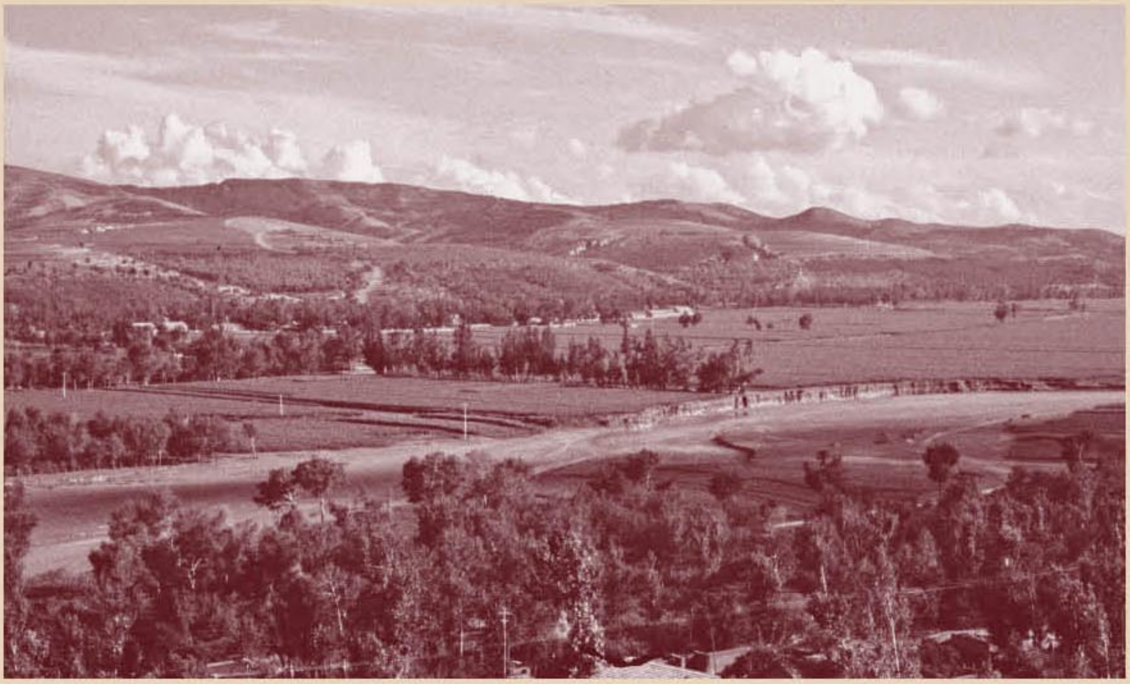
Settlement Patterns in the Chifeng Region



Chifeng International Collaborative Archaeological Research Project

Center for Comparative Archaeology
University of Pittsburgh

Pittsburgh

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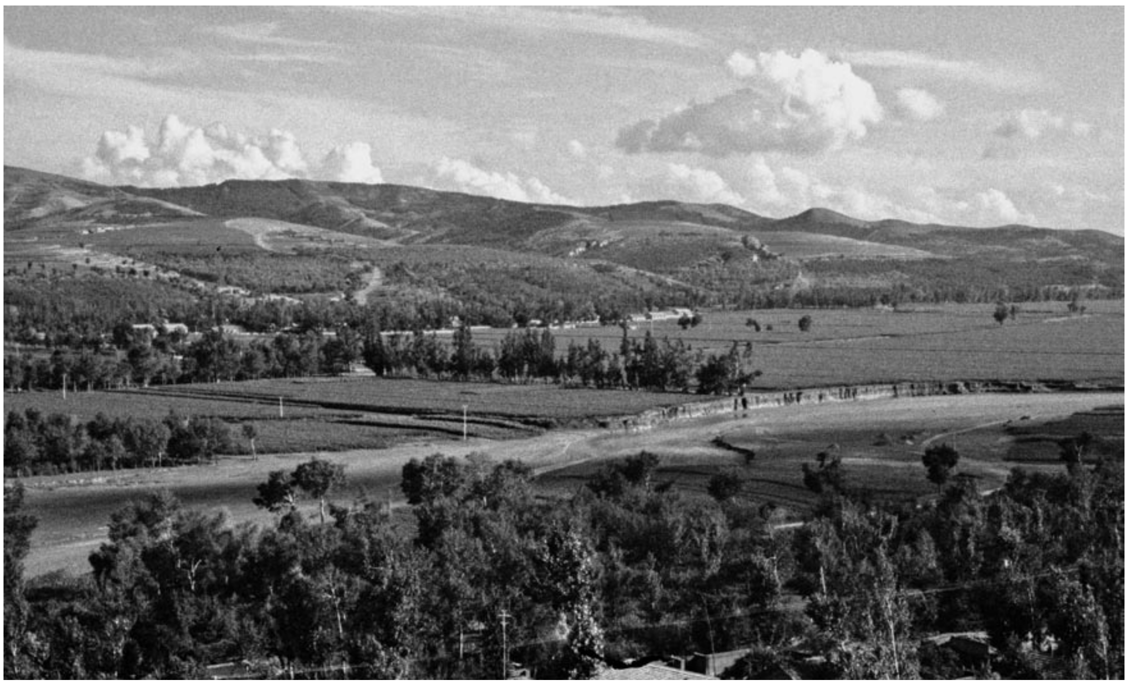

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Chapter 1

Introduction

Katheryn M. Linduff and Ta La

The Chifeng region of northeastern China where this project was located provided an opportunity to study a trajectory of societal change that can be compared with that of the Central Plain that has so strongly dominated thinking about Chinese prehistory and early history (Fig. 1.1). This thinking has emphasized the dependable high agricultural productivity of the Central Plain in the precocious emergence of social complexity and the eventual development of expansionistic states that forged empires of immense scale. Shifts in the last three decades to greater decentralization in political as well as economic spheres in China have encouraged and supported, perhaps unintentionally, regional studies outside of the Yellow River Basin among archaeologists. Coupled with changes in regulations which require the reporting and preservation of artifacts and sites, including those inadvertently discovered in the course of other activities such as the building of roads and housing, these studies have literally turned up evidence of human activity from earliest times onward all over present-day China, and very often far outside the Central Plain. Much of these investigations showed without doubt that many regions developed independently of the Central Plain as well as contributed to the emergence of the historic culture so well documented there.

Publications on these materials and sites have grown along with the ability of the local communities to fund studies of them, while thinking among Chinese archaeologists has reconsidered the significance of this evidence in relation to traditional explanations for the emergence of Chinese civilization. Regionalism as a concept in relation to ancient China's Neolithic was clearly articulated by Su Bingqi (the founder of the archaeology program at Jilin University), and his long series of publications laid out a regional approach to its study in China. His work emphasized the need to look for multiple sources for Chinese civilization and one large region he highlighted was one variously called the *beifang*, the 'Northern Zone,' or the 'Northern Corridor' which stretches from Liaoning in the east, to the north of the Central Plain provinces along the Yellow River, to Xinjiang in the west (cf. Su 1987; Su and Yin 1981). The northeast of that larger region in which we conducted the Chifeng Project includes the distinctive Hongshan period sites such as Niuheliang with its large architectural monuments as well as spectacularly carved jades. Careful attention to chronological sequences provided through study of pottery types and styles has documented a long sequence of habitation across much of the *beifang*.

Ancient Chinese written records characterized the importance of the dynastic centers as catalysts for change in areas outside of the core area. But how to account for the remarkably distinctive local traditions now documented in places such as the Chifeng area has preoccupied scholars both in China and elsewhere. Ancient writings from the late Zhou period, as well as Shang and Zhou-date inscriptions, mentioned and even described groups beyond the core with whom Central Plain peoples interacted, and newly excavated materials were often thought to document peoples mentioned in the written sources (Li 2006). A shift from an agricultural to a more pastoral economy, which was proposed in the Han period literature, has been thought to correspond in the northeast to the shift from the Lower to the Upper Xiajiadian archaeological cultures identified in the Chifeng region, for example. Although this approach was thought to confirm that this change took place, it could not explain archaeologically how and why those changes occurred. Those long held interpretations have been interrogated by our work.

Chifeng International Collaborative Archaeological Research Project

Interest in regional analysis proposed both in recent Chinese as well as Western archaeological thought brought together the research team of the Chifeng International Collaborative Archaeological Research Project (subsequently, the Chifeng Project). We documented patterns of change in settlement in the Chifeng region by conducting a systematic regional field survey that aims here to begin to explain those changes. Experts with research interests in northeastern China along with researchers from outside of China whose expertise is not available in China were part of the Chifeng Project team. Their combined expertise and knowledge made use of previously accumulated data as well as addressed questions about the area in new ways. Conversations among these scholars led the Chifeng Project to its emphasis on regional settlement analysis. Al-

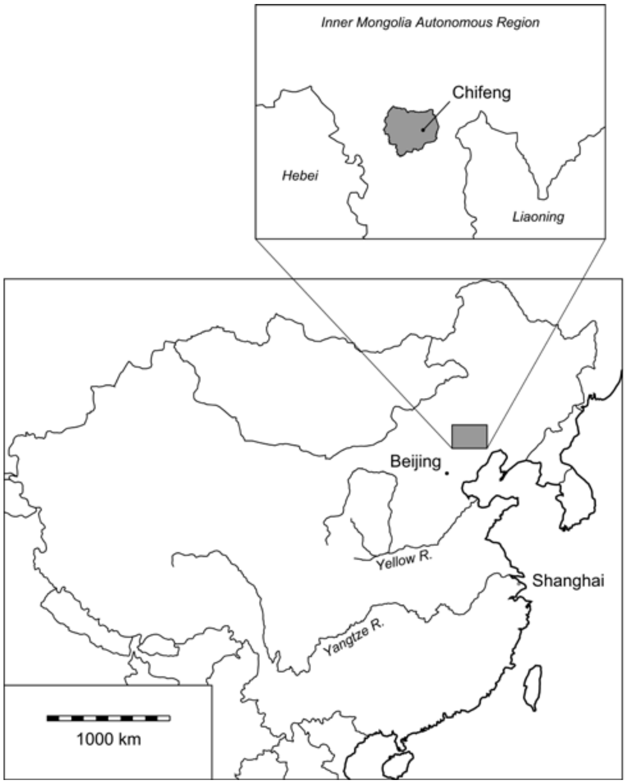


Figure 1.1. Location of the Chifeng Project survey area, surrounding urban Chifeng in northeastern China.

though this method has been applied in other parts of the world, this kind of research and field methods have had limited use in China, and never before in the *beifang*.

The project was first discussed during a research fellowship of Professor Zhang Zhongpei (Jilin University, Institute of Archaeology, Chinese Academy of Social Science Beijing) at the University of Pittsburgh during 1995–1996. As a student of Su Bingqi, Professor Zhang was especially interested in regional development of societal complexity within the current borders of northeast China. His interest and ours was to create a program that would encourage more American archaeologists to do this sort of research in China and to organize a Sino-foreign team that would allow professional archaeologists (both Chinese and foreign) and their students to conduct archaeological excavation and survey inside of China. A detailed proposal to conduct archaeological research emerged from these talks in Pittsburgh, and teams including faculty and students from Jilin University, the University of Pittsburgh, The Hebrew University, the Institute for Archaeology at the Chinese Academy of Social Sciences in Beijing and the Inner Mongolia Institute of Cultural Relics and Archaeology were created.

Our principal research activity was a regional-scale settlement study. The field seasons (1999–2001, 2003, 2006, 2007) provided information on the period from ca. 6000 BCE through ca. 1100 CE. Our work has collected information necessary to organize previous archaeological data and bring them to bear on reconstructing social, political, cultural, and economic patterns for the region. The Chifeng Project followed up on a systematic settlement pattern survey of an area of 210 km^2 carried out in 1995 by Gideon Shelach (1999) and seeks to contribute to the incorporation of ancient Chinese sequences into comparative studies of the origins and development of complex societies. The main effort of the Chifeng Project was a regional settlement study (Fig. 1.2) in which we systematically surveyed 1,234 km^2, including 19 km^2 surveyed as part of dissertation research carried out by Christian Peterson (2006). In addition, stratigraphic tests were carried out in the Chifeng Project area at two sites that were fundamental to the establishment of chronological control and to the recovery of samples of artifacts and ecofacts from stratigraphically secure contexts.

This volume is a report on the regional settlement study carried out by the Chifeng Project between 1998 and 2007. The sequence begins with the recognition of sedentary agricultural communities in the late seventh and early sixth millennia BCE, and continues through the emergence of social differentiation and ritual centers in what have been labeled chiefdoms in the late fifth and fourth millennia. These are followed by the crystallization of a pattern of small chiefdom-like polities in the late third millennium, which undergo a major organizational transformation at the end of the second millennium that, while not fully understood, clearly does not simply represent the collapse of these polities. This sequence is roughly contemporaneous with the development of the initial chiefdoms and states of the Central Plain (Yangshao, Longshan, Xia, Shang, and Zhou). Finally the region feels the political impact of imperial organization expanding from the Central Plain in the third century BCE through the establishment of the Liao state in the first millennium CE.

Chifeng offers some environmental contrasts to the immense expanses of well-watered and highly productive farmland of the Central Plain. The Chifeng region is cooler and drier than the Central Plain—enough so that the climatic fluctuations of the past ten thousand years could have created periods of marginal agricultural production. In contrast to the general impression held by many that the entire *beifang* consists of desert and grassland unsuitable for agriculture, however, the alluvial valley floors in the Chifeng region are very fertile (Fig. 1.3), and rolling uplands are also highly productive for agriculture (Fig. 1.4) under modern climatic conditions. The prime concentration of agricultural land is the large tract of alluvium around Chifeng city, but it would have been vulnerable to flooding throughout the period of study, just as it is today. Irrigation today makes it possible to increase production in the valley floor, and would have been even more important in any period of lower precipitation. What the result of periods of lower precipitation might have been in relation to economic adaptation the region was of interest to us as well.

Our regional settlement analysis for the Chifeng sequence complements information from site excavation

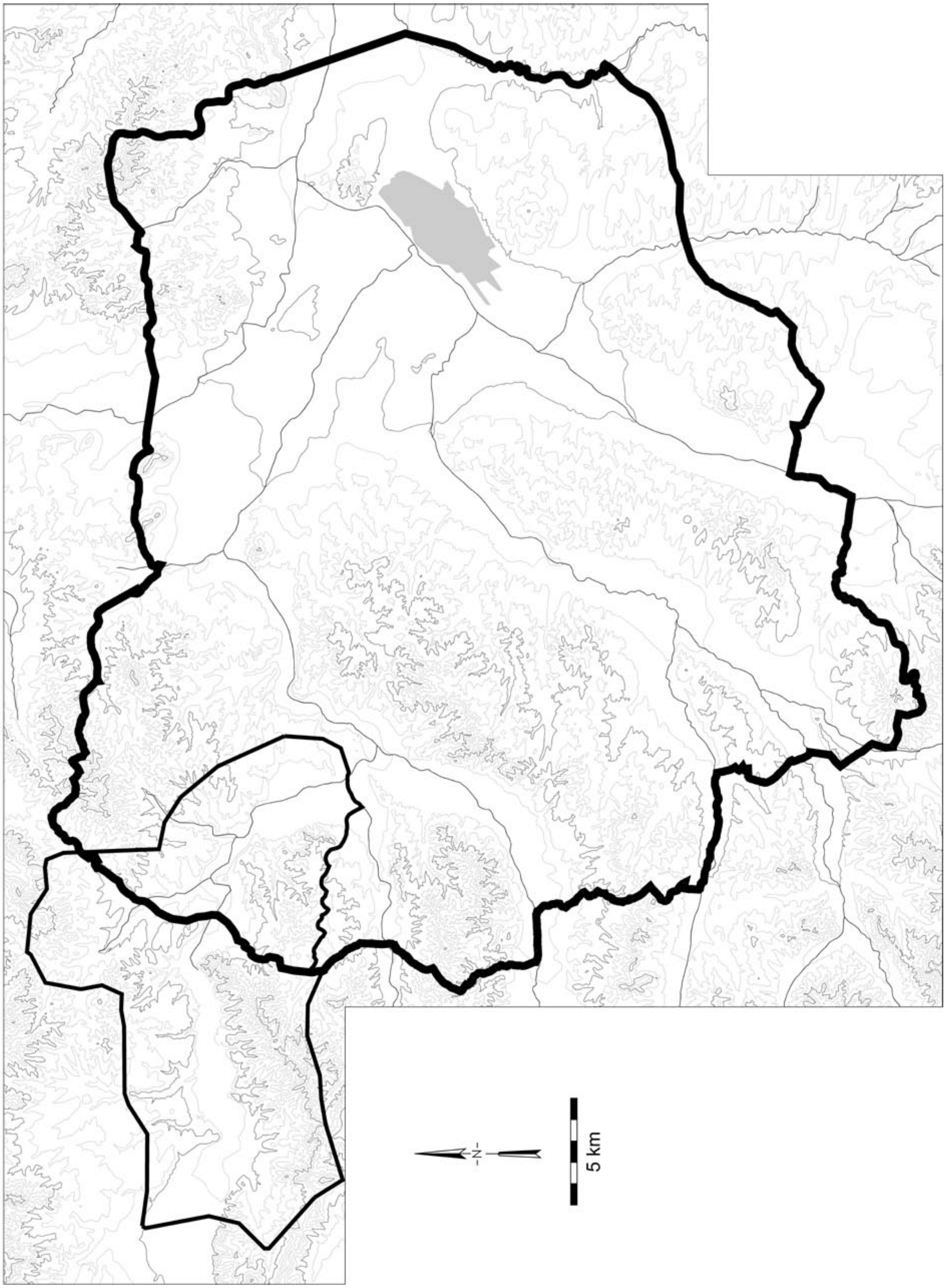


Figure 1.2. The Chifeng Project survey area. Heaviest line shows the boundaries of the Chifeng Project survey; lighter line at the northwest shows the boundaries of the survey carried out by Shelach (1999); shaded gray area at the east shows the area of urban Chifeng as of the early 1990s.

carried out over the past several decades, and provides a more comprehensive characterization of the development of regional-scale societies that will facilitate the comparative study necessary to pursue such issues. Such regional-scale research was particularly sensitive to the processes through which early sedentary populations established themselves in a region and devised means of exploiting its resources. We have delineated the waxing and waning of regional population, together with its changing patterns of distribution, and can use more detailed information from site excavation to understand further the human activities and organization. For the Chifeng region, we sought this comprehensive view so that its trajectory of social change can be more effectively compared to those of the Central Plain and other regions—regions not only within China, but in other parts of the world as well. This volume does not attempt to carry out such comparisons. Some comparative studies using Chifeng Project data have already been published elsewhere and point the way for such studies in the future (Shelach 2004, 2006; Teng 2004, 2006; Drennan and Dai 2010, 2011; Drennan and Peterson 2004a, 2004b, 2005, 2006, 2008; Peterson and Drennan 2005, 2012; Drennan, Peterson, and Fox 2010; Peterson and Shelach 2010). The aim of this report instead is to provide the details of the fieldwork, data, and analysis from the Chifeng Project that support our reconstruction of its social sequence.

Digital data and other supporting information are provided online to complement the chapters of the printed volume (see Appendix B). In the text that follows, Chapter 2 deals with the interrelated subjects of ceramics and chronology, and discusses the stratigraphic testing carried out by the project with the principal aim of contributing to the clarification of chronological issues. These subjects must precede consideration of the regional survey and its results since they form the foundation for analysis of the materials and data recovered in the regional survey. Because they are an integral part of the results of the stratigraphic testing and can only be understood in conjunction with the rest of Chapter 2, the nonceramic artifacts and floral and faunal remains recovered through excavation are also discussed here.

Chapter 3 takes up the environment of the Chifeng region as well as changes in that environment through time, relying on the chronological framework established in Chapter 2. Modern exploitation of the region's resources provides a baseline for considering prehistoric land use patterns, and geomorphological study contributes toward this end as well as to questions of interpreting the archaeological record.

Chapter 4 describes the methodology used for collecting regional settlement data in the field, for making both relative and absolute demographic estimates, and for delineating ancient human communities at both local and supra-local scales. It brings materials from chapters 2 and 3 together to establish the environmental basis of settlement distribution as it changed through time.

Chapter 5 concludes the volume with a synthesis of the sequence of social change in the Chifeng region through 7,000 years, interpreting the patterns observed in the analysis of regional settlement patterns and relating them to knowledge obtained from excavation at sites of various periods (including the stratigraphic testing discussed in Chapter 2). This synthesis of changing human communities is the central product of the Chifeng Project. It is offered in the hope of providing a sound basis for comparisons between the Chifeng region and other regions, in the quest for better understandings of the dynamics of long-term human social change.

