likely that such population growth would continue until available arable lands had been exploited and carrying capacity under available systems of production had been reached (Chamberlain 2006:66-7; Dewar 1984), after which one would expect either a retraction in settlement or an intensification in subsistence practices to occur (Boserup 1965).

As stated by LeBlanc (1997:236), much of the archaeological evidence for warfare is subtle, and direct evidence of actual fighting and destruction is hard to identify. Hence, most archaeologists rely on indirect sources, such as artwork demonstrating battle scenes, remains of weapons, and defensive structures (Allen and Arkush 2006; Vencl 1984). With the appearance of the eight Baodun and the single Sanxingdui walled settlements, which have sizes ranging between 100,000 m^2 and more than 3.6 km^2, warfare enters the debate on the Chengdu Plain. Contemporary Neolithic and early Bronze Age walled sites in other regions of China are often cited as key indicators of social complexity (Falkenhausen 2008; Xu Hong 2000) and emerging city-states (Demattè 1999; Su Bingqi 1999: 130-1; Yates 1997). Scholars have varied opinions upon the functions of these large-sized defended settlements, most considering them as regional centers for specialized production, resource control and redistribution, religious cult, and political administration (Li Liu and Chen Xingcan 2000; Ma Shizhi 1992; Pei Anping 2001; Ren Shinan 1998; Sui Yuren 1988).

However, these explanations alone do not explicitly demand the construction of defensive walls (Pei Anping 2004; Underhill 1994). Some Chinese archaeologists consider the walls to be primarily for flood control (Huang Haode and Li Shulei 2005; Liu Xingshi 1998; Tang Qicui 2012), based on their gentle outer slopes as preserved today (around 30° to 40°), surrounding ditches, absence of gates, and locations on river terraces (Chen Yunhong and Yan Jinsong 2004). However, wall slope and degree of encirclement do not always reflect wall function (Arkush and Stanish 2005). More importantly, many of these sites were occupied for some time before wall construction occurred, without being destroyed by floods (see chapter 3).

A more likely explanation involves defence against war. Taking the fortified villages, known as *pa*, constructed in New Zealand around AD 1500 as an example (Allen 2006; Irwin 2013; Kirch 2000:281-3), the thousands of these structures that survive in the North Island were highly correlated with Maori warfare in which raiding frequently escalated into full-scale wars of territorial conquest. Similar to the construction of the walled settlements on the prehistoric Chengdu Plain, so too unfortified settlements in New Zealand incorporating sweet potato storage pits often preceded the construction of the earthworks and palisades.

Evidence that also supports a war-related function for the Chengdu Plain earthen walls comes from the presence of elaborately polished and sharpened stone spearheads and arrowheads, found mainly in walled settlements such as Baodun, Gucheng, Yufucun, Mangcheng, Shuanghe, and Sanxingdui (Yueliangwan) (Jiang Cheng and Li Mingbin 2002; Jiang Cheng and Yan Jinsong 1999; Jiang Cheng *et al.* 1998, 2001; Jiang Zhanghua *et al.* 1998; Li Mingbin and Chen Yunhong 2001; Ma Jixian 1998; Uchida 2000; Wang Yi *et al.* 1997). A few such weapons have been found in some unwalled sites, including Zhixin Jinsha Phase I, Gewei Pharmacy Phase I, Zhongyi, Chujiacun, Zhonghai guoji and Huili Packing factory (Chen Yunhong *et al.* 2009, 2010; Zhou Zhiqing and Liu Yumao 2007a, 2011; Zhou Zhiqing and Tang Zhihong 2004; Zhou Zhiqing *et al.* 2005c), but the numbers are small. It is difficult to avoid the conclusion that these walled settlements were competing regional centers that controlled numbers of unwalled villages in their rural hinterlands (Sun Hua and Su Rongyu 2003:214-5).

The abandonment of the eight smaller Baodun walled urban centers by 2000 BC and the emergence of the much large Sanxingdui walled center during the 2nd millennium BC could imply an incorporation of formerly separate competing groups, but it remains unknown whether this involved military conquest. The only possible evidence of violence comes from a human skull that was placed in the center of Huachengcun pit H14 (Liu Yumao and Rong Yuangda 2001), but it is difficult to determine if it belonged to a war victim.

Regional amalgamation on the Chengdu Plain between 2500 and 2000 BC could have been accomplished primarily by non-violent political alliance, but the possibility of true replacement, the elimination of one group and takeover by another, should not be excluded. The artefacts of Erlitou style recovered at Sanxingdui, such as the single winged bronze bells (Ao Tianzhao 2008, 2009), bronze plaques with turquoise inlay (Wang Qing 2004), jade *yazhang* forked blades, jade *ge*, and jade *yue* axes (Falkenhausen 2006), suggest to many Chinese archaeologists that the Sanxingdui people descended from a population fusion between Baodun and refugees from the legendary Xia Dynasty (possibly the Erlitou culture in Henan) (Du Jinpeng 1995; Shen Zhongchang and Huang Jiaxiang 1984; Xiang Taochu 2005). Since most substantial migration in worldwide human history has resulted in warfare (Leblanc 2006), conflicts between immigrants and locals on the Chengdu Plain at the beginning of the 2nd millennium BC are perhaps to be expected.

Immediately after the consolidation of competing groups, the population would have begun to grow as constraints on growth were reduced due to the transformation of former buffer zones into arable land. A new level of social complexity would have been established consequent on this population growth. This process possibly occurred through several generations, until the population carrying capacity was again approached, possibly at the end of the 2nd millennium BC. During this long phase, the leaders who coordinated the organizational change in production would have wished to maintain social stability by devising new hierarchical rules and social structures. Their descendants would try to institutionalize their social ranking as inheritable, leading eventually to the emergence of a lineage based or dynastic elite, such as that represented in the Renshengcun cemetery at Sanxingdui (Cheng Dean and Lei Yu 2004) (see chapter 3 and table 4.1).

By the time of Shierqiao, the former areas of buffer territory were probably already settled and brought under more unified control. People were compelled to find new methods to mitigate carrying capacity stress (Harrod and Martin 2014:23-32), perhaps including the exploitation of marginal lands and the enhancement of ideologically sanctioned mechanisms for resource redistribution. Both strategies surely accelerated the rate of increase in social complexity.

Archaeological evidence for exploitation of marginal land is manifested by the discovery of Shierqiao sites in the middle reaches of the Qinggyi and Dadu rivers, along the western border of the Sichuan basin. These sites include Shaxi, Maiping, Taoping, Majiashan, and Sanxing (Chen Dean and Zeng Jun 2007; Chen Jian *et al.* 2006; Chen Weidong and Zhou Kehua 2008; Guo Fu *et al.* 2012; Lei Yu 1990, 2006). This expansion might also have related to resource exploitation, given that the jade and other stone sources exploited to make many of the artefacts found at Jinsha and Shierqiao came from the Longmen and Qionglai ranges (Chen Jian 2013; CMICRA 2006b:18; CMICRA and SAMBU 2002:164; He Kunyu

2007a, b; Liu Jian 2004; Xiang Fang *et al.* 2008; Yang Yingdong and Chen Yunhong 2013; Yang Yongfu *et al.* 2002).

The political power of the Shierqiao elites, like that of the Shang, was presumably secured by controlling the right to communicate with the supernatural through some form of ritual monopoly (Chang Kwangchih 1983). To date, a possible Shierqiao ceremonial centre has been excavated at Meiyuan Northeast, Jinsha (Wang Fang *et al.* 2004) (see chapter 3), and a pyramid-shaped earthen mound of this phase, that possibly functioned as an altar, was discovered at Yangzishan in Chengdu (Li Mingbin 2003b; Lin Xiang 1988; Wang Jiayou and Li Fuhua 2002; Yang Yourun 1957). Similar to the oracle bones of the Shang and Zhou discovered in northern China, turtle plastrons with round drilled indentations, possibly having similar ritual functions related to invoking the supernatural, have also been excavated in central Chengdu City (Luo Erhu 1988). In addition, there are the kneeling stone statuettes with their hands tied behind their backs excavated at Fangchijie (Xu Pengzhang 2003) and Jinsha (Zhu Zhangyi *et al.* 2002b:166-81) (Figure 3.17). These stone statuettes perhaps represent captives who had contravened the reciprocal systems of exchange (CMICRA and SAMBU 2002:162-81; Wu Hung 1997).

However, marginal lands were not limitless, and variations in carrying capacity during the Shierqiao phase appear from the palaeoenvironmental evidence to have become more severe (see chapter 2). The emphasis (discussed below) on placing substitute artefacts (bronze willow leaf-shaped daggers) in graves dated between 800 and 650 BC probably reflects some degree of retraction in the quantity of available wealth for mortuary expenditure, prior to the rise of the Shu polity.

4.6 Mortuary Analysis on the Development of Social Stratification

Archaeological reconstruction of social organization and structure using mortuary data commenced with the work of American New Archaeologists published between the late 1960's and early 1980's (Carr 1995:112-9; Pearson 1999:73-4). Those who supported this perspective believed that mortuary treatment was correlated in some manner with an individual's social *persona*, which was in turn shaped by the organization of the society. Therefore, variability in the degree of mortuary complexity, such as energy expenditure, spatial segregation, and the distribution of material symbols across the burial population, should provide data for the evaluation of the community's social organization (Binford 1971; Saxe 1970; Tainter 1978:107).

This perspective was in turn criticized by many archaeologists in the mid 1980s (Carr 1995:110-1; Pearson 1999:84-7), who argued that mortuary contexts are not simply the reflections of a social order. Instead, they reflect a complex interplay between the deceased, the mourners, and other circumstantial factors (Cannan 1989). Sometimes, mortuary ritual may be an arena for mourners to minimize differences in social status, so what archaeologists might reconstruct from mortuary patterns can be contrary to sociopolitical reality (Hodder 1982:1-12, 195-201; Pearson 1982, 1984; Shanks and Tilley 1982; Shennan 1982; Ucko 1969). Therefore, mortuary data should be examined within specific historical contexts.

Western debate over the use of mortuary data to study past social structure rarely had any impact on Chinese archaeology until the 1990s. Mortuary data were more frequently utilized by Chinese archaeologists to reconstruct chronology (for example, Li Feng 1988; Luo Kaiyu 1992), to identify social inequality (for example, He Deliang 1991; Xie Chong'an 2009; Zhang Zhongpei

2012), and to investigate rituals and distinctive funeral customs (for example, Liang Taihe 2009; Wang Renxiang 2003). Although significant changes in mortuary treatment were also utilized to infer changes in social organization (for example, Xie Duanju 1975; Zhang Zhongpei 1981, 1989), research was usually tied to a rigid concept of parallel development from matrilineal to patrilineal, egalitarian to stratified, as invoked by deeply rooted Marxist theory (Li Liu 2004:10-1; Pearson 1988).

However, the situation is now changing owing to the increasing number of mortuary studies in China by western scholars and by Asian scholars trained in the west (for example, Allard 2001; Fung 2000; Li Liu 1996b, 2004:117-158; Shelach 2001; Yao 2005, 2008; Yun Kuen Lee 1996, 2001). These studies have shown that increased elaboration and greater variability in mortuary remains can be highly correlated with the existence of social stratification (Shelach 2001; Underhill 2000; Yun Kuen Lee 2001).

On the Chengdu Plain, more than 1000 graves dating between 2500 BC and the first millennium BC have been excavated, but most of them, especially those discovered at Jinsha, have not been reported. The available data suggest that most graves occur in cemeteries independent of the residential areas. These cemeteries appear to have been planned, because most graves have similar orientations and there is little intercutting. To date, only three skeletal reports have been published on the Jinsha (Wei Dong and Zhu Hong 2008; Zhang Qing and d'Alpoim Guedes 2008) and Shijiefang human remains (Zhang Jun and Zhu Zhangyi 2006), and one brief report on the grave goods from the Renshengcun cemetery (Xiao Xianjin and Wu Weixi 2010). In addition, many site reports only document rich graves, with burials containing few or no objects often ignored or mentioned only in passing. Most local archaeologists preferred to study the Warring States graves because of the more abundant grave content that facilitate historiographical studies (e.g. Song Zhimin 1990c, 2003; Yan Jinsong 2002).

Despite this relative shortage of data, available data about graves reported from Chengdu Plain sites are listed in table 4.1, in chronological order. These graves are separated into 6 groups by date, with group A roughly paralleling the Baodun phase, group B Sanxingdui and early Shierqiao, and groups C to E the remainder of Shierqiao. Group F is probably out of the temporal scope of this thesis, loosely dated to the middle and late Spring and Autumn period (ca. 650-500 BC).

My perspective on mortuary data assumes that when people choose to display vertical social position through mortuary treatment, they will tend to do it in terms of differential expenditure of energy (Carr 1995:165; Tainter 1973, 1975). This can be reflected in grave size, elaboration of grave structure, and content. I calculate size as surface area (length times width) instead of volume because so many graves do not have recorded depths. Graves with uncertain lengths and/or widths are not analysed.

Table 4.1: Mortuary data by grave in Chengdu Plain sites between 2500 and 500 BC. M = grave; N = not present, Y = present.

(1) Group A (ca. 2500-2000 BC)

Shijiefang (Zhu Zhangyi 2001)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M1	?	N	N	unknown	?	1 bone ornament.
M6	?	N	N	unknown	?	1 circular bone tool, 1 bone tube, and 1 bone awl.
M7	1.19	N	N	supine	adult	8 bone artefacts.
M15	0.55	N	N	supine	infant	
M17	0.95	N	N	supine	adult	

Shijiefang yielded 19 graves arranged in rows with little disturbance. Between 1 and 14 bone artefacts were discovered in most of them.

Yufucun (Li Mingbin and Chen Yunhong 2001)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M14	0.76	N	N	supine	adult	

Yufucun yielded 4 graves, but only M14 was reported. Densely distributed in a cemetery, no graves have coffins or grave goods.

Huachengcun (Liu Yumao and Rong Yuanda 2001)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M10	2.36	N	N	flexed	adult	1 ground stone chisel.
M15	1.82	N	Y	supine	adult	

Huachengcun yielded 16 rectangular graves, but only M10 and M15 were reported.

Zhixin jinshayuan (Zhou Zhiqing and Tang Zhihong 2004)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M167	0.89	N	N	supine	adult	
M168	0.56	N	N	unknown	adult	
M169	0.62	N	N	unknown	infant	

M170	0.83	N	N	supine	adult	
M171	1.08	N	N	supine	adult	
M172	1.38	N	N	supine	adult	
M173	0.93	N	N	supine	adult	
M174	0.97	N	N	supine	adult	
M175	0.89	N	N	supine	adult	
M176	1.08	N	N	supine	adult	

Gewei Pharmacy Phase I (Zhou Zhiqing *et al.* 2005c)

grave	**size (sq m)**	**coffin**	**ledge**	**burial posture**	**age**	**grave goods**
M1	1.38	N	N	unknown	?	
M2	1.00	N	N	unknown	?	
M3	1.68	N	N	unknown	?	1 pot.

Hangkonggang (Xie Tao *et al.* 2005a)

grave	**size (sq m)**	**coffin**	**ledge**	**burial posture**	**age**	**grave goods**
M1	0.99	N	N	unknown	?	1 jade adze.
M2	0.98	N	N	unknown	?	
M3	1.31	N	N	unknown	?	

Zhongyi (Chen Yunhong *et al.* 2009)

grave	**size (sq m)**	**coffin**	**ledge**	**burial posture**	**age**	**grave goods**
M1	0.77	N	N	supine	adult	

Zhongyi yielded 2 graves, but M2 was not reported.

Chujiacun (Chen Yunhong *et al.* 2010)

grave	**size (sq m)**	**coffin**	**ledge**	**burial posture**	**age**	**grave goods**
M2	0.63	N	N	unknown	?	

Shunjiang xiaoqu Phase III (Zhou Zhiqing and Liu Yumao 2010b)

grave	**size (sq m)**	**coffin**	**ledge**	**burial posture**	**age**	**grave goods**
M1	0.81	N	N	supine	adult	

Huili Packing factory (Zhou Zhiqing and Liu Yumao 2011)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M1	2.34	N	N	supine	adult	
M2	0.91	N	N	supine	adult	
M3	0.53	N	N	unknown	?	
M4	0.36	N	N	unknown	?	

Caojiaci (Yang Zhanfeng 2012a)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M1	0.58	N	N	flexed	adult	

Baodun (CMICRA, DHSU and IYRWU 2000:16)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M3	1.33	N	N	supine	adult	
M7	0.32	N	N	unknown	infant	

Baodun yielded 5 graves (M3, M4, M6, M7 and M8), but only M3 and M7 were reported.

Gucheng (Yan Jinsong *et al.* 2001)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M20	0.99	N	N	supine	adult	

(2) Group B (ca. 1800-1200 BC)

Sanxingcun (Chen Yunhong 2006b)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M5	1.50	N	N	supine	adult	

Sanxingcun yielded 5 graves dating to the transition between the Baodun and Sanxingdui cultures. All graves have rectangular pits and no grave goods. M1, M2, M3, and M4 are infant burials.

Chujiacun (Chen Yunhong *et al.* 2010)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M1	>1.02	N	N	unknown	?	

Renshengcun (Chen De'an and Lei Yu 2004)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M5	4.65	N	N	unknown	?	3 jade owls, 3 jade ornaments, 1 jade axe, 3 globular basalt beads, and 2 round pebbles.
M10	4.81	N	N	unknown	?	2 pots, 1 jade spearhead, 1 jade chisel, and 5 globular basalt beads.
M14	3.73	N	Y	unknown	?	1 jade artefact.
M18	0.92	N	N	unknown	?	
M21	4.51	N	N	unknown	?	4 jade artefacts, 1 jade spearhead, and 2 bone artefacts.
M23	2.34	N	N	unknown	?	
M29	6.46	N	Y	unknown	?	3 jade artefacts, 8 globular basalt beads, 1 stone chisel, 3 bone artefacts, and 3 sections of elephant tusk.

Sanxingdui (Wang Youpeng *et al.* 1987)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M1	0.91	N	N	supine	adult	
M2	1.52	N	N	flexed	infant	
M3	0.37	N	N	unknown	infant	
M4	0.48	N	N	flexed	infant	

Sanxingdui yielded 4 graves. M1 and M2 are dated to Sanxingdui phase 3, and M3 and M4 to Sanxingdui phase 2.

Zhengyin xiaoqu (Chen Yunhong and Wang Bo 2005)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M1	2.76	Y	N	unknown	?	

Group C (ca. 1100-950 BC)

Lanyuan (Zhou Zhiqing *et al.* 2003)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M61	0.95	N	N	supine	adult	unknown number of pots, stone tools, bronze *jin* and jade adzes.

Huangzhongcun gandao B yanxian (Zhou Zhiqing 2004)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M116	0.83	N	N	supine	adult	1 pot.

Wanbo (Chen Yunhong *et al.* 2004)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M183	1.11	N	Y	supine	?	5 pots and 1 spindle whorl.
M184	?	N	N	unknown	?	1 pot.
M185	?	N	N	unknown	?	1 pot.
M187	?	N	N	unknown	?	2 pots.
M189	1.25	N	N	supine	?	3 pots.
M190	1.56	N	N	supine	?	2 pots and 1 spindle whorl.
M191	?	N	N	unknown	?	2 pots.
M193	0.37	N	N	unknown	?	2 pots and 1 spindle whorl.
M195	0.38	N	N	supine	?	2 pots.
M197	0.71	N	N	supine	adult	4 pots and 1 spindle whorl.
M198	?	N	N	unknown	?	1 potter vessel.
M200	1.00	N	N	supine	?	3 pots and 1 spindle whorl.
M201	?	N	N	unknown	?	1 pot.
M202	?	N	N	unknown	?	1 pot.
M205	1.26	N	N	supine	adult	
M206	?	N	N	unknown	?	1 pot.
M207	0.57	N	N	supine	?	2 pots.
M209	1.30	N	N	secondary	adult	
M215	?	N	N	unknown	?	1 pot.
M452	?	N	N	unknown	?	1 pot.
M454	0.85	N	N	supine	?	2 pots.
M455	0.5	N	N	supine	?	2 pots.
M458	1.21	N	N	supine	?	3 pots.

M459	0.96	N	N	supine	?	4 pots.
M460	?	N	N	unknown	?	2 pots.
M462	?	N	N	unknown	?	1 pot.
M463	?	N	N	unknown	?	1 pot.
M470	4.95	Y	N	secondary	adult	

Chunyu huajian (Chen Yunhong 2006a)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M401	1.46	N	N	prone	?	
M402	1.01	N	N	supine	adult	
M403	1.12	N	N	prone	adult	
M404	1.14	N	N	supine	adult	
M405	1.2	N	N	supine	adult	1 pot and 1 spindle whorl.
M406	0.78	N	N	supine	adult	
M407	1.00	N	N	supine	adult	
M408	0.88	N	N	supine	adult	1 spindle whorl.
M409	0.70	N	N	supine	adult	
M410	1.39	N	N	supine	adult	
M411	0.71	N	N	supine	adult	1 spindle whorl.
M412	1.17	N	N	supine	adult	
M413	1.14	N	N	supine	adult	1 spindle whorl.
M414	0.44	N	N	supine	infant	1 spindle whorl.
M415	0.88	N	N	supine	adult	
M416	1.35	N	N	supine	adult	
M417	1.22	N	N	supine	?	

Songjia heba (He Kunyu 2009)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M1	2.57	N	N	unknown	adult	10 pots and 4 stone rods.
M2	2.66	N	N	unknown	infant	6 pots and 7 stone rods.

Lijia yuanzi (Yi Li *et al.* 2011)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M1	1.92	N	N	supine	adult	
M2	0.72	N	N	supine	adult	

M3	2.48	N	Y	supine	adult	
M4	2.28	N	N	supine	adult	
M5	3.22	N	Y	supine	adult	1 stone mortar.

Tiantaicun (Yang Zhanfeng 2012d)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M1	0.85	N	N	unknown	?	

Zhonghai guoji Commune Site 2 (Zhou Zhiqing and Liu Yumao 2012)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M9	1.44	N	N	unknown	?	
M10	1.05	N	N	supine	adult	
M11	1.09	N	N	supine	adult	1 pot.

Shuiguanyin (Deng Boqing 1959)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M4	?	N	N	unknown	?	3 pots.
M5	?	N	N	unknown	?	1 pot.

Shuiguanyin yielded 8 graves, but only graves M1, M2, M4, and M5 were reported. Graves M3, M4, M5, M6 and M7 are older.

Group D (ca. 950-800 BC)

Sanhe huayuan (Zhu Zhangyi and Liu Jun 2001)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M12	1.74	N	N	supine	adult	1 bronze dagger
M13	1.36	N	N	secondary	adult	

13 graves were excavated at Sanhe huayuan, but only graves M12 and M13 were reported.

Lanyuan (Zhou Zhiqing *et al.* 2003)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M33	2.43	N	Y	secondary	adult	5 pots, 4 bronze axes, 1 bronze *ge*, unknown number of stone tools,1 jade *yazhang* and unknown number of jade chisels.
M64	?	?	?	?	?	1 stone axe and 1 jade chisel.
M86	?	?	?	?	?	1 stone axe.

More than 100 graves were excavated at Lanyuan, but only M33 and M61 were reported. The Lanyuan graves are in rows and reveal little disturbance. Most skeletons are extended, supine, and a few are secondary. In addition, few graves had goods, but the contents of M33 were very rich.

Wanbo (Chen Yunhong *et al.* 2004)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M177	?	?	?	unknown	?	
M181	?	?	?	unknown	?	
M182	3.48	Y	N	supine	adult	
M188	?	?	?	unknown	?	

60 graves were excavated at Wanbo. Except for M182, M188, and M470, all lack coffins. Most of the graves have supine or secondary burials. Graves without goods are not listed. M177, M181, M182, and M188 are younger than the others.

Xinhelu xiyanxian (Wang Lin and Zhou Zhiqing 2010)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M2702	1.23	N	?	supine	adult	
M2703	0.96	N	?	supine	adult	
M2704	1.12	N	?	supine	adult	1 pot.
M2707	0.74	N	?	supine	adult	
M2708	0.41	N	?	supine	infant	
M2709	0.50	N	?	supine	infant	
M2714	>1.56	N	?	supine	adult	1 pot.
M2715	>1.50	N	?	supine	adult	
M2718	>1.81	N	?	supine	adult	
M2721	>1.85	N	?	supine	?	
M2723	>1.04	N	?	supine	?	

M2724	1.05	N	?	supine	?	1 pot.
M2726	?	N	?	supine	adult	
M2728	>0.38	N	?	supine	adult	
M2730	1.00	N	?	supine	adult	1 pot.
M2731	1.09	N	?	supine	adult	1 bronze fragment.
M2733	>0.39	N	?	supine	adult	
M2734	>1.07	N	?	supine	adult	
M2755	1.08	N	?	supine	adult	
M2756	>0.78	N	?	supine	adult	1 pot.
M2757	0.78	N	?	supine	adult	
M2759	0.97	N	?	supine	adult	2 pots.
M2785	0.65	N	?	supine	infant	1 pot.

Shufeng Huayuancheng Phase II (Tang Fei *et al.* 2003)

grave	**size (sq m)**	**coffin**	**ledge**	**burial posture**	**age**	**grave goods**
M21	1.52	N	N	supine	adult	1 pot.
M22	0.49	N	N	secondary	infant	
M23	0.61	N	N	secondary	infant	
M24	0.88	N	N	secondary	adult	
M25	0.96	N	N	supine	adult	
M26	>0.96	N	N	supine	adult	1 spindle whorl and 1 pot.
M27	1.82	N	N	secondary	adult	2 pots, 3 stone chisels, 1 stone *bi*.
M28	1.26	N	N	supine	adult	
M29	?	?	N	unknown	?	
M30	>0.38	N	N	unknown	?	
M31	>0.41	N	N	unknown	?	
M37	0.62	N	N	supine	infant	1 pot.
M38	1.55	N	N	secondary	adult	
M39	1.88	N	N	supine	adult	1 pot.
M40	?	?	N	unknown	?	

Shufeng Huayuancheng Phase II yielded 15 graves, including M20-31 and M37-40. M29 and M40 were not excavated due to disturbance by M28, M38 and M39.

Guoji huayuan (Zhou Zhiqing *et al.* 2006)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M825	0.93	N	N	supine	adult	1 stone *yazhang* and 1 pot.
M826	1.00	N	N	supine	?	
M827	0.84	N	N	supine	?	
M828	0.81	N	N	supine	?	
M829	>0.4	N	N	supine	?	
M830	>0.73	N	N	supine	?	
M831	1.11	N	N	supine	?	
M832	0.4	N	N	supine	infant	
M833	0.53	N	N	supine	?	
M834	0.92	N	N	supine	?	
M835	0.58	N	N	prone	?	
M836	1.18	N	N	supine	?	
M837	>0.28	N	N	supine	infant	
M838	>0.7	N	N	supine	?	
M839	0.80	N	N	supine	?	
M840	0.90	N	N	supine	?	
M842	0.66	N	N	prone	?	
M843	0.98	N	N	supine	adult	1 spindle whorl.
M844	2.88	N	N	secondary	adult	1 pot and 1 spindle whorl.
M845	1.06	N	N	supine	adult	
M846	0.78	N	N	supine	?	
M847	0.64	N	N	secondary	?	
M849	1.30	N	N	supine	adult	2 pots.
M919	0.87	N	N	supine	?	
M920	1.94	N	Y	supine	adult	1 stone mortar.
M921	0.67	N	N	supine	infant	
M922	2.43	N	Y	secondary	adult	1 pot.
M923	0.92	N	N	supine	?	
M924	1.53	N	Y	supine	?	
M926	1.25	N	N	supine	adult	
M927	0.97	N	N	supine	adult	
M928	4.22	Y	Y	supine	adult	4 pots.
M932	0.88	N	N	supine	?	
M933	0.42	N	N	supine	infant	
M934	0.73	N	N	supine	?	

M935	0.85	N	N	supine	?	
M936	>0.23	N	N	supine	infant	
M937	1.38	N	N	supine	adult	1 pot.
M938	3.10	N	N	supine	3 infants	1 stone mortar.
M939	1.00	N	N	prone	adult	1 stone mortar.
M941	1.05	N	N	supine	adult	
M942	1.00	N	N	supine	adult	
M950	0.99	N	N	supine	?	
M951	0.82	N	N	supine	adult	
M952	1.11	N	N	supine	adult	
M953	0.90	N	N	supine	?	
M954	>0.46	N	N	supine	adult	
M955	>0.15	N	N	secondary	adult	

Shuiguanyin (Deng Boqing 1959)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M1	7.32	N	N	unknown	?	44 pots, 3 bronze *ge*, 1 bronze spearhead, 1 bronze axe, 1 bronze *yue* axe, 1 bronze knife and 16 stone rods.
M2	4.92	N	N	unknown	?	24 pots, 3 bronze *ge*, 1 bronze *yue* axe, 1 bronze spearhead, 1 bronze knife, 15 miniature bronze ornaments.

Shuiguanyin yielded 8 graves, but only M1, M2, M4, and M5 were reported. M1, M2 and M8 are younger than M3, M4, M5, M6 and M7. The grave sizes of M1 and M2 are estimated from hand-drawn illustrations with scales.

Group E (ca. 800-650 BC)

Qingjiangcun (Jiang Zhanghua and Yan Jinsong 2001)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M1	3.9	N	Y	supine	adult	2 small ground beads.

Minjiang xiaoqu (Li Mingbin and Wang Fang 2001)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M1	1.84	N	N	unknown	?	

Minjiang xiaoqu yielded 5 graves, but only M1 was reported.

Chengdu Municipal Museum (He Kunyu *et al.* 2011b)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M1	1.46	N	N	supine	adult	

Chengdu Municipal Museum contains 2 graves, but M4 was not reported.

Renfang (Tang Fei *et al.* 2005)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M267	0.87	N	N	supine	?	
M268	1.38	N	N	supine	adult	1 miniature bronze dagger.
M269	1.35	N	N	supine	adult	1 pot.
M270	1.25	N	N	supine	adult	1 bronze dagger.
M271	0.87	N	N	unknown	?	1 bronze dagger and 1 bronze spearhead.
M272	1.08	N	Y	unknown	?	
M273	0.79	N	Y	supine	?	
M274	1.15	N	N	unknown	?	
M275	2.07	Y	N	unknown	?	1 turquoise.
M276	1.36	N	N	supine	adult	1 bronze dagger.
M277	1.19	N	N	unknown	?	
M278	1.05	N	N	unknown	?	
M279	1.55	N	N	supine	?	
M280	0.48	N	N	unknown	?	1 bronze dagger and 2 miniature bronze daggers.

14 graves were excavated at Renfang. M268 and M269, M272 and M273, and M276 and M277 were multiple burials.

Group F (ca. 650-500 BC)

Guoji huayuan (Zhou Zhiqing *et al.* 2006)

grave	size (sq m)	coffin	ledge	burial posture	age	grave goods
M841	11.37	Y	N	secondary	?	2 stone mortars and 2 pots.
M848	3.19	Y	N	supine	adult	1 stone mortar.
M850	2.96	Y	N	supine	adult	1 stone mortar, 1 bronze circular ornament, and 8 bronze ornaments for weapons.
M916	8.21	Y	N	supine	adults	1 bronze *ge*, 1 bronze dagger, and 1 pot.
M917	10.44	Y	N	supine	adults	2 stone mortars.
M918	3.63	Y	N	supine	adults	1 stone mortar and 1 spindle whorl.
M940	2.29	Y	N	supine	adult	1 bronze *ge*, 1 bronze dagger, 1 stone mortar, 1 bronze circular ornament, 11 bronze ornaments for weapons, 1 jade adze, 1 spindle whorl, 1 circular disk-shaped stone tool, and 1 broken stone tool.
M943	8.10	Y	N	supine and prone	adults	2 bronze *ge*, 2 bronze swords, 2 stone mortars, 1 bronze circular ornament, 26 bronze ornaments for weapons, 1 jade artefact, and 1 stone chisel.
M944	2.30	Y	N	supine	?	1 stone mortar and 1 spindle whorl.
M945	8.77	Y	N	supine	adults	1 stone mortar, 2 pots, and 1 bronze circular ornament.
M946	2.81	Y	N	supine	adult	1 stone mortar.
M947	7.68	Y	N	supine	adults	2 stone mortars.
M948	5.41	Y	N	supine	adults	2 spindle whorl.
M949	2.46	Y	N	supine	adult	

Xinhelu xiyanxian (Wang Lin and Zhou Zhiqing 2010)

grave	size *(sqm)*	coffin	ledge	burial posture	age	grave goods
M2725	3.90	Y	Y	supine	adults	11 pots, 16 bronze spearheads, 15 bronze daggers, 1 pommel of a dagger, 15 *ge*, 10 stone mortars, 2 possible human sacrifices, and a large number of deer bones and antlers. 1 female aged 18~22 and 1 male aged 25~30 were buried in the western and eastern chambers near the main chamber.

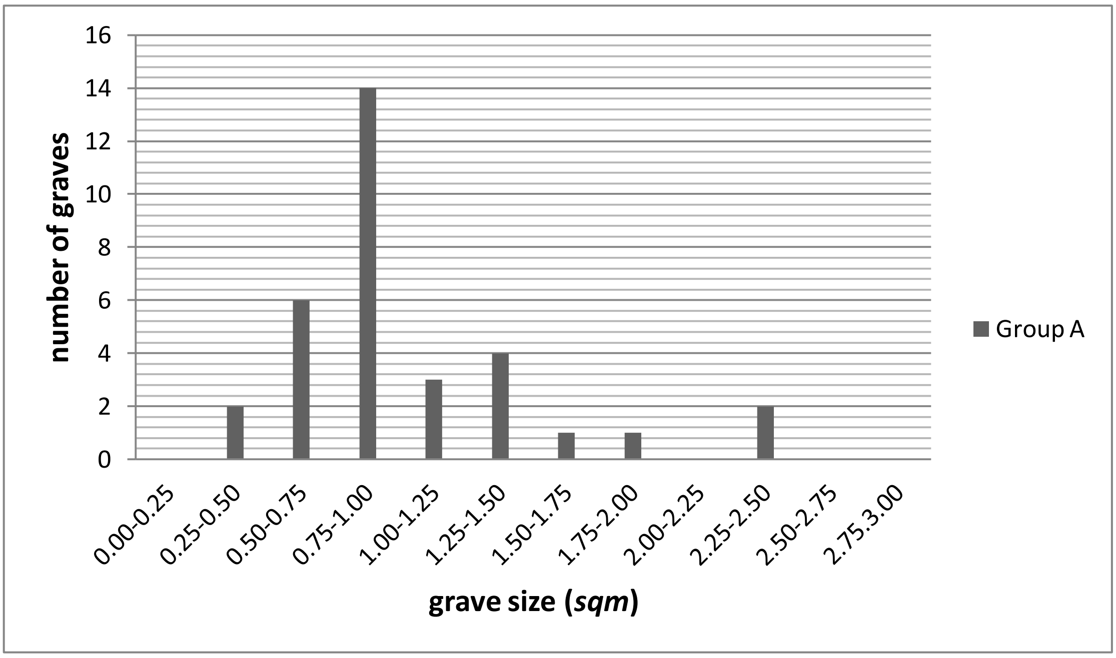
The total numbers of graves and sites with graves in each group are listed in table 4.2. Because the number of graves dating between 1100 and 800 BC at Lanyuan (Zhou Zhiqing *et al.* 2003) has not been reported, the information for groups C and D is uncertain. Hence, statistical analysis of groups A, C and D will be more reliable because of their larger sample sizes.

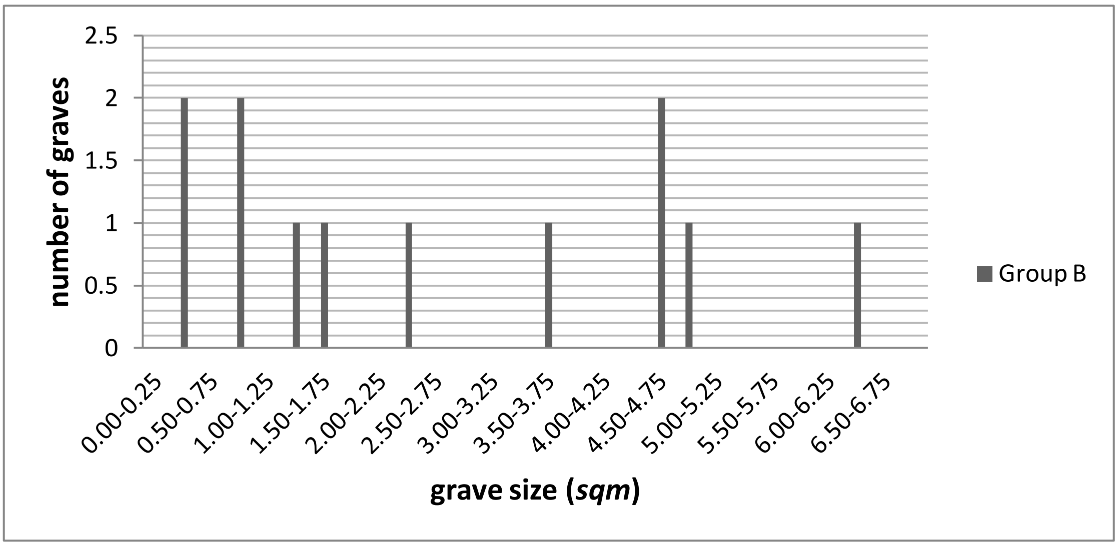
Table 4.2: Numbers of graves and sites with graves on the prehistoric Chengdu Plain.

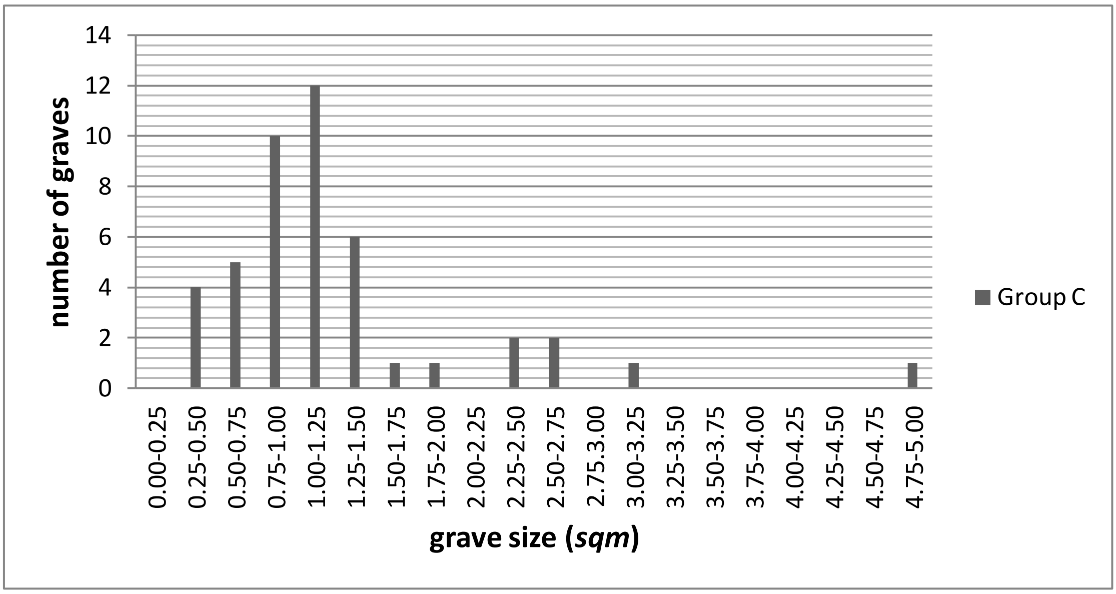
Group	Date	Number of graves	Number of sites with graves
(A)	2500-2000 BC	70	13
(B)	1800-1200 BC	40	5
(C)	1100-950 BC	> 88	9
(D)	950-800 BC	> 117	7
(E)	800-650 BC	22	4
(F)	650-500 BC	15	2

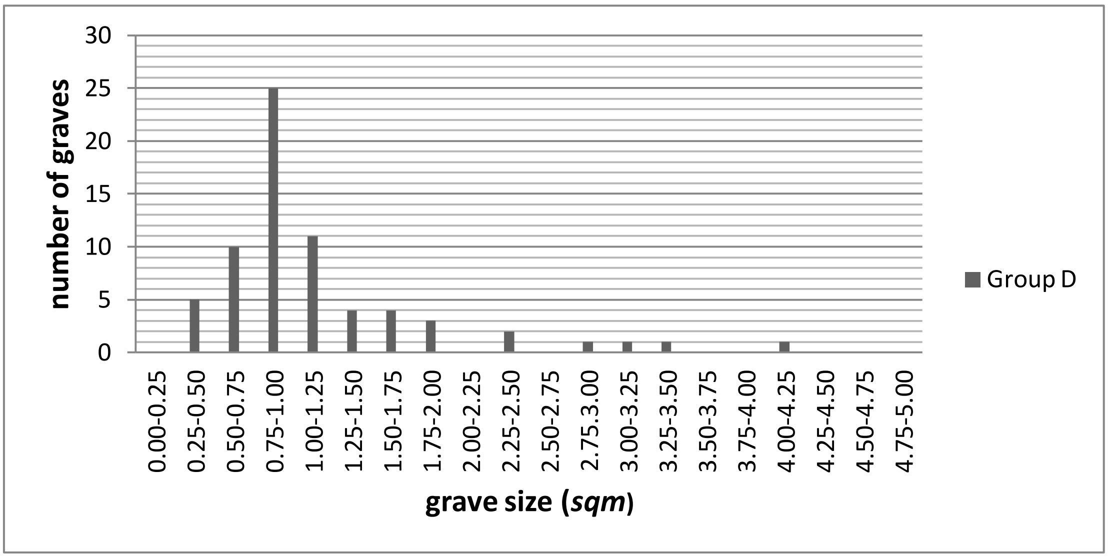
4.7 Analysis of grave sizes

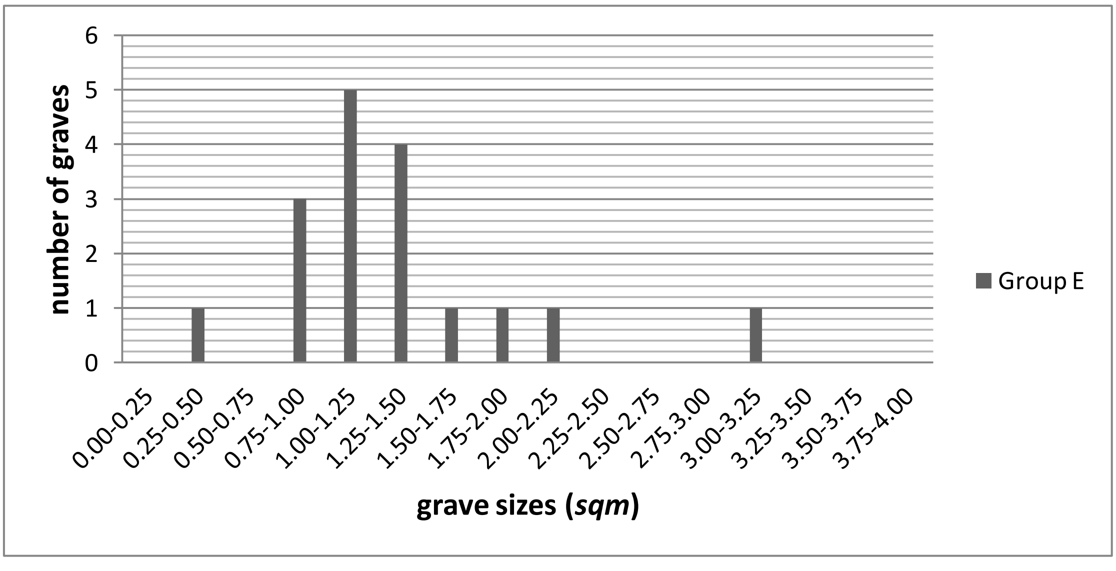
To visually examine the potential changes in social complexity over time, grave sizes in each group are graphed in chronological order (Figure 4.1). The histograms for groups A, C, D, and E demonstrate downwardly skewed normal distributions, with larger graves distributed to the right. The multiple peaks of groups B and F possibly result from unrepresentative and undersized samples. In group B, there are 13 graves from 4 sites, most from Renshengcun (Chen De'an and Lei Yu 2004). In group F, there are 16 graves from 3 sites, most from Guoji huayuan (Zhou Zhiqing *et al.* 2006). Based on the uncommonly rich Group B and F grave contents and mortuary furniture, it may be that both cemeteries were unique in sociopolitical context.






number of graves
grave size (*sqm*)
Group C
0.00-0.25
0.25-0.50
0.50-0.75
0.75-1.00
1.00-1.25
1.25-1.50
1.50-1.75
1.75-2.00
2.00-2.25
2.25-2.50
2.50-2.75
2.75.3.00
3.00-3.25
3.25-3.50
3.50-3.75
3.75-4.00
4.00-4.25
4.25-4.50
4.50-4.75
4.75-5.00


number of graves
grave size (*sqm*)
Group D
0.00-0.25
0.25-0.50
0.50-0.75
0.75-1.00
1.00-1.25
1.25-1.50
1.50-1.75
1.75-2.00
2.00-2.25
2.25-2.50
2.50-2.75
2.75.3.00
3.00-3.25
3.25-3.50
3.50-3.75
3.75-4.00
4.00-4.25
4.25-4.50
4.50-4.75
4.75-5.00


number of graves
grave sizes (*sqm*)
Group E
0.00-0.25
0.25-0.50
0.50-0.75
0.75-1.00
1.00-1.25
1.25-1.50
1.50-1.75
1.75-2.00
2.00-2.25
2.25-2.50
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2.75.3.00
3.00-3.25
3.25-3.50
3.50-3.75
3.75-4.00

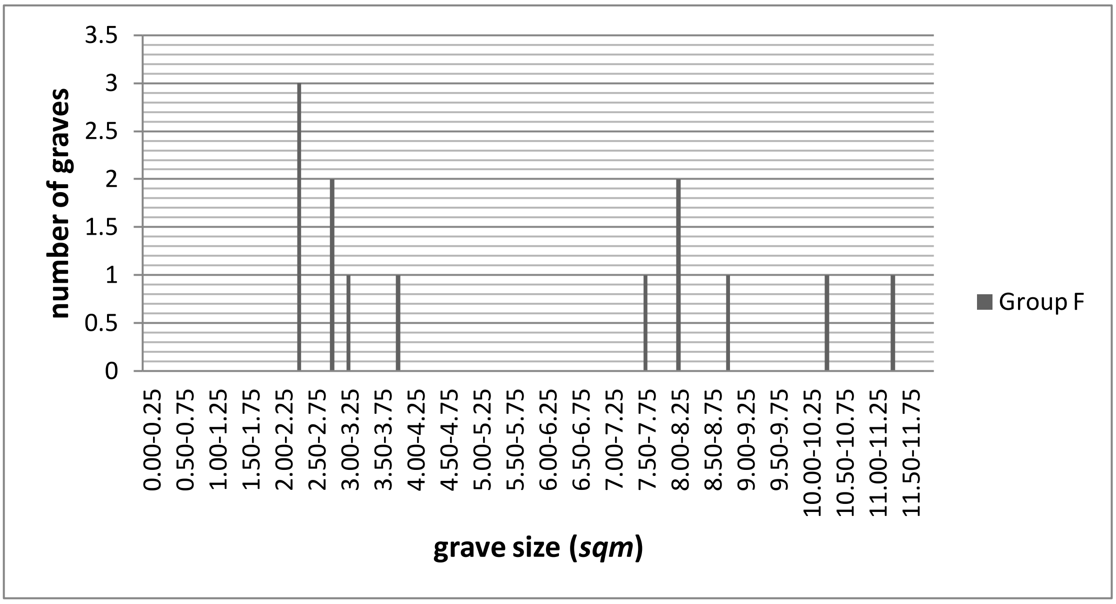


Figure 4.1: Summaries of grave size distribution.

Grave size functions as an intuitive index to measure the degree of energy expenditure in mortuary contexts. To compare the average grave sizes in each group, the means are computed (Table 4.3). Given that mean is strongly affected by distant outliers, in this analysis the 5% trimmed means for groups C and D are also calculated. As shown in table 4.3, the means of groups B and F are highest, but these values probably result from the small sample sizes and the influence of very large grave pits containing multiple deceased at Guoji huayuan, including M841, M916, M917, M943, M945, M947, and M948. A similar problem occurs with the high mean of group E, because the majority of samples are from Renfang (Tang Fei *et al.* 2005), which appears to have been a cemetery used exclusively for high ranked persons. From these data, it is concluded that energy expenditure in mortuary practice did not vary significantly until 650 BC, with Group F, when the average grave size for single interments increased to 4.176 sq. m.

Table 4.3: Grave sizes and standard deviations through time.

	Group A	Group B	Group C	Group D	Group E	Group F
Mean	1.023	2.683	1.281	1.169	1.391	5.568
5% trimmed mean	-	-	1.188	1.088	-	-
SD	0.476	1.890	0.821	0.709	0.73	3.09
5% trimmed SD	-	-	0.636	0.62	-	-
CV	0.465	0.704	0.535	0.570	0.525	0.555

The standard deviation (SD) is a useful index to examine the dispersion of samples around the mean. The higher the standard deviation, the greater is the dispersion (Drennan 2010:29-32). Nevertheless, the standard deviation must always be compared against the size of the mean. In order to compare real degrees of dispersion between multiple data sets, the coefficient of variation (CV), or the ratio of the standard deviation to the mean, should be utilized. The higher the CV, the more variable is the data sets. In this analysis, the CV values of groups C and D are calculated by using the 5% trimmed mean and the 5% trimmed SD to remove the effects of outliers.

As listed in table 4.3, group B has the highest CV, but this merely demonstrates the dispersion of grave sizes in the Renshengcun cemetery. A similar problem occurs with group F. Omitting the biased CV values of groups B and F, it is likely that the relative degree of variation in grave sizes before 950 BC was less significant than during the first millennium BC. There are also a small number of large graves (> 3 sq. m.) during the Shierqiao phase, including M470 at Wanbo (Chen Yunhong *et al.* 2004) and M5 at Liujia yuanzi (Yi Li *et al.* 2011) in group C; M182 at Wanbo and M928 at Guoji huayuan (Zhou Zhiqing *et al.* 2006) in group D; and M1 at Qingjiangcun (Jiang Zhanghua and Yan Jinsong 2001) in group E.

This situation suggests that the degree of social stratification for most members of society was higher during the Shierqiao phase than in the preceding Baodun and Sanxingdui phases. The Shierqiao emergence of far larger graves also suggests the emergence of more highly ranked families than previously.

4.8 Analysis of grave contents

The Chengdu Plain graves can be analysed in terms of six variants that demonstrate differences in energy expenditure: (1) simple graves; (2) multiple graves; (3) graves with earthen ledges surrounding the central pit; (4) graves with a single plank to put the body on; (5) graves with hollow log coffins; and (6) graves with full log coffins (see Figure 3.38-3.41).

Between 2500 and 1000 BC, the majority of the graves on the Chengdu Plain held only single deceased. Few had ledges or any mortuary offerings. The use of a single plank first appeared in M1 at Zhengyin xiaoqu, dated to 1200 BC (Chen Yunhong and Wang Bo 2005). The oldest log coffin was unearthed in M928 at Guoji huayuan (Zhou Zhiqing *et al.* 2006), dated between 950 and 800 BC. Graves with coffins became common during the late Spring and Autumn period (ca. 650-500 BC), such as the 14 graves at Guoji huayuan and many dating to the Warring States phase (Li Mingbin 1999). Based on the data in table 4.1, the graves predating 650 BC which have ledges or coffins are usually large in size, but some smaller graves also have ledges, including M183 at Wanbo, M33 at Lanyuan, M920, M922, M924 at Guoji huayuan, M272, and M273 and M275 at Renfang.

Grave content is another indicator of energy expenditure in mortuary contexts, because the quantity and quality of grave goods might positively correlate with the sociopolitical status of the deceased. In addition, an increasing variability in the provision of grave goods might reflect increasing social or economic stratification. As shown in table 4.4, there were only low numbers of goods in graves of Baodun group A, including M1, M6, and M7 at Shijiefang (Zhu Zhangyi 2001), M10 at Huachengcun (Liu Yumao and Rong Yuanda 2001), M3 at Gewei Pharmacy Phase I (Zhou Zhiqing *et al.* 2005c), and M1 at Hangkonggang (Xie Tao *et al.* 2005a). Most had only one item, but M6 and M7 at Shijiefang contained 3 and 8 miniature bone artefacts respectively (Table 4.1). Generally speaking, the available Baodun evidence, except for the polished jade chisel in M1 at Hangkonggang, shows little sign of high energy expenditure.

Table 4.4: Percentages of graves with offerings in groups A to F.

	Date	Number of graves with offerings	Total number of graves	Percentage with offerings
Group A	2500-2000 BC	6	70	8.6%
Group B	2000-1200 BC	5	40	12.5%
Group C	1100-950 BC	38	> 88	unknown
Group D	950-800 BC	29	> 117	unknown
Group E	800-650 BC	8	22	36.4%
Group F	650-500 BC	14	15	93.3%

The group B graves with offerings are all located at Renshengcun, where a total of 106 grave goods included 61 jade artefacts, 37 globular basalt beads, 2 globular gravels, 5 pots, and an elephant tusk broken into 3 sections (Chen De'an and Lei Yu 2004). Compared to the graves goods dating to the Baodun phase, the Renshengcun jade artefacts demonstrate no sign of usage and were thus not daily utensils. The grave goods in this cemetery were frequently placed around the heads or above the waists of the deceased (Xiao Xianjin and Wu Weixi 2010). For instance, M29 had 8 basalt beads around the femur of the deceased, and M10 had 5 around the waist. The cultural meaning of these basalt beads is unclear, but geological sourcing by Chengdu University of Technology in 2001 derives the basalt from Mt. Emei in the southwestern Sichuan basin (Dong Jing, personal communication), about 200 km distant from Chengdu City.

On the whole, the distribution of grave goods at Renshengcun suggests some degree of social stratification. Most graves contained one or no items, but M5 and M29 had the largest quantity and the most variation in categories of artefact. Based on this unbalanced distribution in the 29 Renshengcun graves, one might suggest that sociopolitical stratification developed during the transition from Baodun into Sanxingdui. Unfortunately, however, the other graves of this phase at Sanxingcun, Chujiacun, Sanxingdui, and Zhengyin xiaoqu all lacked grave goods.

The percentage of group C graves with burial goods remains uncertain, but available data suggest that offerings were common, mostly pots and spindle whorls (Table 4.1). At Huangzhongcun gandao B yanxian (Zhou Zhiqing 2004), Wanbo, Chunyu huajian (Chen Yunhong 2006a), and Shuiguanyin (Deng Boqing 1959), the graves generally contain 1 or 2 pots, and some richer graves have more items. Spindle whorls, items usually associated with female activity, were usually buried with the pots, or sometimes alone. No grave had more than one whorl. Two slightly richer graves at Songjia heba (He Kunyu 2009) contained pots and stone rods 10-15 cm long. The richest group C grave was excavated at Lanyuan (Zhou Zhiqing *et al.* 2003), where M61 contained a bronze *jin*, and unrecorded numbers of pots, stone tools and jade adzes. However, the items were clearly daily utensils and tools for production rather than exquisite unused status artefacts, so the status of the owner remains uncertain.

The percentage of group D graves with grave contents is also uncertain, but the percentage of graves without goods is higher than for group C (Table 4.4). At the major group D sites of Xinhelu xiyanxian (Wang Lin and Zhou Zhiqing 2010), Shufeng huayuancheng (Tang Fei *et al.* 2003), and Guoji huayuan (Zhou Zhiqing *et al.* 2006), graves with goods generally have 1 or 2 pots, and only a small number of graves contain more pots or other items. Again, spindle whorls never exceed one per grave. The only rich group graves are M33 at Lanyuan, and M1 and M2 at Shuiguanyin (Deng Boqing 1959). Except for M27 at Shufeng huayuancheng Phase II, intermediate ranked burials like M1 and M2 in group C at Songjia heba were absent in group D.