Figure 1.3. A section of the flat alluvial valley floor in the Chifeng Project survey area. (Available online in color, see Appendix B.)

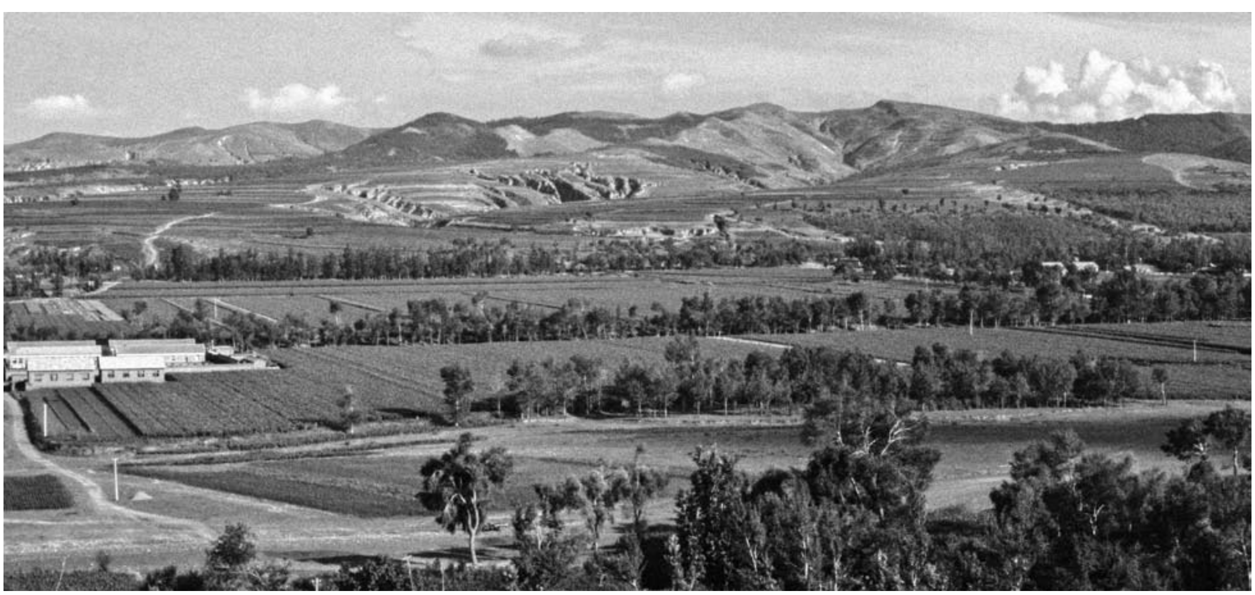


Figure 1.4. Flat valley floor in the foreground rising gently into the rolling uplands behind, with steeper slopes in the background. (Available online in color, see Appendix B.)

Chapter 2

Stratigraphic Testing, Ceramics, and Chronology

The central fieldwork of the Chifeng Project was regional survey, but small-scale stratigraphic tests were also carried out at two sites. The principal objective of these excavations was to contribute to the refinement of the chronology upon which the analysis of the settlement data would depend. The series of archaeological cultures that had been defined for the Chifeng region (and that all extended across a much larger territory as well) provided the framework of the ceramic chronology for settlement analysis. As of the beginning of the Chifeng Project, however, two parts of this chronology were less fully documented than the rest, and the stratigraphic testing focused on these two parts of the sequence. A secondary objective of the stratigraphic testing was to provide additional information useful for the interpretation of the surface remains recovered by the regional survey. Toward the realization of both these aims, a strategy of small tests was pursued to obtain a number of samples of ceramics (as well as other artifacts and ecofacts) in stratigraphic relation to each other in depositional sequences in different parts of each site. Because the aims of the stratigraphic testing were to contribute to the foundation upon which the settlement analysis was constructed, the testing program is discussed in this chapter before proceeding to the regional survey.

Site 674 (Fig. 2.1), recorded in the regional survey, was selected for testing during the 2001 season because it had high densities of surface ceramics, suggesting considerable intensity of occupation and thus the likelihood of good depth of stratigraphic accumulation. As of the time Site 674 was chosen, there was a gap between the available radiocarbon dates for Lower and Upper Xiajiadian, leaving it unclear where the dividing line between the periods should be placed or whether there might even be a regional occupational hiatus between them. The surface ceramics at Site 674 were primarily Lower and Upper Xiajiadian, with substantial amounts of each, so it offered the possibility of helping to clarify the nature and date of the transition between these two periods.

Site 342 (Fig. 2.1), also recorded in the regional survey, was selected for testing in 2006. As at Site 674, high densities of surface sherds were recorded during the regional survey. At 342 an even longer occupation was in evidence, since all the periods of the sequence except the last (Liao) were represented among the regional survey surface collections. There was thus the possibility of producing additional information concerning the transition from Lower to Upper Xiajiadian, since ceramics of both these periods occurred in substantial quantity. There was also the possibility of learning more about the enigmatic period preceding Lower Xiajiadian, since, although not abundant in the regional survey collections, Xiaoheyan ceramics were at least present. Yet earlier Hongshan ceramics occurred in somewhat higher frequency, so a stratigraphic sequence beginning before this troublesome part of the chronology and running right through it might be found.

The first section of this chapter describes the ceramics characteristic of the series of archaeological cultures that had been delineated on the basis of stratigraphic excavations carried out through a long period of archaeological field research in the region prior to the beginning of the Chifeng Project. The ceramic descriptions focus, not on whole vessels, but rather on the kinds of characteristics that are easily observed on sherds, as recovered from the

Figure 2.1. Locations of the two sites where stratigraphic testing was carried out in the Chifeng survey area.

surface on archaeological survey. The second section of the chapter discusses the excavation methods employed and the stratigraphic results at each of the two sites. The third section of the chapter takes up the question of assigning dates to the periods, based primarily on radiocarbon determinations, including those whose contexts in the two sites tested by the Chifeng Project are presented in the second section.

The fourth section of the chapter describes the analysis of lithic artifacts, faunal remains, and bone artifacts recovered in the stratigraphic tests at sites 674 and 342. Neither faunal remains nor bone artifacts are preserved on the surface, so these are the only samples of such materials recovered by the Chifeng Project. Lithic artifacts are, of course, preserved on the surface, but since most sites in the Chifeng survey area were occupied during several periods, it is not generally possible to know to which period surface lithics pertain. The stone tools from the tests, then, are the most securely dated sample of such materials recovered by the Chifeng Project. Brief summary tabulations of these three classes of materials are included in the fourth section, and some of what can be learned from them is incorporated into the concluding Chapter 5 of the volume.

The final section of this chapter is a more extended analysis of floral remains recovered in the stratigraphic testing. The results of this analysis are also incorporated into the synthesis that concludes the volume.

2.1. Ceramic Chronology

Zhu Yanping and Guo Zhizhong

The success of any regional survey depends on accurate dating of artifacts collected from the surface. Among these artifacts sherds are by far the most important because they are usually the most numerous and because vessel forms, decoration, firing characteristics, surface finish, and paste and temper characteristics change rapidly enough to allow for good chronological control. Chronological identification of sherds is especially important for regional settlement studies with the aim not only of identifying periods of occupation but also of estimating regional population levels. As discussed more fully in Chapter 4.2, the best proxy for regional population levels is the amount of garbage disposed of on the landscape. Because of their abundance in the first place and their resistance to decay, sherds become the most archaeologically visible constituent of this garbage. This, together with their amenability to chronological identification, places sherds at center stage in talking about the spatial distributions and sizes of prehistoric human populations. Settlement analysis, then, depends on quantifying sherd refuse at a regional scale for different periods. This requires more than just the identification of a few 'diagnostic' sherds. It is essential to assign at least best-guess dates to a large proportion of the sherds collected in the field and to minimize the number of sherds left in the unidentified category. This must be accomplished to a similar degree for all periods. Otherwise periods with more distinct and easily-identified ceramics will be overrepresented while periods with ceramics that are more difficult to identify will be underrepresented.

Luckily, the ceramics of the Chifeng region are well known. Previous archaeological work carefully established the typical attributes of each of a series of archaeological cultures, and these definitions are the basis for identifying the different chronological phases that make up the sequence for settlement analysis. Except for the Xiaoheyan period, whose ceramics are not yet so clearly defined, it is possible to make a chronological assignment, not only for diagnostic sherds, such as vessel rims, bases, and supports, but also for most body fragments as well. This extensive previous work made it possible to assign the vast majority of the sherds collected during the survey to their periods, even though many of them were only very small fragments. Those which simply did not show positive characteristics linking them to one of the periods discussed below were left unidentified, and their numbers are registered in the ceramic data. The aim of this section is to describe the attributes on which the chronological determinations were based.

Xinglongwa Period

The Xinglongwa period takes its name from the Xinglongwa site in Aohan Banner, Inner Mongolia, which was first excavated in 1983 (Zhongguo 1985). Xinglongwa ceramics are found all along the Xilamulun River drainage and north and south of the Yan Mountains (Zhongguo 1997b). They extend from Inner Mongolia into eastern and northeastern Hebei and western Liaoning provinces (Yang and Liu 1993, 1997). In addition to the Xinglongwa site itself, excavated sites with Xinglongwa remains in Inner Mongolia include Xinglonggou (Aohan Banner; Zhao 2004), Baiyinchanghan (Linxi County; Neimenggu 1993), Nantaizi (Keshiketeng Banner; Neimenggu 1994b, 1997), and Jinguishan (Balinzuo Banner). In Liaoning there is also Chahai (Fuxin County; Xin and Fang 2003; Liaoningsheng 1988, 1994; Fang 1991); in Hebei, Dongzhai (Qianxi County; Hebeisheng 1992); and in Beijing, Shangzhai (Pinggu County).

The ceramic inventory of the Xinglongwa period is very limited and easy to identify. There are few vessel types, all of them open containers or bowls with relatively straight walls and flat bases. They have simple rims and no handles, and the walls are thick and uneven. The vessels are all hand-modeled from red sandy clays, which are often tempered with fragments of black crushed stone and mica. The texture is often crumbly, and the surface scales off easily. Bowls have thinner walls than the larger containers do, and the interior and exterior surfaces may be more similar. Bowls are made of slightly better quality material.

Xinglongwa pottery was fired at a relatively low and uneven temperature. As a result, the surface is often black or mixed black and reddish-brown, contrasting with a reddish core. Other sherds may have grayish or yellowish surfaces, and even relatively small sherds often show patches of different colors.

Xinglongwa sherds are especially easy to identify because almost the entire surface is decorated with stamped patterns. Typical patterns are crosses or X's (*jiaochawen*) and Z's (*zhiziwen*) (Fig. 2.2). The cross patterns are made by pressing a short straight tool into the unfired surface, then lifting it and pressing it in again at right angles. The Z patterns are what is called rocker-stamping in some parts

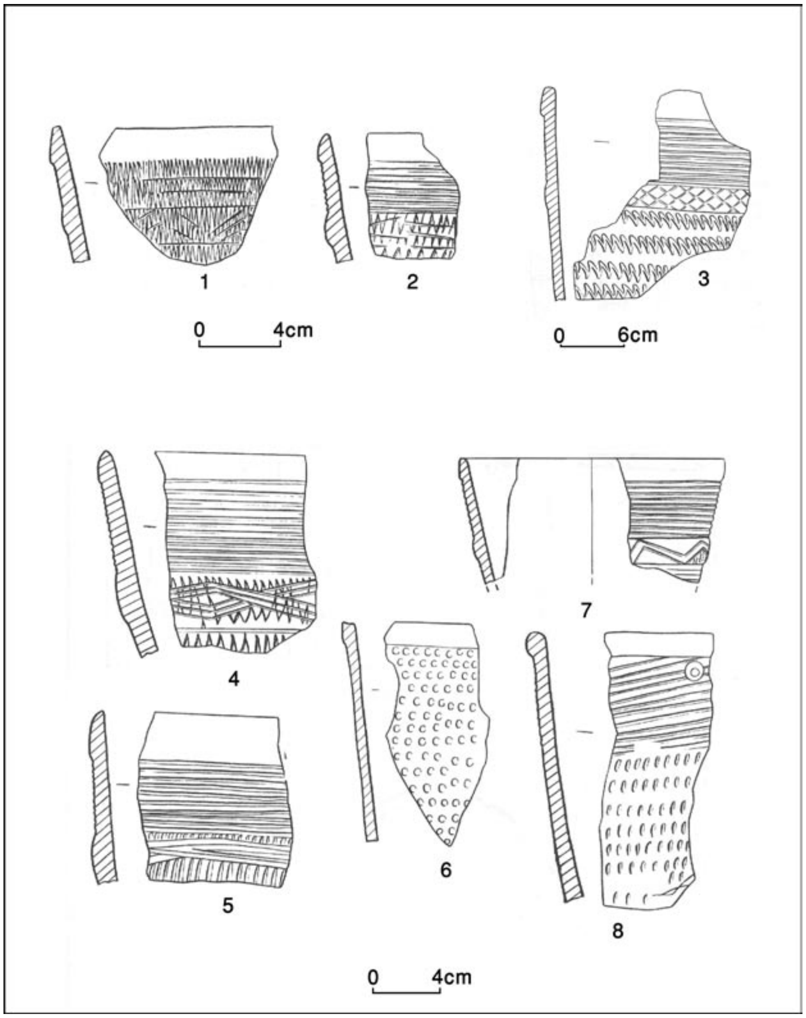


Figure 2.2. Xinglongwa sherds (after Neimenggu 2004:73, 103, 110).

of the world; the stamping tool does not leave the surface, but is rocked from side to side, advancing in a step-wise zig-zag pattern. Other stamped patterns form hachure consisting of parallel lines in a single direction or perpendicular sets of parallel lines, forming a grid-like pattern. Dense zones of stamped circles and dots (Fig. 2.2, no. 6) have also been found but are not common. On the larger cylindrical jars an appliqué clay strip is sometimes added around the upper part of the vessel, and varied geometrical patterns are incised in it. Remains of such appliqué strips (either still attached or not) are sometimes found on survey.

Zhaobaogou Period

The Zhaobaogou period was named after the Zhaobaogou site in Aohan Banner, Inner Mongolia, excavated in 1986 (Zhongguo 1988; Zhu 1997). Zhaobaogou materials, like those of Xinglongwa, are found across a large territory, extending well beyond the Chifeng survey area. Other excavated sites with Zhaobaogou materials in Inner Mongolia include Xiaoshan (Zhongguo 1987) and Nantaidi (Aohan Banner; Zhongguo 1997b), Xiaoshandegou (Wengniute Banner), and Baiyinchanghan (Neimenggu 1993, 2004) and Shuiquangou (Linxi County). In Hebei, Xizhai (Qianxi County), Anxinzhuang (Qianan County), and Jingoutun (Luanping County) are also believed to contain Zhaobaogou materials.

The Zhaobaogou ceramic industry continues many elements of the Xinglongwa tradition, but sherds of the two periods are usually easy to distinguish because the quality of Zhaobaogou ceramic production is higher, and because Zhaobaogou decorations are more complex. Straight-wall, cylindrical jars are common in Zhaobaogou times, but in comparison to the Xinglongwa period, more vessels have arched walls and deep bellies and these shapes can be identified in the curvature of sherds collected on survey. Some Zhaobaogou vessels have an unusual oval shape which is easily noticed, even on medium-sized body sherds. As in Xinglongwa, most vessels have open mouths and simple rims. Most vessels have flat bases, but low ring bases, not seen during the Xinglongwa period, sometimes appear.

The decorative tradition of Xinglongwa, with its typical stamped Z motifs, also continues during the Zhaobaogou period (and beyond, into Hongshan times). Zhaobaogou sherds, however, are quite distinct from their predecessors because of their much more varied and complex decoration (Figs. 2.3 and 2.4). In addition to the stamping techniques already discussed, incised motifs are also very common. Appliqué designs are also found, although they are less common. As in Xinglongwa times, most of the vessel body is decorated, which makes it easy to identify even small Zhaobaogou sherds. In addition to the Z motif (Fig. 2.3, nos. 6 and 7), vessels are decorated with geometric patterns (*jihewen*) formed by long horizontal, vertical, oblique and curved lines. The spaces between these geometric patterns are often filled with parallel lines or dots (Fig. 2.3, no. 4, and Fig. 2.4, nos. 1, 5, and 6). Geometric motifs include zig-zag patterns in the shapes of the letters F, S, and W, and complex designs made of a single line twisting around in interwoven loops. Zhaobaogou Z patterns are usually made up from overlapping long vertical and horizontal lines. The Z patterns of horizontal lines overlapped with vertical ones are usually short and organized into very orderly arrangements. Such Z patterns are quite different from those of Xinglongwa times and are easy to recognize.

The combination of different types of Z motifs with geometric designs and spaces filled with dots or short par-

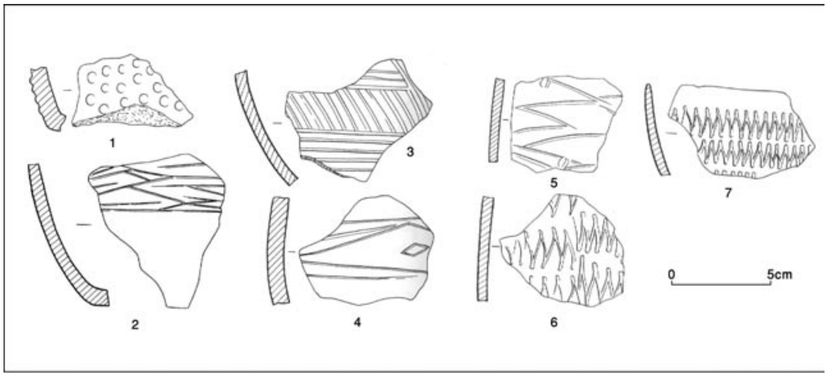


Figure 2.3. Zhaobaogou sherds
(after Zhongguo, Neimenggu, and Jilin 2002:112, 252).

allel lines is unique to the Zhaobaogou period, and distinguishes it from the earlier Xinglongwa period and the later Hongshan period.

Hongshan Period

Hongshan remains were identified from Japanese-led excavations during the 1930s at Hongshanhou in Chifeng City, but few sites have been extensively excavated (Guo 1995). At their maximum extent, Hongshan materials stretched from the Qilaotu Mountains to the Keerqin Sandy Lands and reached as far south as the Bohai Gulf and as far north as Daxing'anling. Other excavated sites in Inner Mongolia with Hongshan remains include Zhizhushan (Zhongguo 1979) and Xishuiquan (Chifeng City; Zhongguo 1982), Baiyinchanghan (Linxi County; Neimenggu 1993, 2004), Erdaoliang (Balinzuo Banner; Neimenggu 1994a), Nasitai (Balin-you Banner; Balinyouqi 1987; Neimenggu 1994b), and Xinglongwa and Xitai (Aohan Banner). Excavated Hongshan sites in Liaoning include Hutougou (Fuxin County), Chengzishan (Lingyuan County; Li 1986), Dongshanzui (Kazuo County; Liaoningsheng, Zhaowudameng, and Chifengxian 1983; Guo and Zhang 1984), Niuheliang (Jianping County; Chaoyangshi and Liaoningsheng 2004; Li 1984; Liaoningsheng 1986; Liaoningsheng 1997, 2001b, 2008a, 2008b; Wei 1994), and Shaguotun (Jinxi County).

Hongshan ceramics clearly continue the Xinglongwa-Zhaobaogou tradition, but are also distinguishable from them and can easily be identified even when only small fragments are found. The ceramics of this long period have been sorted into subphases, but these chronological refinements rely heavily on whole vessels found in graves and ceremonial contexts. The subphases are not readily identifiable on sherds from habitation remains, which make up the bulk of the survey collections, so the Hongshan period is not subdivided in the survey analysis.