There are some clues in these distributions that sociopolitical centralization on the Chengdu Plain was intensified in the early first millennium BC. The energy expenditure represented by the grave goods in the highest ranked group D graves is much higher than in group C. For instance, Shuiguanyin M1 yielded 44 pots, 3 bronze *ge*, 1 bronze spearhead, 1 bronze axe, 1 bronze *yue* axe, 1 bronze chisel, 1 oval-shaped stone tool of unknown function, 1 animal tooth (unknown species), and 16 stone rods that possibly functioned as grinding tools. The grave occupant was placed centrally in the rectangular pit and surrounded by pots on three sides, with the other goods placed on the body. Graves with such luxurious mortuary treatment were absent in group C.

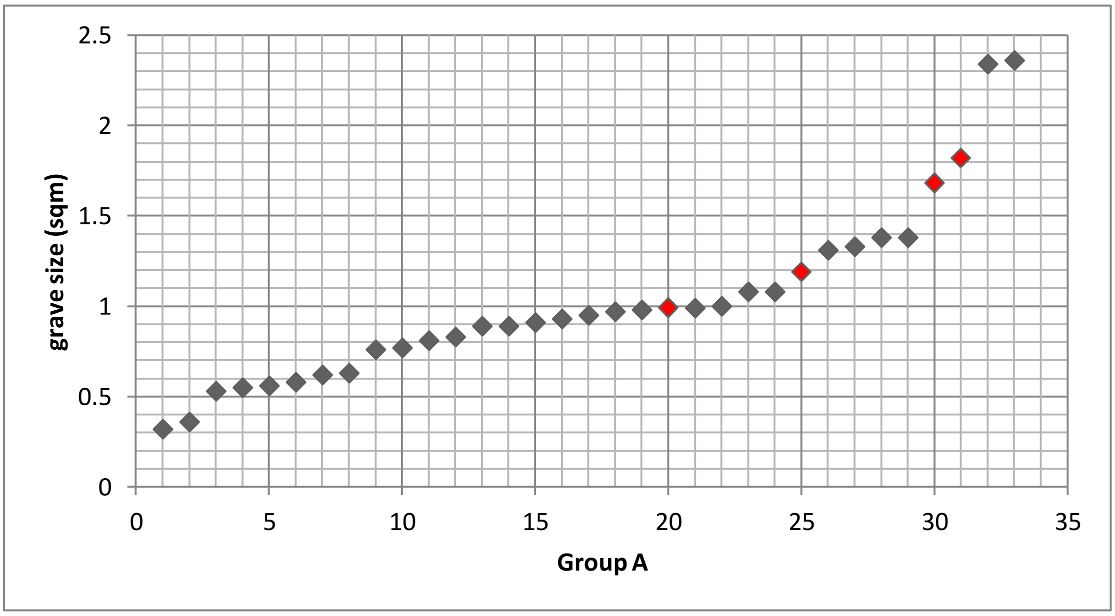
Furthermore, the more diversified group D grave goods possibly suggest a centralization of military and ritual power, manifested in the repertoire of bronze weapons and *yazhang* forked blades. The bronze weapons excavated in Sanhe huayuan M12, Lanyuan M23, and Shuiguanyin M1 and M2 include 1 dagger, 2 knives, 5 *ge*, 2 *yue* axes, and 2 spearheads. *Yazhang* were excavated in Lanyuan M33 and Guoji huayuan grave M825 (Table 4.1). The function of these *yazhang* remains obscure, but similar items occur in late Neolithic and Bronze Age contexts in many regions of China, and in the Neolithic Phung Nguyen culture of northern Vietnam (Deng Cong 1994; So 2001; Yang Yachang 2001; Zhao Chengfu and Dong Quansheng 1997; Wei Jiang 2002). Except for the two specimens found in Yuehe M1 in Henan (Zhao Chengfu *et al.* 1997), and some from Hong Kong that have controversial dates (Li Xueqin 1992; Xiao Yiting 1998; Yang Yachang 2001), the two specimens from Lanyuan and Guoji huayuan are probably younger than the *yazhang* mentioned above.

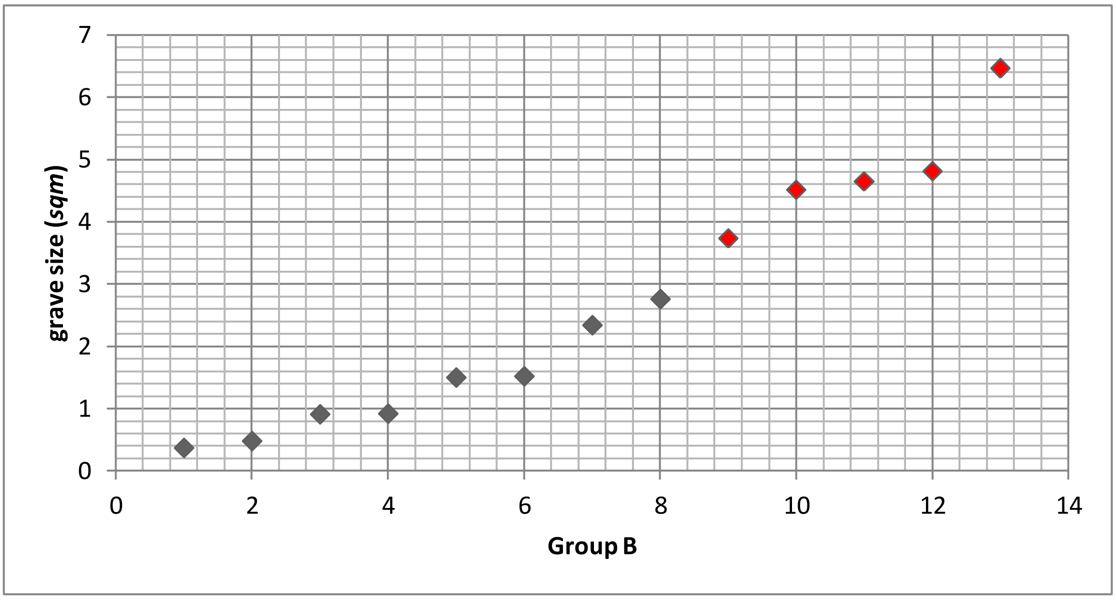
Two additional clues to support speculation about sociopolitical centralization come from the mortuary treatment of infants. Guoji huayuan M938 had a row of three infant skeletons buried in supine positions in a large square pit tightly sealed with brownish black soil, but no grave goods were discovered. Grave M37 at Shufeng huayuancheng Phase II contained an infant skeleton with a pottery *zhan* vessel (Table 4.1). Such mortuary treatment for infants does not occur in preceding phases. Based on assumptions by Saxe (1970, cited in Tainter 1978:106), it could indicate some degree of social ranking inherited at birth.

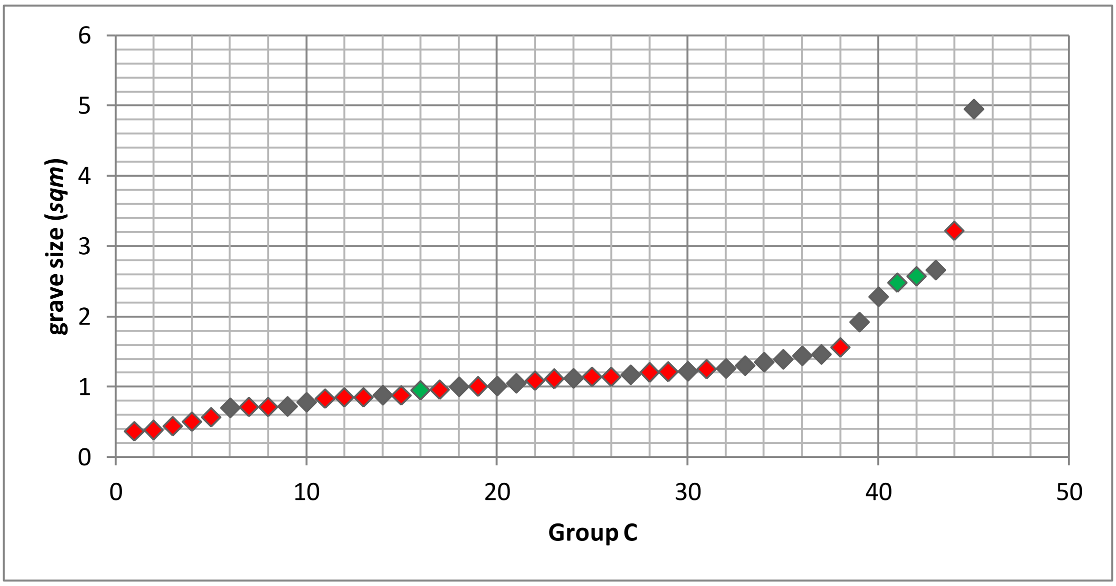
Grave good distributions in groups D, E and F considered together suggest no further significant change in ranking until about 650 BC. However, the ritual artefacts placed in group D graves, such as *yazhang*, *bi* discs, and bronze *yue* axes, were no longer placed with the dead in group E. Indeed, the richest group E graves were poorer in goods than those of group D; the richest group E grave yielded only 3 items. Whether this reflects small sample bias (group E has only 22 graves from 4 sites: Tables 4.1 and 4.4), or a changing ideology favouring thrift remains uncertain, but 3 miniature willow leaf-shaped daggers in the forms of *mingqi*, artefacts to substitute for real grave goods, were discovered in Renfang graves M268 and M280 (Tang Fei *et al.* 2005) (Table 4.1). The usage of the *mingqi* may indicate either attempts to preserve the image of ritual propriety by lowering costs, or, alternatively, introduction of new ideas regarding the afterlife and the separation between the realm of the dead and that of the living (Falkenhausen 2004, cited in Shelach and Pines 2006). Bronze willow leaf-shaped daggers were no doubt highly esteemed grave goods demonstrating social status during this phase (Pu Muzhou 1992:26).

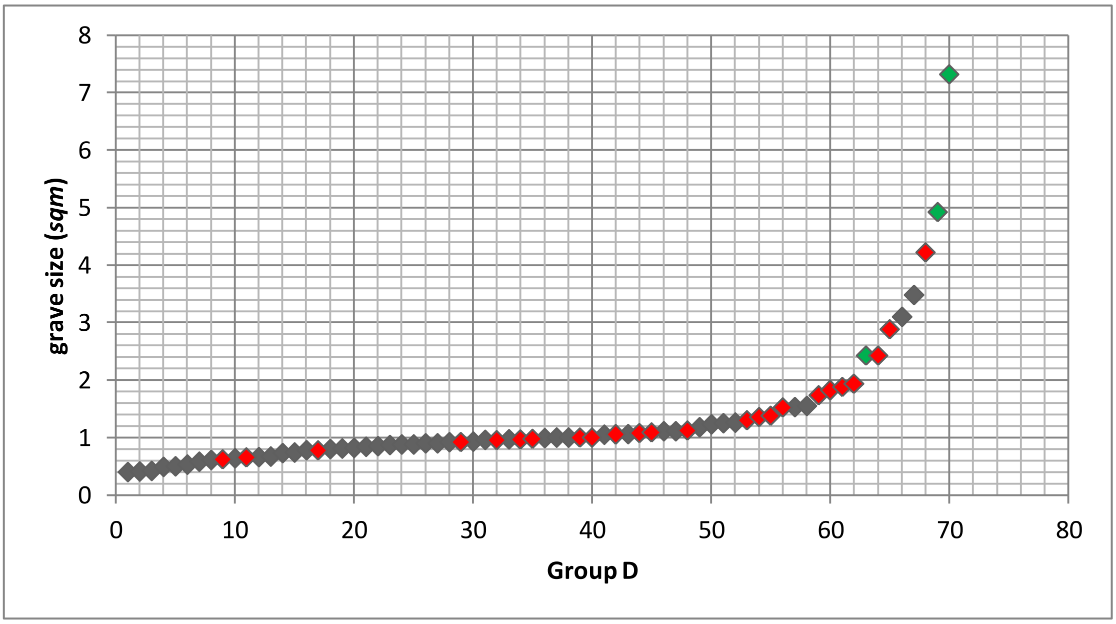
4.9 Correlation between grave size and grave contents

Correlations between grave size, the abundance, and the diversity of grave goods are now examined. In a highly stratified society, we might expect such correlations to indicate different levels of mortuary energy expenditure. In Figure 4.2, the horizontal axis has graves arranged by size from smallest to largest. The vertical axis shows grave size. Those with the most abundant and diversified grave goods are marked in green, those with fewer artefacts are in red, and those with none are in gray. The more positive the correlation, the more red and green points will appear to the upper right in the charts.




grave size (sqm)
Group B


grave size (sqm)
Group C


grave size (sqm)
Group D

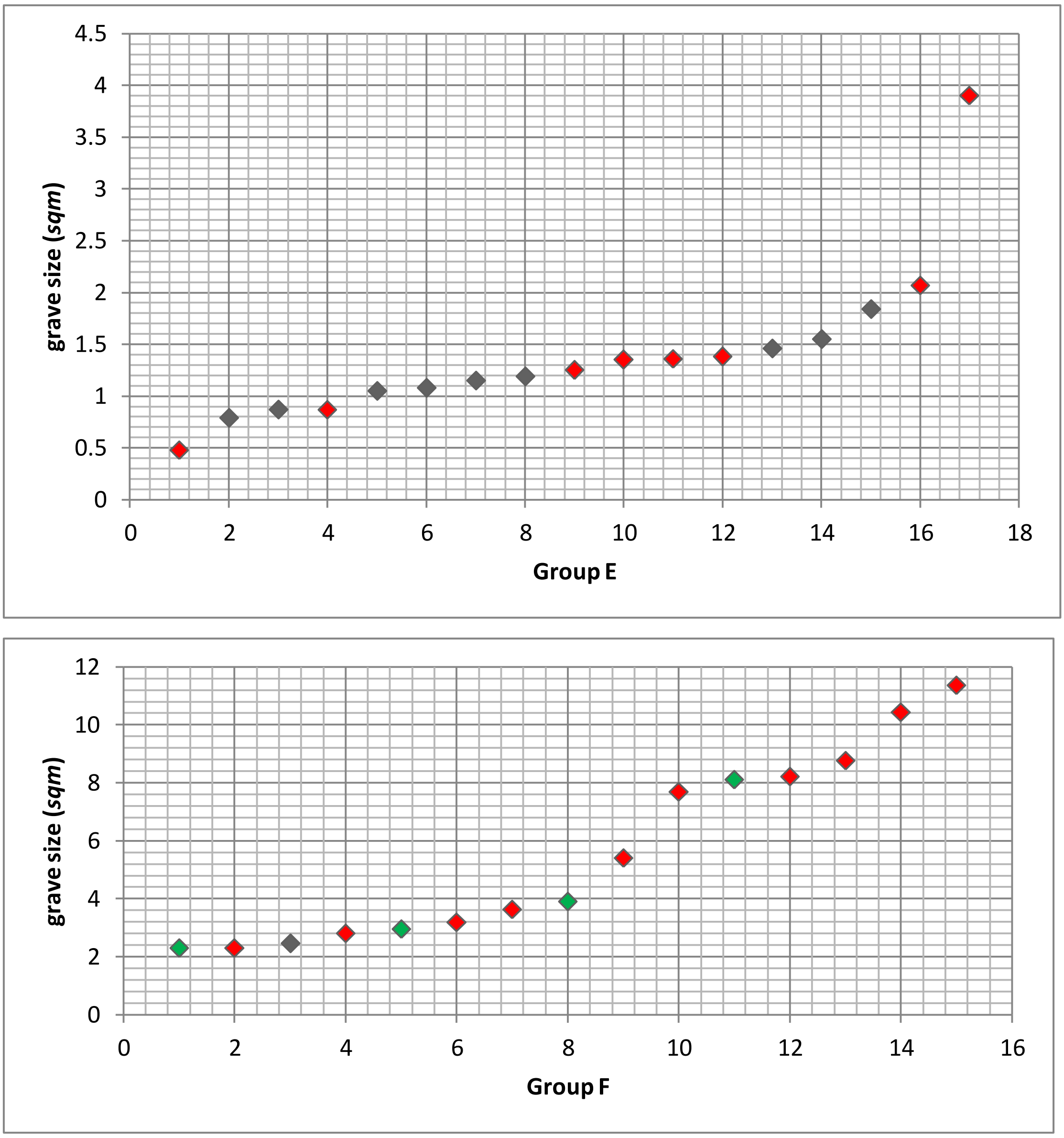


Figure 4.2: Graphs to show the relationships between grave size, and abundance and variability of grave goods.

These graphs suggest that grave size does correlate positively with abundance and variability of grave goods, because most of the green and red dots are distributed towards the upper right of the diagrams. The exception is group F, but here the randomly distributed green and red dots could result from a biased data base. The positive correlation is very clear for groups A and B, where no grave goods occurred in the poorer graves. Nevertheless, this correlation is less consistent for groups C, D and E, in which some small graves, such as Lanyuan

M61, Renfang M280 and Wanbo M183, also yielded abundant grave contents. Also, some large graves like Wanbo M470 and M182 had no grave goods.

Therefore, it is likely that people of the Shierqiao phase had a range of options available when carrying out mortuary rituals. Families with greater power or resources than others could choose more than one option. Prior to Shierqiao, the correlation between grave size and number of grave goods from 1800 to 1200 BC is obscured by the problems with group B. It can only be hoped that future work will provide more mortuary data to resolve these problem.

4.10 Conclusion

An evolutionary model accounting for the development of social complexity on the Chengdu Plain has been proposed in this chapter. It is unfortunate that the model presented cannot incorporate the Sanxingdui artefact pits K1 and K2 or the Zhuwajie bronze hoards (see chapter 3), because of the problems discussed with their dating. In addition, one of the key concepts of this model, the incorporation of former buffer zones between competing groups in the territories of expanding polities, is still an assumption, and may always remain so failing better chronological control of the Baodun sites. Absolute dating, especially of Sanxingdui in Guanghan county and Qinglongcun in Pengzhou city, could shed much light on this problem. Otherwise, all arguments accounting for the growth of social complexity on the Chengdu Plain, for example those by Huang Jianhua (2002) and Sun Hua (2013), as well as those presented here, can only be considered preliminary.

Chapter 5

Pottery production on the Chengdu Plain between 2500 and 800 BC

The model to explain social development on the ancient Chengdu Plain, presented in chapter 4, requires that the mode of production in a context of increasing sociopolitical consolidation would have progressively altered from an unspecialized household economy to a greater level of economic specialization. Although this model is normally focused on increasing intensification of agricultural production, it is reasonable to envisage that similar developments would have occurred in non-agricultural sectors of the economy. Increases in demand engendered by population growth, ceremonial obligations, and sociopolitical competition for status would have triggered increasingly intensive and efficient forms of craft production (for example, D. Arnold 1985:156; Boserup 1965; Brumfiel and Earle 1987:5-6; Clark 1995:290; Earle 1981; Feinman *et al.* 1984:299; Lewis 1996; Rice 1991:259-60; Spielmann 2002). In terms of general economic principles, increasing production would be attained by greater specialization and a division of labour (Smith 2001 [1776]), especially under a cooperative mode of production at a level beyond that of the basic household (Dow 1985:149).

In attempting to evaluate the model in the context of sociopolitical development on the Chengdu Plain, this chapter chooses one type of craft item, pottery, for examination. According to Rice (1996:179), intensification is an economic process involving increasing investment of labour and resources, with consequent increases in scale, efficiency, and degree of mass production. Hence, this chapter analyses the archaeological data relevant for pottery production on the

Chengdu Plain dating between 2500 and 800 BC, covering organization of production, manufacturing technology, raw material composition, and the use of metric indices to investigate degree of standardization.

5.1 Organization of craft production and social complexity

Research on the relationship between organization of craft production and social complexity began with Rice's (1981) evolutionary model of pottery production. This was based on data from the Maya Lowlands, and suggested that increasing social complexity and the related establishment of specialized production were paralleled by increasing standardization of paste composition and vessel shape, as well as by an increasing distinction between elite and non-elite wares (Rice 1981:222-4). To elaborate her model, Rice (1984, 1987, 1989, and 1991) also defined a number of terms and concepts such as specialization, standardization, and diversity.

According to Rice (1987:182), the study of pottery production should be based on considerations of how the pottery was made, who made it, and for whom it was made. Other factors include the role and status of the potters, and the relationships between producers, distributers and consumers (Costin 1991; Sinopoli 1988; Stark 1995; Stein and Blackman 1993; Underhill 2003). Since Peacock (1982) and van der Leeuw (1977), several typologies to describe the modes in the organization of production have been used (for example, Costin 1991:8-9; Rice 1987:183-4; Tosi 1984).

At a chiefdom-level of cultural complexity (see chapter 4), two of Rice's modes of production are useful as starting points for investigating the organization of labour to make pottery vessels. These are the household industry, and the individual workshop. The concept of household industry refers to specialization on a relatively small scale, in which a few households in a village will specialize in pottery production and exchange their vessels for goods from others. The concept of the individual workshop refers to specialized production in spaces kept exclusively for pottery manufacture. Compared with household industry, specialized production can involve manufacture of greater quantities of vessels as well as exchange of vessels over longer distances, as Underhill (1991) has suggested for Neolithic China.

Several shortcomings in such mode of production classifications have been indicated by Costin (1991:6-8, 2001:277) and Rice (1987:186-7). These include the difficulties in making cross-cultural comparisons, the ambiguity of terminologies as used by different scholars, and deficiencies in the databases necessary to form a universally applicable typology of modes of production. For instance, behavioural data on the context, concentration, scale and intensity of production can frequently be invisible or ambiguous in the archaeological record (Rice 1984; Underhill 1991). In addition, developments in the organization of production may not always follow a unilinear evolutionary trend, even though the growth from a household economy to specialized workshop production might still represent a general tendency. Diverse modes of production can also coexist at the same time in any fairly complex society (Bayman and Nakamura 2001; Costin 2001:274; Santley 1994; Sinopoli 1991:102-3; van der Leeuw 1984:748-57), hence there need be no simple correlation between organization of craft production and sociopolitical structure. Nevertheless, the archaeological record with its diachronic insights can still aid in the understanding of correlations between different modes of production and social complexity (Costin 1991:18-43).

5.2 Craft specialization and standardization

Craft specialization has been considered by some archaeologists to be one of the key causal factors in the political economy of complex societies (Schortman and Urban 2004). Since Evans (1978), craft specialization has been explicitly investigated in many general overviews and edited collections (J. Arnold 1996; Clark 1995; Clark and Parry 1990; Costin 1991, 2001; Costin and Wright 1998; Cross 1993; Hruby and Flad 2007; Rice 1991; Tosi 1984; Wailes 1996). By considering production techniques and organization, and relationships between consumers and producers, scholars have produced different definitions of the concept of specialization, variously focused on considerations of site function (Mueller 1984:490-392, 1987:15), resource exploitation (Rice 1991), and relationship between producers and consumers (Ames 1995:158; Janucek 1999). But producer specialization is the most frequently discussed category (Clark and Parry 1990:297; Cross 1993; Rice 1991:263; Stark 1991b; Stein and Blackman 1993), placing stress on the production of specific craft items by a relatively small number of focused and skilled individuals (Mueller 1987:15).

In this thesis, I define craft specialization as the investment of labour or capital towards the production of alienable goods for non-dependent consumption, following Clark and Parry (1990:297) and Stein and Blackman (1993). In essence, specialization involves the production of surplus for exchange (Bates and Lees 1977; Clark 1995). This economic-incentive mode of production is frequently carried out by independent specialists, rather than by dependent specialists attached to and sponsored by the elite, who require items for display, ceremony and status competition (Brumfiel and Earle 1987:5; Earle 1981; Peregrine 1991; Underhill 1996, 2002b:197-9, 2002c). In contrast, independent specialists operate autonomously, producing goods or services in response to economic, social, or political demand from a variety of sources. It is generally assumed that independent specialists preceded dependent specialists in the course of social evolution (Stein 1996; White and Pigott 1996, but see Clark 1996, Earle 1987b).

Generally speaking, pottery was not an important prestige item in many areas of the world, and the production and use of pottery often are regarded as peripheral to the development of social stratification (Underhill 1990:7-8; 2002b:8). For instance, it would appear that pottery production on the prehistoric Chengdu Plain was mostly conducted by independent specialists, and was not controlled by any centralized institution or by people of high social status. This is apparent because the types and quality of pottery unearthed at sites with luxurious artefacts and large-sized houses which are presumed to have been occupied by elite families, such as Lanyuan, Meiyuan Northeast and Sanhe huayuan in the Jinsha site cluster (Wang Fang *et al.* 2004; Zhou Zhiqing *et al.* 2003; Zhu Zhangyi and Liu Jun 2001), and Yueliangwan at Sanxingdui, are little different from pottery in other sites of the presumed non-elite population. This suggests that pottery vessels on the prehistoric Chengdu Plain were mostly non-prestige (utilitarian) items that circulated purely within the subsistence economy.

An increasing scale of specialization can be identified in many regions of the world archaeological record in terms of evolutionary changes in manufacturing facilities, specialist tools, and the existence of workshops independent of residential areas (Costin 1991; Evans 1978; B. Stark 1985; Shafer and Hester 1983; Tosi 1984:25). Increasing scale can also be revealed through indirect records related to degrees of standardization, efficiency and skill (Costin 1991:32-43; Costin and Hagstrum 1995). In this thesis, standardization is regarded as producing a high level of homogeneity, and as driving a reduction in stylistic variability (Rice 1991:268). Indeed, increasing degrees of standardization are usually taken to reflect increasing intensity of production and degree of specialization, and pottery standardization can be examined statistically through an analysis of variation in dimensions (Balfet 1965:163; Benco 1988; Kvamme *et al.* 1996; Longacre *et al.* 1988; Sinopoli 1988:586; Underhill 2003).

Any hypothesis of standardization applied to pottery will need to search for indicators of uniformity which might reflect mass production by relatively few specialists (Blackman *et al.* 1993; Clark and Parry 1990; Costin 1991, 2000; Costin and Hagstrum 1995; Kramer 1985: Rice 1981:220-1), as well as the introduction of new technological devices such as tournettes, moulds, or stamps for decoration (Feinman *et al.* 1981; Hagstrum 1985). Standardized sizes for pots can facilitate stacking and transportation (London 1991; Underhill 2003).

In order to investigate ceramic standardization, archaeologists have examined vessel compositions (Kreiter *et al.* 2009), and have also used descriptive and inferential statistics on metric variables. These include histograms and distribution curves (Rice 1981), factor analysis (Hagstrum 1985), vessel diversity measures (Arthur 2014; Benco 1988; Underhill 1991, 2002b), contingency tables (Feinman *et al*. 1984 used the Phi [φ^2] coefficient), Coefficient of Variation, F-tests, ANOVA (for example, Arnold and Nieves 1992; Benco 1988; Blackman *et al.* 1993; Dai Xiangming 2006; Longacre 1991; Longacre *et al.* 1988; Sinopoli 1988; Sun Zhouyong 2008; Underhill 2003), and non-parametric alternatives (Kvamme *et al*. 1996). In most ethnoarchaeological studies, researchers have utilized metric datasets drawn from whole vessels and well-established vessel classes. Their sample sizes are generally large, and hence have statistical significance. Some have also employed smaller datasets from specific discovery circumstances, such as a stack of kiln wasters from Tell Leilan, Syria (Blackman *et al.* 1993). But such situations are relatively rare in many archaeological assemblages, which often feature large quantities of broken and unmatched sherds without close spatial and chronological control.

While positive correlations between the emergence of social complexity and increasing craft standardization have sometime been claimed (Longacre 1999; Longacre *et al.* 1988; Blackman *et al.* 1993), it is obvious that there can be no simple correlation between craft item standardization and specialized production, since there are so many economic, technological, and social factors that can also enhance or reduce the evidence for standardization. These include raw material differences, potter expertise, consumer demand, and so forth (D. Arnold 2000; Arnold and Nieves 1992, Arthur 2014; Blackman *et al.* 1993; Berg 2004; Costin and Hagstrum 1995; London 1991; Longacre 1999; Rathje 1975:430; Roux 2003; B. Stark 1995; Underhill 2003). On the whole, ethnoarchaeologists have, for the most part, failed to find universally applicable social correlates for specialization and standardization. This has led to a new kind of questioning of previous assumptions and a new and deeper understanding of the processes involved (Hegmon 2000). The following study must be considered preliminary since the data available for analysis do not have fine spatial and chronological control. However, some valuable information still can be presented as a guide for future studies.

I now proceed to my analysis of the potential for specialized production of pottery on the Chengdu Plain between 2500 and 800 BC. It is centred on a two-part evaluation of archaeological data, firstly in terms of the direct evidence based on excavated kiln foundations, and then in terms of the indirect evidence based on rim sherd measurements.

5.3 Direct evidence of pottery production on the Chengdu Plain

Although pottery is a ubiquitous aspect of prehistoric Chengdu Plain archaeology, progress in understanding its production has been relatively recent (Yang Yang 2013). Over 250 kiln remnants dating between 2500 and 800 BC have been securely identified on the plain, with a large number dating to the early first millennium BC at Jinsha in Chengdu City (Zhou Zhiqing, personal communication). Based on the design of firing chambers and the flow of heat, the published kilns are gourd-shaped updraft kilns with a separate firing chamber and fire box, separated by a narrow flue to transfer the heat. Some also include a separate fire setting area next to the fire box (Figures 5.1 and 5.2). They can be further classified into two types. Those with a flue consisting of just a constriction are categorized as type A (Figure 5.3), and those with a tunnelled flue as type B. The firing chambers of the type B kilns are generally larger than those of type A. The published data on Chengdu Plain kilns are listed in table 5.1, in chronological order where determinable.

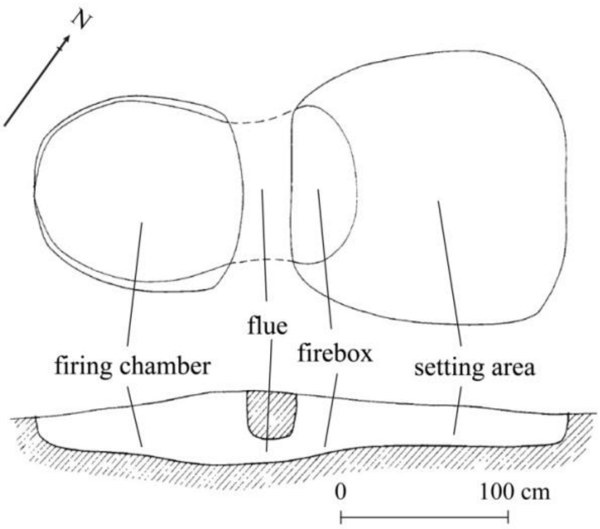


Figure 5.1: The type B kiln excavated at Xicheng tianxia (redrawn after Cheng Yunhong *et al.*2007, with modifications).

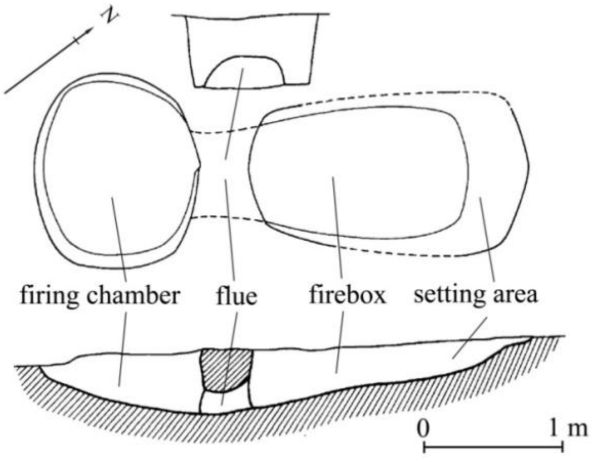


Figure 5.2: The type B kiln excavated at Sanhe huayuan (redrawn after Zhu Zhangyi and Liu Jun 2001, with modifications).

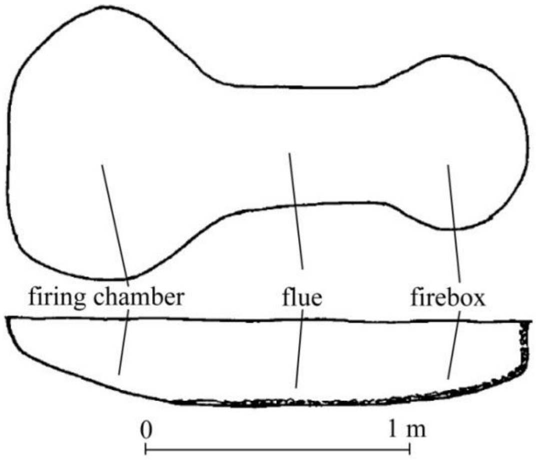


Figure 5.3: The type A kiln excavated at 'Laboratory Building of Qingshuihe Campus, UESTC' (redrawn after Zhou Zhiqing and Liu Yumao 2008a, with modifications).

Table 5.1: Published prehistoric ceramic kilns excavated on the Chengdu Plain.

Site	Type	Quantity	Date
Laboratory Building of Qingshuihe Campus, UESTC (Zhou Zhiqing and Liu Yumao 2008a)	A	1	before 2000 BC
Zhixin Jinshayuan Phase I (Zhou Zhiqing and Tang Zhihong 2004)	A	1	before 2000 BC

Yufucun (Li Mingbin and Chen Yunhong 2001)	A	1	before 2000 BC
Guiyuanqiao (Wan Jiao and Lei Yu 2013a)	A	1	ca. 2600-2300 BC
Sanxingdui (Chen Xiandan 1989a)	A	1	ca. 1500-1200 BC
Minjiang xiaoqu (Li Mingbin and Wang Fang 2001)	B	1	ca. 1200-900 BC
Xinhuacun (Xie Tao 2013)	B	1	ca. 1200-900 BC
Sanguancun (Yang Zhanfeng 2013)	B	3	ca. 1200-900 BC
Zhonghai guoji Commune site 2 (Zhou Zhiqing and Liu Yumao 2012)	B	3	ca. 1200-900 BC
Chief Equipment Supply Depot of the Department of Logistics (Jiang Ming *et al.* 2013)	B	4	ca. 1000-900 BC
Huangzhongcun gandao B (Zhou Zhiqing 2004)	B	2	ca. 1000-900 BC
Putian Cable Corporation (Zhou Zhiqing and Liu Yumao 2008b)	B	3	ca. 1000-900 BC
Chunyu huajian (Chen Yunhong 2006a)	B	2	ca. 1000-900 BC
Guoji huayuan (Zhou Zhiqing *et al.*2006)	?	?	ca. 1000-900 BC
Lanyuan (Zhou Zhiqing *et al.* 2003)	B	3	ca. 900-800 BC
Xinghelu xiyanxian (Wang Lin and Zhou Zhiqing 2010)	B	1	ca. 800-700 BC
Xicheng tianxia (Chen Yunhong *et al.* 2007)	B	2	ca. 800-700 BC
Sanhe huayuan (CMICRA 2005b:5; Zhu Zhangyi and Liu Jun 2001)	B	17	ca. 800-700 BC
Wan’an Pharmaceutical Packing Factory (Zhou Zhiqing *et al.* 2005b)	?	1	unknown

To date, only 5 type A kilns have been discovered and they show some minor morphological variability. The example excavated in the site called "Laboratory Building of Qingshuihe Campus, UESTC" (Zhou Zhiqing and Liu Yumao 2008a) is similar in plan to most of the type B kilns (Figure 5.3), but that excavated at Zhixin Jinshayuan Phase I (Zhou Zhiqing and Tang Zhihong 2004) has a more elongated plan (Figure 5.4). The design of the Yufucun kiln is unique, with a 260 cm long by 110 cm wide trench (Li Mingbin and Chen Yunhong 2001). Carbonized bamboo fuel was identified in the fill.

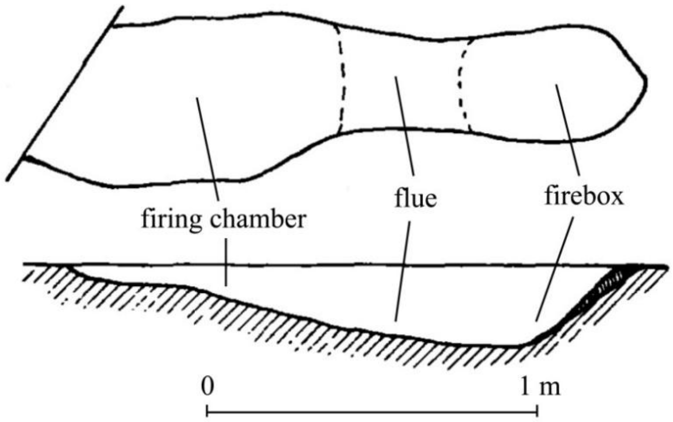


Figure 5.4: The type A kiln excavated at Zhixin Jinshayuan Phase I (redrawn after Zhou Zhiqing and Tang Zhihong 2004, with modifications).

The type A kiln excavated at Guiyuanqiao also has an elongated plan (Figure 5.5), and some burnt earth was identified in the fill. Close to this kiln, a unique structure (K7) consisting of two connected circular pits with fire hardened walls and flat bottoms was also excavated. Separated by a low earthen ridge, both pits contained cobbles of varying sizes (Figure 5.6). The connection between this structure K7 and the type A kiln is unknown (Wan Jiao and Lei Yu 2013a).

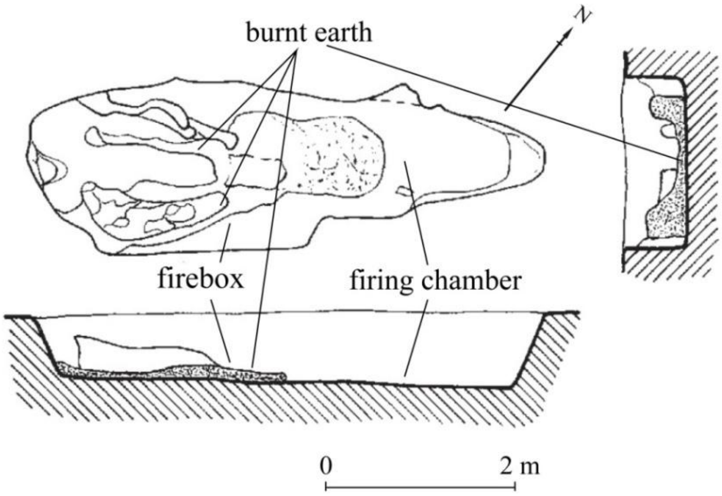


Figure 5.5: The type A kiln excavated at Guiyuanqiao (redrawn after Wan Jiao and Lei Yu 2013a, with modifications).

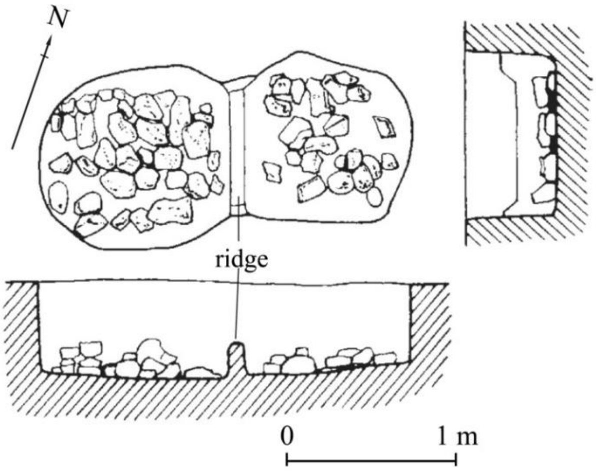


Figure 5.6: Two connected pits (structure K7) with cobbles excavated at Guiyuanqiao (redrawn after Wan Jiao and Lei Yu 2013a, with modifications).

The only kiln remnant discovered at Sanxingdui was briefly reported by Chen Xiandan (1989a, 2009). Possibly a type A kiln, only an irregular firebox and apparent flue remain. The firing chamber is around 220 cm long and 12-25 cm deep, and the maximum width is 163 cm. Smoke marks and fire hardened surfaces were identified on the walls and bottom of the chamber (Figure 5.7).

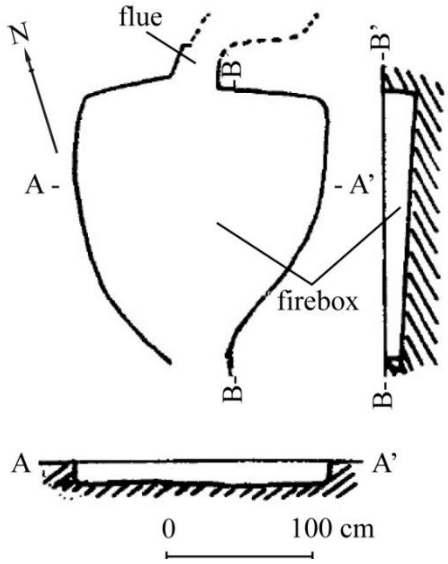


Figure 5.7: The top view (upper left) and side views (right and lower) of a possible type A kiln excavated at Sanxingdui (redrawn after Chen Xiandan 1989a, with modifications).

Largely excavated in the Jinsha site cluster, the type B kilns outnumber those of type A. They are quite uniform in overall design, especially in the constricted waist, but exhibit some degree of variation in dimensions and plans (see figures 5.1, 5.2, 5.8 and 5.9 for comparison). In the firing chamber of the type B kiln excavated at Minjiang xiaoqu (Figure 5.9), more than 10 intact vessels were recovered, including pointed-based *zhan*, pointed-based *bei*, and ring-shaped pedestals (Li Mingbin and Wang Fang 2001). It is not known why these fired pots were left in the firing chamber, but no sign indicating rapid abandonment of the site was detected. If they reflect a single firing event, the pottery probably does not indicate the existence of an individual workshop (as defined above), because mass production will usually result in a single type of vessel.

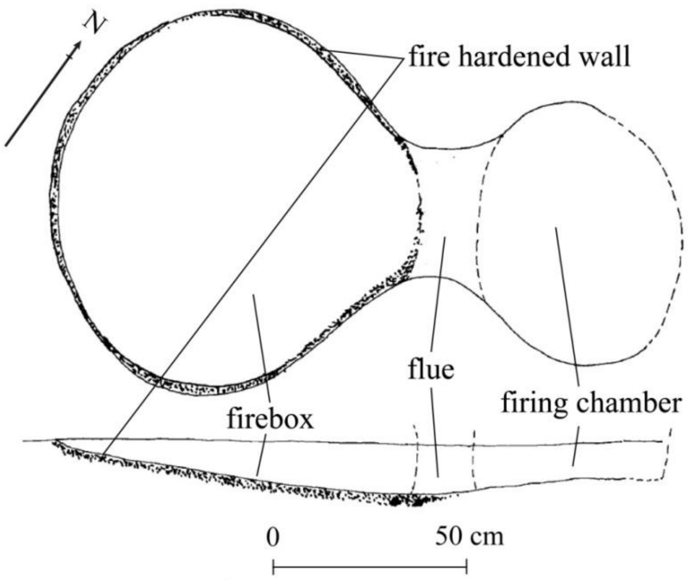


Figure 5.8: The type B kiln excavated at Zhonghai guoji Commune site 2. The tunnelled flue has been destroyed (redrawn after Zhou Zhiqing and Liu Yumao 2012, with modifications).

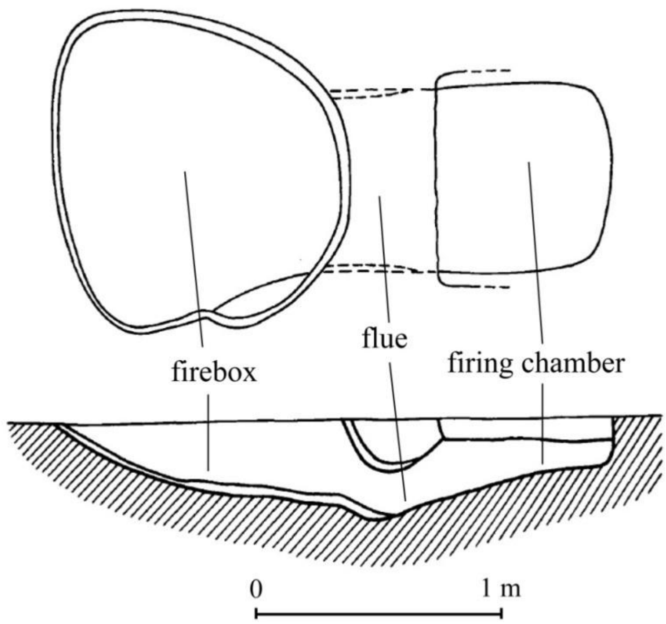


Figure 5.9: The type B kiln excavated at Minjiang xiaoqu (redrawn after Li Mingbin and Wang Fang 2001, with modifications).

Aside from the remnants of kilns, other direct evidence for pottery production on the Chengdu Plain dating between 2500 and 800 BC remains scarce. Only two possible pits for paste or clay preparation and three ceramic stamping tools have been reported. The possible pits for clay or paste preparation include H44 at Baodun (Jiang Zhanghua *et al.* 1998) and H15 at Mangcheng (Wang Yi *et al.* 2001:69). Loosely dated to the Baodun phase, both contain a layer of clean and fine sticky white clay, called *baishanni* in Chinese (indicating that the clay is as smooth and sticky as the skin of a white ricefield eel of the species *Monopterus albus*), with great plasticity upon the addition of a limited amount of water. However, no mineralogical or chemical examinations have been conducted of this clay.

Three ceramic stamps were excavated at Zhengyincun (Chen Yunhong and Liu Yumao 2003), Sanguancun (Yang Zhanfeng 2013), and Huachengcun (Liu Yumao and Rong Yuanda 2001). Those from Sanguancun and Huachengcun have engraved lines and fin-shaped handles, and that from Zhengyincun bears an engraved geometric symbol like an eye (Figures 5.10 and 5.11). Stamped parallel lines are commonly discovered on Baodun pottery, but the geometric pattern like an eye has not been found on any sherd. The stamps from Sanguancun and Huachengcun are loosely dated to the Baodun phase and that from Zhengyincun to early Shierqiao.

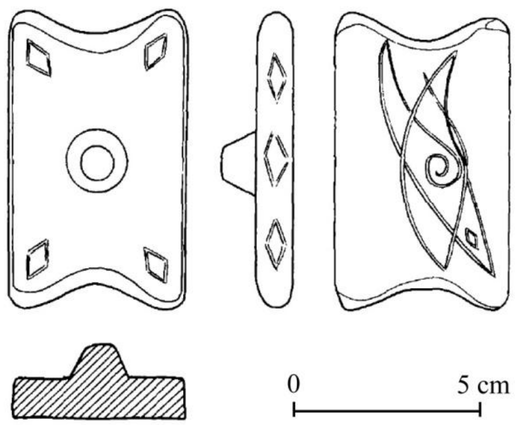


Figure 5.10: The ceramic stamp unearthed at Zhengyincun (Chen Yunhong and Liu Yumao 2003).

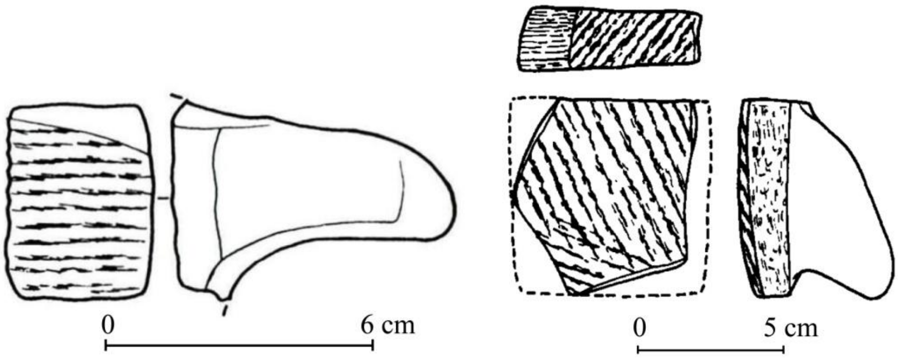


Figure 5.11: The ceramic stamps with fin-shaped handles unearthed at Sanguancun (left) and Huachengcun (right) (Liu Yumao and Rong Yuanda 2001; Yang Zhanfeng 2013).

It is possible that a large quantity of small flat shale and slate discs and some wheel-shaped sandstone artefacts were utilized as rotating devices in pottery production. The former probably functioned as pot rests or hand turntables that permitted a potter to rotate the vessel during forming (Rice 1987:132-3). In contrast, the wheel-shaped artefacts possibly functioned as true potter's wheels.

To date, around 200 of the flat stone discs have been excavated at Meiyuan Northeast in Jinsha (Wang Fang *et al.* 2004), Shierqiao (SPICRA and CMICRA 2009:127-9) and Xinyicun in Chengdu City (Jiang Zhanghua *et al.* 2004); Sanxingdui in Guanghan county (DHSU 1961); Zhuwangcun (Zuo Zhiqiang *et al.* 2013), Zhengyincun (Chen Yunhong and Liu Yumao 2003) and Guilinxiang in Xindu District, Chengdu City (Yan Jinsong and Chen Yunhong 1997); and Zone A of Jinhai'an Phase II in Jintang county (Liu Yumao and Liu Shouqiang 2009). The largest numbers were excavated at Shierqiao and Meiyuan Northeast, which produced 142 and 46 specimens respectively. Those from Meiyuan Northeast have uncertain dates, but most others date between the late 2nd and early 1st millennia BC.

Manufactured mainly by percussion flaking and lightly retouched along the edges by pressure flaking, these stone discs are generally circular, up to 40 cm in diameter, and 6 cm thick. The edges of some recovered from Zhengyincun were ground (CMICRA 2005b:20). It is common that one side will have a smooth and sometimes ground surface, and some have a small circle engraved in the center of the rough side. (Figures 5.12 and 5.13).

Figure 5.12: Flat stone discs exhibited in Jinsha site Museum.

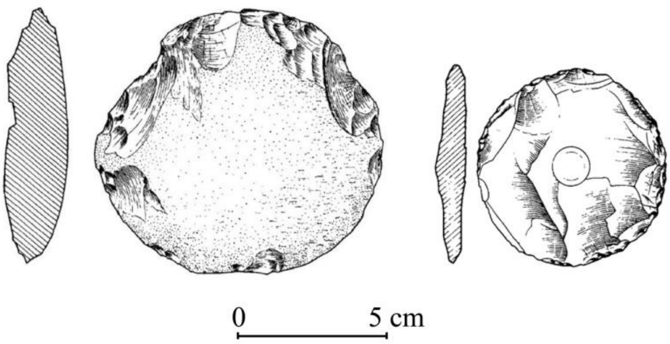


Figure 5.13: Two flat stone discs excavated at Zhengyincun (left) and Meiyuan Northeast in Jinsha (right) (redrawn from Chen Yunhong and Liu Yumao 2003, Wang Fang *et al.* 2004, with modifications).

The notion that these stone discs were rotating devices in pottery production still requires more conclusive evidence. In fact, they have also long been considered by some as unfinished *bi* discs for ritual purposes (Figure 5.14). The existence of a number of such discs buried in several orderly stacks next to finished *bi* and *yazhang* in ritual pits at Meiyuan Northeast (Figure 5.15) (CMICRA 2005b:20-1) could suggest such an explanation. However, perhaps they had different usages, the larger ones being for pottery production, and the smaller ones being unfinished *bi* discs. The drilled out circles on the rougher sides of many of the smaller examples suggest that they were being made into annular rings of some kind.

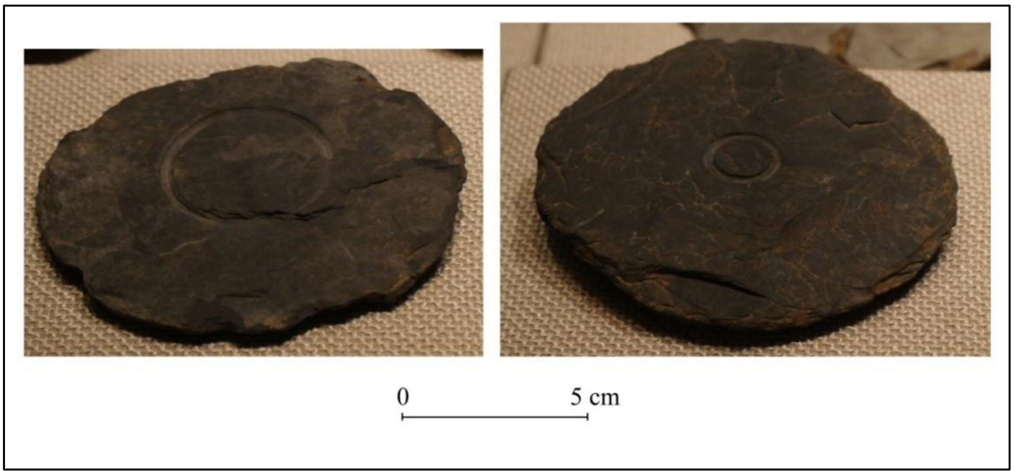


Figure 5.14: Stone discs with circular drill marks.

Figure 5.15: Stone discs *in situ* at Meiyuan Northeast (CMICRA 2005b:21).

The idea that the centrally-perforated wheel-shaped stone artefacts unearthed at Jinsha and Sanxingdui (Dye 1931; Graham 1934) were potter's wheels also needs more conclusive evidence, since similar items recovered at Sanxingdui have also long been considered to be *bi* discs for ritual purposes (Figure 5.16). Some of those recovered at Sanxingdui are up to 1.8 m in diameter and 5 cm thick, and those exhibited in the Jinsha site museum are up to 1 m in diameter and 20-30 cm thick (Figure 5.17). However, the dates of these artefacts remain unknown and they have not been published in any official site report.

Figure 5.16: Presumed large *bi* disc recovered at Sanxingdui.

Figure 5.17: The wheel-shaped stone artefact unearthed at Jinsha.

5.4 Discussion

The evidence presented suggests that pottery production took place in several settlements on the Chengdu Plain over a long period of time. It also illustrates two technological advances in pottery production, one being a change in kiln structure towards an increasing size of the firing chamber, and the other a trend towards a more unified type B shape of kiln, with a turning point around 1200 BC. These developments signify greater efficiency and a better control of heat in firing (D. Arnold 1985:210-1; Kramer 1985:81; Rice 1987:158). Both advances would make mass production of pottery feasible.

To identify a change in mode of pottery production from a household industry to an individual workshop industry, one needs (in theory) to evaluate changes in activity areas, these being places where labour is allocated for the performance of one or more stages of manufacture. Ideally, a household industry should be recognizable by archaeological evidence for pottery manufacture in or near each residence in a settlement. A more specialized workshop industry should be recognizable by a concentration of production into a limited number of areas within a site (Tosi 1984: 23-4).

The available data from the Chengdu Plain between 2500 and 800 BC do not clearly affirm the development of a more specialized mode of pottery production, because most pottery-making facilities have been excavated within residential areas, indicative only of a household level of industry. The only exceptions are the 17 type B kilns at Sanhe huayuan in the Jinsha site cluster (CMICRA 2005b:5), which are clustered in an area occupied by five large rectangular houses (F5-F9) and four adjacent smaller ones (F1-F4) (Zhu Zhangyi and Liu Jun 2001) (see chapter 3). All excavated below cultural layer 4A, many of these kiln overlap and have disturbed each other, suggesting continued activity between 950 and 850 BC. It is unfortunate that the data about these kilns are poorly reported and that an excavation plan of Sanhe huayuan was not included in the site report. Hence, it is not able to ascertain the intensity of pottery production during this phase via these kilns, but the possibility that they indicate the existence of a specialised workshop industry should not be overlooked.

5.5 Petrography and point count analyses

According to Rice (1981:222-4), specialized production of pottery can correlate with an increasing standardization of paste composition, within both elite and non-elite wares. To investigate the possible existence of such a correlation, the following study of thin-section petrography examined the mineral composition of a sample of Chengdu Plain sherds dating between 2500 and 800 BC.

Thin-section petrography involves using polarising optical microscopy to examine the microstructures and compositions of visible inclusions (Reedy 1994; Riederer 2004). Pioneered for archaeological pottery by Henry Clifton Sorby in the 1860s (Peterson 2009:3; Worley 2009), and further by Lepsius (Peterson 2009:3), Shepard (1956:1-5, 139, 157-9) and Matson (Kolb 1988:7), thin-section petrography has become a widely used technique within archaeological science. It focuses mostly on raw material sourcing (Braekmans *et al.* 2011; Ixer and Vince 2009; Montana *et al.* 2009; Stoltman *et al.* 2009), regional interaction and exchange (Boileau *et al.* 2009; Neff *et al.* 2006; Stoltman 1999; Stoltman *et al.* 2005), and technological and social aspects of pottery production (Braun 2012; Fargher 2007; García-Heras 2000; Kreiter *et al.* 2009).