In general the quality of Hongshan pottery is much higher than that of the preceding periods. Sandy clays are less common, and fine clays become much more frequent. All pottery was fired at relatively high temperatures, so it is less crumbly than even the Zhaobaogou ceramics, and its color is more homogeneous. For the first time there is a clear distinction between coarse-paste ceramics, taken to be for daily utilitarian purposes, and fine-paste ceramics,

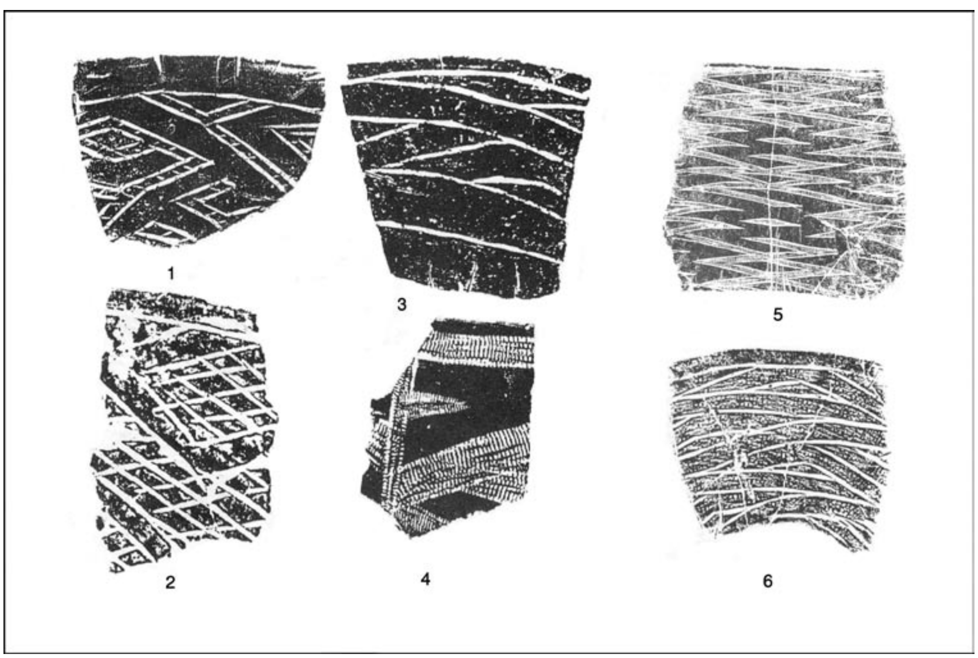


Figure 2.4. Decoration on Zhaobaogou sherds (after Zhongguo 1997a:145, 157, 160).

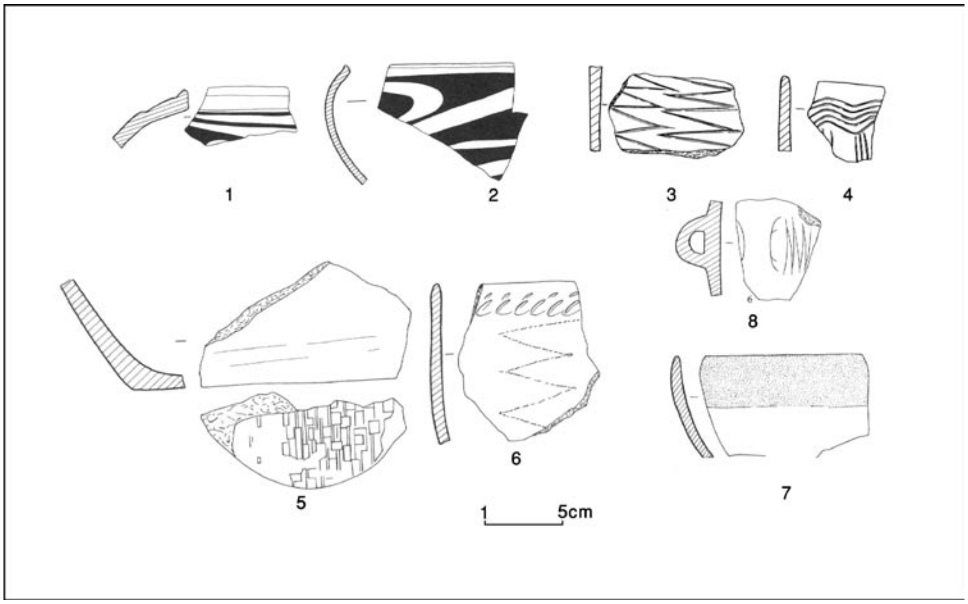


Figure 2.5. Hongshan sherds (after Zhongguo, Neimenggu, and Jilin 2002:19, 89, 101, 114, 304).

thought to be for ceremonial use or prestige display. These fine-paste ceramics often have thinner walls of more even thickness; exterior surfaces are sometimes burnished.

During Hongshan times, the proportion of large cylindrical jars decreases, and the proportion of bowls, small-mouthed jars, urns, and low-bellied jars increases. Rims are mostly simple, although some are more pronounced than before. Many of the vessels still have flat bases; sometimes with mat impressions (Fig. 2.5, no. 5). Less common, but also found, are ring bases and pedestals. Lids and small ear-like handles are also known (Fig. 2.5, no. 8).

On vessels of daily use, the Z pattern is still the most common decorative motif, although it is somewhat different in style from earlier designs; the lines are more curved and more closely spaced than before. The geometric designs typical of Zhaobaogou ceramics are much less common, and when they do appear they are less stylized. Fingernail-impressed and braided (*duiwen*) motifs are also common. Entirely undecorated vessels also occur.

Painted decoration is a new (and almost exclusive) attribute of Hongshan pottery (Fig. 2.5, nos. 1 and 2). Rare occurrences of painted pottery were reported from the Zhaobaogou site, but no sherds resembling these descriptions were found in the Chifeng survey. A yet different sort of painting also occurs rarely in Xiaoheyan times, and a few polychrome vessels are known from Lower Xiajiadian graves, but, again, no such sherds turned up in the survey collections. Black, red, and violet pigments are used for decorating fine-paste vessels. Standard painted motifs include zig-zags, solid bands, parallel horizontal lines, triangles, diamonds, hooks, and fish-scale shapes, among others. Very distinctive small fine-paste bowls with thin reddish walls and a dark band on the upper wall and rim (Fig. 2.5, no. 7) are easy to identify even if only a tiny fragment is found. Another distinctive attribute is a red burnished exterior surface.

Xiaoheyan Period

Xiaoheyan ceramics were first delineated in the 1970s from excavations at Nantaidi in Xiaoheyan Township (Aohan Banner) in Inner Mongolia (Liaoningsheng, Zhaowudameng, and Aohanqi 1977). Prior to that, similar pottery had occasionally been found, but not in sufficient quantity to permit distinguishing it from Hongshan ceramics. Excavation of the Danangou cemetery in Wengniute Banner (Liaoningsheng 1998), also contributed valuable material for defining Xiaoheyan. Xiaoheyan ceramics have been recognized in an area that is similar to that described above for Zhaobaogou: from the Xilamulun River in the north (Xia, Deng, and Wu 2000; Tang, Zhu, and Wang 2007), to the Bohai Gulf in the south, and the Yiwulü Mountains in the east. To the west, Xiaoheyan ceramics are reported from the headwaters of the Xilamulun River. The greatest known concentration of Xiaoheyan ceramics occurs in the Nuluerhu Mountains. In addition to Nantaidi and Danangou (Liaoningsheng 1998), excavations yielding Xiaoheyan ceramics in Inner Mongolia include those at Baiyinchanghan (Linxi County; Neimenggu 1993), Shangdian (Keshiketeng Banner), and Shiyangshihushan (Aohan Banner). In Liaoning, there are also Xiaoheyan ceramics from the Shaguotun site (Jinxi County). All across this area, though, sites with Xiaoheyan ceramics are extremely rare.

As a result of this scarcity, Xiaoheyan ceramics remain the least well known in the Chifeng sequence. One possibility is that we are currently able to identify only a portion of the sherds that pertain to this period, and that others are currently attributed to Hongshan times or to the later Lower Xiajiadian period.

Xiaoheyan ceramics are primarily made of sandy clays, with the result that the texture of most Xiaoheyan sherds is more crumbly than that of Hongshan sherds. Some Xiaoheyan clays are tempered with mica or ground shells, giving the sherds a distinctive texture. Xiaoheyan ceramics show highly varied colors, ranging from black and gray to brown and red. The color of individual vessels (and even sherds) is often not homogeneous. Different colors are often shown in the cross sections of sherds, with the outside being black but the core of a lighter color. The vessels are all hand modeled.

Many Xiaoheyan vessels have large open mouths and simple rims, but some also have high necks or more pronounced outward turning rims. Common vessel forms include bowls, goblets, and large jars, some with round bellies and some with relatively straight walls. Most vessels have flat bases, although high pedestal bases are also known. Small ear-like handles are even more common than during the Hongshan period.

In contrast to previous periods, most Xiaoheyan pottery is not decorated. When decoration appears, incised and pressed designs are still the most common. These include cord impressions, checkered patterns, and crossed patterns. The Z motif, typical of all previous periods, almost entirely disappears. Appliqué and raised clay belt patterns are known.

Paintingisthemosteasily recognized characteristic of Xiaoheyan sherds. Sometimes the painting was done after firing and is therefore less well preserved. Painted patterns are mainly geometric shapes and lines, including parallel straight lines, parallel oblique lines, interwoven line patterns, triangles, rows of semi-circles, and less formal geometric forms. Designs in the shape of animals, identified as frogs, birds, and ibex, are also known, but they were not commonly found in the Chifeng survey. Paint colors vary from black and gray to reddish brown.

It is usually easy to distinguish between the painted decoration of Xiaoheyan and Hongshan ceramics. In contrast to Hongshan painted decoration, Xiaoheyan ceramics sometimes have painted motifs over a painted background. On these vessels the background is usually painted in light color (white or cream), and the motifs are darker (black or red). Hongshan painted motifs usually cover larger spaces and tend to have more rounded forms, while Xiaoheyan motifs are much more linear and geometric.

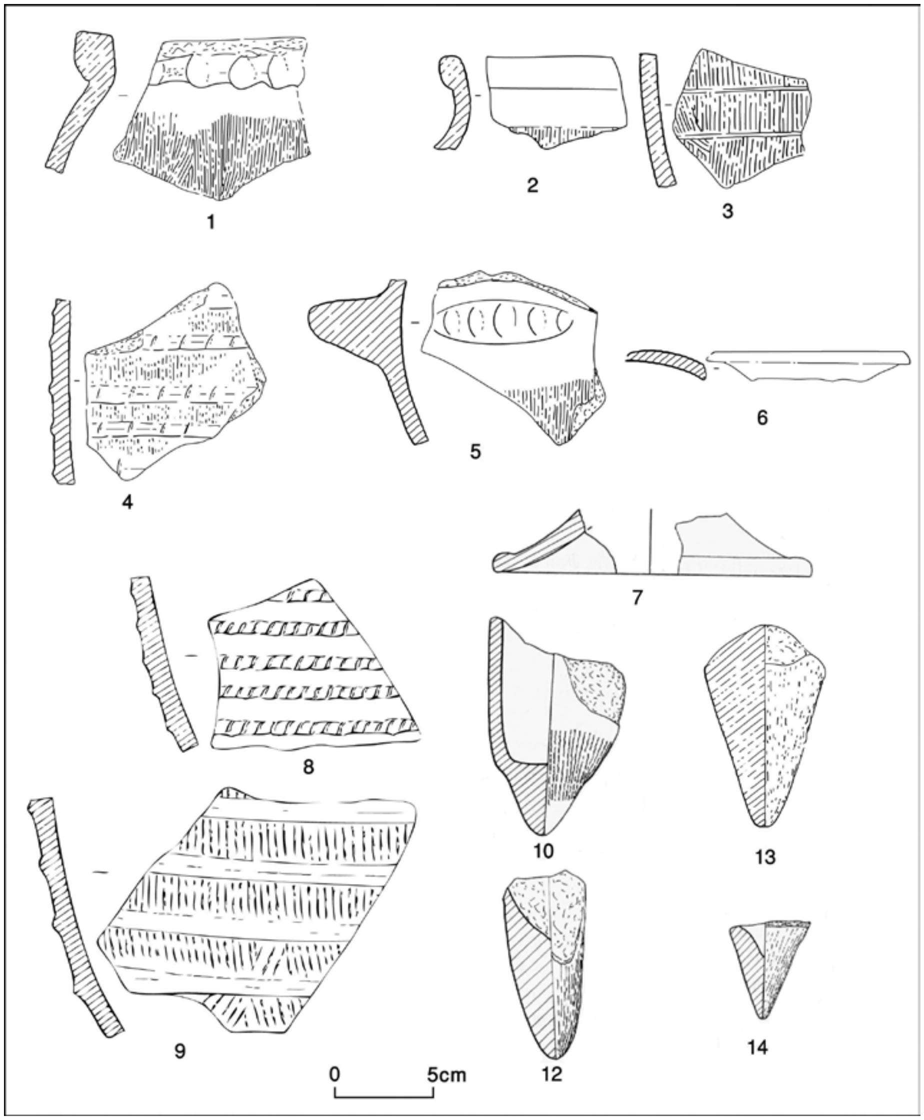


Figure 2.6. Lower Xiajiadian sherds (after Zhongguo, Neimenggu, and Jilin 2002:26, 35, 74, 91, 175, 220, 224, 257, 278, 293).

Lower Xiajiadian Period

Lower Xiajiadian is named after the Xiajiadian site in Chifeng City. Lower Xiajiadian materials came to be spread northward across the Xilamulun River, beyond the zones covered by the earlier materials described above. Known sites prior to the Chifeng survey numbered in the thousands, far more than for the earlier periods. They are especially densely distributed in the area between the Yangchangzi River and the Nuluerhu Mountains. Important excavated Lower Xiajiadian sites in Inner Mongolia include Zhizhushan (Zhongguo 1979) and Yaowangmiao (Chifeng City; Zhongguo 1961, 1974), Dadianzi (Aohan Banner; Zhongguo 1996), Dashanqian (Kalaqin Banner; Wang 2004; Zhongguo and Jilin 2004), Hedong (Kalaqin Banner; Liaoningsheng and Chaoyang 1983), Sifendi (Liaoningsheng, Zhaowudameng, and Chifengxian 1983), Xindian, Fushanzhuang, Xidao, Sanzuodian (Neimenggu 2007), and Shangjifangyingzi (Songshan District). Excavated Lower Xiajiadian sites in Liaoning include Pingdingshan (Fuxin City), Fengxia (Liaoningsheng 1976) and Kangjiatun (Beipiao City; Liaoningsheng 1976, 2001a), Shuiquan (Jianping County; Li 1984), and Shuishouyingzi (Jinxi County). Lower Xiajiadian remains are sometimes found associated with materials identifiable to the late Shang Dynasty, with which it is contemporaneous, especially south of the Nuluerhu Mountains, but occasionally also north of the Xilamulun River.

Lower Xiajiadian sherds are easily distinguished from those of previous periods. The quality of the ceramics, the production techniques, the vessel forms, and the decoration are all quite different from earlier ceramics in this region. Lower Xiajiadian ceramics were fired at much higher temperatures and in much more stable conditions than earlier pottery, giving the sherds a sometimes almost metallic hardness. Color is very homogeneous and ranges from dark gray to light black. Reddish brown wares also occur, but less commonly. Two main kinds of clay body were used: relatively plain clay and sandy clay. For the first time in the sequence most pottery was wheel made or molded, rather than hand modeled.

The inventory of Lower Xiajiadian vessel forms is much richer than that of previous periods. The most commonly seen forms include *li* and *yan* cooking vessels, *ding* tripods, tall-legged *dou*, cauldrons, goblets, footed cups, jars with small or medium mouths, basins, plates, and bowls. Each form has various subforms. All vessels have curved walls; the common cylindrical forms typical of previous periods were no longer made. Many vessels have outwardly flared rims, which are often quite elaborate (Fig. 2.6, nos. 1, 2, and 6). Solid and hollow conical supports are very common, but other shapes also occur (Fig. 2.6, nos. 10–13). Tall ring bases and pedestal legs are also known (Fig. 2.6, no. 7). Small flange handles occur rarely (Fig. 2.6, no. 5). Lower Xiajiadian body sherds are usually easy to identify, and the *ding* and *li* supports are common and very conspicuous in survey collections.

Undecorated sherds are not uncommon for Lower Xiajiadian, but sherds with fine stamped decoration are more numerous. Most common are bands of shallow parallel lines (Fig. 2.6, nos. 1–4 and 9) sometimes labeled basket impressions (*lanwen*) or cord-marking (*shengwen*), although it is unlikely that they were produced in either of these ways. Zones of these impressions are sometimes placed adjacent to each other, either in parallel or at an angle. Sometimes the bands of shallow parallel lines are separated by undecorated zones or by raised ridges. Narrow raised clay belts decorated with incised or impressed patterns are also common (Fig. 2.6, nos. 4 and 8). Some undecorated wares are coated with a slip (black or red) and partly polished. Vessels painted after firing are known from Lower Xiajiadian graves but were not found in the Chifeng survey.

Upper Xiajiadian Period

Like Lower Xiajiadian, Upper Xiajiadian is named after the Xiajiadian site in Chifeng City. The territory from which Upper Xiajiadian ceramics are known is similar to that for Lower Xiajiadian; the number of sites and tombs is substantial (Zhu 1987, 2004). Other major excavated Upper Xiajiadian sites in Inner Mongolia include Xiaoheishigou (Ningcheng County), Dashanqian (Kalaqin Banner; Zhongguo and Jilin 2004), Longtoushan (Keshiketeng Banner; Neimenggu 1991; Qi 1991), Tabuaobao (Balinyou

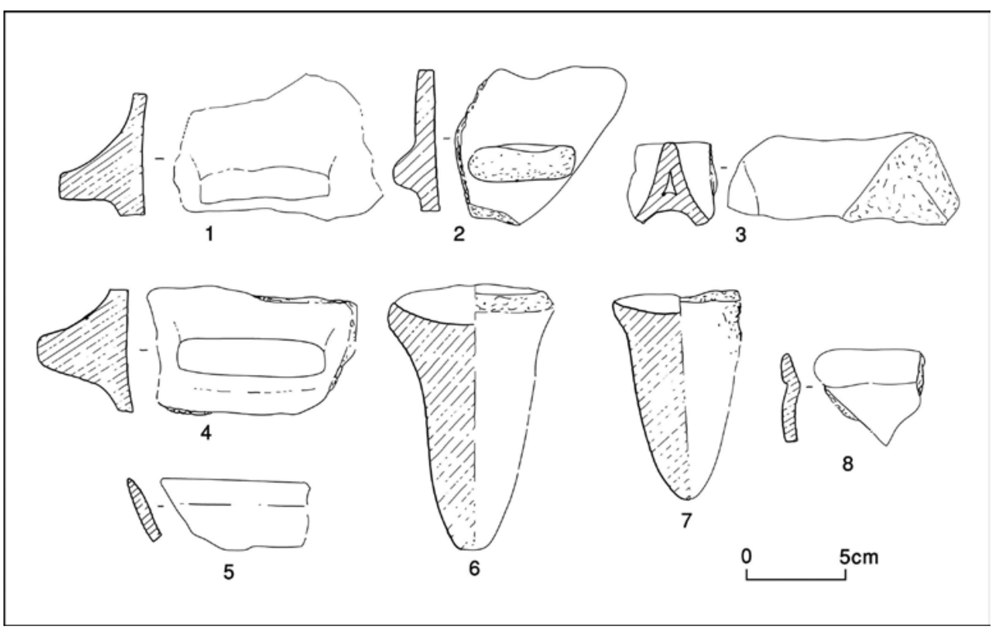


Figure 2.7. Upper Xiajiadian sherds (after Zhongguo, Neimenggu, and Jilin 2002:86, 150, 164, 209, 211).

Banner), Dajing (Linxi County; Wang 1994), Zhoujiadi (Aohan Banner; Zhongguo 1984) and Xidao (Songshan District). By Upper Xiajiadian times, historical sources from other parts of China help to position the ceramic sequence in time. Upper Xiajiadian remains are apparently contemporaneous with the Zhou Dynasty in the Spring and Autumn period and might reach back as far as late Shang.

The forms of Upper Xiajiadian vessels are often quite similar to those of Lower Xiajiadian, but sherds of the two periods are easily distinguished by their quality, color, and decoration. Upper Xiajiadian pottery was fired at a much lower temperature than that of Lower Xiajiadian, so Upper Xiajiadian sherds crumble much more easily. The most distinctive pottery of the Upper Xiajiadian period is made of sandy clay. It is mostly red or reddish brown in color, but because of uneven firing temperatures, black and gray spots often cover parts of the vessel's body and are clearly visible even on relatively small sherds. More Upper Xia-

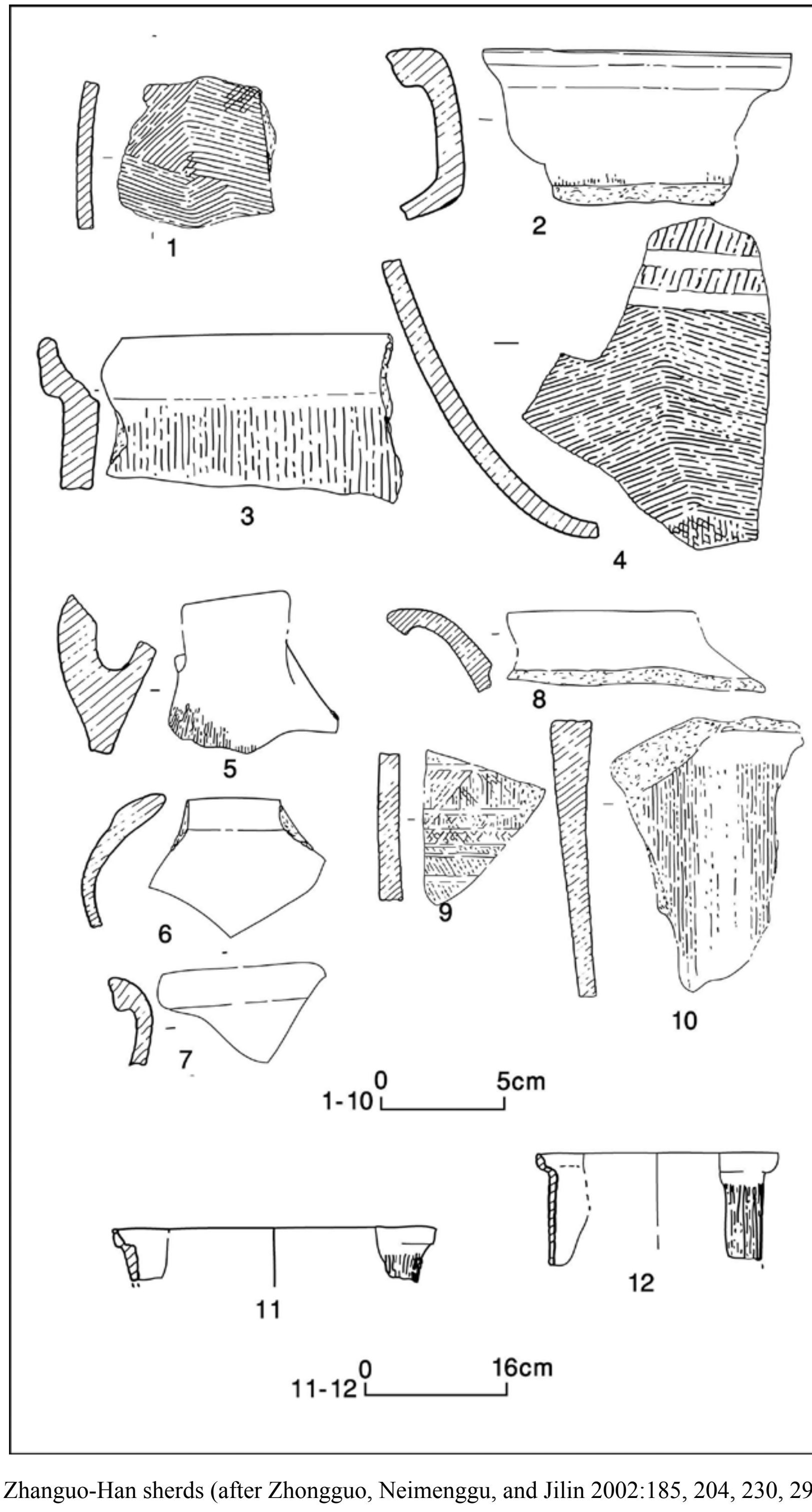


Figure 2.8. Zhanguo-Han sherds (after Zhongguo, Neimenggu, and Jilin 2002:185, 204, 230, 290, 294, 307).

jiadian vessels are hand modeled or pressed into molds, compared with more widespread use of the potter's wheel during Lower Xiajiadian. As a result, the shapes of Upper Xiajiadian vessels are less regular and the vessel walls are less uniform in thickness.

Li and *yan* vessels are still common but their walls are straighter than before. Conical *li* feet, which were often found during survey, tend to be bigger than those of Lower Xiajiadian, and they are usually undecorated (Fig. 2.7, nos. 6 and 7; and compare to Fig. 2.7, nos. 10–13). The bases of *li* vessels, with remains of the attachments of the three supports, are especially distinctive Upper Xiajiadian sherds in the survey collections (Fig. 2.7, no. 3). Tall-footed *dou* vessels and bowls with open mouths are also common. The treatment of vessel rims is simpler than during Lower Xiajiadian (Fig. 2.7, nos. 5 and 8), but flange and ear-like handles are more common (Fig. 2.7, nos. 1, 2, and 4).

In contrast to most Lower Xiajiadian sherds whose surfaces are stamped, the surfaces of almost all Upper Xiajiadian sherds are plain. Some more elaborate surface treatments are known; footed cups, bowls, and jars, for example, are sometimes coated with a polished dark red slip. Painted decorations are extremely rare.

Zhanguo-Han Period

The ceramic industry of the late pre-imperial (Zhanguo, or Warring States) and early imperial (Qin and Han) periods is very different from that of previous periods in the Chifeng region and is perhaps associated with traditions external to it. Remains of the Zhanguo-period Great Wall built by the Yan state are visible in the greater Chifeng area, and the Yan commanderies of Youbeiping and Liaoxi were here (Wang 2004). Subsequently the survey area came under the sway of the Han Dynasty. A range of different ceramics, corresponding to different ethnic groups, were used to identify this period on survey. All vessels by this time are wheel-made and are fired at very high temperatures, producing an even harder ceramic than in Lower Xiajiadian times. Two main types of Zhanguo-Han pottery are widely recognized in the survey collections. The first is made of fine clay and is gray in color. The second is reddish orange in color and contains an extraordinary amount of mica temper. The unique color of this second type and the shiny mica apparent on its surface make it very easy to identify.

The most typical Zhanguo-Han vessel forms are round-bottomed cauldrons, deep-bellied basins, broad-shouldered jars with short collars, small-mouthed kettles with round bellies, and plate-shaped footed cups with long stems. Many vessel forms have a clear neck separating the body of the vessel from its mouth (Fig. 2.8, nos. 2, 3, 11, and 12), something that is not seen on vessels of previous periods. The rims of the vessels are also more elaborate than before; many flare outwards and have square edges (Fig. 2.8, nos. 2, 3, 7, and 8). Handles are not very common, but some relatively large ones exist (Fig. 2.8, no. 5). *Ding* and *li* supports are much less common than before, and do not include the conical supports typical of Lower and Upper Xiajiadian. Tall pedestals are found but are not very common.

Many of the vessels are decorated with stamped patterns that are quite similar to the so-called cord-marking of the Lower Xiajiadian period. These stamped decorations are neatly arranged in patterns or parallel strips (Fig. 2.8, nos. 1, 4, and 9). Undecorated vessels are less common.

Liao Period

The ceramics labeled Liao in the Chifeng survey analysis do not correspond to the Liao Dynasty proper, but rather represent the period following the Han Dynasty up through the Ming and Qing dynasties. Since the research questions that motivated the Chifeng survey concerned much earlier times, the analysis attempted merely to identify occupations dating to this broad historical period. No attempt was made to sort out its different parts. It does seem, though, that the majority of the materials classified in the Chifeng analysis as Liao do pertain to the period of the Liao Dynasty. Materials of the Jin (金) and Yuan dynasties also account for a considerable share of the total, but those of Wei-Jin (魏晉), Sui, Tang, Ming and Qing dynasties are relatively few.

Liao ceramics are easily distinguished from those of earlier times because of their very high quality (fired at much higher temperatures than ever before) and by their color, forms, surface treatments, and decoration. Most Liao ceramics are made of fine clay and have an even gray or sometimes almost black color. Most are wheel-made, although a few are hand modeled.

High jars with round bellies and tall necks are very typical. Also common are bottles, bowls, and urns with narrow mouths and curled rims. Most vessels have very elaborate necks and rims. Handles are known but are not common, and most vessels have flat bases.

Many Liao sherds are undecorated, but incised, impressed, and raised patterns are also common. Decoration includes impressed clay belts, incised wave patterns, comb patterns, and others. Liao times also include the dawn of glazed ceramics and porcelain in this region, so all glazed and porcelain sherds that were not clearly modern were included in the counts for the Liao period. Fired bricks and remains of water pipes are also commonly found at Liao sites and are identified in this region as belonging to the post-Han period.

2.2. Excavation Methods and Stratigraphy

Robert D. Drennan

The approach to stratigraphic testing was the same at both of the sites selected. First a large number of systematic surface collections were made by the same methodology used in the regional survey. (See Chapter 4.1, below, for more details of this collecting methodology.) At Site 674, 24 collections were made; and at Site 342, a total of 88. Each consisted of a circle 3 m in diameter, drawn on the surface, within which all artifacts were collected and returned to the laboratory for washing and analysis. At both sites, the collection circles were broadly scattered across the occupied zone. The purpose of these collections was to provide a detailed assessment of the nature of surface remains at these two sites for comparison to the much more cursory means of collecting information in the regional survey. The systematic collection results also facilitated comparing the conclusions about the history of occupation at these two sites that could be made on the basis of surface remains with the impression gained from stratigraphic testing. These comparisons are discussed below in Chapter 4.2.

Once the surface collections had been completed, small tests, usually 1 by 2 m, were excavated in different parts of each site. In several instances tests began by taking advantage of recent disturbances, such as agricultural terracing, excavation of drainage ditches, and the like, to clean and examine stratigraphic profiles and to begin stratigraphic excavation in the deposits at their bases, reaching early strata without having to dig through substantial amounts of later accumulation above them. The time available during the 2001 field season meant that only four tests could be carried out at Site 674. These were widely distributed in four different sectors of the site. Ten tests were completed at Site 342, although they were not as broadly distributed across the site as would have been useful for getting a general view of the site's stratigraphy owing to the disruption of growing crops that such a distribution would have caused.

Excavation was carried out initially by scraping horizontally with square-bladed shovels, so as to be able to notice changes in the nature of the soil. All dirt was screened through quarter-inch (6 mm) mesh, and all ceramics and other artifacts were bagged separately by layer and returned to the laboratory for cleaning and analysis. All fragments of bone were also collected and bagged, as well as visible pieces of carbon. Excavation proceeded in this way in each test unit to a depth of 10 cm or until a change in the color or nature of the soil was encountered, whichever came first. The floor of the excavation was then cleaned and examined before another layer was begun. The depth of each cleaned floor below the datum established for the test was recorded for each corner of the test as well as midway along each long wall. If different depositional units were noted on the cleaned horizontal surface, the next layer was dug in separate sectors that corresponded to them, so that the artifacts recovered could be assigned to these natural stratigraphic units separately. Shovels were laid aside and trowels were used for more careful excavation as needed, based on the complexity of the stratigraphy and the size of the units being excavated. When sufficient amounts of carbon for radiocarbon dating were observed (usually one or a few nearby large chunks), these were collected and wrapped in aluminum foil. The positions of radiocarbon samples were recorded by measurements in three dimensions. Excavation continued until sterile subsoil was reached, and sometimes continued into it a little to be sure that no further cultural material was forthcoming.

Once excavation was complete, stratigraphic profile drawings were made of all four walls of the test. These served as the basis for the interpretation of the depositional sequence. Individual lots of artifacts recovered from the excavation of each layer could be related to these profile drawings according to the measurements taken as they were excavated. Artifacts from the individual lots could then be grouped together according to how they corresponded to the "natural" units of cultural deposition. The periods during which those units were deposited were then determined on the basis of the ceramics included in the deposits. At Site 674, samples of soil for extraction of pollen were collected from each major stratigraphic unit in tests B, C, and D after the profiles had been drawn.

Detailed information on the stratigraphic sequences of all tests and complete data on all materials recovered, excavation unit by excavation unit, are available online (see Appendix B). The information online includes stratigraphic profiles, photographs, and synthetic accounts of construction and stratigraphic sequences for each test. The contexts of the samples for radiocarbon dating discussed in the next section are identified.

In summary, although materials of most of the periods in the sequence were present on the surfaces of the two sites tested, almost all the stratigraphic deposition exposed dated to Lower Xiajiadian or Upper Xiajiadian.

Xinglongwa, Zhaobaogou, Hongshan, and Xiaoheyan ceramics were also recovered from the stratigraphic tests, but always as small quantities of earlier materials mixed into stratigraphic units deposited in Lower or Upper Xiajiadian times. Substantial amounts of Lower Xiajiadian ceramics were recovered from "pure" contexts—that is, contexts showing little or no evidence of mixing with materials of other periods. Substantial amounts of Upper Xiajiadian ceramics were also recovered, but virtually all stratigraphic units deposited in Upper Xiajiadian times at both sites also contained a considerable admixture of Lower Xiajiadian ceramics that had clearly been brought up and redeposited along with Upper Xiajiadian materials. It was no surprise that the last two periods of the sequence were much more scantily represented since the two sites tested had been selected precisely to avoid much stratigraphic accumulation from these late periods.

Finally, then, the stratigraphic tests produced good amounts of artifacts and ecofacts clearly pertaining to the Lower Xiajiadian period. They also produced good amounts of artifacts and ecofacts that comprise samples representing Lower and Upper Xiajiadian materials mixed together. It is only for Lower Xiajiadian, then, that it is possible to discuss artifact and ecofact assemblages in a direct and straightforward way. At least the direction of change in assemblages into Upper Xiajiadian times can also be discussed as well, on the basis of mixed deposits laid down during the Upper Xiajiadian period but with considerable quantities of Lower Xiajiadian materials mixed in. Good samples for radiocarbon dating of both Lower and Upper Xiajiadian deposits were recovered, and their contribution to refinement of absolute chronology is discussed in the next section. Ceramics are not further discussed in this chapter, since the small tests at sites 342 and 674 added little to our knowledge of what the ceramics of Lower and Upper Xiajiadian were like. Lithics, faunal remains, bone tools, and floral remains are discussed in the following sections, where they are tabulated for each site in two principal chronological categories: unmixed Lower Xiajiadian materials, and mixed Lower and Upper Xiajiadian materials.

2.3. Absolute Dating

Gideon Shelach, Robert D. Drennan, and Christian E. Peterson

The chronological scheme presented in the first section of this chapter is, of course, a set of periods defined by the distinctive characteristics of their ceramics. For many analytical purposes, it is sufficient simply to recognize these different ceramic complexes and to know which follows which. Some aspects of our analysis, however, depend on knowing the actual lengths of the periods and, of course, from Lower Xiajiadian times onwards, the sequence deals with periods that are historically documented in other locations in East Asia. It is thus of relevance to place these periods in time.

Radiocarbon dates from sites within and near the Chifeng region and associated with these ceramic complexes are listed in Table 2.1. These include samples recovered from the stratigraphic testing at sites 342 and 674 which are reported for the first time in the second section of this chapter and its accompanying online data. The dates in the table are organized chronologically in Fig. 2.9 according to the ceramic complexes they correspond to. The chronological scale of Fig. 2.9 is divided into the periods these ceramic complexes represent, and these are the starting and ending dates of the periods used elsewhere in this volume. In general, the set of dates shows a high degree of consistency, with relatively little of the overlap between dates for adjacent periods that is to be expected for statistical and other reasons. There are several parts of the sequence, however, where the dates are quite sparse. Perhaps only the Lower Xiajiadian period can be considered well dated. The division of the absolute time scale into periods as discussed below is summarized in Fig. 2.10.

The Neolithic begins in Chifeng with the Xinglongwa period, for which we have used the beginning date of 6000 BCE that is currently established in the literature. Two of the seven dates available for Xinglongwa are before 6000 BCE, and if additional such early dates are forthcoming, it might be necessary one day to move this beginning date farther back in time. Strictly on the basis of the dates in Fig. 2.9, a dividing line between Xinglongwa and Zhaobaogou might be placed at around 5400 BCE. We have, however, chosen to place this line at 5250 BCE since this is also currently established in the literature. The end of the Zhaobaogou period fits comfortably with the dates in Fig. 2.9 at about 4500 BCE. This leaves the earliest two Hongshan dates situated in the period assigned to Zhaobaogou. On this basis it might be tempting to move the dividing line a little bit earlier in time. On the other hand, these two early Hongshan dates are separated from the rest of the dates for the Hongshan period by a very wide gap since the other six dates available for Hongshan ceramics all fall after 4000 BCE. The two early dates are thus potentially suspect, and leave open the possibility that the Hongshan period begins substantially after 4500 BCE. Additional radiocarbon dates for late Zhaobaogou and early Hongshan deposits would be most helpful—either in providing better support for placing the dividing line between the two periods at 4500 BCE, as is commonly done in the literature, or in providing evidence that the line should be moved to an earlier or later point on the time scale. In our analyses, we have followed the conventional 4500 BCE dividing line.

The Hongshan period is commonly ended in the literature at 3000 BCE. This is conveniently soon after the most recent Hongshan date and just before the earliest date for Xiaoheyan ceramics. There are, however, only three dates for Xiaoheyan ceramics: this early one and two nearly a millennium later. The earliest date for Lower Xiajiadian falls into this space between the early date for Xiaoheyan and the two later ones. Xiaoheyan radiocarbon dates, then, like every other kind of Xiaoheyan material are fairly scarce, and additional information about this part of the sequence is much needed. The stratigraphic tests carried out at sites 342 and 674 did not yield materials that helped delineate Xiaoheyan or place it in time any more precisely. We have thus followed convention and ended the Hongshan period at 3000 BCE.

A sequence of very consistent and much more abundant radiocarbon dates places the beginning of Lower Xiajiadian times at 2000 BCE, discounting the one earliest Lower Xiajiadian date. This leaves exactly the third millennium BCE to the sparsely documented Xiaoheyan culture. The abundant spate of Lower Xiajiadian dates runs up to 1200 BCE, overlapping slightly with the earliest date or two for Upper Xiajiadian ceramics. Radiocarbon dates from sites 342 and 674 have helped make it clear that there is no chronological gap between Lower and Upper Xiajiadian. The absence of any stratigraphic gap in occupation at this point in time at either site further confirms this. We have put the dividing line between Lower and Upper Xiajiadian at 1200 BCE, discounting the earliest Upper Xiajiadian date and the latest two for Lower Xiajiadian, which are quite substantially separated from the overall pattern. Upper Xiajiadian is not documented by as many radiocarbon dates as Lower Xiajiadian, but there is a particularly con-

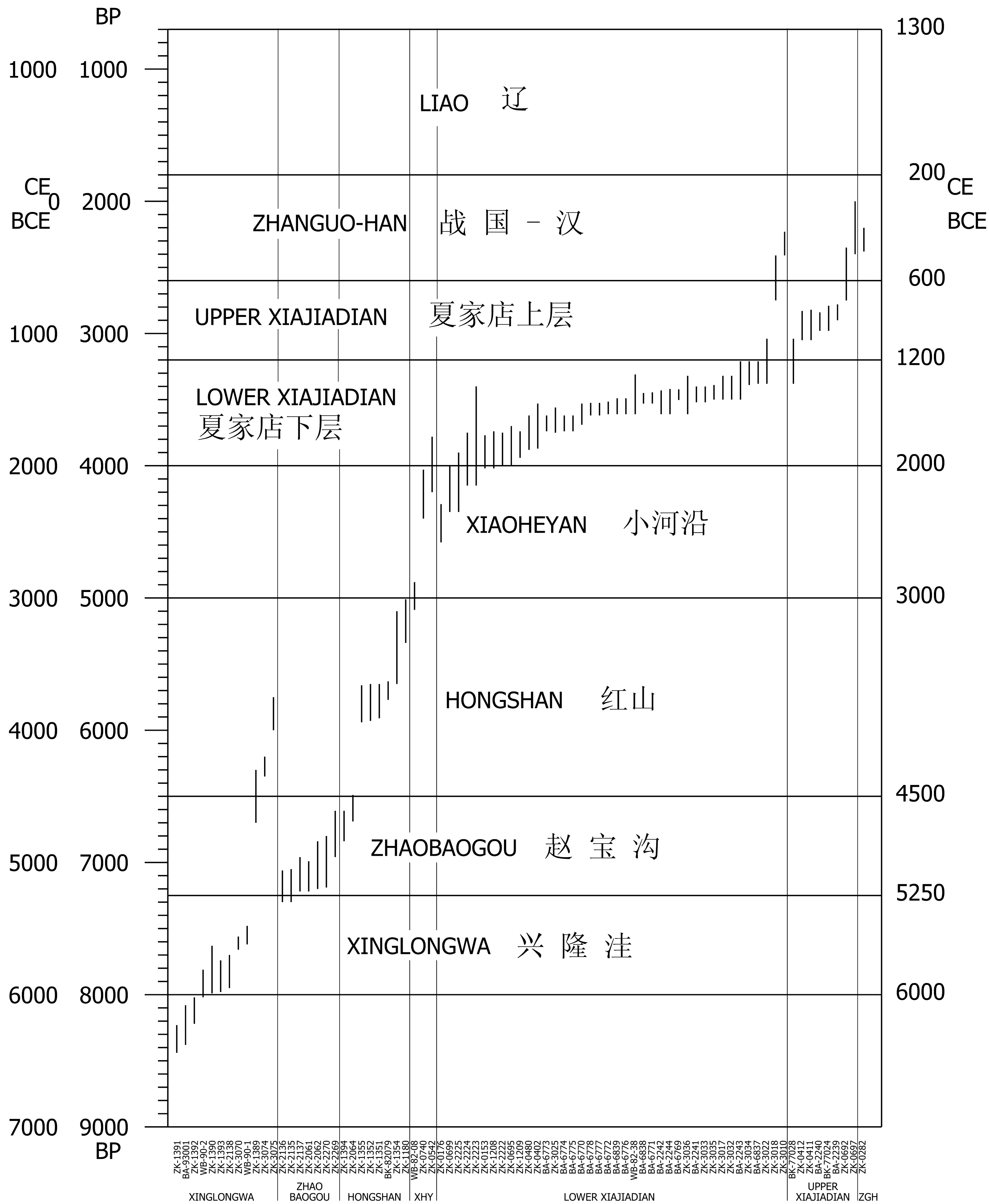


Figure 2.9. Radiocarbon dates for the greater Chifeng region.