Thin-section petrographic studies can give information about pottery clay matrices and non-plastic temper materials (Bishop *et al.* 1982:283). To examine qualitatively the pastes of the pottery examined in this study, a point count thin-section analytical technique is adopted. This is a systematic sampling procedure that derives data from observations made at fixed intervals across the entire area of the thin-section (Stoltman 1989). To utilize this procedure, the examiner must have access to a binocular polarising optical microscope equipped with a measuring eyepiece with a cross hair, as well as to a stage with an attachment that allows the thin-section to be moved in fixed increments beneath the cross hair. A more advanced observation system allows photomicrographs to be taken with a digital camera, transmitted to a computer, and enlarged for more detailed examination (Figures 5.18 and 5.19). This additional equipment can make point counting less laborious, but it can still take 2 to 3 hours for an experienced examiner to count a single slide. Supervised by Prof. Chen Wenshan, a geologist at the National Taiwan University, the petrographic point counting of this research was conducted by the author. The equipments were set up at Chen's office.

Figure 5.18: The stage with an attachment that allows the thin-section to be moved in fixed increments.

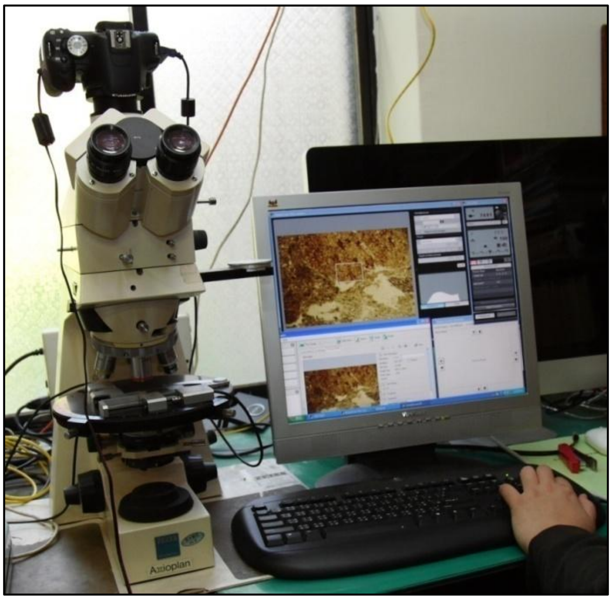


Figure 5.19: A binocular polarising optical microscope is connected with a computer system that allows photomicrographs to be digitally displayed on the screen.

In this petrographic analysis, 1000 points on the entire area of each thin-section were utilized for counting. At each one, the point directly beneath the cross hair was assigned to one of three classes: tempering material, clay matrix, and voids. Visible mineral grains over 0.0625 mm in size were classed as tempering material, and those too small to be identified petrographically were classed as clay matrix.

5.6 Petrographic observations

A total of 93 sherds from 9 sites: Baodun, Zhonghai guoji sites 2 and 4, Sanxingdui, and the sites of Zhixin Jinshayuan, Lanyuan, Meiyuan Northeast, Guoji huayuan, and Sanhe huayuan in the Jinsha site cluster, produced useable thin-sections. The sherds were from archaeologically excavated cultural layers, refuse pits and kiln remnants, and stored in the Sanxingdui and Beihu workstations. I was allowed to use these sherds for destructive analysis because they are unmatched, and hence have no importance for exhibition. The samples were selected with the help of local assistants and curators who are experienced in classifying the archaeological materials excavated at the sites mentioned above. They are convinced that they can correctly determine the vessel types by the shapes of rim and base sherds and the other morphological characters of vessels, minimizing the possibility of mistakenly lumping two or more discrete classes of artefact into a single category (Longacre *et al.* 1988).

Because archaeological materials from China legally belong to the Chinese national government, foreigners are not allowed to take them overseas for analysis. Hence, all the thin-sections were prepared at Chengdu University of Technology. The 93 samples that were successfully analysed petrographically are listed in table 5.2, in chronological order. The vessel types represented by these sherds are illustrated in figures 5.20 to 5.28, and in figures 2.3, and 2.6 to 2.9 in chapter 2. The results are listed in table 5.3.

Table 5.2: Thin-section pottery samples subjected to petrographic analysis.

1. Zhixin Jinshayuan (ca. 2500-2000 BC)

No	Pottery type	Sherd type	Source of sample
001	cord-marked *guan* with decorated rim	rim	2002CQIXI T3103 ⑤
002	cord-marked *guan* with decorated rim	rim	2002CQIXI T3103 ⑤
003	cord-marked *guan* with decorated rim	rim	2002 CQIXI T3006 ⑤
004	cord-marked *guan* with decorated rim	body	2002 CQIXI T3006 ⑤
005	cord-marked *guan* with decorated rim	rim	2002CQIXI T3004 ⑤

2. Meiyuan Northeast (ca. 2500-2000 BC)

No	Pottery type	Sherd type	Source of sample
001	ring-footed *zun* with flared rim	rim	CQJI T6811 ㊵
002	ring-footed *zun* with flared rim	rim	CQJI T6711-6712 ㊹
003	ring-footed *zun* with flared rim	rim	CQJI T6711-6712 ㊹
004	ring-footed *zun* with flared rim	rim	CQJI T6712 ㊵

005	cord-marked *guan* with decorated rim	rim	CQJI T6810 ㊵
006	cord-marked *guan* with decorated rim	rim	CQJI T6810 ㊵
007	cord-marked *guan* with decorated rim	rim	CQJI T6810 ㊵
008	cord-marked *guan* with decorated rim	rim	CQJI T6711-6712 ㊷
009	cord-marked *guan* with decorated rim	ring foot	CQJI T6711-6712 ㊷

3. Baodun (ca. 2500-2000 BC)

No	Pottery type	Sherd type	Source of sample
001	cord-marked *guan* with decorated rim	rim	2010CXBIV T3312 ⑦
002	cord-marked *guan* with decorated rim	rim	2010CXBIV G4
003	cord-marked *guan* with decorated rim	rim	2010CXBIV T3307 ⑦
004	cord-marked *guan* with decorated rim	rim	2010CXBIV G4
005	cord-marked *guan* with decorated rim	rim	2010CXBIV T3309 ⑦
006	ring-footed *zun* with dished rim	rim	2011CXBIV T2729 ⑦
007	ring-footed *zun* with dished rim	rim	2011CXBIV T2530 ⑥
008	ring-footed *zun* with dished rim	rim	2011CXBIV T2827 ⑥
009	ring-footed *zun* with dished rim	rim	2011CXBIV T2531 ⑧
010	ring-footed *zun* with dished rim	rim	2011CXBIV T2528 ⑥
011	ring-footed *zun* with flared rim	rim	2010CXBIV H21
012	ring-footed *zun* with flared rim	rim	2010CXBIV T3209 ⑦
013	ring-footed *zun* with flared rim	rim	2010CXBIV G4
014	ring-footed *zun* with flared rim	rim	2010CXBIV T3309 ⑦
015	ring-footed *zun* with flared rim	rim	2010CXBIV T3311 ⑦

4. Sanxingdui (ca. 1700-1500 BC)

No	Pottery type	Sherd type	Source of sample
001	small flat-based *guan*	body	99 GSZY T302 ⑩
002	small flat-based *guan*	rim	99 GSZY T302 ⑪
003	small flat-based *guan*	rim	99 GSZY T203、303 ⑩
004	wide-lipped and flat-based *weng*	rim	2000 GSGg H103 (T3008)
005	wide-lipped and flat-based *weng*	rim	2000 GSGg H103 (T3008)
006	wide-lipped and flat-based *weng*	rim	2000 GSGg H103 (T3008)
007	wide-lipped and flat-based *weng*	rim	2000 GSGg H103 (T3008)

5. Zhonghai guoji Commune site 2 (ca. 1500- 1400 BC)

No	Pottery type	Sherd type	Source of sample
001	tubular lid handle	handle	04CJGII H25 ②
002	tubular lid handle	handle	04CJGII H26 ④
003	∞-shaped lid handle	handle	04CJGII H26 ③

004	∞-shaped lid handle	handle	04CJGII H26 ④
005	long-necked and flat-based *guan*	rim	04CJGII H26 ③
006	long-necked and flat-based *guan*	rim	04CJGII H26 ④
007	small flat-based *guan*	rim	04CJGII H26 ④
008	small flat-based *guan*	rim	04CJGII H26 ④
009	small flat-based *guan*	rim	04CJGII H26 ④
010	small flat-based *guan*	rim	04CJGII H26 ③
011	small flat-based *guan*	rim	04CJGII H26 ③
012	high-stemmed *dou*	handle	04CJGII H25 ①

6. Sanxingdui (ca. 1500-1300 BC)

No	Pottery type	Sherd type	Source of sample
001	small flat-based *guan*	rim	99 GSZY T004 ⑨
002	small flat-based *guan*	rim	99 GSZY T301 ⑨
003	small flat-based *guan*	rim	99 GSZY T004 ⑧
004	small flat-based *guan*	rim	99 GSZY T004 ⑧
005	wide-lipped and flat-based *weng*	rim	2000 GSGg H124
006	wide-lipped and flat-based *weng*	rim	2000 GSGg H124
007	wide-lipped and flat-based *weng*	rim	99 GSZY T301 ⑨
008	wide-lipped and flat-based *weng*	rim	99 GSZY T301 ⑨

7. Zhonghai guoji Commune site 4 (ca. 1100-1000 BC)

No	Pottery type	Sherd type	Source of sample
001	long-necked and flat-based *guan*	rim	04CJGIV T114 ⑤
002	long-necked and flat-based *guan*	rim	04CJGIV T114 ⑤
003	long-necked and flat-based *guan*	rim	04CJGIV T11 ⑤

8. Lanyuan (ca. 1000-900 BC)

No	Pottery type	Sherd type	Source of sample
001	pointed-based *zhan*	base	01CQJII T2939 ⑥
002	pointed-based *zhan*	rim	01CQJII T2939 ⑥
003	pointed-based *zhan*	rim	01CQJII T2829 ⑥
004	pointed-based *zhan*	base	01CQJII T2829 ⑥
005	small flat-based *guan*	rim	01CQJII T3028 ⑥
006	small flat-based *guan*	rim	01CQJII T3028 ⑥
007	long-necked and flat-based *guan*	rim	01CQJII T2842 ⑥
008	long-necked and flat-based *guan*	rim	01CQJII T2833 ⑥
009	long-necked and flat-based *guan*	rim	01CQJIIT 2929 ⑥
010	long-necked and flat-based *guan*	rim	01CQJII T2925 ⑥

011	long-necked and flat-based *guan*	rim	01CQJII T2927 ⑥

9. Sanhe huayuan (ca. 900-800 BC)

No	Pottery type	Sherd type	Source of sample
001	pointed-based *bei*	base	99CHS H43
002	pointed-based *zhan*	rim	99CHS H147
003	pointed-based *zhan*	rim	99CHS H147
004	pointed-based *zhan*	rim	99CHS H147
005	pedestal-shaped pot support	rim	99CHS Y1
006	pedestal-shaped pot support	rim	99CHS Y1
007	long-necked and flat-based *guan* (kiln waster)	rim	99CHS Y1
008	long-necked and flat-based *guan* (kiln waster)	rim	99CHS Y1
009	long-necked and flat-based *guan* (kiln waster)	rim	99CHS Y1
010	lid	rim	99CHS H147
011	lid	rim	99CHS H147

10. Guoji huayuan (ca. 900-750 BC)

No	Pottery type	Sherd type	Source of sample
001	lipped *guan*	rim	2004 CJJVII T1246 ⑤
002	lipped *guan*	rim	2004 CJJVII T1348 ⑤
003	pointed-based *bei*	base	2004 CJJVII T1169 ⑤
004	lipped *weng*	rim	2004 CJJVII T1049 ⑤
005	lipped *weng*	rim	2004 CJJVII T1153 ⑤
006	lipped *weng*	rim	2004 CJJVII T1246 ⑤
007	lipped *weng*	rim	2004 CJJVII T1246 ⑤
008	lipped *weng*	rim	2004 CJJVII T1246 ⑤
009	long-necked *gui*	rim	2004 CJJVII T1349 ⑤
010	long-necked *gui*	rim	2004 CJJVII T1154 ⑤
011	long-necked *gui*	rim	2004 CJJVII T1154 ⑤
012	long-necked *gui*	rim	2004 CJJVII T1157 ⑤

Table 5.3: The results of petrographic point counting. 1000 points counted per sample.

1. Zhixin Jinshayuan (ca. 2500-2000 BC)

No.	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)
001	104	3	3	97	63	660	22	0	0	0	0	0	48
002	75	16	20	70	51	696	23	0	0	0	0	0	49
003	59	8	2	38	16	770	30	0	3	5	0	0	69
004	76	3	5	50	127	678	18	2	0	1	0	1	39
005	119	2	0	62	107	659	13	0	0	3	0	0	35

(a): quartz; (b): feldspar; (c): granite; (d): other igneous rock; (e): void; (f): clay matrix; (g): metasandstone; (h): slate; (i): schist; (j): pyroxene; (k): mica; (l): hornblende; (m): iron-rich concretion.

2. Meiyuan Northeast (ca. 2500-2000 BC)

No.	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)
001	101	9	7	59	71	700	16	0	2	1	0	1	33
002	89	1	4	66	143	679	4	0	0	2	0	0	12
003	92	6	2	48	35	708	35	0	0	0	0	0	74
004	122	2	0	57	49	685	25	0	0	2	0	2	56
005	59	1	0	39	93	591	71	0	0	1	1	0	144
006	94	25	33	33	36	712	21	0	0	2	0	0	44
007	99	14	6	22	38	705	37	0	0	3	0	0	86
008	72	18	12	17	39	745	31	4	0	0	0	0	62
009	93	33	11	81	117	655	3	0	0	1	0	1	5

(a): quartz; (b): feldspar; (c): granite; (d): other igneous rock; (e): void; (f): clay matrix; (g): metasandstone; (h): slate; (i): schist; (j): pyroxene; (k): mica; (l): hornblende; (m): iron-rich concretion.

3. Baodun (ca. 2500-2000)

No.	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)
001	56	15	7	74	65	672	32	2	1	0	0	3	73
002	64	22	12	94	57	702	14	0	3	2	0	0	30
003	86	12	23	57	103	635	29	0	4	0	2	0	49

004	75	17	31	82	51	607	41	2	0	5	3	3	83
005	82	18	9	62	77	664	24	1	5	3	0	5	50
006	74	24	12	89	39	673	28	0	3	0	0	2	56
007	92	34	17	58	58	703	12	0	0	0	0	0	26
008	89	15	21	63	69	653	25	2	0	5	4	4	50
009	87	9	16	46	77	638	38	0	4	2	6	1	76
010	116	15	19	63	92	634	18	0	0	0	0	5	38
011	76	25	25	47	78	670	19	6	2	3	7	3	39
012	89	7	9	54	73	657	31	0	3	8	0	6	63
013	94	12	23	48	58	712	15	1	0	2	3	0	32
014	96	8	31	65	57	646	25	5	3	6	0	6	52
015	84	14	21	76	44	698	17	1	2	4	2	1	36

(a): quartz; (b): feldspar; (c): granite; (d): other igneous rock; (e): void; (f): clay matrix; (g): metasandstone; (h): slate; (i): schist; (j): pyroxene; (k): mica; (l): hornblende; (m): iron-rich concretion.

4. Sanxingdui (ca. 1700-1500 BC)

No.	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)
001	62	67	18	15	67	759	1	0	0	5	0	0	5
002	37	5	1	34	47	862	2	8	0	0	0	0	4
003	64	76	14	26	62	743	3	0	0	0	1	0	11
004	27	47	29	25	47	784	10	0	0	0	0	0	31
005	36	31	44	19	48	732	21	2	0	3	0	0	64
006	29	29	28	16	24	820	12	0	0	3	3	0	36
007	60	29	23	26	22	740	32	0	0	2	0	0	66

(a): quartz; (b): feldspar; (c): granite; (d): other igneous rock; (e): void; (f): clay matrix; (g): metasandstone; (h): slate; (i): schist; (j): pyroxene; (k): mica; (l): hornblende; (m): iron-rich concretion.

5. Zhonghai guoji Commune site 2 (ca. 1500- 1400 BC)

No.	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)
001	81	5	3	17	39	782	32	0	0	0	0	0	41
002	57	1	0	15	47	771	52	0	0	1	0	0	56
003	37	0	0	18	13	765	95	0	0	0	0	0	72

004	254	0	1	10	260	460	6	0	0	0	0	0	9
005	29	0	0	12	165	725	24	0	0	16	1	0	28
006	81	4	6	48	128	623	46	0	4	1	0	0	59
007	24	2	0	18	48	727	120	0	0	2	0	0	59
008	14	0	0	12	32	760	103	1	0	0	0	0	78
009	52	7	2	18	24	810	59	0	0	1	0	0	27
010	16	0	2	15	95	716	102	0	0	0	0	0	54
011	28	0	0	13	33	838	46	0	0	1	0	0	41
012	25	0	0	29	25	781	79	0	0	0	0	0	61

(a): quartz; (b): feldspar; (c): granite; (d): other igneous rock; (e): void; (f): clay matrix; (g): metasandstone; (h): slate; (i): schist; (j): pyroxene; (k): mica; (l): hornblende; (m): iron-rich concretion. Samples 004 and 005 were partially over-ground during thin section preparation, and hence not all inclusions could be identified.

6. Sanxingdui (ca. 1500-1300 BC)

No.	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)
001	69	40	7	18	71	701	94	44	0	0	0	0	50
002	40	17	10	19	26	804	24	0	0	2	3	0	55
003	26	31	9	4	48	866	0	0	0	0	1	0	15
004	21	25	20	15	31	755	57	0	0	4	0	0	72
005	70	25	37	6	22	805	12	0	0	2	0	0	21
006	44	26	33	22	39	813	4	0	0	0	0	0	19
007	57	58	20	33	67	763	2	0	0	0	0	0	0
008	29	31	9	39	75	776	30	0	0	2	0	0	9

(a): quartz; (b): feldspar; (c): granite; (d): other igneous rock; (e): void; (f): clay matrix; (g): metasandstone; (h): slate; (i): schist; (j): pyroxene; (k): mica; (l): hornblende; (m): iron-rich concretion.

7. Zhonghai guoji Commune site 4 (ca. 1100-1000 BC)

No.	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)
001	81	0	2	39	74	665	102	0	0	0	0	0	37
002	50	0	0	43	202	609	65	0	0	1	0	0	30
003	50	1	7	48	93	755	17	2	0	1	0	0	26

(a): quartz; (b): feldspar; (c): granite; (d): other igneous rock; (e): void; (f): clay matrix; (g): metasandstone; (h): slate; (i): schist; (j): pyroxene; (k): mica; (l): hornblende; (m): iron-rich concretion. Sample 002 was partially were partially over-ground during thin section preparation, and hence not all inclusions could be identified.

8. Lanyuan (ca. 1000-900 BC)

No.	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)
001	114	1	0	89	82	701	2	0	0	0	0	0	11
002	137	1	1	74	31	722	19	0	0	2	0	4	9
003	73	0	1	56	48	693	41	1	2	0	0	0	85
004	120	1	2	44	21	723	30	0	0	5	0	0	54
005	61	2	2	58	18	800	16	0	0	1	0	0	42
006	38	2	2	20	51	731	67	0	0	2	0	0	87
007	68	1	0	34	133	679	32	0	3	0	1	0	49
008	107	8	15	25	25	776	37	0	3	1	0	0	3
009	45	64	10	55	11	801	13	0	0	1	0	0	0
010	97	1	0	73	72	680	68	0	1	0	0	0	8
011	53	1	0	59	167	639	70	0	0	1	1	0	9

(a): quartz; (b): feldspar; (c): granite; (d): other igneous rock; (e): void; (f): clay matrix; (g): metasandstone; (h): slate; (i): schist; (j): pyroxene; (k): mica; (l): hornblende; (m): iron-rich concretion.

9. Sanhe huayuan (ca. 900-800 BC)

No.	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)
001	87	21	19	74	128	625	12	0	0	0	1	0	33
002	61	32	10	42	97	724	23	3	0	0	0	0	8
003	69	33	14	43	26	752	26	2	0	2	0	0	33
004	64	20	0	49	148	639	34	0	0	0	0	0	46
005	56	27	18	32	159	648	18	4	0	3	0	0	35
006	52	16	26	28	103	749	6	0	0	0	0	0	20
007	26	30	12	44	36	718	41	0	0	6	4	0	83
008	96	11	21	30	80	731	11	0	0	0	0	0	20
009	118	25	45	31	81	665	5	0	0	5	1	0	24
010	50	10	5	45	85	782	7	9	0	3	0	0	4

011	48	40	6	47	1	757	45	0	0	3	0	0	53

(a): quartz; (b): feldspar; (c): granite; (d): igneous rock; (e): void; (f): clay matrix; (g): metasandstone; (h): slate; (i): schist; (j): pyroxene; (k): mica; (l): hornblende; (m): iron-rich concretion.

10. Guoji huayuan (ca. 900-750 BC)

No.	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)
001	34	27	32	47	68	763	19	0	2	0	0	0	8
002	61	35	8	48	65	753	12	0	0	0	0	0	18
003	29	25	26	57	168	694	0	1	0	0	0	0	0
004	55	31	32	33	48	756	27	0	0	0	1	0	17
005	38	2	0	25	98	792	15	2	2	0	0	0	26
006	87	14	5	64	64	715	39	2	0	0	1	2	7
007	67	0	12	67	120	660	63	0	0	0	1	1	9
008	46	22	9	48	48	789	13	0	0	0	0	2	23
009	53	2	12	42	114	715	26	0	0	1	0	0	35
010	49	5	9	39	27	763	46	0	0	1	0	1	60
011	59	6	2	37	143	639	73	0	0	0	0	1	40
012	87	3	0	32	44	763	45	0	0	0	0	7	19

(a): quartz; (b): feldspar; (c): granite; (d): igneous rock; (e): void; (f): clay matrix; (g): metasandstone; (h): slate; (i): schist; (j): pyroxene; (k): mica; (l): hornblende; (m): iron-rich concretion. Sample 003 was partially over-ground during thin section preparation, hence the high number of voids.

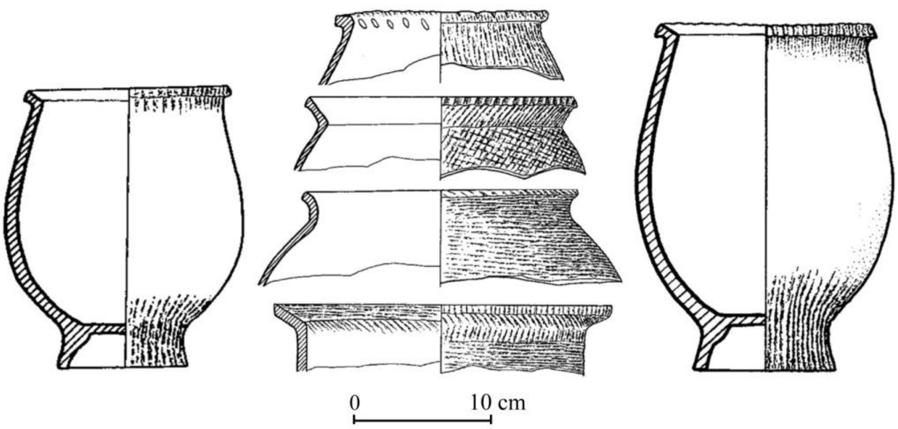


Figure 5.20: Cord-marked *guan* with notched rims (redrawn after CMICRA, DHSU and IYRWU 2000, with modifications).

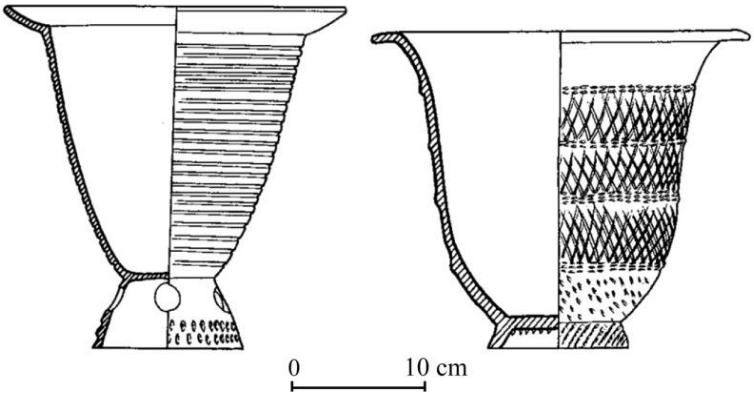


Figure 5.21: Ring-footed *zun* with dished rim (left) and horizontal flared rim (right) (redrawn after CMICRA, DHSU and IYRWU 2000, with modifications).

Figure 5.22: Wide-lipped and flat-based *weng* (after SPICRA *et al.* 2009:364).

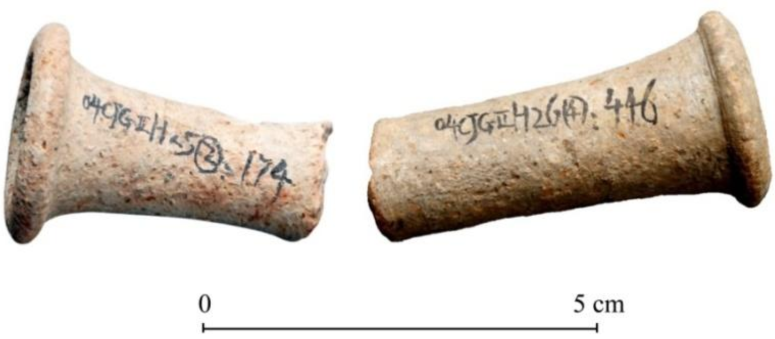


Figure 5.23: Tubular lid handles from Zhonghai guoji Commune site 2.

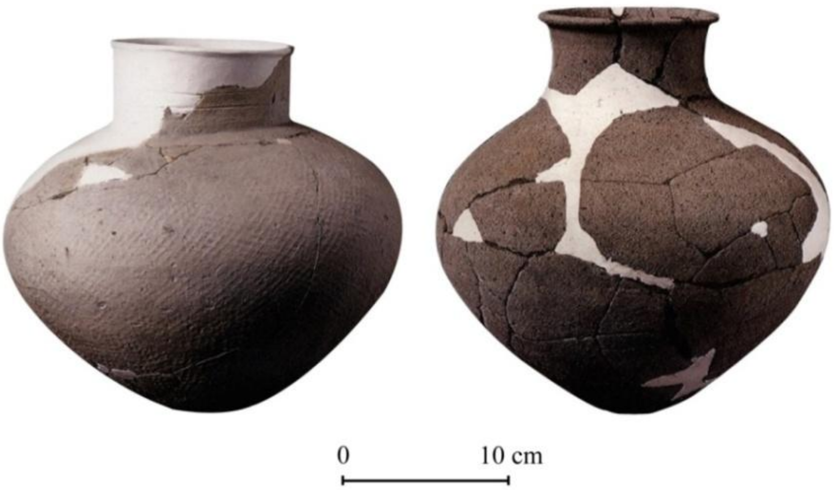
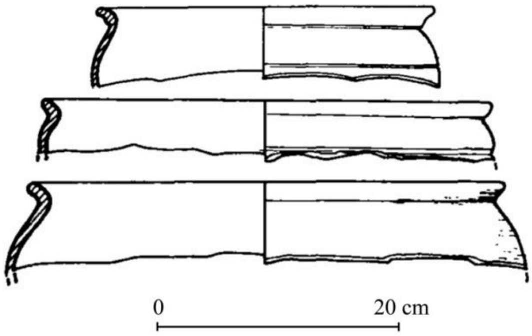


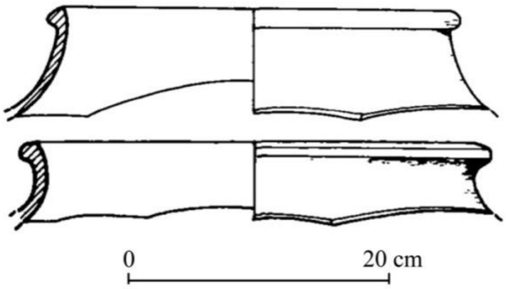
Figure 5.24: Long-necked and flat-based *guan* (after SPICRA *et al.* 2009:340-1)

Figure 5.25: Pedestal-shaped pot support (after SPICRA *et al.* 2009:425).