TABLE 2.1. RADIOCARBON DATES FOR THE GREATER CHIFENG REGION

Lab. No.	Date BP*	Calibrated Date*	Period	Site	Reference
BA-2239	2649 ± 60	900-780 BCE	Upper Xiajiadian	674 (Chifeng)	this report
BA-2240	2770 ± 60	980-840 BCE	Upper Xiajiadian	674 (Chifeng)	this report
BA-2241	3183 ± 60	1520-1400 BCE	Lower Xiajiadian	674 (Chifeng)	this report
BA-2242	3230 ± 60	1610-1430 BCE	Lower Xiajiadian	674 (Chifeng)	this report
BA-2243	3100 ± 100	1500-1210 BCE	Lower Xiajiadian	674 (Chifeng)	this report
BA-2244	3220 ± 60	1610-1420 BCE	Lower Xiajiadian	674 (Chifeng)	this report
BA-6769	3190 ± 35	1495-1430 BCE	Lower Xiajiadian	342 (Chifeng)	this report
BA-6770	3335 ± 35	1690-1530 BCE	Lower Xiajiadian	342 (Chifeng)	this report
BA-6771	3235 ± 35	1530-1445 BCE	Lower Xiajiadian	342 (Chifeng)	this report
BA-6772	3280 ± 35	1610-1515 BCE	Lower Xiajiadian	342 (Chifeng)	this report
BA-6773	3375 ± 40	1740-1620 BCE	Lower Xiajiadian	342 (Chifeng)	this report
BA-6774	3370 ± 35	1740-1620 BCE	Lower Xiajiadian	342 (Chifeng)	this report
BA-6775	3370 ± 35	1740-1620 BCE	Lower Xiajiadian	342 (Chifeng)	this report
BA-6776	3260 ± 35	1610-1490 BCE	Lower Xiajiadian	342 (Chifeng)	this report
BA-6777	3300 ± 35	1620-1525 BCE	Lower Xiajiadian	342 (Chifeng)	this report
BA-6778	3305 ± 35	1620-1525 BCE	Lower Xiajiadian	342 (Chifeng)	this report
BA-6837	3025 ± 35	1380-1210 BCE	Lower Xiajiadian	Sanzuodian	Zhang Jiafu, personal communication
BA-6838	3240 ± 30	1530-1450 BCE	Lower Xiajiadian	Sanzuodian	Zhang Jiafu, personal communication
BA-6839	3265 ± 30	1610-1490 BCE	Lower Xiajiadian	Sanzuodian	Zhang Jiafu, personal communication
BA-93001	7360 ± 150	6380-6080 BCE	Xinglongwa	Chahai	Liaoningsheng 1994:9
BK-77024	2720 ± 90	980-790 BCE	Upper Xiajiadian	Linxi Dajing	Zhongguo 1991:54
BK-77028	2970 ± 115	1380-1040 BCE	Upper Xiajiadian	Linxi Dajing	Zhongguo 1991:54
BK-82079	4895 ± 70	3770-3630 BCE	Hongshan	Dongshanzui	Zhongguo 1991:76
WB-82-08	4345 ± 80	3090-2880 BCE	Xiaoheyan	Shipengshan	Zhongguo 1991:55
WB-82-38	3180 ± 90	1610-1310 BCE	Lower Xiajiadian	Fanzhangzi	Zhongguo 1991:55
WB-90-1	6590 ± 85	5620-5480 BCE	Xinglongwa	Baiyinchanghan	Neimenggu 2004:501
WB-90-2	7040 ± 100	6020-5810 BCE	Xinglongwa	Baiyinchanghan	Neimenggu 2004:501
ZK-0153	3550 ± 80	2020-1770 BCE	Lower Xiajiadian	Fengxia	Zhongguo 1991:68
ZK-0176	3965 ± 90	2580-2290 BCE	Lower Xiajiadian	Zhizhushan	Zhongguo 1991:55
ZK-0282	2220 ± 75	380-200 BCE	Zhanguo-Han	Daliudaogou	Zhongguo 1978:285
ZK-0402	3390 ± 90	1870-1530 BCE	Lower Xiajiadian	Dadianzi	Zhongguo 1991:56
ZK-0411	2780 ± 100	1050-820 BCE	Upper Xiajiadian	Linxi Dajing	Zhongguo 1991:54
ZK-0412	2795 ± 85	1050-830 BCE	Upper Xiajiadian	Linxi Dajing	Zhongguo 1991:55
ZK-0480	3420 ± 85	1880-1620 BCE	Lower Xiajiadian	Dadianzi	Zhongguo 1991:56
ZK-0542	3640 ± 120	2200-1780 BCE	Xiaoheyan	Shipengshan	Zhongguo 1991:55
ZK-0692	2360 ± 70	750-350 BCE	Upper Xiajiadian	Shuiquan	Zhongguo 1991:66
ZK-0695	3540 ± 75	2000-1700 BCE	Lower Xiajiadian	Shuiquan	Zhongguo 1991:66
ZK-0697	2140 ± 115	400-0 BCE	Upper Xiajiadian	Shuiquan	Zhongguo 1991:66
ZK-0699	3780 ± 90	2350-2000 BCE	Lower Xiajiadian	Shuiquan	Zhongguo 1991:66
ZK-0740	3785 ± 100	2400-2030 BCE	Xiaoheyan	Shipengshan	Zhongguo 1991:55
ZK-1180	4455 ± 85	3340-3010 BCE	Hongshan	Wudaowan	Zhongguo 1991:59
ZK-1208	3545 ± 95	2020-1740 BCE	Lower Xiajiadian	Fanzhangzi	Zhongguo 1991:56
ZK-1209	3510 ± 75	1940-1740 BCE	Lower Xiajiadian	Fanzhangzi	Zhongguo 1991:56
ZK-1351	4970 ± 80	3910-3650 BCE	Hongshan	Niuheliang	Li 2008:80
ZK-1352	4975 ± 85	3930-3650 BCE	Hongshan	Niuheliang	Zhongguo 1991:67
ZK-1354	4605 ± 125	3650-3100 BCE	Hongshan	Niuheliang	Li 2008:80
ZK-1355	4995 ± 110	3940-3660 BCE	Hongshan	Niuheliang	Li 2008:80
ZK-1389	5660 ± 170	4700-4300 BCE	Xinglongwa	Xinglongwa	Zhongguo 1991:56
ZK-1390	6895 ± 205	5990-5630 BCE	Xinglongwa	Xinglongwa	Zhongguo 1991:57
ZK-1391	7470 ± 115	6440-6230 BCE	Xinglongwa	Xinglongwa	Zhongguo 1991:57
ZK-1392	7240 ± 95	6220-6020 BCE	Xinglongwa	Xinglongwa	Zhongguo 1991:57
ZK-1393	6965 ± 95	5980-5740 BCE	Xinglongwa	Xinglongwa	Zhongguo 1991:57
ZK-1394	5865 ± 90	4840-4610 BCE	Hongshan	Xinglongwa	Zhongguo 1991:57
ZK-2061	6150 ± 85	5220-4990 BCE	Zhaobaogou	Xiaoshan	Zhongguo 1991:58
ZK-2062	6060 ± 85	5200-4840 BCE	Zhaobaogou	Xiaoshan	Zhongguo 1991:58
ZK-2064	5735 ± 85	4690-4490 BCE	Hongshan	Xinglongwa	Zhongguo 1991:57
ZK-2135	6210 ± 85	5300-5050 BCE	Zhaobaogou	Zhaobaogou	Zhongguo 1991:57
ZK-2136	6220 ± 85	5300-5060 BCE	Zhaobaogou	Zhaobaogou	Zhongguo 1991:58
ZK-2137	6155 ± 95	5220-4960 BCE	Zhaobaogou	Zhaobaogou	Zhongguo 1991:58
ZK-2138	6925 ± 95	5950-5700 BCE	Xinglongwa	Chahai	Liaoningsheng 1994:9
ZK-2222	3535 ± 55	2000-1750 BCE	Lower Xiajiadian	Chaoyang	Zhongguo 1991:67
ZK-2223	3430 ± 250	2150-1400 BCE	Lower Xiajiadian	Chaoyang	Zhongguo 1991:68
ZK-2224	3580 ± 75	2150-1750 BCE	Lower Xiajiadian	Chaoyang	Zhongguo 1991:68
ZK-2225	3725 ± 135	2350-1900 BCE	Lower Xiajiadian	Chaoyang	Zhongguo 1991:68
ZK-2269	5915 ± 125	4960-4610 BCE	Zhaobaogou	Xinjing	Zhongguo 1991:55
ZK-2270	6045 ± 90	5190-4800 BCE	Zhaobaogou	Xinjing	Zhongguo 1991:55
ZK-3010	2300 ± 50	410-230 BCE	Lower Xiajiadian	Dashanqian	Zhongguo 2000:70
ZK-3017	3141 ± 51	1500-1320 BCE	Lower Xiajiadian	Dashanqian	Zhongguo 2000:70
ZK-3018	2451 ± 57	750-410 BCE	Lower Xiajiadian	Dashanqian	Zhongguo 2000:70
ZK-3022	2966 ± 108	1380-1040 BCE	Lower Xiajiadian	Dashanqian	Zhongguo 2000:70
ZK-3025	3374 ± 55	1750-1560 BCE	Lower Xiajiadian	Dashanqian	Zhongguo 2000:71
ZK-3032	3140 ± 56	1500-1320 BCE	Lower Xiajiadian	Dashanqian	Zhongguo 2000:71
ZK-3033	3180 ± 57	1520-1400 BCE	Lower Xiajiadian	Dashanqian	Zhongguo 2000:71
ZK-3034	3027 ± 55	1390-1210 BCE	Lower Xiajiadian	Dashanqian	Zhongguo 2000:71
ZK-3035	3164 ± 57	1500-1390 BCE	Lower Xiajiadian	Dashanqian	Zhongguo 2000:71
ZK-3036	3184 ± 77	1610-1320 BCE	Lower Xiajiadian	Dashanqian	Zhongguo 2000:71
ZK-3070	6694 ± 48	5660-5560 BCE	Xinglongwa	Xinglongwa	Zhongguo 2001:84
ZK-3074	5425 ± 53	4350-4200 BCE	Xinglongwa	Xinglongwa	Zhongguo 2001:84
ZK-3075	5133 ± 54	4000-3750 BCE	Xinglongwa	Xinglongwa	Zhongguo 2001:84

*One-sigma error range. Calibration by Oxcal Version 3.10.

sistent set of six dates that anchor the middle of the period. Its end is placed at 600 BCE, based more on historical records than on radiocarbon dates.

The last two periods in Fig. 2.9, Zhanguo-Han and Liao, are not much documented by radiocarbon dates, since they are well known historically. These are the most recent periods the analyses presented here deal with. It is worth emphasizing in this context that, given the nature of regional settlement study, the Liao period here corresponds to a recognizable set of ceramics and not exactly to the historical records for the Liao Dynasty proper. Since ceramics are the principal chronological tool employed in regional settlement analysis additional stratigraphic excavations at Liao sites would give added depth to the delineation of this ceramic complex, and radiocarbon dates associated with these ceramics could also enable us to specify more precisely their beginning and ending dates.

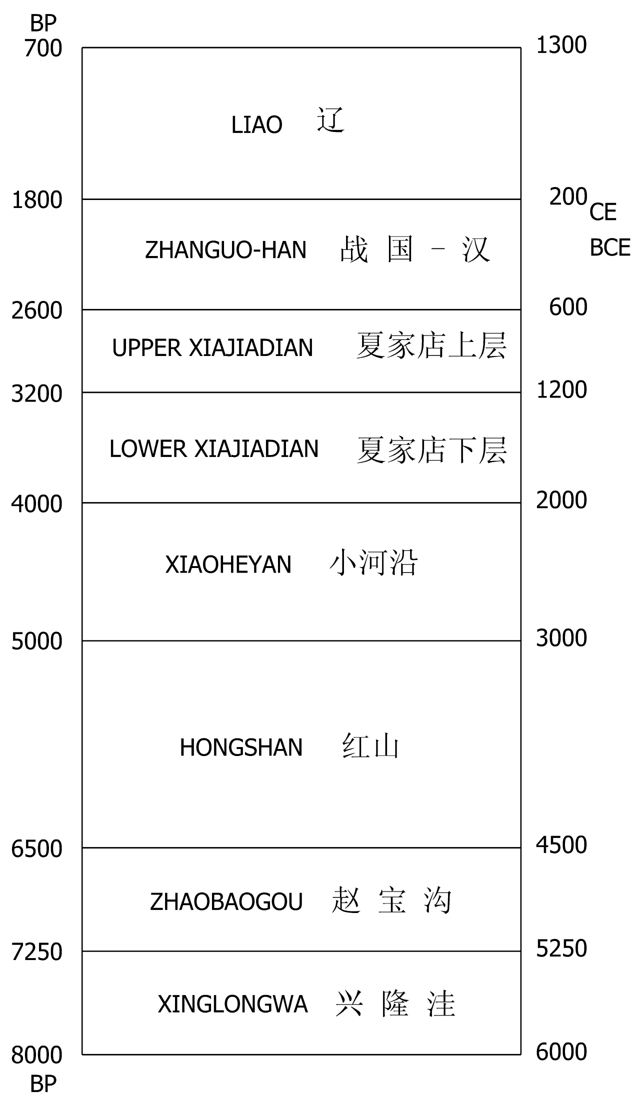


Figure 2.10. Summary of the chronology used in this volume.

2.4. Lithics, Faunal Remains, and Bone Artifacts

Christian E. Peterson

The excavations at sites 674 and 342 yielded a total of 443 lithic artifacts, 2,572 faunal remains, and 31 bone artifacts. Each artifact or bone element recovered was examined by eye and at 10–20X magnification under strong raking light. These examinations occurred in the field, followed standard archaeological practice, and were made with reference to published archaeological literature on each artifact class (as comparative collections were not available). The criteria used in artifact identification and any additional methods used in their analysis are discussed below. Results of these analyses are discussed as relevant in Chapter 5, and the complete detailed data are available online (see Appendix B).

As discussed in Section 2.2, most of the materials recovered in tests at the two sites pertained to Lower and Upper Xiajiadian. Only Lower Xiajiadian was represented by a substantial number of stratigraphic contexts with materials unmixed with those of other periods. The deposits actually dating to Upper Xiajiadian times all contained, along with Upper Xiajiadian ceramics, an admixture of Lower Xiajiadian ceramics that had been churned up from stratigraphically lower deposits by Upper Xiajiadian period activities. The same mixing will, of course, characterize other classes of artifacts and ecofacts as well—classes of material that lack the stylistic characteristics that make it possible to recognize this pattern in the ceramics. The principal conclusions to be derived, then, with regard to these other classes of materials from the tests at sites 674 and 342 concern what they indicate about Lower Xiajiadian activities, and what the direction of change in activity patterns is between Lower and Upper Xiajiadian.

Lithic Artifacts

The excavated lithic assemblages contain flaked, ground, and pecked stone artifacts and associated productive debris. All lithic artifacts were washed and allowed to dry prior to examination. Four kinds of information were recorded for each: the tool or debitage type and its condition; the method of manufacture; the presence of cortex (if greater than 10% of the dorsal surface); and the presence of macroscopically visible use wear. This use wear appeared as patches of sheen or gloss (in contrast to a uniform polish imparted during manufacture), multiple striations located parallel to a working edge, and damage to or microfracture of a working end or edge (including crushing and isolated attritional flake removals). The condition and relative completeness of each artifact was characterized further by its additional assignment to one of seven tool categories (complete, almost complete, broken [proximally, distally, medially, laterally], and indeterminate as to portion), or four debitage categories (complete flakes, broken flakes, flake fragments, and debris or shatter), following the approaches of Peterson and Bennett (2006) and Sullivan and Rosen (1985) respectively. Retouch or systematic rejuvenation of working edges provided indications of prior artifact use.

A total of 305 lithic artifacts representing 23 different artifact types were recovered from Lower Xiajiadian and mixed Lower-Upper Xiajiadian deposits (Table 2.2). Although test excavations at both sites were scattered over an area wide enough to sample a variety of domestic contexts and/or other activity areas, the number of lithic artifacts recovered from each is insufficient to compare strata from different excavation units directly in terms of the proportions of different artifacts represented, differences in stages of artifact production inferred from the kinds of debitage and amount of cortex-bearing debitage present, or differences in artifact use wear recorded. Artifact types were later collapsed into 10 more generalized categories for purposes of a simple comparison between Lower Xiajiadian materials and those from mixed Lower-Upper Xiajiadian contexts. These categories include flakes, blades, other cutting/scraping tools, agricultural tools, plant processing tools, implements used in hunting/warfare, those reflecting lithic production, those used in the manufacture of other craft goods, personal ornaments, and indeterminate artifacts (Table 2.3). A comparison of these 10 more generalized categories revealed little difference between assemblages except in terms of flakes and non-flake indicators of lithic production. The proportion of artifacts representing stone tool production (cores, hammerstones, tool blanks, and shatter) is substantially higher in Lower Xiajiadian strata than in mixed Lower-Upper Xiajiadian strata. Conversely, the proportion of flakes is higher in mixed deposits than in uniformly Lower Xiajiadian ones. These differing proportions might well represent the beginnings of a shift away from stone tool technology toward the more specialized use of metal tools for some activities during Upper Xiajiadian times.