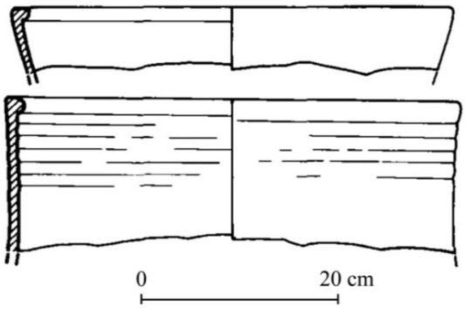
<table>
<tr><td colspan="2">Guoji huayuan 001</td></tr>
<tr><td></td><td></td></tr>
<tr><td>exterior surface</td><td>interior surface</td></tr>
<tr><td colspan="2">Guoji huayuan 002</td></tr>
<tr><td></td><td></td></tr>
<tr><td>exterior surface</td><td>interior surface</td></tr>
</table>

Figure 5.26: Lipped *guan* rims and two examples from Guoji huayuan, Jinsha (after Zhou Zhiqing *et al.* 2006).



Guoji huayuan 004: lipped *weng*	
	
exterior surface	interior surface

Figure 5.27: Lipped *weng* rims and an example from Guoji huayuan, Jinsha (after Zhou Zhiqing *et al.* 2006).

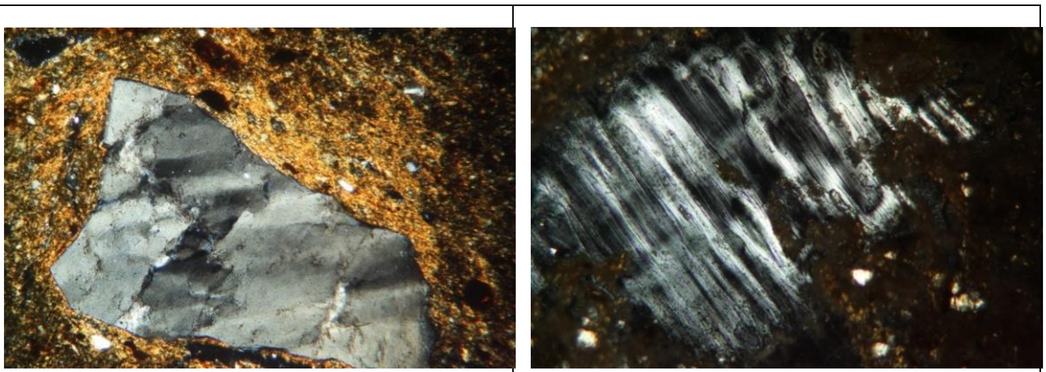


Guoji huayuan 009: long-necked *gui*	
	
exterior surface	interior surface

Figure 5.28: Long-necked *gui* rims and an example from Guoji huayuan, Jinsha (after Zhou Zhiqing *et al.* 2006).

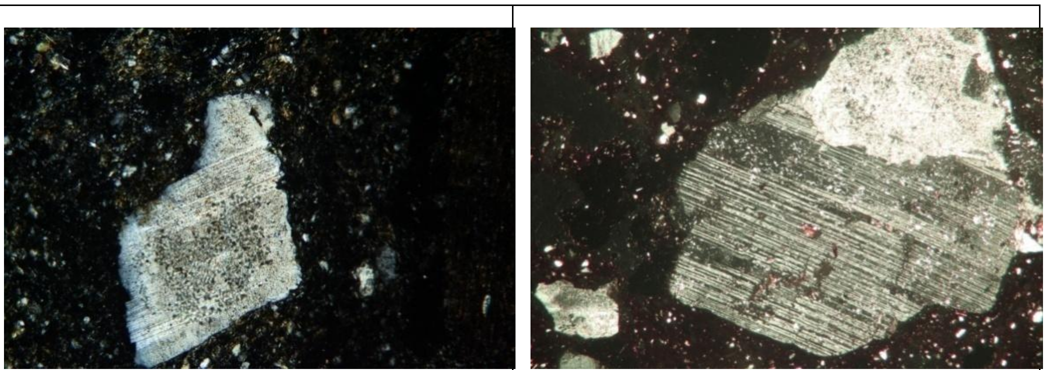
The petrographic observations suggest that the 93 sherds selected for point counting are generally similar in their mineral and rock fragment temper inclusions, which include monocrystalline quartz, feldspar, mica and other opaque minerals, as well as fragments of polycrystalline quartz, microcrystalline quartz, metasandstone, schist, granite, and other igneous rocks (Figures 5.29 to 5.39). The proportions of the clay matrix between the inclusions range from 60% to 80%, with a few outliers exceeding 85%. These observations parallel those from a separate petrographic examination of 4 pottery samples excavated at Baodun (CMICRA *et al.* 2000:206-7).

The elongated grains and voids observed in the thin-sections are frequently oriented in parallel, and the iron-rich concretions tend to be round and are usually mixed with tiny grains of quartz sand. The overall fabrics of the total of 93 thin-sectioned samples range from very fine, containing only small volumes of silty sand (Figure 5.40), to very coarse, loosely bonding many large inclusions that were poorly sorted. In general, the thicker the sherds, the more and larger the inclusions. Mostly of quartz and feldspar, the large inclusions are usually angular and poorly sorted. It is possible that some of the voids result from burning out of organic materials during manufacture or dislodging of temper during thin-section preparation.



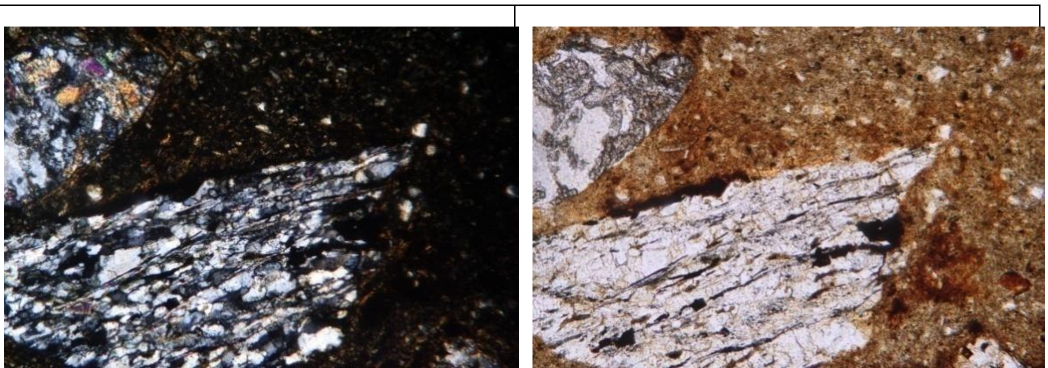
Crossed nicols	Crossed nicols

Figure 5.29: Thin-section micrographs of a large grain of monocrystalline quartz, Guoji huayuan 006 (left) and 005 (right).



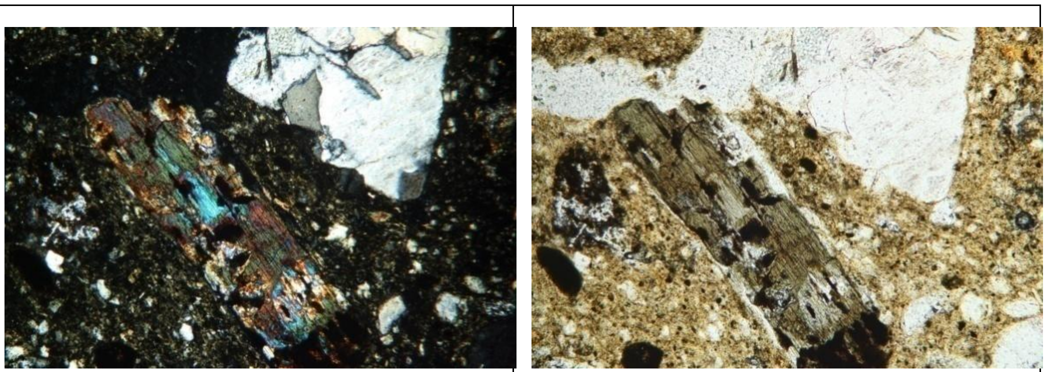
Crossed nicols	Crossed nicols

Figure 5.30: Thin-section micrographs of large feldspar grains, Guoji huayuan 005 (left) and Sanxingdui 005 (right).



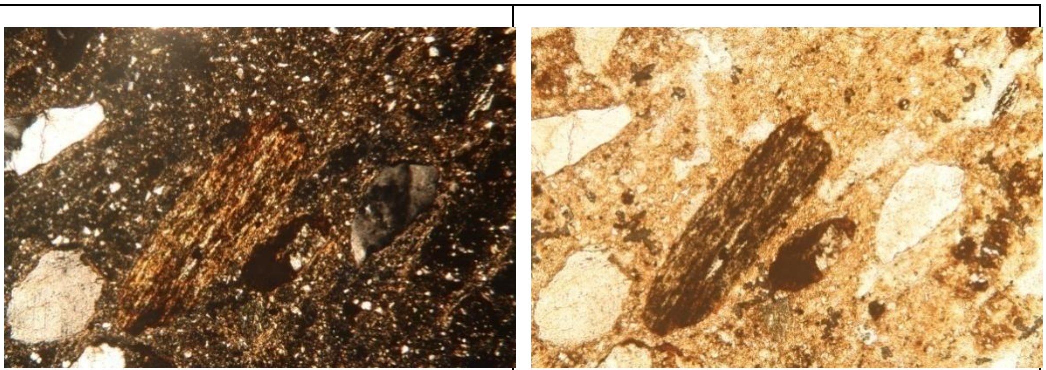
Crossed nicols	Open nicols

Figure 5.31: Thin-section micrographs of a large granite fragment, Guoji huayuan 005.



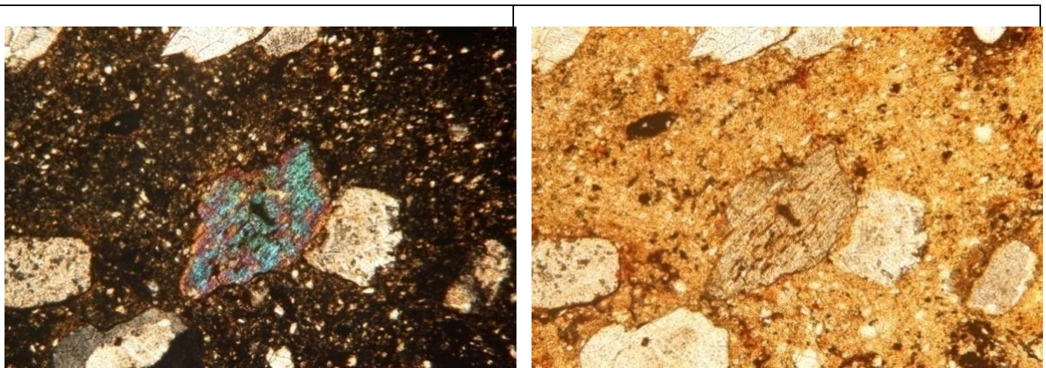
Crossed nicols	Open nicols

Figure 5.32: Thin-section micrographs of an amphibole grain (the elongated structure), Guoji huayuan 005.



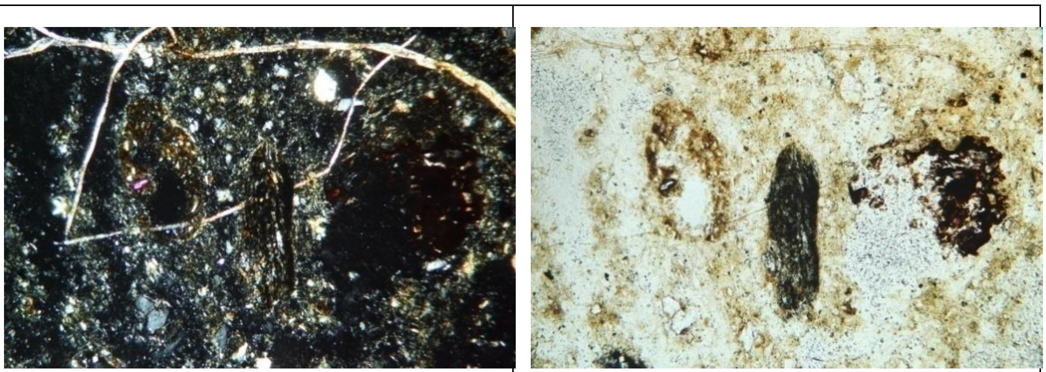
Crossed nicols	Open nicols

Figure 5.33: Thin-section micrographs of a grain of fine schist (centered), Baodun 005.



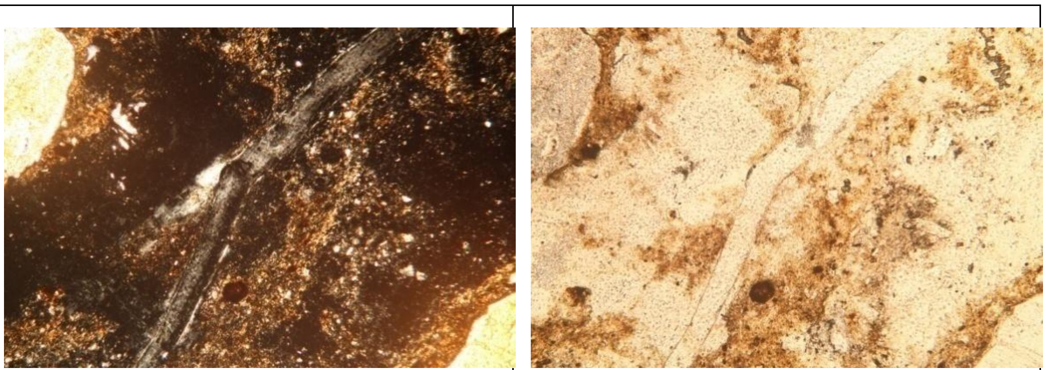
Crossed nicols	Open nicols

Figure 5.34: Thin-section micrographs of a pyroxene grain (centered), Baodun 005.



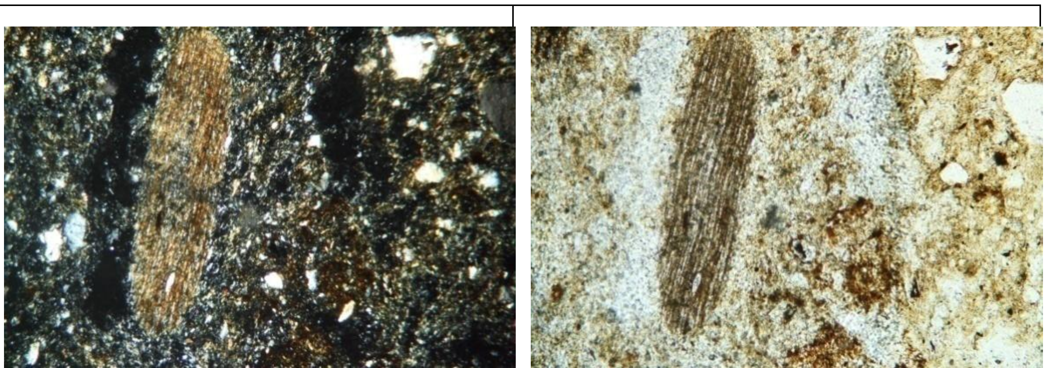
Crossed nicols	Open nicols

Figure 5.35: Thin-section micrographs of muscovite mica (needle-shaped structures), Guoji huayuan 007.



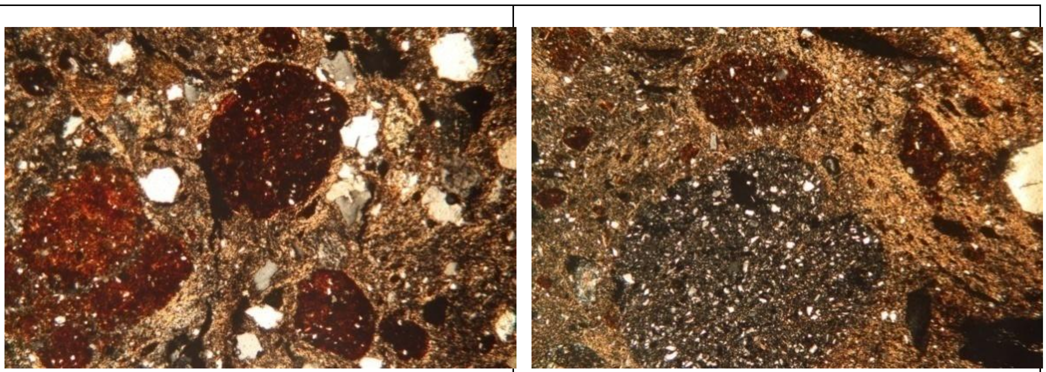
Crossed nicols	Open nicols

Figure 5.36: Thin-section micrographs of biotite mica (needle-shaped structures), Baodun 004.



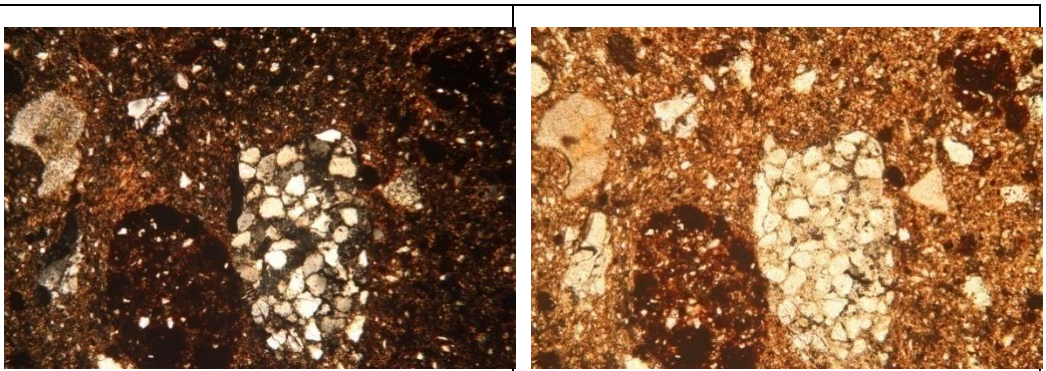
Crossed nicols	Open nicols

Figure 5.37: Thin-section micrographs of a piece of slate (centre-left), Guoji huayuan 005.



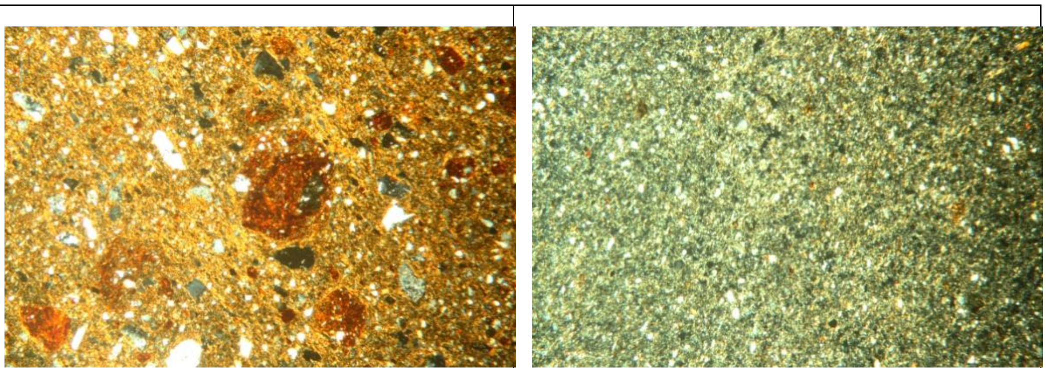
Crossed nicols	Crossed nicols

Figure 5.38: Thin-section micrographs of iron-rich concretions, Meiyuan Northeast 005.



Crossed nicols	Open nicols

Figure 5.39: Thin-section micrographs of a large sand clast (centre-right), Meiyuan Northeast 005.



Crossed nicols	Crossed nicols

Figure 5.40: Thin-section micrographs of Sanxingdui fine pottery, dominated by silty sands.

Through a comparison with 6 surface-collected soil samples from locations in Chengdu City, Pengzhou City, Chongzhou City, and Guanghan county, and by inference from the geological setting of the Sichuan basin and its surroundings, it is highly likely that all this pottery was produced using indigenous temper sands transported by the Min and Tuo rivers from western Sichuan into the Chengdu Plain. The middle segment of the Longmen and Qionglai ranges through which these rivers flow is the nearest granite zone to the Chengdu Plain.

5.7 Statistical analysis of the proportion of non-plastics inclusions

In order to examine the issue of standardization of fabric composition, it is not necessary to survey quantitatively each kind of mineral inclusion on the basis of petrographic point counting since ancient potters would have selected their materials on the basis of some obvious physical property, rather than exact mineralogical content (D. Arnold 2000:364; Rice 1987:118-9). Precise mineralogical composition is more important for studies of raw material origin (D. Arnold 1985:21; Rye 1976, 1981:32-6). However, it is to be expected that specialized potters would have paid more attention than household ones to preparing standardized textures, both to mass produce certain types of vessel, and to reduce risk of loss in firing (Rice 1984; 1987:201; 1996).

The texture of an unfired pot is mainly influenced by the proportion, size and shape characteristics of its non-plastic inclusions (Rice 1987:72). The statistical analysis that follows examines the proportion of non-plastics in the thin-sections derived from petrographic point counting. Coefficient of variation (CV) is used to express the degree of standardization. This is a robust statistical technique used commonly for comparing degrees of standardization in samples of artefacts (Vanpool and Leonard 2011:55). It is defined as the standard deviation divided by the sample mean, often multiplied by 100 and expressed as a percentage.

Taking cord-marked *guan* with decorated rims (ca. 2500- 2000 BC), for example, (see Tables 5.2, 5.3 and 5.4), there are 15 examples of this type of vessel from Zhixin Jinshayuan 001-005, Meiyuan Northeast 006-009, and Baodun 001-005. The total number of non-plastics and voids in each sample is added, and the mean and standard deviation for the whole group are calculated. Then, the CV is obtained by dividing the standard deviation (45.89) by the mean (323.4). To express as a percentage, the CV is multiplied by 100 and rounded to one decimal point.

There are 19 pottery vessel types available for statistical analysis, and their CVs for the proportions of inclusions plus voids are listed in table 5.4. Statisticians have determined that the CV is a biased estimate in small samples (usually under 30), and that they should be corrected using the equation 'Corrected CV = (1+1/4n)*CV' (n= sample size) (Vanpool and Leonard 2011:55-6). This is done in the following tables.

Table 5.4: CV analysis of numbers of non-plastics plus voids in thin-sections of 19 dated pottery vessel types.

Type 1: Cord-marked *guan* with decorated rims (ca. 2500-2000 BC).

Sample size	15	Zhixin Jinshayuan 001~005, Meiyuan Northeast 006~009 and Baodun 001~005.
Mean	323.4	
Standard deviation	45.89	
CV	14.2%	
Corrected CV	14.4%	

Type 2: Flared mouth and ring-footed *zun* (ca. 2500-2000 BC).

Sample size	9	Meiyuan Northeast 001~004 and Baodun 011~015.
Mean	316.1	
Standard deviation	21.6	
CV	6.8%	
Corrected CV	7%	

Type 3: Dish-shaped mouth and ring-footed *zun* (ca. 2500-2000 BC).

Sample size	5	Baodun 006~010.
Mean	339.8	
Standard deviation	25.4	
CV	7.5%	
Corrected CV	7.9%	

Type 4: Small flat-based *guan* (ca. 1700-1500 BC).

Sample size	3	Sanxingdui 001~003.
Mean	212	
Standard deviation	52.7	
CV	24.9%	
Corrected CV	27%	

Type 5: Wide lipped and flat-based *weng* (ca. 1700-1500 BC).

Sample size	4	Sanxingdui 004~007.
Mean	231	
Standard deviation	35.5	
CV	15.4%	
Corrected CV	16.4%	

Type 6: Small flat-based *guan* (ca. 1500-1300 BC).

Sample size	9	Zhonghai guoji Commune site 2 007~011 and Sanxingdui 001~004.
Mean	224.8	
Standard deviation	54	
CV	24%	
Corrected CV	24.7%	

Type 7: Wide lipped and flat-based *weng* (ca. 1500-1300 BC).

Sample size	4	Sanxingdui 005~008.
Mean	210.8	
Standard deviation	20.5	
CV	9.7%	
Corrected CV	10.3%	

Type 8: Tubular lid handles (ca. 1500-1300 BC).

Sample size	2	Zhonghai guoji Commune site 2 001~002.
Mean	223.5	
Standard deviation	5.5	

CV	2.50%	
Corrected CV	2.8%	

Type 9: Long necked and flat-based *guan* (ca. 1100-1000 BC).

Sample size	2	Zhonghai guoji Commune site 4 001 and 003.
Mean	290	
Standard deviation	45	
CV	15.5%	
Corrected CV	17.4%	

Type 10: Pointed-based *zhan* (ca.1000-900 BC).

Sample size	4	Lanyuan 001~004.
Mean	290.25	
Standard deviation	13.1	
CV	4.50%	
Corrected CV	4.8%	

Type 11: Small flat-based *guan* (ca. 1000-900 BC).

Sample size	2	Lanyuan 005~006.
Mean	234.5	
Standard deviation	34.5	
CV	14.7%	
Corrected CV	16.5%	

Type 12: Long necked and flat-based *guan* (ca. 1000-900 BC).

Sample size	5	Lanyuan 007~011.
Mean	285	
Standard deviation	62.3	
CV	21.9%	
Corrected CV	23%	

Type 13: Pointed-based *zhan* (ca. 900-800 BC).

Sample size	3	Sanhe huayuan 002~004.
Mean	295	
Standard deviation	48	
CV	16.3%	
Corrected CV	17.7%	

Type 14: Ring-footed pedestal (kiln wasters) (ca. 900-800 BC).

Sample size	2	Sanhe huayuan 005~006.
Mean	301.5	

Standard deviation	50.5	
CV	16.8%	
Corrected CV	18.9%	

Type 15: Long necked and flat-based *guan* (kiln waster) (ca. 900-800 BC).

Sample size	3	Sanhe huayuan 007~009.
Mean	295.3	
Standard deviation	28.5	
CV	9.7%	
Corrected CV	10.5%	

Type 16: Lid (ca. 900-800 BC).

Sample size	2	Sanhe huayuan 010~011.
Mean	230.5	
Standard deviation	12.5	
CV	5.4%	
Corrected CV	6.1%	

Type 17: Lipped *guan* (ca. 900-750 BC).

Sample size	2	Guoji huayuan 001~002.
Mean	242	
Standard deviation	5	
CV	2.1%	
Corrected CV	2.4%	

Type 18: Lipped *weng* (ca. 900-750 BC).

Sample size	5	Guoji huayuan 004~008.
Mean	257.6	
Standard deviation	49.7	
CV	19.3%	
Corrected CV	20.3%	

Type 19: Long-necked *gui* (ca. 900-750 BC).

Sample size	4	Guoji huayuan 009~012.
Mean	280	
Standard deviation	50.7	
CV	18.1%	
Corrected CV	19.2%	

5.8 Discussion

There is no absolute threshold to determine whether a group of artefacts shows standardization (Rice 1996:179). However, Eerkens and Bettinger (2001) focused upon two threshold CV values, 1.7 and 57.7, in their assessment of maximal and minimal degrees of standardization in artefact assemblages. A CV of 1.7% represents the limit of human ability to perceive a difference in size without an aid of physical standard, hence absolute standardization, whereas a CV of 57.7% suggests that production was random or completely unstandardized. According to Eerkens (2000), for most prehistoric artefact assemblages produced manually by multiple individuals, CV values below 4-5% will be markers of standardization, and values below 2-3% will possibly indicate situations in which craftmen were utilizing formal measurements, scales, or moulds. In contrast, CV values exceeding 57.7% will suggest intentional creation of variation, perhaps in situations where individual manufacturers were actively trying to differentiate their products from those of others, or examiners mistakenly mixing more than one type of artefact in their analysis (Longacre *et al.* 1988).

In general, the CV analysis of textural variability in the 19 vessel types suggests that pottery production on the Chengdu Plain between 2500 and 800 BC had no significant correlation with increasing social complexity. The CV values do not decrease in accordance with standardization over time, and indeed tend to be random. As stated by D. Arnold (2000:369-70) and Rice (1996:262), in most cases the compositional analyses of ceramic paste tells us more about the sources of raw material than about the organization of pottery production.

However, some surprisingly low CV values are identified for vessel types 8 (2.8%), 10 (4.8%), 16 (6.1%), and 17 (2.4%). These include the two tubular lid handles from Zhonghai guoji Commune site 2 (Figure 5.23), the four pointed-based *zhan* from Lanyuan (Figure 5.41), lids 010 and 011 from Sanhe huayuan (Figure 5.42), and the two lipped *guan* from Guoji huayuan (Figure 5.26). Except for the Lanyuan pointed-based *zhan* samples 003 and 004, all sherds of each type have a similar colour. The low CV values suggest that standardized pastes were prepared deliberately by experienced potters, but the small sample sizes make this interpretation still uncertain.

Lanyuan 001: pointed-based *zhan*	
	
exterior surface	interior surface

Lanyuan 002: pointed-based *zhan*	
	
exterior surface	interior surface

Lanyuan 003: pointed-based *zhan*	
	
exterior surface	interior surface

Lanyuan 004: pointed-based *zhan*	
	
exterior surface	interior surface

Figure 5.41: Rim and base sherds of pointed-based *zhan* unearthed at Lanyuan, Jinsha.

Sanhe huayuan 010: lid	
	
exterior surface	interior surface

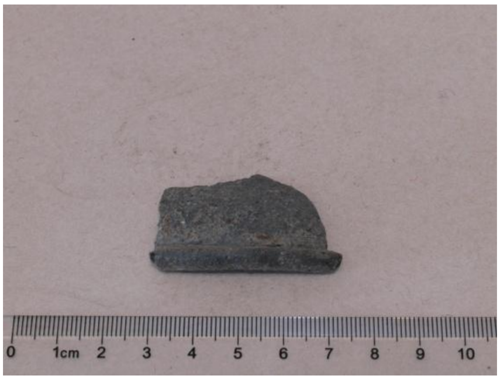
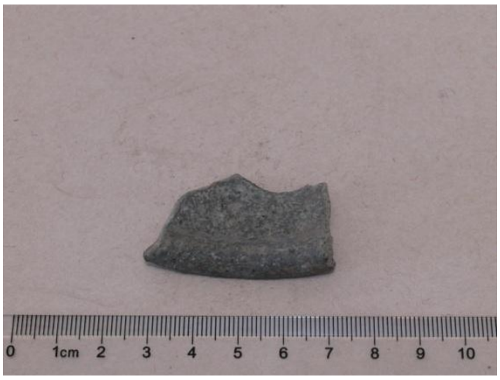
Sanhe huayuan 011: lid	
	
exterior surface	interior surface

Figure 5.42: Rim sherds of lids unearthed at Sanhe huayuan, Jinsha.

The two rim sherds from Sanhe huayuan are probably broken pieces of a single lid because they were both excavated together in trash pit H147. The two groups of sherds from Lanyuan were excavated from the same cultural layer (layer 6) in test pits (T2939 and T2829), and are similar in shape, colour, and texture. This raises the possibility that the low CV values reflect not standardization but the simple fact that all were produced by a single potter. Therefore, the CV analysis fails to provide conclusive evidence to support Rice's evolutionary model in the context of the Chengdu Plain (1981).

Indeed, ethnoarchaeological study has suggested that the factors that affect paste variability are multidimensional and multicausal (D. Arnold 2000). These include natural mineralogical variability in the raw materials, the number and distribution of raw material sources across the landscape, the perceptions of potters concerning suitable raw materials, and factors of land tenure and ownership (Rice 1996:190). Hence, the fairly random CV values of paste variability derived from this petrographic study are not very surprising.

5.9 Metrical analysis

To test Rice's (1981, 1987:202) evolutionary model of pottery production from another angle, the following study focuses on evaluating another potential indicator: degree of vessel standardization in shape and size. The vessels selected for analysis are the pointed-based *zhan* from many sites on the Chengdu Plain, especially those in the Jinsha site cluster, dating between 1100 and 800 BC. The selected variables are mouth diameter, vessel height, and the ratio of mouth diameter to vessel height. The coefficient of variation (CV) is computed and rounded to two decimal points because this value allows vessel groups that have different sample means and standard deviations to be compared with one another (Crown 1995; Longacre 1999). As with the temper analysis, for sample sizes under 30, CV values are corrected by computing the mathematical equation 'Corrected CV = (1+1/4n)*CV' (n= sample size) (Vanpool and Leonard 2011:55-6).

Because there were relatively few complete vessels preserved in the workstations at Beihu and Sanxingdui, and because nearly all of the broken and unmatched sherds from past excavations have been discarded, my dataset relies mostly on information from site reports.

To assess whether differences in CV values for the above three variables exist for each vessel type, and are significant at a given level, a number of statistical techniques can be used. These include ANOVA (*F*-test), *Q*-tests, *posteriori* tests, and homogeneity of variance (HOV) tests (P. Arnold 1991b; Arnold and Nieves 1992; Benco 1988; Kvamme *et al.* 1996; Longacre *et al.* 1988; Roux 2003; Sinopoli 1988; B. Stark 1995; Underhill 2003). However, these tests assume that the underlying sample populations have normal distributions and approximately equal means, but this does not hold in most archaeological situations (Eerkens and Bettinger 2001; Guo Meng 2013; B. Stark 1995). Therefore, the same CV boundaries of 1.7% and 57.7% suggested by Eerkens and Bettinger (2001) to infer the degrees of standardization versus deliberate non-standardization in the tempers are also utilized here.

Before proceeding further, it is necessary to describe the chosen analytical unit, the pointed-based *zhan.* Chinese archaeologists use a traditional set of terms which originate from ancient texts and modern usage to designate shape classes of containers in a variety of raw materials. Some terms date to the Song Dynasty (AD 920-1279) (An Zhimin 1953: 73; Chang Kwangchih 1981). The term *zhan* has been used for more than 1000 years, specifically meaning a wine container (HYDCD 2002:752; Wang Li *et al.* 2000:778). This term was borrowed by Sichuan archaeologists to represent the bowl-shaped and pointed-based vessels excavated on the Chengdu Plain, mostly dating to the first millennium BC. From my observations of the available ceramic samples in the Sanxingdui and Beihu workstations, it seems that many pointed-based *zhan* were coiled vessels that were smoothed possibly using a slowly rotating hand wheel, because hairline cracks between coils are evident along parallel planes. The use of pointed-based *zhan* occurred in daily life, possible ritual settings, and burials.

Although the *zhan* have similar pointed or blunt bases, there is morphological variation in rims, necks and vessel shapes that has been noted by Chinese archaeologists. To facilitate the following analysis and to avoid lumping two or more discrete classes of vessel into a single category (Longacre *et al.* 1988), the pointed-based *zhan* are classified into 6 types. Excluding types 1 and 2, which have uncertain dates, their possible chronological distributions are illustrated in figure 5.43.

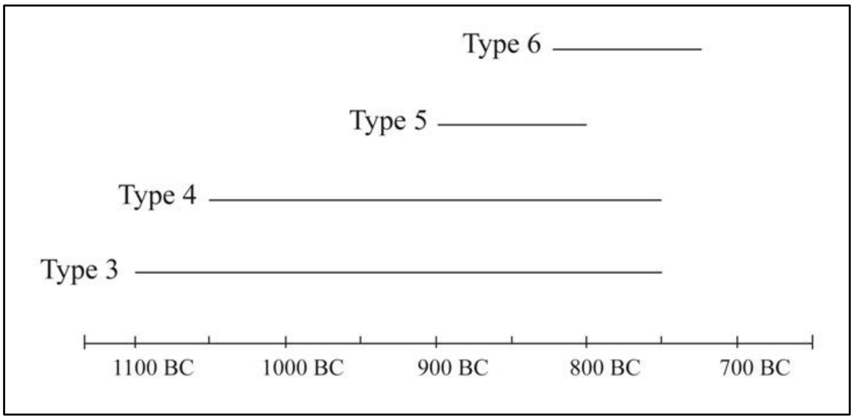


Figure 5.43: The chronological distributions of *zhan* of types 3-6 on the Chengdu Plain.

Type 1 *zhan* have unrestricted bow-shaped profiles, short everted lips, and nipple-shaped bases. The mouth diameters of these unrestricted vessels range between 10 and 15 cm, and heights between 4 and 6 cm. A total of 5 type 1 *zhan* were selected for metric analysis, from Sanxingdui pit K1, Shierqiao and Qingjiangcun (Jiang Zhanghua and Yan Jinsong 2001; SPICRA 1999:145-8; SPICRA and CMICRA 2009: 77-9). The shape of the Shierqiao layer 12 vessel is slightly different from the others in having a unrestricted bowl-shaped profile, a upturned direct rim, and a carination just below the lip. The dates of the 2 samples from Sanxingdui pit K1 are unknown, but the others appear to date loosely between 1100 and 900 BC (Figures 3.35, 5.44 and 5.45).

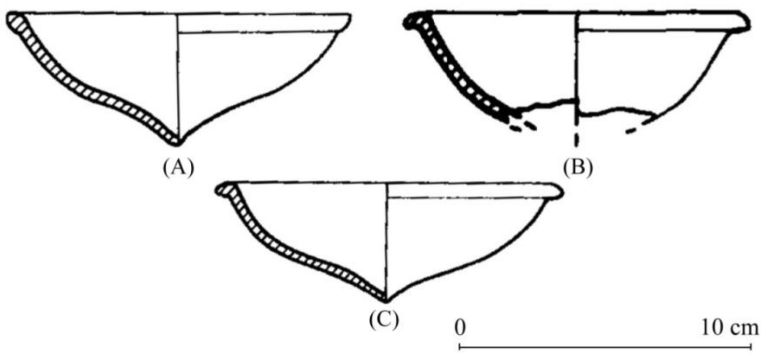


Figure 5.44: Type 1 *zhan* from Sanxingdui pit K1 (A and C) and Qingjiangcun (B) (after Jiang Zhanghua and Yan Jinsong 2001; SPICRA 1999:146, with modifications).

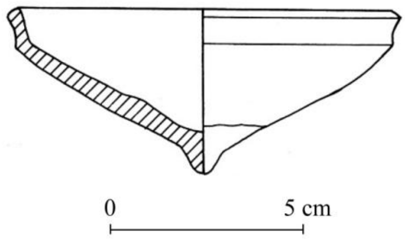
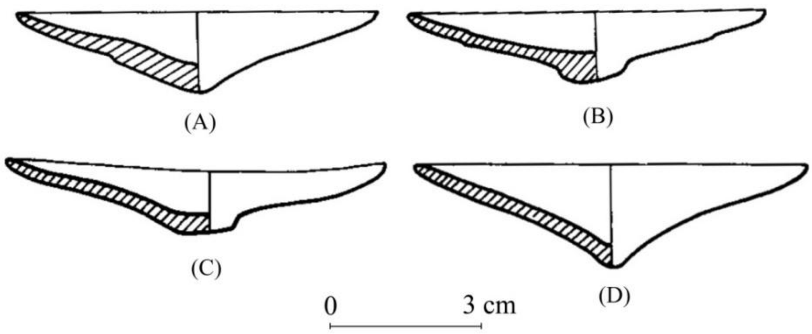


Figure 5.45: Carinated type 1 *zhan* from Shierqiao layer 12 (SPICRA and CMICRA 2009:79, with modification).

All the type 2 *zhan* are from Sanxingdui pit K1. They are shallow dish-shaped vessels with unrestricted profiles and straight direct rims, 7.5-8.5 cm in mouth diameter and 1-2 cm high (SPICRA 1999:145-9) (Figures 5.46 and 5.47). The dates of the type 2 *zhan* are also unknown, but probably postdate 1100 BC (see chapter 3).



Type 5.46 Type 2 *zhan* from Sanxingdui pit K1 (SPICRA 1999:146, with modifications).

Figure 5.47: Type 2 *zhan* from Sanxingdui pit K1

Type 3 *zhan* are restricted bowl-shaped vessels with incurved direct rims, fairly blunt bases, and curved shoulders (Figures 2.8 and 5.48). They were the longest in use, largest in quantity, and widest in distribution across the Chengdu Plain of all the types of *zhan*. The total of 71 selected for metric analyses belonged to three occupation phases: ca.1100-950 BC, 950-850 BC, and 850-750 BC. The average mouth diameter of the oldest group is about 1.5 cm larger than the youngest, but vessel heights underwent no significant change through time, ranging between 4.3 and 4.9 cm.

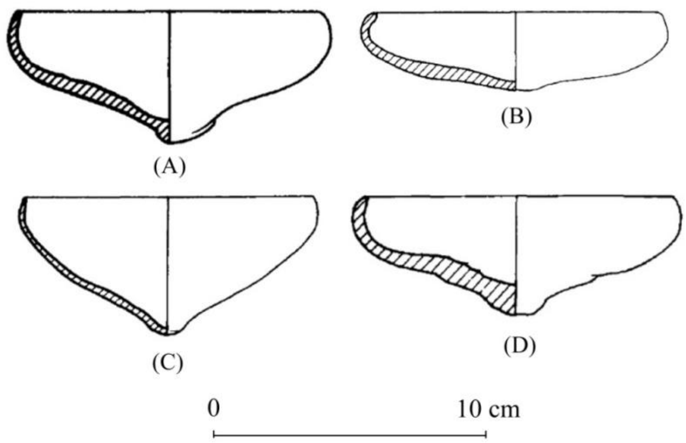


Figure 5.48: Type 3 *zhan* from (A) Sanhe huayuan, (B) Dafucun, (C) Furongyuan South, and (D) Xinyicun (after Chen Yunhong *et al.* 2009; Jiang Zhanghua *et al.* 2004; Liu Jun *et al.* 2005; Zhu Zhangyi and Liu Jun 2001, with modifications).

Type 4 *zhan* are also restricted and have an everted rim (Figure 5.49). They have the tallest average vessel height of all the *zhan* types. Their bases can be sharp or blunt, sometimes with redundant clay left attached, as commonly at Jinsha. Peaking in date between 950 and 750 BC, the type 4 *zhan* were possibly contemporary with the type 3 direct-rimmed *zhan*. No significant trends in mouth diameter and vessel height can be identified through time.

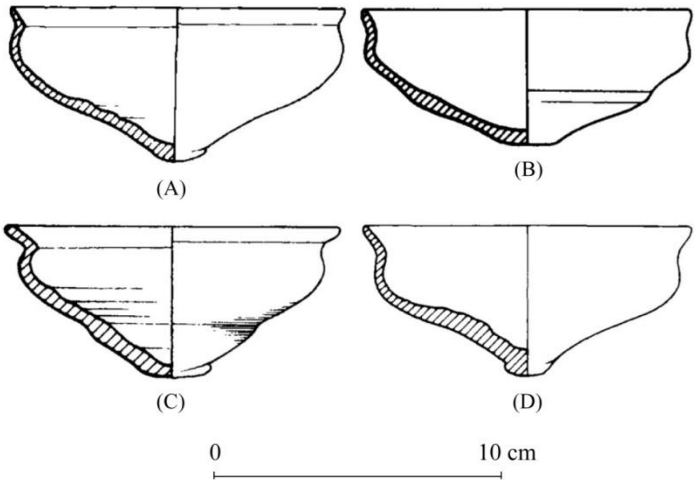


Figure 5.49: Type 4 *zhan* from sites of (A) Lanyuan, (B) Sanhe huayuan, (C) Xinhelu xiyanxian, and (D) Wanbo (after Chen Yunhong *et al.*2004; Wang Lin and Zhou Zhiqing 2010; Zhou Zhiqing *et al.* 2003; Zhu Zhangyi and Liu Jun 2001, with modifications).

Only 13 type 5 *zhan* were selected for analysis, from Xinyicun, Datang Telecommunication Phase II, and the Chief Equipment Supply Depot of the Department of Logistics (Jiang Ming *et al.* 2013; Jiang Zhanghua *et al.* 2004; Zhou Zhiqing *et al.* 2005a). Their dates range between 900 and 800 BC. The type 5 *zhan* are similar to type 3, but are distinguished by having a vertical direct rather than a restricted rim profile. Their mouth diameters are about 3 to 4 cm larger than those of type 3 (Figure 5.50).

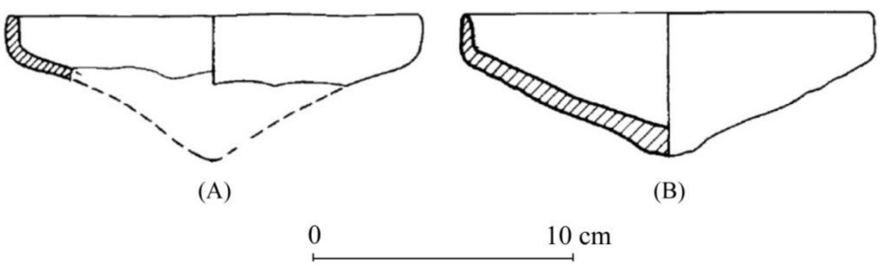


Figure 5.50: Type 5 *zhan* from (A) Datang Telecommunication Phase II and (B) Xinyicun (after Jiang Zhanghua *et al.* 2004; Zhou Zhiqing *et al.* 2005a, with modifications).

Type 6 *zhan* appeared on the Chengdu Plain fairly late, around 800 BC (Figure 5.51). They have unrestricted profiles and upturned direct rims.

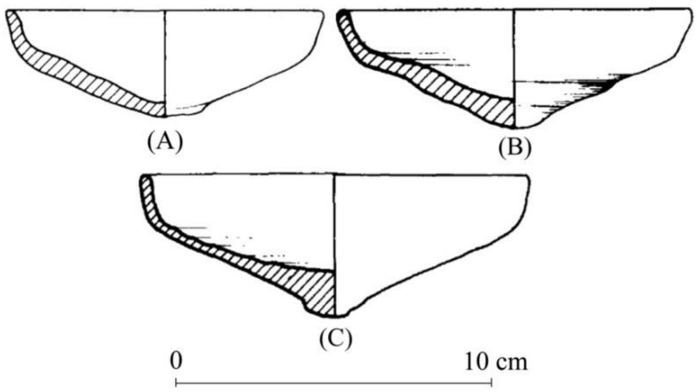


Figure 5.51: Type 6 *zhan* from (A) Xicheng tianxia, (B) Xinhelu xiyanxian, and (C) Xinyicun (after Chen Yunhong *et al.* 2007; Jiang Zhanghua *et al.* 2004; Wang Lin and Zhou Zhiqing 2010, with modifications).

The measurements for (1) mouth diameter, (2) vessel height, and (3) ratio of mouth diameter to vessel height are listed in table 5.5. Average mouth diameters and vessel heights are listed in table 5.6, and the CV values for the 6 types of *zhan* are listed in table 5.7. Incomplete vessel heights are marked by an asterisk, and in these cases the ratios of vessel diameter to height were not computed.

Table 5.5: Metrical data for the 6 types of pointed-based *zhan.* (1) mouth diameter, (2) vessel height, and (3) mouth diameter/vessel height.

(1) Type 1 *zhan.*

Site	(1) /cm	(2) /cm	(3)	Source of sample
Sanxingdui pit K1	13.4	5.2	2.58	K1:320
	13.4	4.6	2.91	K1:334
Qingjiangcun	13.2	3.6*	N/A	T4:33
Shierqiao	14.0	5.7	2.46	IT2⑬:4
	9.9	4.3	2.30	IT2⑫:3

(2) Type 2 *zhan*.

Site	(1) /cm	(2) /cm	(3)	Source of sample
Sanxingdui pit K1	7.6	1.7	4.47	K1:346-5
	7.7	1.5	5.13	K1:346-7
	7.6	1.2	6.33	K1:346-8
	7.3	1.7	4.29	K1:346-10
	8.3	2.1	3.95	K1:346-2

(3) Type 3 *zhan* (ca. 1100-950 BC).

Site	(1) /cm	(2) /cm	(3)	Source of sample
Sanhe huayuan	13.0	5.3	2.45	H150:1
Qingjiangcun	10.4	3.4	3.06	T2:12
Songjia heba	12.0	4.0*	N/A	H9:1
	16.0	3.5*	N/A	T1⑤:94
Dafucun	14.0	3.2*	N/A	T3⑥:18
	16.0	3.3*	N/A	T3⑥:2
	16.0	4.0*	N/A	T1⑥:9
	12.0	4.3*	N/A	T2⑥:2
Zhonghai guoji Commune Site 2	13.2	5.4	2.44	H5:6
	16.0	2.6*	N/A	H5:47

(4) Type 3 *zhan* (ca. 950- 850 BC).

Site	(1) /cm	(2) /cm	(3)	Source of sample
Sanhe huayuan	13.7	5.6	2.45	H158:14
	13.1	5.3	2.47	H158:4
	15.1	5.9	2.56	H158:23
	14.5	6.6	2.20	H158:18
Wanbo	11.4	4.0	2.85	M207:2
	10.0	4.0	2.50	M463:1
	11.5	4.5	2.56	M462:1
Huangzhongcun gandao B	12.0	4.8	2.50	H515:2
	11.0	4.2	2.62	H519:1
	12.5	3.8	3.29	H519:2
Furongyuan South	14.2	6.1	2.33	H2085:1
	13.0	4.2	3.10	H1692:1
	14.2	4.2	3.38	H1622:1
	13.4	5.1	2.63	H2085:2
	11.8	5.6	2.11	H2097:1

Xinghelu xiyanxian	13.0	5.4	2.41	H7103:1
	13.0	3.0*	N/A	H7103:8
Shierqiao	13.0	5.8	2.24	IT6⑫:34
	11.4	4.1	2.78	IT18⑫:3
Minjiang xiaoqu	12.0	4.3	2.79	H10:1
	11.5	5.5	2.09	H14:7
	10.0	4.3	2.33	H6:9
	13.6	4.8	2.83	T1919:1
	12.5	4.3	2.91	H6:3
Songjia heba	11.0	4.5	2.44	M2:5
Dafucun	12.2	5.0	2.44	H1:1
	16.0	3.6*	N/A	T1⑤:58
	12.0	3.2	N/A	T3⑤:13
	12.0	2.6*	N/A	T3⑤:6
Putian Cable Corporation	12.8	5.0	2.56	H2:1
	15.0	3.5*	N/A	T3④:15
	13.0	2.6*	N/A	T3④:13
Datang Telecommunication Phase II	12.6	4.4	2.86	H10:4
	10.4	4.2	2.48	T2⑤:2
	13.0	7.0	1.86	H6:1
Qinglongcun	6.0	3.2	1.88	H3:1
	11.5	4.4	2.61	T2④:4

(5) Type 3 *zhan* (ca. 850-750 BC).

Site	(1) /cm	(2) /cm	(3)	Source of sample
Sanhe huayuan	12.2	5.4	2.26	H128:11
	12.4	5.5	2.25	H128:12
	10.9	4.5	2.42	H128:3
Shufeng Huayuancheng phase II	11.0	4.8	2.29	M27:1
	11.6	5.0	2.32	M37:1
	12.6	5.6	2.25	M26:2
Guoji huayuan	13.0	5.2	2.50	M928:3
	13.6	3.4	4.00	M849:2
Huangzhongcun gandao A yanxian	11.0	5.0	2.20	T4555⑤:12
	11.0	4.0*	N/A	T4656⑤:2
Xinhelu xiyanxian	12.8	6.2	2.06	H6793:1
	11.8	5.2	2.27	H6793:2
	11.8	5.5	2.15	H7094:4

	12.5	5.2	2.40	H7094:10
	12.6	5.8	2.17	H7096:1
	13.6	5.8	2.34	H7096:2
	13.8	5.6	2.46	H7096:3
	14.0	3.5*	N/A	H7096:16
	11.0	3.2	3.44	T4⑤:2
	11.0	4.2	2.62	T4⑤:1
Chief Equipment Supply Depot of the Department of Logistics	10.4	4.2	2.48	H7086:5
Shierqiao	10.9	4.6	2.37	IIT43⑩:8
	10.1	4.2	2.40	IIT30⑩:2
	11.0	4.2	2.62	IIT43⑩:9
Chengdu Municipal Museum	12.0	2.6*	N/A	T0307⑭:13
Xinyicun	14.4	4.8	3.00	T104⑥:9
	12.9	4.5	2.87	T101⑧:12
Qingjiangcun	11.2	3.2	3.50	T3:10

(6) Type 4 *zhan* (ca. 1100-950 BC).

Site	**(1) /cm**	**(2) /cm**	**(3)**	**Source of sample**
Sanhe huayuan	12.2	6	2.03	H150:11

(7) Type 4 *zhan* (ca. 950-850 BC).

Site	**(1) /cm**	**(2) /cm**	**(3)**	**Source of sample**
Wanbo	12.6	5.8	2.17	M200:3
	11.3	4.8	2.35	M200:1
	12.6	5.7	2.21	M193:1
	12.2	5.4	2.26	M193:2
	11.0	6.0	1.83	M185:1
	11.4	5.8	1.97	M191:1
	11.6	6.5	1.78	M202:1
	13.0	6.6	1.97	M201:1
Huangzhongcun gandao B yanxian	13.0	4.2*	N/A	IT79⑤:1
Chief Equipment Supply Depot of the Department of Logistics	11.2	7.6	1.47	H7090:1
Shierqiao	17.0	6.5	2.62	IT2⑫:41
	12.8	5.0	2.56	IT1⑫:21
Minjiang xiaoqu	12.5	6.1	2.05	H49:4
	13.0	5.7	2.28	H15:1

Zhonghai guoji Commune Site 2	12.0	6.2	1.94	M11:1

(8) Type 4 *zhan* (ca. 850-750 BC).

Site	(1) /cm	(2) /cm	(3)	Source of sample
Huangzhong gandao A yanxian	14.0	3.9*	N/A	H514:22
	12.0	5.1*	N/A	H514:2
	13.0	4.5*	N/A	H514:32
	13.0	4.4*	N/A	TG2⑤:10
Xinhelu xiyanxian	13.0	5.8	2.24	M2704:1
	11.5	5.3	2.17	M2718:1
Chief Equipment Supply Depot of the Department of Logistics	12.3	6.3	1.95	H7086:2
	10.0	5.3	1.89	H7086:4
	14.0	7.3	1.92	H7086:3
	10.5	6.1	1.72	H7089:4
	14.0	4.0*	N/A	T0507⑤:7
	13.4	7.5	1.79	T0505⑤:1

(9) Type 5 *zhan* (ca. 900-800 BC).

Site	(1) /cm	(2) /cm	(3)	Source of sample
Chief Equipment Supply Depot of the Department of Logistics	13.1	5.6	2.34	Y221:1
Xinyicun	16.0	5.6	2.86	T303⑦:26
	15.0	5.4	2.78	T303⑦:35
	15.6	5.4	2.89	T104⑦:17
	12.0	5.4	2.22	T303⑦:15
	15.2	5.6	2.71	T101⑦:32
	12.9	4.8	2.69	T202⑧:4
Datang Telecommunication Phase II	16.6	5.5	3.02	H5:35
	17.2	5.3	3.25	T2⑤:22
	17.4	5.6	3.11	H5:12
	19.0	6.25	3.04	H5:23
	16.2	6.4	2.53	H5:15
	19.6	7.8	2.51	H5:11

(10) Type 6 *zhan* (ca. 850-750 BC).