TABLE 2.2. DEFINITIONS OF TOOL AND DEBITAGE TYPES

Tool/Debitage Type	Description
Cores	Objective pieces from which flakes were struck. Examples of both unidirectional cores (originating from one platform only) and multidirectional cores (originating from multiple platforms) were observed.
Flakes	Detached irregular flakes with or without usewear, but no evidence of retouching. Platforms, bulbs of percussion, dorsal scars, and/or margins clearly visible.
Retouched flakes	Flakes with or without usewear evidencing at least three contiguous microflake removals from a single edge to repair or rejuvenate them.
Blades	Detached elongate flakes with regular parallel margins. Usewear may or may not be present. Original estimated lengths were at least double the measurable widths.
Retouched blades	Blades with or without usewear evidencing at least three contiguous microflake removals from a single edge to repair or rejuvenate them. Often trapezoidal in cross-section.
Hammerstones	Objects used as precussors for stone tool manufacture, or as a generic hammering/chopping tool. All showed signs of usewear in the form of battering or crushing on their ends and/or edges.
Grooved abraders	Oblong or rectangular stones with grooves or depressions worn as a consequence of shaping or sharpening tool edges during manufacture or maintenance.
Tool blanks (preforms) or unfinished tools	A preform or tool blank intentionally unfinished (and intended for exchange), or abandoned before completion due to breakage, error, or raw material flaw. No usewear evident.
Axes/adzse/chisels	Bifacial cutting/chopping/gouging tools (undifferentiated as to hafting) with clear bits, butts, and/or beveled edges (at an angle parallel with that the object body). May be ground and/or flaked.
Shovels/hoes/plows	Wide-bladed and sometimes shouldered bifacial agricultural tools. Flaked preforms ground and/or polished to produce the finished tools.
Grinding slabs/querns	Pecked and/or ground slabs or querns for processing vegetable matter. Used in conjunction with rollers/mullers or other grinding implements.
Handheld grinding rollers/ mullers	Pecked and/or ground oblong rollers D-shaped or triangular cross-sections. Used in conjunction with grinding slabs/querns.
Multi-function grinding implements	Flattened, usually palm-sized, coarse-to-fine surfaced stone objects used to process vegetable matter, other organic materials, or in stone tool manufacture.
Unifacially-worked scraping/ chopping tools	Tools constructed from large flakes with additional flake removals from edges on one face only.
Bifacially-worked scraping/ chopping tools	Tools constructed on large flakes with additional flake removals from edges on both faces.
Knives	Straight, ovate, or lunate cutting tools with elongate blades. Some were backed.
Projectile points	Small but regular (predominantly triangular) unifacial or bifacial points hafted as projectiles.
Awls	Elongate tools with rectangular or circular cross-sections that taper to blunt points with evidence of polish, crushing, or microflaking due to rotation under pressure.
Drills	Tools with shouldered elongate bits protruding from a thicker object body. Bits show evidence of gloss, edge crushing or microflaking associated with rotation under pressure.
Gravers	Narrow objects with beveled ends (at an angle perpendicular to that of the object body) used to gouge or scrape softer materials.
Ornaments	Personal adornments of ground and/or perforated stone.
Indet. flaked tools/fragments	Tools or tool fragments manufactured by flaking but indeterminate as to function.
Indet. pecked tools/fragments	Tools or tool fragments manufactured by pecking but indeterminate as to function.
Indet. ground tools/fragments (no polish)	Tools or tool fragments manufactured by grinding but indeterminate as to function. No surface polish imparted through manufacture.
Indet. ground and polished tools/fragments	Tools or tool fragments manufactured by grinding but indeterminate as to function. Buffed or polished during the final stage of manufacture.
Indet. flaked and ground tools/fragments	Tools or tool fragments manufactured by a combination of flaking and grinding but indeterminate as to function.
Indet. flaked, ground and polished tools/fragments	Tools or tool fragments manufactured by a combination of flaking, grinding, and polishing but indeterminate as to function.
Indet. tools/fragments (no inform-ation on method of manufacture)	Tools or tool fragments indeterminate as to function for which methods of manufacture could not be ascertained.
Debris/debitage	Debris (including shatter) or other non-flake debitage that could not be identifed as a tool.
Utilized debris/debitage	Debris (including shatter) or other non-flake debitage with usewear indicative of opportunistic cutting and/or scraping.

TABLE 2.3. MAJOR CATEGORIES OF LITHIC TOOLS BY PERIOD

	Lower Xiajiadian		Lower-Upper Xiajiadian	
	n	%	n	%
Flakes	119	61%	75	68%
Blades (used as tool insets?)	5	3%	1	1%
Other general cutting/scraping tools	9	5%	3	3%
Agricultural production	4	2%	3	3%
Plant processing	1	1%	2	2%
Hunting/warfare	2	1%	0	0%
Lithic production	49	25%	20	18%
Other craft production	0	0%	1	1%
Personal adornament	0	0%	1	1%
Indeterminate use	5	3%	5	5%
Total	194	100%	111	100%

Faunal Remains

Faunal remains recovered through excavation were dry-brushed to remove any remaining soil prior to examination. All remains were fragmentary but otherwise well preserved. Conjoinable elements were counted as single specimens. All specimens were first identified to taxonomic class (e.g. Pisces, Bivalvia [Pelycepoda], Aves, Mammalia, etc.). When possible, more specific taxonomic determinations were then made (as thoroughly as possible in the field without comparative material). Those specimens for which more specific determinations could not be made were assigned to one of four size categories within each class: small, small-medium, medium-large, and large. The skeletal element, the portion of the skeletal element, and its side (if paired) were recorded when identifiable. The proportional completeness of each element was also estimated when possible. In cases where the specific element was not identifiable, it was recorded as "indeterminate." No attempt was made to determine the relative age and/or sex of the animal represented. All specimens were examined for evidence of thermal alteration (in the form of burned or calcined bone), cut marks, and carnivore and rodent gnaw marks. Any additional comments deemed pertinent to interpretation were also recorded.

Counts of taxa for Lower Xiajiadian (1,227 bones) and for mixed Lower-Upper Xiajiadian deposits (884 bones) at the two sites are presented in Table 2.4. The majority of bones belong to indeterminate medium to large mammals, while those of medium to large domesticated mammals (goats, sheep, pigs, and cattle) comprise the bulk of identified taxa. Some potentially consumed wild fauna are present, but since these do not make up a large proportion of the bones, and since they are all much smaller animals than sheep, goats, pigs, and cattle, it is clear that a considerable majority of the meat consumed was provided by these domesticated animals. The implications of these proportions and of differences in the proportions of bones of the major domesticates between Lower Xiajiadian contexts and mixed Lower-Upper Xiajiadian contexts are discussed further in Chapter 5.

Bone Artifacts

The analysis of worked bone and bone artifacts followed that described above for faunal remains. In addition, the method of manufacture and inferred function of each artifact were also recorded (where such determinations could be made). The majority of bone tools appear to have been sawn or cut and snapped prior to grinding. The profiles of four unfinished pieces retain clear evidence for having been detached from the parent material in one of these two ways. Many artifacts appear to have been ground flat before being shaped into their final forms. Some were intentionally polished as a final stage in the production process; others appear to have acquired this polish (in addition to other striations) as a result of their use. A total of 23 bone artifacts could be assigned to Lower Xiajiadian or mixed Lower-Upper Xiajiadian strata at sites 674 and 342, including bone spades, awls, needles of various sizes, projectile points, personal ornaments, and other indeterminate tools and worked bone (Table 2.5). While sample sizes are too small to confidently compare differences in the proportional composition of bone artifact assemblages between sites, the activities represented collectively by both include at the very least agricultural production, leather-working, sewing, hunting, and personal adornment.

TABLE 2.4. FAUNAL REMAINS BY PERIOD

	Lower Xiajiadian		Lower-Upper Xiajiadian	
	n	%	n	%
Major Domesticates				
Ovicapridae	39	3%	22	2%
Bos	3	0%	5	1%
Bovidae	3	0%	3	0%
Bovidae/Cervidae	4	0%	4	0%
Sus	71	6%	14	2%
Sus scrofa	29	2%	64	7%
Canis	7	1%	4	0%
Wild Potential Food Sources				
Aves	38	3%	6	1%
Bivalva	1	0%		0%
Mollusca	3	0%	5	1%
Pisces	1	0%	4	0%
Other Taxa				
Artiodactyla	1	0%		0%
Carnivora	1	0%		0%
Rodentia	47	4%	26	3%
Homo	1	0%		0%
Indeterminate Mammals				
Small	89	7%	40	5%
Small-Medium	15	1%	46	5%
Medium-Large	861	70%	629	71%
Large	13	1%	12	1%
Total	1,227	100%	884	100%

TABLE 2.5. BONE ARTIFACTS BY PERIOD

	Lower Xiajiadian		Lower-Upper Xiajiadian	
	n	%	n	%
Bone spades	0	0%	1	8%
Awls	0	0%	3	25%
Needles	3	27%	1	8%
Projectile points	1	9%	3	25%
Indeterminate bone tools	3	27%	0	0%
Ornaments	1	9%	1	8%
Indeterminate worked bone	3	27%	3	25%
Total	11	100%	12	100%

2.5. Plant Remains

Zhao Zhijun

During the stratigraphic testing at Sites 342 and 674, samples of soil were collected for flotation from ashy deposits or ones where substantial amounts of carbonized plant matter were noted. These samples were returned to the field laboratory, and the volume of soil collected was recorded for each sample. The volume of soil floated averaged about 3 liters per sample. Flotation was by hand, with only very simple techniques employed. The soil was poured slowly into a bucket of water and gently stirred by hand to enable carbonized plant matter to float to the surface. The generally sandy character of the soils at both sites meant that clumping was not a problem, so it was not necessary to add a deflocculant. Larger pieces were picked from the surface of the water, and a smaller fraction was recovered by sieving through fine mesh cut from nylon stockings. Some flotation samples, of course, failed to produce any recoverable carbonized material, despite the appearance of the deposits from which they were collected. The recovered material was air-dried out of the sun. Finally, samples of recovered material from 90 separate contexts (53 from Site 342 and 37 from Site 674) were transported to Beijing for analysis in the Archaeobotanical Laboratory of the Chinese Academy of Social Science. The total volume of soil subjected to flotation for these 90 samples amounted to about 270 liters. (Volume data are missing for eight samples, but they are included in this total, estimated at 3 liters each, the mean for the others, which total 246.3 liters for 82 samples.)

As with other classes of materials already discussed, the chronological identification possible for plant remains produced two principal groups: those from unmixed Lower Xiajiadian contexts and those from contexts with mixed Lower and Upper Xiajiadian materials. They thus provide a picture of Lower Xiajiadian plant remains, complemented by an indication of the direction of change in proportions as they shift toward those characteristic of Upper Xiajiadian times. Some plant remains came from contexts of even less certain date, as mentioned below.

Carbonized Wood

In the laboratory, the samples were cleaned, and carbonized wood was separated from carbonized seeds. The main sources of carbonized wood are probably incompletely burned fuel and burned lumber from structures and other uses. Most of the carbonized wood fragments were quite small. Inspection under the microscope shows cell structures of wood. Carbonized wood was not identified by taxon, but fragments larger than 1 mm were weighed, and the total weight recorded for each sample. A total of 253 g of carbonized wood was separated out from all 90 samples. Since these 90 samples came from some 270 liters of soil, the amount of carbonized wood in the soil floated averaged approximately 0.9 g per liter. Based on previous experience, this density of carbonized wood per unit volume at sites 342 and 674 is high. This may reflect nothing more than the fact that flotation samples were collected only from ashy soils and those with visibly large amounts of carbonized material. The amount of carbonized wood per liter also varies substantially from one excavation unit to another. Units 674X012, 674X014, and 674X117 are high outliers with more than 7.5 g of carbonized wood per liter of soil floated. These three units were undoubtedly associated with some activity involving fire, as their ashy nature also confirms, but all three are of uncertain time periods so this observation is of limited value.

Carbonized Seeds

A total of 65,602 carbonized seeds were recovered from the 90 flotation samples from sites 342 and 674, for an average of over 700 seeds for each context sampled. Considering that, on average, each sample consisted of only some 3 liters of soil, the content of seeds in these two archaeological sites is very high. After identifying plant taxa, the seeds can be further divided into four different major groups: cultigens, weeds, other plants, and unidentified plants. These groups are summarized in Table 2.6, and the complete details for all taxa and excavation units are available online (see Appendix B).

Cultigens

Four different cultigens were identified: foxtail millet (*Setaria italica*), broomcorn millet (*Panicum miliaceum*), soybeans (*Glycine max*), and cannabis (*Cannabis sativa*). A total of 61,341 seeds of these four taxa were identified, making up 93.5% of the total number of seeds from the flotation samples.

Foxtail Millet

Foxtail millet was the most abundant among the seeds, comprising 57,873 identified specimens or 88.2% of the

TABLE 2.6. SEEDS OF MAJOR PLANT CATEGORIES

	Cultigens		Weeds		Other Plants		Unidentified		Total	
	n	%	n	%	n	%	n	%	n	%
All Contexts	61,341	93.5%	3,654	5.6%	59	0.1%	548	0.8%	65,602	100.0%
LXJD (both sites)	7,176	70.8%	2,591	25.6%	54	0.5%	311	3.1%	10,132	100.0%
Mixed LXJD-UXJD (both sites)	540	47.9%	354	31.4%	1	0.1%	233	20.7%	1,128	100.0%
Site 342: LXJD	4,760	66.2%	2,075	28.8%	52	0.7%	307	4.3%	7,194	100.0%
Site 342: Mixed LXJD-UXJD	21	70.0%	5	16.7%	0	0.0%	4	13.3%	30	100.0%
Site 674: LXJD	2,416	82.2%	516	17.6%	2	0.1%	4	0.1%	2,938	100.0%
Site 674: Mixed LXJD-UXJD	519	47.3%	349	31.8%	1	0.1%	229	20.9%	1,098	100.0%

TABLE 2.7. SEEDS OF CULTIGENS

	Foxtail Millet		Broomcorn Millet		Soybeans		Cannabis		Total Cultigens	
	n	%	n	%	n	%	n	%	n	%
All Contexts	57,873	94.3%	3,420	5.6%	8	0.0%	40	0.1%	61,341	100.0%
LXJD (both sites)	5,357	74.7%	1,817	25.3%	1	0.0%	1	0.0%	7,176	100.0%
Mixed LXJD-UXJD (both sites)	453	83.9%	50	9.3%	0	0.0%	37	6.9%	540	100.0%
Site 342: LXJD	3,062	64.3%	1,697	35.7%	1	0.0%	0	0.0%	4,760	100.0%
Site 342: Mixed LXJD-UXJD	20	95.2%	1	4.8%	0	0.0%	0	0.0%	21	100.0%
Site 674: LXJD	2,295	95.0%	120	5.0%	0	0.0%	1	0.0%	2,416	100.0%
Site 674: Mixed LXJD-UXJD	433	83.4%	49	9.4%	0	0.0%	37	7.1%	519	100.0%

Figure 2.11. Grains of foxtail millet from excavation unit 570 at site 342.

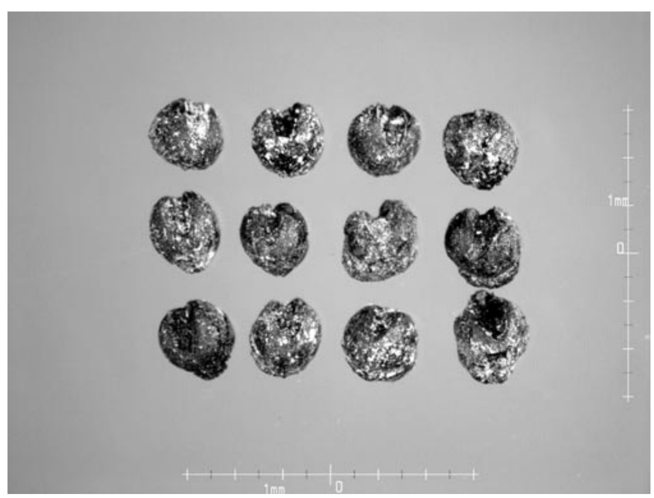


Figure 2.12. Grains of foxtail millet from excavation unit 049 at site 674.

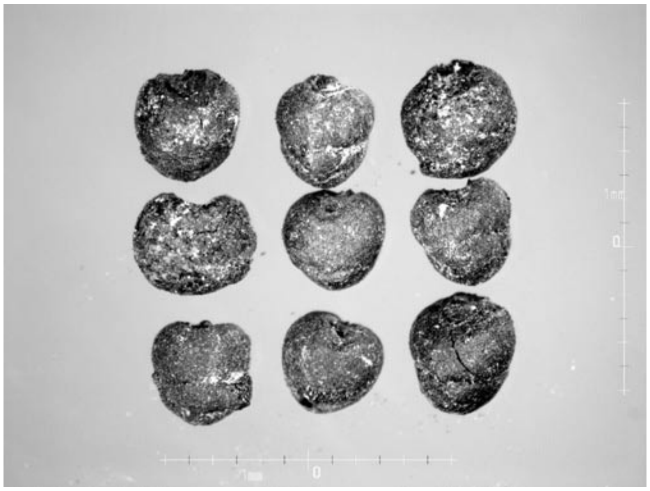


Figure 2.13. Grains of broomcorn millet from excavation unit 570 at site 342.

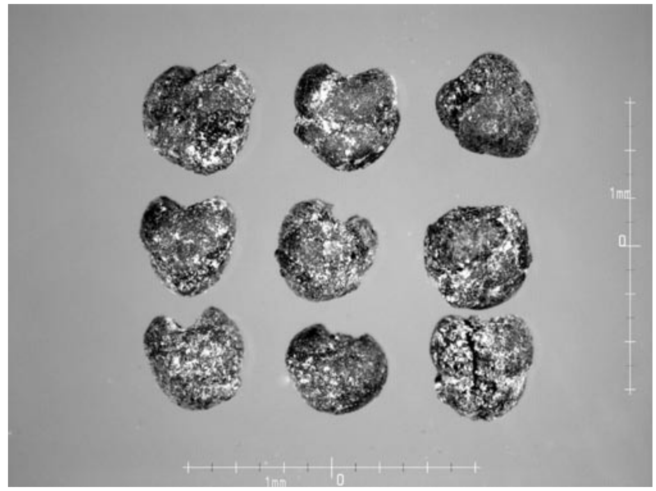


Figure 2.14. Grains of broomcorn millet from excavation unit 049 at site 674.

seeds, and fully 94.3% of the identified seeds of cultigens (Table 2.7). The characteristics of the foxtail millet grains make it possible to divide them into two clearly different categories. One kind was nearly spherical with a diameter of 1.2 mm or more. These millet grains have smooth surfaces and long embryos. They are often deeply cracked from burning (Figs. 2.11 and 2.12). The other kind is elongated and oval. The grain is not plump. The grains are about 1.2 mm long, but less than 1.0 mm in width and thickness. After comparison with modern specimens, these seeds with narrower, immature grains were classified as blighted grain. They represent some 3.5% of the foxtail millet grains recovered.

Broomcorn Millet

Broomcorn millet was much less abundant: a total of 3,420 grains—5.2% of the seeds identified and 5.6% of the seeds of cultigens. Most specimens are large and spherical, with diameters greater then 1.6 mm. The surfaces are rough and embryos are are short with V-shaped cracks (Figs. 2.13 and 2.14). The broomcorn millet also included a small number of immature or blighted seeds (11.3% of the identified broomcorn millet grains).

In addition to the identified foxtail and broomcorn millet grains, some flotation samples had compacted balls consisting of large numbers of millet grains. The balls were so compacted, however, that the grains could not be counted, and it was not possible to determine whether they were foxtail or broomcorn millet (Fig. 2.15).

Soybeans

Soybeans were represented by a total of six whole and two fragmentary seeds. The complete seeds were oval in overall shape, with rounded backs and slightly sunken bellies. Rectangular bean navels were located in the upper belly (Fig. 2.16). The whole specimens were 4.28–5.83 mm in length and 2.37–3.17 mm in width. Modern wild soybeans have been collected from several different locations. Those from the Huangshan area in Anhui province have an average length of 3.49 mm and an average width of 2.77 mm. Wild specimens from the Russian Far East have an average length of 3.49 mm and an average width of 2.60 mm. The specimens recovered from sites 342 and 674 are clearly substantially larger than these modern wild soybeans and much closer to the average size of present-day cultivated soybeans. They would thus seem to have been agricultural plants, and are grouped here with the cultigens.

Cannabis

Cannabis is represented by 40 seeds from the flotation samples, mostly from a single excavation unit at site 674 of mixed Lower and Upper Xiajiadian date. None at all came from site 342. Cannabis belongs to the family Cannabidaceae; its seed is oily, flat and egg-shaped. All the carbonized seeds recovered from the flotation samples are distorted; their shells are cracked and measure 3–4 mm in diameter (Fig. 2.17).

Weeds

Weedy plants are represented in the seeds from the flotation samples by three families: Poaceae, Leguminosae, and Chenopodiaceae.

Family Poaceae

Family Poaceae accounted for a total of 2,286 seeds, or 3.5% of the total. Some of these grasses could be further identified to genus. There were 1,071 carbonized seeds of *Setaria* sp., all oval, with slightly bulging backs, flat bellies, and well-preserved embryos. They vary in size from 0.5 to 1.2 mm in length and from 0.2 to 0.9 mm in width. Also among the Poaceae seeds were a few *Echinochloa* sp. and *Panicum* sp. The *Echinochloa* sp. seeds were oval,

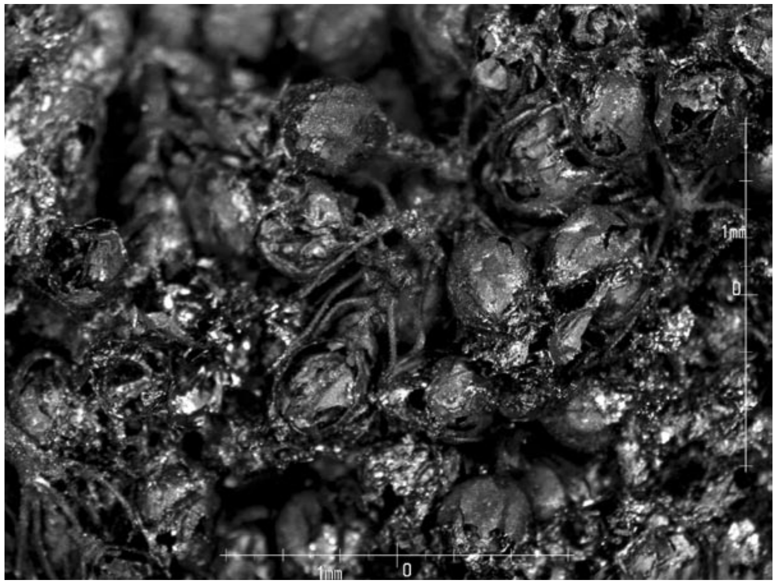


Figure 2.15. Compact ball of millet grains from excavation unit 014 at site 674.

more than 1.0 mm long, and with wide embryos amounting to between two-thirds and three-fourths of the length of the caryopsis.

Family Leguminosae

Family Leguminosae was represented by 654 seeds (1.0% of the total seeds recovered). Leguminosae is a large family including many species of distinct kinds: woody and herbaceous plants, as well as vines. The legume seeds in the samples from sites 342 and 674 were quite small, about 1.5–2.0 mm in length and 1.0 mm in width (Fig. 2.18). They probably represent an herbaceous member of the family. One may belong to the genus *Astragalus*. In addition to these unidentified legumes, there were 32 specimens of wild soybeans (*Glycine soja*). In shape they were similar to the cultivated soybeans, but they were substantially smaller—about 3.0 mm long and 2.0 mm wide (Fig. 2.19).

Family Chenopodiaceae

Family Chenopodiaceae yielded slightly more seeds: 714 or 1.1% of the total. The majority of these belong to the genus *Salsola*. The *Salsola* sp. seeds are flat and circular in shape. The spiral shape of the embryo is clear, as is the small size of about 1.0 mm in diameter.

Other Plants

A few other identifiable seeds of plants not belonging among either cultigens or weeds were also recovered, in-

Figure 2.16. Soybean from excavation unit 368 at site 342.

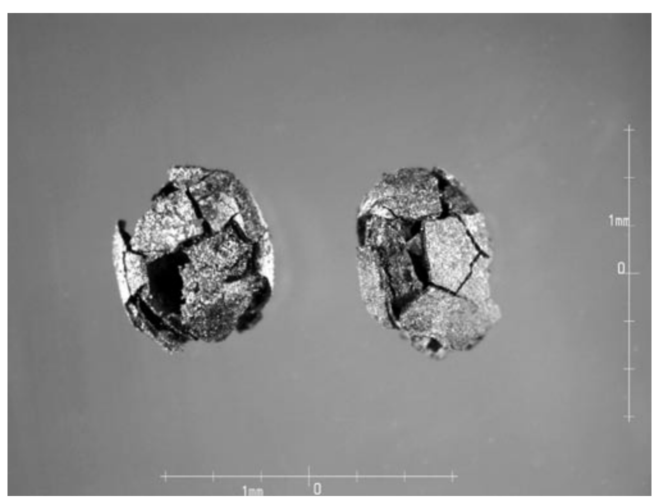


Figure 2.17. Seeds of *Cannabis sativa* from excavation unit 031 at site 674.

Figure 2.18. Seeds of legumes from excavation unit 509 at site 342.

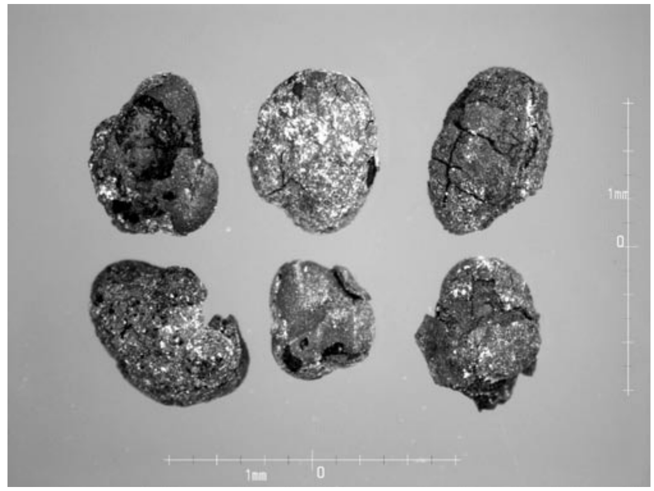


Figure 2.19. Wild soybeans from excavation unit 526 at site 342.

cluding *yuli* or bush cherry (*Prunus japonica*), *dongkui* or mallow (*Malva crispa*), and Cucurbitaceae.

Bush Cherry

Bush cherry belongs to the rose family (Rosaceae). Two seeds were identified. The shells are hard and lozenge-shaped. They are 6.6 mm long and 4.4 mm wide (Fig. 2.20). An additional eight seeds belong to the family Rosaceae, but their genera have not been identified.

Mallow

Mallow belongs to the family Malvaceae. A total of 48 seeds were recovered. They are circular or fan-shaped with thick backs and flat bellies with a concave indentation in the middle. Their diameter is approximately 2.0 mm (Fig. 2.21).

Family Cucurbitaceae

Family Cucurbitaceae was represented by a single seed.

Unidentified Plants

A total of 548 carbonized seeds could not be identified because they were without clear features or their characteristics had been obliterated by over-carbonization (Figure 2.22).

Discussion

Perhaps the most fundamental observation to make in Table 2.6 is that fully 93.5% of the carbonized seeds recovered from sites 342 and 674 were of cultivated species. Such a large proportion leads to the unavoidable conclu-

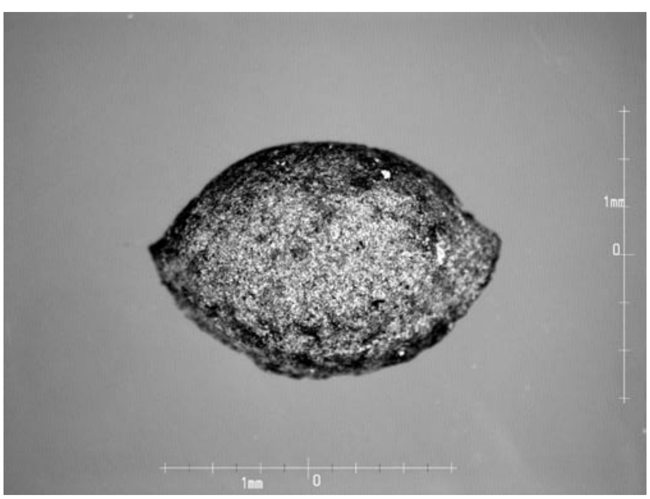


Figure 2.20. Seed of bush cherry from excavation unit 085 at site 674.

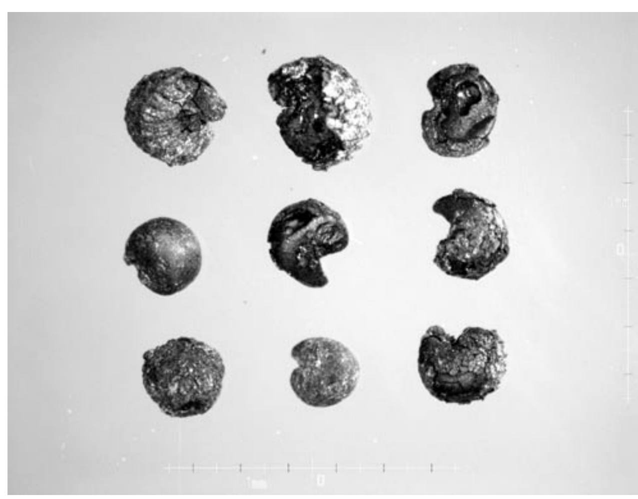


Figure 2.21. Seeds of mallow from excavation unit 509 at site 342.

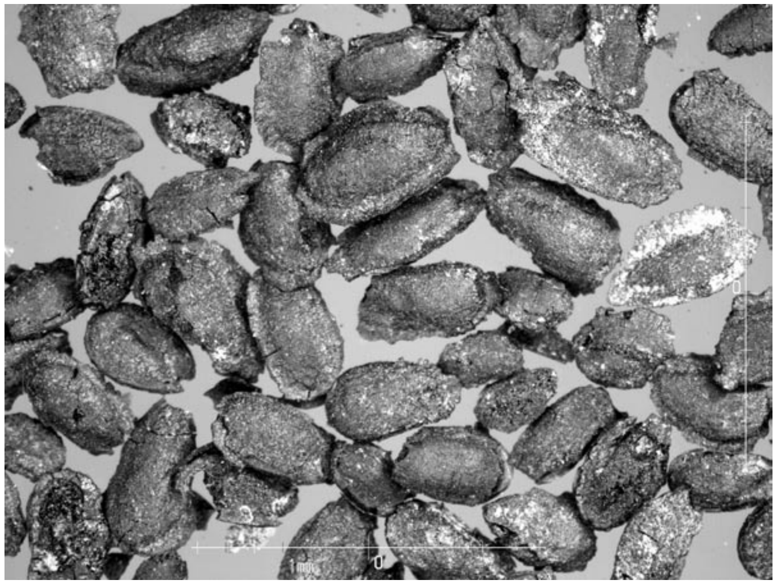


Figure 2.22. Seeds that could not be identified from excavation unit 031 at site 674.

sion that agriculture was the main source of plant food for the inhabitants of these two settlements. Of the four species of cultigens (Table 2.7), soybeans and cannabis occurred only in tiny quantities, leaving millet to comprise the vast majority. In particular, foxtail millet was the overwhelmingly dominant species, comprising 94.3% of the seeds of cultigens. This picture is most consistent with the archaeological remains of settlements practicing agriculture focused on foxtail millet as the major species of production and consumption in everyday life.

The taphonomic factors involving the deposition and preservation of carbonized plant remains, however, are extremely complicated, making quantification especially difficult for this class of material. Up to this point, our interpretations have relied upon counts and proportions of identified seeds. With carbonized plant remains, counts and proportions are often heavily dependent on a few idiosyncratic observations. In the case of this set of materials, for example, the extremely large numbers of foxtail millet seeds rely, in part, on two excavated contexts of uncertain date, which yielded about 36,000 and 10,000 foxtail millet grains, respectively. These two units, by themselves, surely do indicate intensive use of foxtail millet, but we should be cautious about over-reliance on proportions by taxon when nearly four-fifths of the foxtail millet grains identified came from only two of the 90 excavation units sampled.

Under such circumstances, it is useful to supplement counts and percentages with ubiquity measures to provide another perspective on the relative abundance of different species. Ubiquity measures are also usually expressed as proportions. Instead of the proportions of counts of seeds, however, they are the proportions of excavation units in which a particular taxon is present. The 90 excavation units sampled can be divided up between periods and sites as shown in Table 2.8, and the ubiquity measures for major classes of plants and for the four cultigens (that is, the proportion of excavation units where they are present) are in Tables 2.9 and 2.10. Although the gap between cultigens and other classes of plants narrows substantially when we look at the ubiquity measures, cultigens are still the class of plants with the most widespread occurrence at sites 342 and 674. In particular, foxtail millet occurs more widely than any other cultigen, appearing in 86% of the 90 excavation units sampled. Quantification of carbonized seeds, then, whether by counts or by ubiquity places foxtail millet at center stage as the main staple crop in the agricultural systems of these two settlements.

Broomcorn millet is much less abundant in the flotation samples, comprising only 5.6% of the seeds of cultigens. Its ubiquity, however, is not low, since it appears in 59% of the excavation units. It thus seems secondary in importance to foxtail millet, but still of widespread production and use. These findings are fully consistent with a large amount of archaeological evidence that production of foxtail and broomcorn millet in combination was typical of ancient dry farming in what is now northern China.

Soybeans are today an extremely important oil-producing crop worldwide. Global scholarship generally agrees that this crop originated in China, but its origins have been little studied, in part because of a lack of excavated evi-

TABLE 2.8. NUMBERS OF FLOTATION SAMPLES BY SITE AND CHRONOLOGICAL CONTEXT

	LXJD	Mixed LXJD-UXJD	Uncertain	Total
Site 342	44	8	1	53
Site 674	13	16	8	37
Total	57	24	9	90

TABLE 2.9. PROPORTIONS OF MAJOR PLANT CATEGORIES BY SITE AND CHRONOLOGICAL CONTEXT

	Cultigens	Weeds	Other Plants	Uniden-tified
All Contexts	81%	64%	10%	27%
LXJD	84%	19%	9%	28%
Mixed LXJD-UXJD	67%	46%	0%	8%
Site 342: LXJD	95%	18%	9%	34%
Site 342: Mixed LXJD-UXJD	63%	50%	0%	13%
Site 674: LXJD	46%	23%	8%	8%
Site 674: Mixed LXJD-UXJD	69%	44%	0%	6%

dence. The number of carbonized soybeans recovered from sites 342 and 674 was small, and does not suggest their production in large quantity, at least not compared to the millets. These remains are especially important, nonetheless, because the seed measurements do place these remains among cultivated soybeans and because evidence on the origins and development of soybeans is so scarce.

Cannabis is an especially interesting crop. Although it is not used for food, its fibers are excellent raw material for textiles, and oils for medicinal uses can be extracted from its seeds. Cannabis and silk were the main raw materials of which clothing was made in ancient China, so *Cannabis sativa* appears frequently in historical sources. According to Zhao Qi's interpretation of the five basic crops discussed by Mencius (c. 372–289 BCE), the *Tengwen Gong* chapters mention broomcorn millet, foxtail millet, rice, wheat, and beans. Zheng Xuan's (127–200) account replaced rice with cannabis among the five, as had been listed in the *Zhouli (Rites of Zhou*, late first millennium BCE) and the *Tianguan Jiyi*. The *Lüshi Chunqiu Shenshi* (Mister Lü's Spring and Autumn [Annals], c. 239 BCE), simply lists and describes all six. Cannabis clearly played an important role in agricultural production and daily life; of the six species, it is the only one that is not a source of food. Although considerably less abundant and widespread than the millets in the remains at sites 342 and 674, the *Cannabis sativa* seeds found there reconfirm the considerable time depth of this species' importance.

The plant families Gramineae, Leguminosae, and Chenopodiaceae contain many weed species that grow either in cultivated fields or in residential areas. It is thus common to see the seeds of these species in material from flotation at archaeological sites, and sites 342 and 674 are no exception in this regard. People often treat weeds as harmful since they compete with cultivated plants for resources (light, water, soil, nutrients, etc.). Such competition only occurs in a shared living space, where the main competitors to weeds are cultivated plants with similar shapes, growth habits, and demands on the environment. Foxtail and broomcorn millet both belong to the family Gramineae, and most of the weeds that compete with them in cultivated field also belong to this family. It is likely that most of the Gramineae seeds classified as weeds entered sites 342 and 674 mixed in with the harvest of foxtail and broomcorn millet.

Comparisons between the two sites from which these materials come or between the two periods represented are severely hampered by the small size of the sample, and particularly by the need to compare small samples of very uneven sizes, once the contexts are divided up in these ways. Whatever approach is taken to quantification, though, and however the contexts are divided (by period, by site, by site and period), cultigens are always ranked as the most abundant class of plant remains. Among cultigens, foxtail millet shows up as the most abundant and widespread species at both sites. It also occupies this position in contexts dating to Lower Xiajiadian times in both sites, and in contexts of mixed Lower and Upper Xiajiadian materials at both sites. In broad terms, then, an agricultural subsistence system with a primary focus on the cultivation of foxtail millet, supplemented by broomcorn millet, characterizes both sites through both parts of the Xiajiadian period. When examined through the lens of proportions based on seed counts, the importance of cultigens, and especially of foxtail millet, is less in mixed Lower and Upper Xiajiadian materials than in pure Lower Xiajiadian contexts at Site 674, but the reverse is true at Site 342. Confusing interpretation still further, in figures based on ubiquity, it is at Site 674 that cultigens, and especially foxtail millet, increase in importance in the mixed Lower and Upper Xiajiadian materials, while they decrease at Site 342. There is thus no convincing evidence in these remains to suggest the direction of any shift in the role of cultigens, especially foxtail millet, from Lower to Upper Xiajiadian times.

It is interesting to note that the only well-dated soybean specimen came from Lower Xiajiadian deposits at Site 342, while almost all the cannabis seeds came from mixed Lower and Upper Xiajiadian deposits at Site 674. Since the samples are so small, this does not provide convincing evidence of any difference in the production or utilization of these species between the two sites or of change from Lower to Upper Xiajiadian.

In sum, through sampling and flotation, sites 342 and 674 yielded abundant carbonized plant remains for exploring the food production sys-

TABLE 2.10. PROPORTIONS OF SEEDS OF DIFFERENT CULTIGENS BY SITE AND CHRONOLOGICAL CONTEXT

	Foxtail Millet	Broomcorn Millet	Soybeans	Cannabis
All Contexts	86%	59%	3%	3%
LXJD (both sites)	84%	65%	2%	2%
Mixed LXJD-UXJD (both sites)	67%	33%	0%	4%
Site 342: LXJD	95%	77%	2%	0%
Site 342: Mixed LXJD-UXJD	63%	13%	0%	0%
Site 674: LXJD	46%	23%	0%	8%
Site 674: Mixed LXJD-UXJD	69%	44%	0%	6%

tems of Lower and Upper Xiajiadian times. Both periods were characterized by a relatively advanced agricultural economy, belonging to the historically known dry farming tradition of northern China based on cultivating both foxtail millet (*Setaria italica*) and broomcorn millet *(Panicum miliaceum*). Soybeans (*Glycine max*) and cannabis (*Cannabis sativa*) both showed up as relatively uncommon agricultural products. Although both carbonized wood and seeds were abundant in the soils processed by flotation, these remains from small-scale stratigraphic testing can do little more than open the door to the more rigorous and detailed understandings of agricultural production that can come from future systematic study and accumulation of archaeological data.

Chapter 3

Environment

The natural environment is, of course, a fundamental baseline for any effort to understand and interpret ancient regional settlement patterns. The Chifeng Project survey area is drier than China's Central Plain, but it is not today either the desert or open grassland environment often envisioned for China's northern frontier, and indeed encountered in many parts of Mongolia and Inner Mongolia. The Chifeng survey area is now a densely settled and intensively cultivated landscape of considerable agricultural productivity.

The first section in this chapter describes in greater detail the natural environment and its exploitation by its modern inhabitants. This section deals not only with the Chifeng Project survey area, but also with a much larger zone in eastern Inner Mongolia, so as to set the Chifeng Project in its broader environmental context. The focus of the environmental description is on subsistence resources.

The second section of the chapter summarizes what is now known about changing climatic patterns in this larger zone of which the Chifeng Project survey area is a part. Although the existing paleoclimate data are not as complete as one might like, an effort has been made to present as comprehensive and synthetic account as possible, with particular attention to the implications of climate change for human subsistence patterns in the Chifeng Project survey area. This account of climate change is organized according to the chronological scheme discussed in Chapter 2.1 so that, in subsequent chapters, it can be more easily related to changing settlement patterns in the past.

The final section of the chapter turns to the methodological implications that the natural environment has for archaeological settlement study. It reconstructs the development of the landscape in the Chifeng Project survey area during the past 10,000 years. Its aim is to assess the suitability of the flat valley floors for human settlement during this period and the impact that upland erosion and lowland deposition of sediments have had on the archaeological remains of ancient settlements.

3.1. The Natural Environment and Its Modern Exploitation

Teng Mingyu and Gideon Shelach

The Chifeng Project archaeological survey area is cold and dry in the winter, dry and very windy in the spring, and very hot during the summer, cooling rapidly with the onset of autumn. Annual rainfall averages 250–450 mm, with 70% occurring in June, July, and August (Kong et al. 1991). In recent times year-to-year fluctuation in precipitation levels has been extremely large. Modern vegetation is relatively sparse: a mixture of woodland, scrub, semi-arid steppe, and desert occur in the larger physiographic zone of which the Chifeng survey area is a part (Fig. 3.1). Actual desert and semi-arid steppe conditions do not occur within or particularly close to the survey area itself, which is in the reasonably well-watered southern part of the larger zone. The Xilamulun River, some 100 km north of Chifeng, in some places usefully divides the northern dry steppe and desert zone, which is not much farmed today from the wetter region to the south, which can be highly productive for agriculture, especially with even quite simple irrigation technology on a very local scale.