Site	(1) /cm	(2) /cm	(3)	Source of sample
Xicheng tianxia	10.5	3.5	3.00	H4572:11
	10.2	4.0	2.55	H4572:1
	10.0	3.6	2.78	H4572:7
	10.0	3.8	2.63	H4572:2
	9.6	3.6	2.67	H4572:5
	9.8	4.5	2.18	H4572:6
	8.4	4.4	1.91	H4572:12
	9.5	4.5	2.11	H4572:9
	8.0	3.4	2.35	H4572:4
	10.0	3.5	2.86	H4572:13
	10.0	4.0	2.50	H4572:8
	8.8	3.4	2.59	H4572:3
Xinghelu xiyanxian	14.0	4.5	3.11	M2725:17
	13.0	4.5	2.89	M2725:18
	13.0	4.3	3.02	M2725:20
	11.8	4.2	2.81	M2725:15
Shierqiao	12.4	4.2	2.95	IIT40⑪:16
	12.3	4.0	3.08	IIT40⑪:17
	12.4	3.8	3.26	IT50⑩:1
	11.0	3.9	2.82	IIT61⑩:27
Chengdu Municipal Museum	12.8	1.0*	N/A	M1:4
	12.0	2.4*	N/A	T0307⑭:2
	10.4	1.6*	N/A	T0106⑮:1
Xinyicun	16.0	5.8	2.76	T404⑥:48
	15.2	4.4	3.45	T404⑥:40
	14.4	4.6	3.13	T104⑥:8
	9.0	3.9	2.31	T404⑥:9
	16.5	6.0	2.75	T404⑥:39
	12.0	5.0	2.40	T404⑥:49
	12.0	4.6	2.61	T404⑥:21
	10.6	4.6	2.30	T104⑥:15
	12.0	4.5	2.67	T404⑥:15
	12.6	4.5	2.80	T404⑥:28
Wan'an Pharmaceutical Packing Factory	12.0	3.2	3.75	T3⑤:112
	12.0	2.0*	N/A	H10:29

	12.0	2.6*	N/A	H10:32
	14.0	2.8*	N/A	H8:24

Table 5.6: Average mouth diameters and vessel heights of the 6 types of *zhan*.

zhan	**Average mouth diameter /cm**	**Average vessel height /cm**
Type 1 (date unknown)	12.78	4.95
Type 2 (date unknown)	7.7	1.64
Type 3 (1100-950 BC)	13.86	4.35
Type 3 (950-850 BC)	12.40	4.79
Type 3 (850-750 BC)	12.04	4.83
Type 4 (1100-950 BC)	N/A	N/A
Type 4 (950-850 BC)	12.48	5.98
Type 4 (850-750 BC)	12.46	6.05
Type 5 (900-800 BC)	15.83	5.74
Type 6 (850-750 BC)	11.63	4.21

Table 5.7: Diameter and mouth CV values for the 6 types of *zhan* dating between 1100 and 750 BC.

(1) Type 1 *zhan*.

Date	**mouth diameter**	**vessel height**	**mouth diameter/vessel height**
unknown	12.03%	11.61%	9.32%
Sample size	5	4	4

(2) Type 2 *zhan*.

Date	**mouth diameter**	**vessel height**	**mouth diameter/vessel height**
unknown	4.48%	18.82%	18.26%
Sample size	5	5	5

(3) Type 3 *zhan* from the Jinsha site cluster.

Date	**mouth diameter**	**vessel height**	**mouth diameter/vessel height**
1100-950 BC	N/A	N/A	N/A
Sample size	1	1	1
950-850 BC	9.81%	17.13%	13.59%
Sample size	17	16	16
850-750 BC	8.89%	15.77%	18.80%
Sample size	21	19	19

(4) Type 3 *zhan* from all sites on the Chengdu Plain (including Jinsha).

Date	mouth diameter	vessel height	mouth diameter/vessel height
1100-950 BC	14.49%	21.21%	11.75%
Sample size	10	3	3
950-850 BC	13.95%	18.49%	13.71%
Sample size	37	32	32
850-750 BC	9.66%	16.64%	18.40%
Sample size	28	25	25

(5) Type 4 *zhan* from Jinsha site cluster.

Date	mouth diameter	vessel height	mouth diameter/vessel height
1100-950 BC	N/A	N/A	N/A
Sample size	1	1	1
950-850 BC	6.28%	12.89%	13.47%
Sample size	10	9	9
850-750 BC	9.21%	13.49%	12.32%
Sample size	12	7	7

(6) Type 4 *zhan* excavated from all sites on the Chengdu Plain (including Jinsha).

Date	mouth diameter	vessel height	mouth diameter/vessel height
1100-950 BC	N/A	N/A	N/A
Sample size	1	1	1
950-850 BC	11.30%	11.62%	14.42%
Sample size	15	14	14
850-750 BC	9.21%	13.49%	12.32%
Sample size	12	7	7

(7) Type 5 *zhan* excavated at all sites on the Chengdu Plain (including Jinsha).

Date	mouth diameter	vessel height	mouth diameter/vessel height
900-800 BC	13.97%	12.55%	10.79%
Sample size	13	13	13

(8) Type 6 *zhan* from Jinsha site cluster.

Date	mouth diameter	vessel height	mouth diameter/vessel height
850-750 BC	16.04%	10.80%	16.39%
Sample size	16	16	16

(9) Type 6 *zhan* excavated from all sites on the Chengdu Plain (including Jinsha).

Date	mouth diameter	vessel height	mouth diameter/vessel height
850-750 BC	17.35%	14.84%	14.13%
Sample size	37	31	31

5.10 Discussion

Ethnoarchaeological studies suggest that many factors impact on the degree of vessel standardization, even if the potters themselves are specialists (Arnold and Nieves 1992, Arthur 2014; London 1991; Longacre 1999; Roux 2003; B. Stark 1995; Underhill 2003). In archaeological situations with poor spatial and chronological control, a cumulative blurring effect obscures the evaluation of vessel uniformity (P. Arnold 2000:112; Blackman *et al.* 1993; Stein and Blackman 1993). Therefore, it is expectable that CV values for metrical data will be high, even if the workshops themselves manufactured highly standardized products (Sinopoli 1988). Conversely, the low CV values imply that the vessels were purposely manufactured to maintain a certain degree of metric uniformity, or that the standardized vessel dimensions resulted from fixed motor skills.

In table 5.7, the lowest CV value, 4.48%, occurs for the 5 type 2 *zhan* excavated from Sanxingdui pit K1, suggesting they were the most standardized vessels among all the types. Although their dates are unknown, the low CV could imply a single production event. The 10 type 1 *zhan* from Sanxingdui pit K1 are also highly standardized in size and shape (SPICRA 1999:145). Even after adding the two samples from Shierqiao layer 13 and Qingjiangcun into the CV calculation, the revised CV values for mouth diameter (2.22%) and vessel height (8.7%) of the type 1 *zhan* remain low, suggesting they were also highly standardized. The evidence suggests that the potters who manufactured the type 1 and 2 *zhan* were skilful workers, but they do not automatically imply specialization since some ethnoarchaeological studies suggest that not only intensive but also non-intensive production can give quite uniform pots (P. Arnold 1991a, b; London 1991). The higher CVs for vessel height of both type 1 and 2 *zhan* possibly suggest that a standardized vessel height was not sought.

Sections 4 and 6 in table 5.7 indicate that the type 3 and 4 *zhan* have CVs for mouth diameter lower than those for vessel height in each occupation phase. As in the Guizhou ethnoarchaeological observations reported by Underhill (2003:248), the most important dimensions for the potters to standardize was apparently the mouth diameter. To mitigate any cumulative blurring effect by considering the type 3 and 4 *zhan* excavated from the Jinsha site cluster alone (see sections 3 and 5 of table 5.7), the lower CV values for mouth diameter here (0.5 to 5%) suggest that the type 3 and 4 *zhan* also display high degrees of standardization. Sections 4 and 6 in table 5.7 reveal a decrease of CVs with the passage of time, and suggest that the types 3 and 4 *zhan* were becoming more standardized.

In general, the CV values for the type 3, 4, 5, and 6 *zhan* listed in table 5.7, except for one exceeding 20% and a few exceeding 15%, range between 9% and 15%. Owing to difficulties in temporal control, a cumulative blurring effect contributing to the apparent increase in CV values through time is unavoidable. Therefore, we need to consider whether the apparent variation in CV values through time is significant and meaningful.

Compared to the CV values for various attributes of material artefacts synthesized by Eerkens and Bettinger (2001:499), those derived from this study are relatively low. They possibly reflect a level of standardization between that of specialist and household production (CV ranges between 2% and 6%) (Longacre 1999). However, my limited data do not indicate that there was a change in the organization of pottery production on the Chengdu Plain during the first half of the first millennium BC, simply because there is no conclusive evidence for a progressive and increasing level of standardization of pointed-based *zhan* through time. The data appear to be random in this regard.

5.11 Conclusions

In attempting to test Rice's (1981) evolutionary model of pottery production for the Chengdu Plain between 2500 and 800 BC, this chapter has analysed archaeological data relevant for pottery production. It has covered organization of production, manufacturing technology, raw material composition, and the question of standardization. As Rice (1984:47-48) and Menon (2008) have pointed out, purely archaeological evidence for craft specialization is not only difficult to recognize, but can be subject to many differing interpretations because it involves not only techniques but also organization. Although my sample size has been low, it does have the advantage of being drawn from a wide spread of dates and sites. In this regard, it should be representative of general trends. However, my analyses of direct and indirect evidence for pottery production do not at this stage indicate an evolution from a household industry to an individual workshop industry in association with increasing social complexity.

The available data suggest that a household mode of pottery production characterized the Chengdu Plain between 2500 and 800 BC, more than an individual workshop industry, partly because kiln remnants are associated with residential areas rather than specialized workshops (except for the large but unreported Jinsha cluster, which could turn out to be very important for future discussion). However, there is evidence for a considerable investment in technology, including kilns, turntables and potter's wheels, so an industry beyond the most simple level of household production (Rice 1987:184) would be more likely, a suggestion supported by the pointed-based *zhan* that indicate a level of standardization that ought to indicate some degree of specialization.

However, this preliminary investigation suggests that there is no evidence for any complete change in mode of production over time. To meet increasing demand from population growth and increasing social complexity, as pointed out by Sinopoli (2003:247), a simple increase in the number of household producers would also achieve an increased scale of production.

Chapter 6

Conclusions and future perspectives

6.1 Conclusions and considerations for future research

The goal of this thesis has been to examine potential changes in pottery production on the Chengdu Plain between 2500 and 800 BC, with a central focus on the relationships between the organization of pottery production and the degree of social complexity. Based on my examination of data related to manufacturing technology and fabric composition, combined with a usage of metric indices to investigate degrees of standardization, I conclude that a household mode of pottery production, rather than an individual workshop industry, characterized the Chengdu Plain between 2500 and 800 BC, and that there was no significant change in the organization of pottery production through time. This conclusion differs from the evolutionary model of pottery production suggested for the Maya Lowlands by Rice (1981), since intensification of production was not evidently the chosen solution to meet increasing demand. Instead, a simple increase in the number of household producers would have achieved the same outcome (Sinopoli 2003:247).

This conclusion should be regarded as preliminary due to small sample size available for study, and uncertainty about the extent to which the studied samples represent the total excavated corpus of pottery from the Chengdu Plain. However, any attempt to identify increasing specialization in pottery production through ceramic standardization will always face the problem that external economic, technological and social factors, and a cumulative blurring effect due to poor spatial and chronological control, can enhance or reduce the evidence for standardization to a level of ambivalence (D. Arnold 2000; Arnold and Nieves 1992; Blackman *et al.* 1993). This means that any assumption of a positive correlation between craft item standardization and specialized production will be over-simplified.

Reliable evidence to indicate a specialized mode of production will only come from studies of manufacturing facilities, technological aspects of discarded materials, specialist tools, and evidence for actual workshops. One of the central foci for future research will be to examine further the cluster of 17 type B kilns at Sanhe huayuan in the Jinsha site cluster (CMICRA 2005B:5; Zhu Zhangyi and Liu Jun 2001), which might suggest the former existence of a workshop area used exclusively for pottery production.

It will also be necessary to compare the data on pottery production between sites within a single settlement hierarchy in the future. At least some of the large, walled sites might yield evidence for specialized production of labour-intensive vessels attached to and sponsored by the elite, whereas many of the smaller might yield evidence for small scale household production of utilitarian vessels. Another priority should be statistical analysis to examine whether there was a regional-scale shift from painstakingly hand-decorated wares to undecorated mass-produced coarse sandy vessels, especially during the transition from Baodun to Sanxingdui-Shierqiao in the early 2nd millennium BC. Large quantities of utilitarian wares lacking surface decoration might reflect increased speed and efficiency in manufacture (Costin and Hagstrum 1995), in response to intense market competition and greater demand consequent on population growth.

It is also to be hoped that Sichuan archaeologists in the future will not discard broken and unmatched sherds once preliminary site reports have been published, since information about long-term social change can still be recovered from these unattractive archaeological resources through well-designed analyses. In addition to pottery, it will be profitable to examine potential changes in the production of other types of artefact on the Chengdu Plain between 2500 and 800 BC, especially jades, the production of which might have been controlled by elites who required them for display, ceremony and status competition.

In this thesis I have also critically examined the most commonly accepted chronology for the prehistoric Chengdu Plain. Through an analysis of available radiocarbon dates, archaeological stratigraphies, and the contrasting distributions of the Sanxingdui and Shierqiao assemblages, I have suggested that the Baodun culture existed between 2500 and 2000 BC, and was succeeded in parallel by the Sanxingdui and Shierqiao cultures in the 2^{nd} millennium BC. However, the exact chronological boundaries of the Shierqiao culture remain unknown owing to the scarcity of ^{14}C dates. Based on my chronological calculations, the pointed-based pottery normally taken to be the type fossil of the Shierqiao is not appropriate to define the Shierqiao culture as a whole, because this kind of vessel came into existence relatively late, around 1200 to 1100 BC.

My revised chronology implies that the terminal Baodun and the early Shierqiao might have been continuous through time over much of the Chengdu Plain. Future research on the potentially transitional Yufucun culture might solve this problem, because the distributions of the Yufucun and early Shierqiao sites overlap west of Chengdu. Possibly, those early Shierqiao sites that lack pointed-based pottery can be included in Li Mingbin's (2011) Yufucun complex.

By synthesizing anthropological theories on the formation of social inequality (Stanish 2004) and states (Leblanc 2006), combined with an analysis of mortuary data and available protohistorical accounts, I propose in chapter 4 an evolutionary model of the development of those societies that inhabited the prehistoric Chengdu Plain. This begins with the establishment in the early 3rd millennium BC, by the earliest Neolithic immigrants (Guiyuanqiao phase 1) (Wan Jiao and Lei Yu 2013a, b), of an economy based on a combination of broomcorn (*Panicum miliaceum*) and foxtail millet (*Setaria italica*) cultivation. Dramatic population growth consequent on movement by food producers into frontier regions where pre-existing populations were probably engaged mainly in hunting and gathering, and hence were small (Bellwood 2005a:14-19, 2009), might have occurred on the Chengdu Plain between 2500 and 2000 BC. It is likely that population growth and village fission would have continued until available arable lands were all under exploitation and carrying capacity was being approached, around which time one would expect either a population retraction or an intensification of subsistence practices to have occurred.

Such changes during the Baodun phase would have led to increasing intergroup competition, organizational changes in production, and probably to an intensification of social stratification. Regional amalgamation through political alliance or warfare during the early 2nd millennium BC allowed former buffer territories between polities to be turned into productive land, resulting in further population growth. Throughout the 2nd millennium BC, social stratification would have intensified in the general direction of a lineage based or dynastic elite, as on the central plains of the Yellow and Yangzi Rivers. By the end of the 2nd millennium BC, an increasing need for the people of the Shierqiao phase to exploit marginal lands might have led to increasing numbers of ritual sanctions to maintain a cooperative production system in a stable condition.

A priority for future research will be to test the evolutionary model proposed here through analysis of settlement patterns and settlement hierarchies that reveal actual housing remains. Official site reports need to carry more data of this type, and research-oriented excavation and fieldwork need to replace the current emphasis on salvage excavation. Central foci for research would be the formation and abandonment histories of the Baodun and Sanxingdui walled settlements, the relationships between the unwalled villages and the large walled settlements, and more intensive spatial analyses of the Sanxingdui and Jinsha site clusters.

This thesis also briefly reviews past archaeological research in chapter 3 and gives an introduction to significant sites on the Chengdu Plain dating between 2500 and 800 BC. Here, I point out several problems critical for this thesis, including the lack of a ceramic seriation for Baodun phase 1 to 4 pottery, the unbalanced restriction of knowledge about the Sanxingdui culture to the rich discoveries within and around the Sanxingdui walled settlement itself; and the chronological debate over of early Shierqiao and Xinyicun cultures. Poor chronological control has impeded my attempt to explore past social developments in detail. Most of the sites excavated during the last 80 years have not been radiocarbon-dated and the available dates, derived from defective stratigraphy and stylistic comparisons of artefacts, will continue to be controversial.

6.2 Some final considerations

The luxurious artefacts excavated in the Sanxingdui artefact pits K1/K2 have always been the central focus of Sichuan archaeology. Their dates are based on stylistic comparisons of Shang bronzes found in Yinxu in Henan, and these dates have significantly influenced the archaeological chronology of the prehistoric Chengdu Plain. Many scholars considered that the artefact pits were the youngest deposits of the Sanxingdui culture, dated to the late Shang period (1250-1200 BC) (Falkenhausen 2003; Gao Dalun and Li Yingfu 1994; Jiang Zhanghua and Li

Mingbin 2002; Jiang Zhanghua *et al.* 2001; Li Boqian 1996, 1997; Rawson 1996; Sun Hua 2000, 2013; Sun Hua and Su Rongyu 2003; Zhao Dianzeng 2005:236). This date suggested a lower date limit for the beginnings of the Shierqiao culture and the Jinsha site cluster in Chengdu City, because the most direct affinities for the type 1 ceramic *zhan*, gold, bronzes and jade artefacts that were excavated in Shierqiao layer 13 and Meiyuan Northeast, and similar to those excavated in Sanxingdui artefact pits, do not represent the beginnings of these cultural complexes (see chapter 3).

Most students of the prehistory of the Chengdu Plain have treated this chronology as a doctrine, and the younger dates for the Sanxingdui artefact pits proposed by other scholars (Barnard 1990; Jiang Yuxiang 1993; Song Zhimin 1990a; Wang Yanfang *et al.* 1996; Xu Xueshu 1995) have tended to be ignored as lacking in supporting evidence. However, my research has shown that the dating of c.1200 BC for the Sanxingdui artefact pits K1 and K2 is methodologically defective, and that the standard chronology of three successive archaeological cultures, without chronological overlap, running through the 2nd millennium BC is problematic. Hence, I suggest that the Sanxingdui artefact pits should be regarded as of unknown date in their original excavation, even if some of their contents can be dated to the Shang Dynasty in themselves, and that the standard archaeological chronology should be revised in a younger direction. Similar doubts apply to the Zhuwajie bronze hoards and the artefacts excavated mechanically at Meiyuan Northeast in the Jinsha site cluster (see chapter 3).

Another topic that needs to be addressed in future research is the exact date of abandonment of the Sanxingdui walled settlement, because there is in fact no direct evidence that it was actually destroyed and abandoned at the end of Sanxingdui phase 3 (ca. 1200 BC), the final phase of the Sanxingdui culture. On the contrary, there is increasing evidence, such as the eight Sanxingdui phase 4 pits on Yueliangwan terrace (see chapter 3), the presumed Sanxingdui phase 4 assemblage in upper layer 2 of Yueliangwan site 1 (Ma Jixian 1993), and the numerous Sanxingdui phase 4 sites along the Yazi river (Ran Honglin and Lei Yu 2014), to suggest that the Sanxingdui settlement complex was occupied for longer than previously thought (SPICRA 2014). This conclusion raises again those questions mentioned in chapter 2 - do the Sanxingdui phase 4 deposits correspond to a late phase of the Sanxingdui culture, and if so, how do we define the Shierqiao culture beyond the boundaries of the pointed-based pottery, which is presumably younger than the Sanxingdui culture? I must be honest here and state that this thesis fails to resolve these issues in terms of the available data.

Finally, it is to be hoped that the official site report on the archaeological work at Sanxingdui during the past 80 years (Table 3.4) can be published in the near future. Such publication would help to resolve many of the problems encountered in this thesis owing to insufficient data and poor illustration of artefacts in the available literature.

Chinese glossary

Ankang	安康
Anxiang	安鄉
Ba	巴
Baiguan	柏灌
Baihuatan	百花潭
Bailong	白龍
baishanni	白鳝泥
Banpo	半坡
Baodun	寶墩
Baoji	寶雞
Baopingkou	寶瓶口
Baoshan	寶山
Ba-Shu	巴蜀
bei	杯
Beihu	北湖
bi	璧
Bianduishan	邊堆山
Bieling	鱉靈
Bo	僰
Bojiang	泊江
Botiao	柏條
Butuo	布拖
Cancong	蠶叢
Cangbaobao	倉包包
Caojiaci	曹家祠
Chen Zhuang	陳壯
Chengdu	成都
Chenggu	城固
Chengguan	城關
Chifeng	赤峰
Chongqing	重慶
Chongzhou	崇州
Chu	楚
Chujiacun	褚家村
Chunyu huajian	春雨花間
Cong	賨
cong	琮
Dadu	大渡
Dafucun	大夫村
Dai	傣
Dalijiaping	大李家坪
Danjiangkou	丹江口
Dashuidong	大水洞
Datang	大唐
Dayi	大邑
Deyang	德陽
Dian	滇
dou	豆
Dujiangyan	都江堰
Duyu	杜宇
Eebo	峨嶓
Emei	峨眉
Emeishan	峨眉山
Erlitou	二里頭
Fangchijie	方池街
Fangyuan Zhongke	方源中科
Fanjianian	范家碾
Feishayan	飛沙堰
Fengjie	奉節
fengtu	封土
Fengxiang	鳳翔
Fu	涪
Furongyuan	芙蓉苑
Futong	富通
gandao	幹道
gang	缸
Gangzheng	罡正
Gaopian	高駢

Gaoshan	高山
Gaoxinxi District	高新西區
ge	戈
Gewei	格威
guan	罐
Guanghan	廣漢
Guangrong xiaoqu	光榮小區
Guangyuan	廣元
Guannaruo	官納若
Gucheng	古城
Gudunzi	鼓墩子
gui	鬹
Guilinxiang	桂林鄉
Guiyuanqiao	桂圓橋
Guoji huayuan	國際花園
Guoteng	國騰
Han	漢
Hangkonggang	航空港
Hanguan	扞關
Hanlong	漢隆
Hanzhong	漢中
Haxiu	哈休
he	盉
Heishui	黑水
Henan	河南
Hetaocun	核桃村
Hongfengcun	宏峰村
Hongqiaocun	紅橋村
Huachengcun	化成村
Huangzhong xiaoqu	黃忠小區
Huangzhongcun	黃忠村
Huayang guozhi	華陽國志
Hubei	湖北
Huili	匯利
Huiwen	惠文
Huolie	火烈
ji	戟
Jiangbei	江北
Jianglin	蔣林
Jiangwang fudi	將王府邸
Jiangweicheng	姜維城
Jiangyou	江油
Jiaotong	交通
Jiazaihuilang	家在迴廊
jin	斤
Jin	錦
Jindu huayuan	金都花園
Jingangwan	金港灣
Jingpinfang	精品房
Jinhai'an	金海岸
Jinniu	金牛
Jinsha	金沙
Jinshaxiang	金沙巷
Jintang	金堂
Jinyu	金煜
jue	玦、爵
Kaiming	開明
Kaogu	考古
Kaogu xuebao	考古學報
Konglongcun	孔龍村
Lancang	瀾滄
Langjiacun	郎家村
Languang	藍光
Lanyuan	蘭苑
lei	罍
Leibo	雷波
leixingxue	類型學
Leshan	樂山
li	里、鬲
Li Bing	李冰
Liangzhu	良渚
Liao	僚
Liaoning	遼寧
Lijia yuanzi	李家院子
Linqiong	臨邛
Longchuan	龍川

Longmen	龍門
Longquan	龍泉
Longquanyi	龍泉驛
Longshan	龍山
Longxian	隴縣
Longzui	龍嘴
Lubao	盧保
Lujiafen	魯家墳
Luojianian	羅家碾
Maerkang	馬爾康
Mahuangdun	螞蝗墩
Maipingcun	麥坪村
Majia	馬家
Majiashan	麻家山
Mamu	馬牧
Mangcheng	芒城
Manghuai	忙懷
Maoxian	茂縣
Meiyuan	梅苑
Mianning	冕寧
Mianyang	綿陽
Mianyuan	綿遠
Mianzhu	綿竹
Miaodigou	廟底溝
Min	岷
Minjiang	岷江
mingqi	明器
Modi	摸底
Mofu	摩甫
muzheng	牧正
muzhengfuyi	牧正父已
Nanzheng	南鄭
Nu	怒
Pengshan	彭山
Pengxian	彭縣
Pengzhou	彭州
Pi	郫
Pixian	郫縣
Pu	濮
Pujiang	蒲江
Putian	普天
Qiang	羌
Qiangyi	強毅
Qiao Zhou	譙周
Qili huayuan	齊力花園
Qin	秦
Qingbaijiang	青白江
Qingdao	清道
Qingguanshan	青關山
Qinghai-Tibet	青藏
Qingjiangcun	清江村
Qinglongcun	青龍村
Qingshui	清水
Qingyang	青羊
Qingyang xiaoqu	青羊小區
Qingyanggong	青羊宮
Qingyi	青衣
Qinling	秦嶺
Qionglai	邛崍
quxi-leixing	區系類型
Renfang	人防
Renshengcun	仁勝村
Ruyang	如陽
Sanguancun	三觀村
Sanhe huayuan	三合花園
Sanxing	三星
Sanxingcun	三星村
Sanxingdui	三星堆
Shaanxi	陝西
Shang	商
Shangshu	尚書
Shangyejie	商業街
Shawudu	沙烏都
Shaxi	沙溪
Shayema	殺野馬
Shengdeng	聖燈

Shierqiao	十二橋
Shifang	什邡
Shiguci	石鼓寺
Shiji	史記
Shiji zhengyi	史記正義
Shijiahe	石家河
Shijiefang	十街坊
Shimao	石峁
Shiren xiaoqu	石人小區
Shiting	石亭
Shiyan	十堰
Shu	蜀
Shuanghe	双河
Shuangliu	雙流
Shufeng Huayuancheng	蜀鳳花園城
Shuhan	蜀漢
Shuiguanyin	水觀音
Shunjiang xiaoqu	順江小區
Shuwang benji	蜀王本紀
Shuzhuangtai	梳妝台
Sichuan	四川
Sima Cuo	司馬錯
Songjia heba	宋家河壩
Songpan	松潘
Songzi	松滋
Suozitian	梭子田
Taiping	太平
Taipingcun	太平村
tan	覃
tanfugui	覃父癸
tao-tie	饕餮
Tiantaicun	天台村
Tianxianglu	天鄉路
Tongguo	通國
Tuo	沱
Wa	佤
Wanbo	萬博
Wan’an	萬安
Weijiazhuang	韋家莊
Wenchuan	汶川
weng	甕
Wenjiang	溫江
Wenmiao xijie	文廟西街
Wenwu	文物
Wu	武
Wuhou	武侯
Wulong	五龍
Wuyang	舞陽
Xi	西
Xia	夏
Xiaguanzi	下關子
Xiajiang	峡江
Xiaohaizi	小海子
xiaoqu	小區
Xicheng tianxia	西城天下
Xihua University	西華大學
Xindu	新都
Xinfan	新繁
Xinghelu xiyanxian	星河路西延線
Xinjin	新津
Xinjinxi	新錦犀
Xinyicun	新一村
Xinzhuangcun	新庄村
Xiqu guoji	西區國際
Xiquankan	西泉坎
Yaan	雅安
Yaguang	亞光
Yandian	鹽店
Yanduizi	烟堆子
Yanjia yuanzi	燕家院子
Yang Xiong	揚雄
Yangshao	仰韶
Yangxixian zonghelou	羊西線綜合樓
Yangzishan	羊子山

Yansha tinyuan	燕沙庭院
Yandian	鹽店
Yanting	鹽亭
yanxian	延線
yazhang	牙璋
Yazi	鴨子
Yi	夷
Yihai	彝海
Yingpanshan	營盤山
Yinxu	殷墟
Yong	雍
Yongfucun sanzu	永福村三組
Yongjinwan	雍錦灣
yuan	瑗
Yudu huayuan	御都花園
Yue	越、鉞
Yueliangwan	月亮灣
Yufu	魚鳧
Yufucun	魚鳧村
Yunnan	雲南
Yunxi	鄖西
Yunxian	鄖縣
Yuzui	魚嘴
zhan	盞
zhang	丈、璋
Zhang Ruo	張若
Zhangjiapo	張家坡
Zhaoxiang	昭襄
Zhengyin xiaoqu	正因小區
Zhengyincun	正因村
Zhenwucun	真武村
zhi	觶
Zhihuijie	指揮街
Zhixin jinshayuan	置信金沙園
Zhongba	中壩
Zhonghai Guoji	中海國際
Zhongxian	忠縣
Zhongyi	忠義
Zhongzipu	中子鋪
Zhou	周
Zhuwajie	竹瓦街
Zhuyuangou	竹園溝
Zifang	茲方
Zigong	自貢
Ziyang	資陽
Zizhong	資中
Zizhucun	紫竹村
zun	尊

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