Modern irrigation agriculture (maize, millet, sunflowers and many other crops) is intensively practiced on valley floors in the Chifeng survey area. Crops in these valley floor fields are now protected from frequent flooding by dikes along the rivers. More extensive, but still substantial, cultivation (especially of maize and millet) also occurs in the rolling uplands, usually without irrigation. These fields are naturally protected from flooding, but are less productive than valley floor fields and more at risk of crop failure from drought. In drier and higher sectors, several varieties of fruit trees are cultivated, and modern efforts at reforestation have been extensively applied to some of the least cultivable slopes. Very small herds of sheep and goats (often numbering 10 or fewer) are brought from villages on a daily basis to graze in uncultivated patches. Pigs and cattle are raised in the villages.

Physiography

The Chifeng Project archaeological survey area includes urban Chifeng and a total of 1,234 km^2 lying mostly to the west and southwest of the urban zone. The much larger Chifeng administrative region covers more than 90,000 km^2 in eastern Inner Mongolia Autonomous Region (Fig. 3.1), including modern urban Chifeng, the entire Chifeng survey zone, and several surrounding counties. The Chifeng administrative region falls between 41°17′ and 45°11′ north latitude and 116°20′ and 120°58′ east longitude. Primary sources for physiographic description of this greater Chifeng region are Chifengshi (1996:383–384) and Xia, Deng, and Wu (2000:329–336). To the west are the highlands of Inner Mongolia, and to the east is the lower Songliao plain. Within the Chifeng Project survey area, mountains of modest elevation are at the west (up to about 1,250 m above sea level), and the terrain slopes downward to low mountains, hills, and river flood plains (as low as 550 m above sea level) in the east.

Several rivers run across the Chifeng survey area from south and west to north and east, forming level valley floors from 2 to 8 km wide. Several of these valleys merge into a broad flood plain (some 14 km east to west and 11 km north to south) toward the northeast of the Chifeng survey area where urban Chifeng is now located. Rivers are shallow, and frequent flooding occurs in the lower parts of the valley floors, although the effects of this flooding are today much ameliorated by extensive artificially constructed levees. It is these valley floors that are now irrigated by pumping water from wells and channeling water from tributary streams to sustain intensive cultivation.

In the Chifeng Project survey area, the division between flat valley floors and hilly uplands is often sharply marked by cliffs or steep bluffs. Gently sloping hillocks or broad flat natural terraces often lie at the tops of these bluffs at elevations of 20 m or more above the adjacent valley floor. Farther back from the valley floor are higher hills and sometimes sharply dissected terrain with steep slopes and deeply incised narrow valleys. The soils in these hills dry out more quickly after rainfall, and, for the most part, irrigation is not feasible. Dry farming of maize, millet, and other crops is nonetheless extensive and productive. The highest and driest parts of the uplands tend to be used more for orchards and grazing sheep, goats, and cattle. Herds seldom consist of more than 20 or 25 animals, and usually fewer. They are brought out to graze on a daily basis in uncultivated areas, mostly but not exclusively in the uplands. At night they return to the villages, most of which are located along roads that run at the edges of the valley floors near the bluffs.

Temperature, Precipitation, and Soils

The large physiographic zone of which the Chifeng survey area is a part belongs to a semi-arid, continental monsoon climate regime. The yearly average temperature in most parts of this zone is between about 0°C and 7°C, increasing gradually from the higher elevations in the west to the lower elevations in the east. In the highest mountains to the north and west, January mean temperature is −18°C to −22°C and the July mean stays below 20°C. In the south, January means range from −12°C to −18°C; July means, from 20°C to 22°C. The frost-free period lasts 60–115 days in the west and 135–148 days in the east.

The yearly average precipitation for the greater Chifeng region is 381 mm, and because of the topography and monsoons, the distribution of precipitation decreases from southwest to northeast. In the western mountains the annual precipitation is between 450 and 500 mm. The prevailing westerly winds lose much of their moisture in these western mountains, producing annual rainfall of only 330–350 mm farther east.

The summer months from June to August are the wettest. Fully 72% of the annual precipitation falls during these months in an average year. Precipitation records provide a picture of substantial variation in both space and time. For example, the annual precipitation for Linxi County varied between a low of 176 mm and a high of 613 mm during the 40 years for which data are available; in Kulun Banner, the low during this period was 190 mm, and the high was 593 mm. Not only is there a sharp contrast between

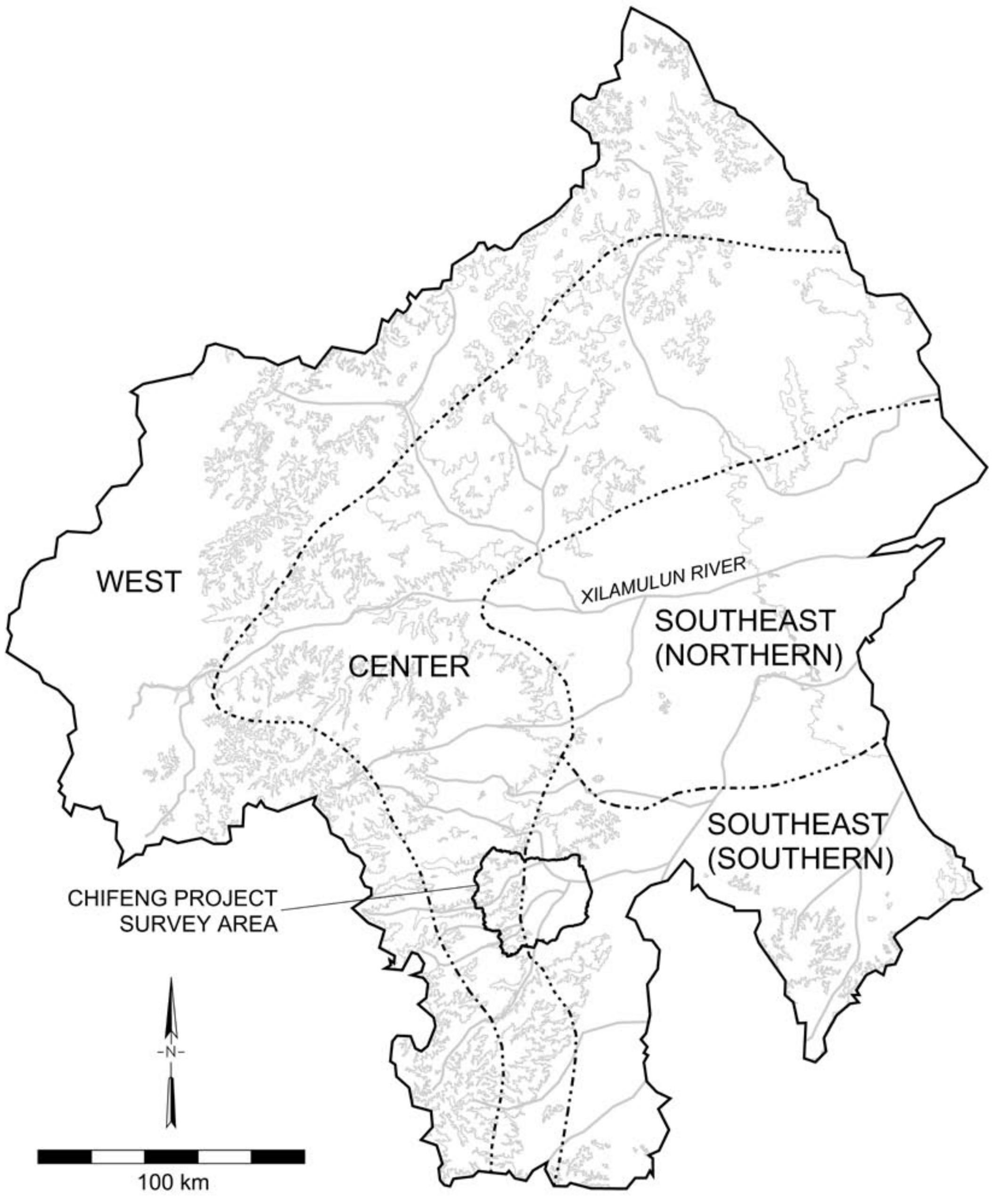


Figure 3.1. The greater Chifeng region with the four subsistence zones discussed in the text (dashed lines).

wet and dry years, the inter-annual variation is strikingly different even at relatively closely spaced locations. Total rainfall in Linxi County was 370 mm in 1967, but only 176 mm in 1968; while the pattern was reversed in Kulun Banner, with 190 mm of rainfall in 1967 and 384 mm in 1968 (Chifengshi 1996:399–406). Agricultural production in the greater Chifeng region is at risk, both from flooding and from drought. Especially severe droughts have afflicted the region since 2005. Even the irrigation systems of the valley floors have been unable to cope with these droughts as water tables have dropped below the level reached by the wells from which irrigation water is pumped. The most severe crop losses caused by droughts, however, occur on the unirrigated upland slopes. The risk of flood damage to valley floor crops has been much ameliorated but by no means completely eliminated by levee construction in modern and historic times. There is no evidence of irrigation or levee construction until Liao times, so risk-hedging behavior would have been even more important to ancient inhabitants than it is now. This could plausibly have encouraged both a focus on cultivation in the least risk-prone locations and a reliance on diverse resources, including drought-resistant cultivars and grazing animals.

Soils in the Chifeng Project survey area fall mainly in the *lihetu* (chestnut brown) and *huangmiantu* (loess) categories. Both are eminently suitable for cultivation.

Varying Subsistence Practices in the Greater Chifeng Region

With its varied topography, elevation, soils, temperature, and precipitation the greater Chifeng region, shows a variety of subsistence strategies (Chifengshi 1996:407–409). It is useful to divide it into three districts for describing this variety (Fig. 3.1).

The Northwest

At the northern and western margins of the greater Chifeng region, altitudes are mostly over 1000 m above sea level. Winters are long and cold; and summers, short and cool. The frost-free period is only 60–115 days, placing a severe limitation on agriculture. Precipitation is abundant, averaging 330–540 mm yearly. The soils are mainly *zongrangxingtu* (dark brown) and *ligaitu* (chestnut) with high proportions of organics. There is lush growth of grasses, and thus excellent pasturage, as well as forests. This district is entirely outside the Chifeng Project survey area.

The Center

Elevations in this district are around 700 m above sea level; terrain consists primarily of low mountains and hills, with narrow river valleys. The area is windy but not very snowy in winter and spring, and warm in autumn and summer, although the difference between daytime and nighttime temperatures can be dramatic. The frost-free period is longer than in the northwest, lasting for about 115–135 days, and offering considerably greater promise for cultivation. Precipitation is relatively low, between about 326 and 380 mm a year. The soil is mainly *lihetu* (chestnut brown), *ligaitu* (chestnut) and *zongrangxingtu* (dark brown). Vegetation is more open than in the northwest, with less development of forests and broader zones of grasses. Today, the inhabitants of this district graze sheep and goats on the natural grasses and cultivate valley floors and rolling hills, relying primarily on rainfall, although small-scale canal irrigation is sometimes practiced in the valley floors. The westernmost portion of the Chifeng Project survey area is included in this district.

The Southeast

This district can be divided into two subareas.

Northern Portion

In the middle and lower reaches of the Xilamulun River and along the northern bank of the Laoha River, elevations are low and soils are mainly sandy and *chaotu* (fluvo-aquic), and include zones of shifting sand dunes. Precipitation is scanty (300–400 mm) and evaporation is high, but the water table is not far below the surface. The frost-free period is long, about 135 to 144 days. Some cultivation is practiced along river banks, but extraction of forest products and grazing animals on wild grasses are more productive. This portion of the district is entirely outside the Chifeng Project survey area.

Southern Portion

Elevations here are about 400–750 m above sea level. Terrain includes rolling hills, and broad valley floors. Mean temperatures are moderate, and the frost-free period is relatively long, lasting for 140–148 days. Average annual precipitation is between 361 and 456 mm. Soils are mainly fertile huangmiantu (loess) and lihetu (chestnut brown). The precipitation levels of this portion of the southeastern district do qualify it as fairly dry, but it is wetter than most of the the rest of the greater Chifeng region. This, together with its broad valley floors and fertile soils, make it is the most suitable area for non-irrigated cultivation. Today there is also more irrigated cultivation in this portion of the southeastern district than in any other part of the greater Chifeng region. Major crops include maize, millet, and sunflowers; peanuts, sweet potatoes, sesame, and many other plants are also grown, both extensively in unirrigated uplands and intensively in irrigated level valley floors. Cultivation of fruit and nut trees becomes increasingly common at higher elevations. Most of the Chifeng Project survey area falls in this southern portion of the southeastern district.

3.2. Climate Change during the Past 10,000 Years

Teng Mingyu and Gideon Shelach

The modern environment of the Chifeng survey area and its exploitation by human populations is the point of departure for considering the impact of climate change on past subsistence systems. Even modest changes in temperature and precipitation levels during the past 10,000 years could have altered the subsistence possibilities of the Chifeng survey area considerably.

Although the potentially important effects of climatic changes on prehistoric populations were acknowledged by Chinese scientists by the 1960s, focused and intensive research aimed at reconstructing sequences of ancient climatic change did not begin until the 1990s. The first conference on environmental archaeology in China was convened in Xi'an in 1990; it was followed by three more conferences. The four published volumes of results from these conferences (Mo et al. 2007) provide a general overview. At the same time paleoclimatic reconstructions have become more common features of excavation reports and discussions of the origins of agriculture. In spite of this recent increase in research on ancient climatic and environmental conditions, many reconstructions are extremely generalized accounts of very large zones that are difficult to correlate with local trajectories of sociopolitical and economic change. More localized reconstructions of climatic change are often rudimentary and must be based on extremely limited data. As a result, one recent review found major contradictions among the currently available schemes for early Holocene climatic change in northern China (Wagner 2006:5).

The summary of climatic change presented here is subject to all these difficulties. Environmental data for the Chifeng Project survey area itself are extremely scarce, so this summary relies heavily on information from the larger region of which the Chifeng survey area is a part and sometimes must cast an even broader net to make educated guesses about the impact past climates have had on subsistence in the survey area. Its central aim is to establish an environmental baseline for discussion of changing patterns of human adaptation (Chapter 4.4) and the trajectory of sociopolitical change (Chapter 5).

Sources of Paleoclimatic Information

Currently, reconstructions of ancient climate and environment for the Chifeng survey area are based primarily on pollen samples from natural and cultural strata in and around archaeological sites, plant macro-remains excavated from sites, and studies of paleosols. Published data are available for 27 localities in the larger region of which the Chifeng survey area is a part (Fig. 3.2). Of these localities, 17 provide data from cultural strata (including burials) in archaeological sites (11 south of the Xilamulun River and the other 6 north of it). Non-cultural contexts are the source of the data from the other 10 localities (7 south of the Xilamulun River and 3 north of it). Altogether, the 27 localities represent the principal terrains on both sides of the Xilamulun River except for mountains higher than 1200 m above sea level. They include the edge of the Keerqin desert; hilly areas at relatively low elevations (Wulanaodudianzi, Baomiying, and Songshushan in east central Wengniute Banner); the valley floors between the Chifeng survey area and the Xiliao River Plain (the Xinglongwa and Xitai sites in eastern Aohan Banner); and some mountainous areas at higher elevations (Guandongche, Jinggouzi, and Reshuitang in Keshiketeng Banner, and Xiaoshandegou in Wengniute Banner). These data sources are distributed across a much larger and more ecologically variable zone than the Chifeng survey area (as described in the previous section of this chapter), but they make possible a view of climatic trends that, in the context of existing paleoclimatic research in northern China, can be considered quite focused. The 27 localities represent the period from ca. 3500 BCE to 1250 CE, although it is not always possible to correlate the different samples chronologically with much precision (Song 2002:41). Consequently, the sequence of climate change it is possible to reconstruct for the Chifeng survey area is not as clear as we would like it to be. The account presented here also draws on more general understandings of climatic trends across northern China.

The Sequence of Climate Change

It is generally agreed that northern China was severely affected by cold conditions at the peak of the last major glaciation. Bones of woolly mammoths and woolly rhinoceroses that have been recovered at more than 200 locations attest to a cold steppe environment. Permafrost soils, found today north of 51° north latitude, extended as far south as 40° north latitude (Winkler and Wang 1993)—well beyond Chifeng at 41°15′ north latitude. After ca. 11,000 BCE the climate became warmer and more humid (Lu 1999:12–13). Most researchers argue that sometime around 9000 BCE, northern China witnessed a cold dry spell parallel to the

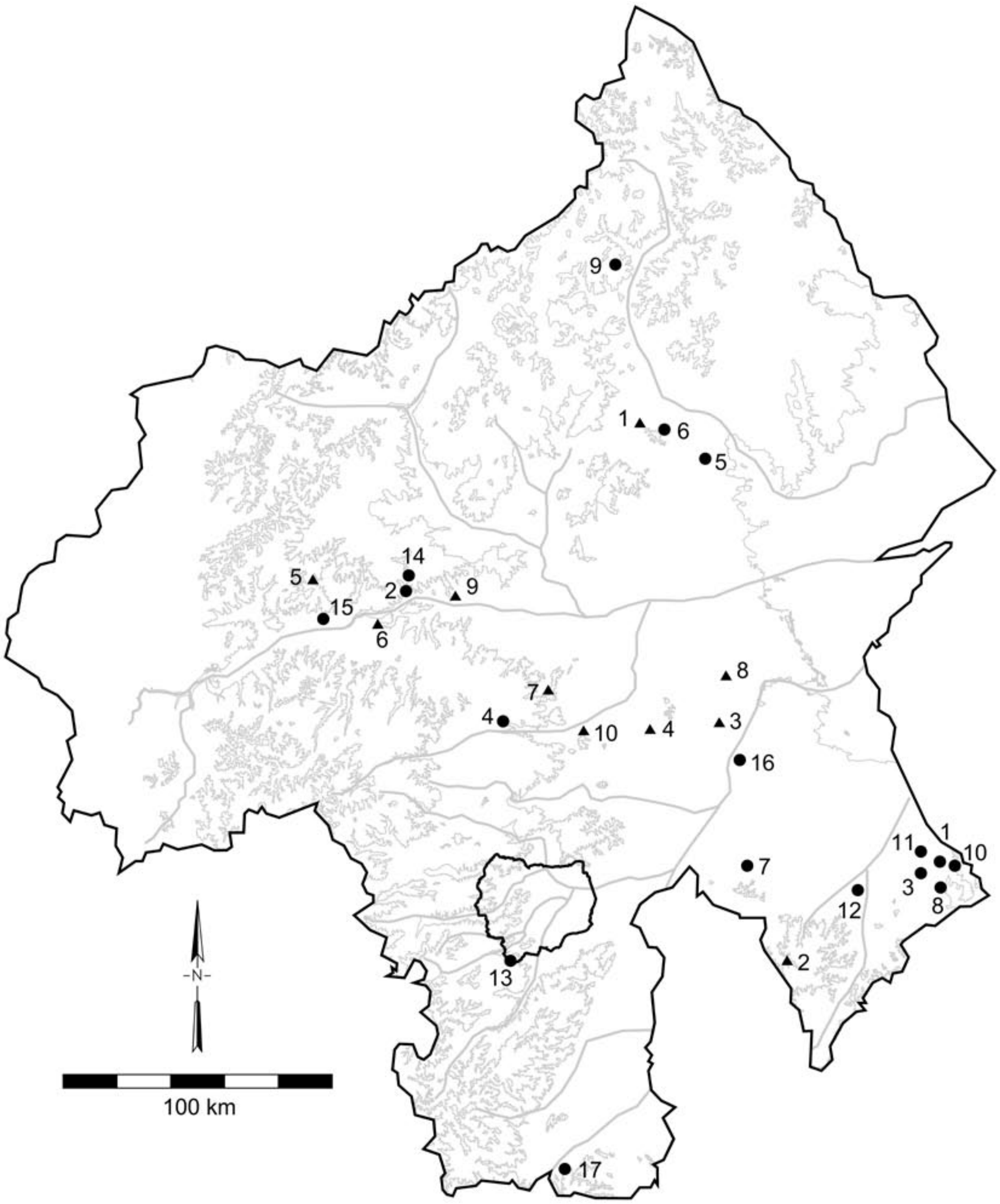


Figure 3.2. The greater Chifeng region with the locations of paleoclimatic data from archaeological sites (circles) and natural sediments (triangles). The archaeological sites are: 1. Xinglongwa, 2. Baiyinchanghan, 3. Xiaoshan, 4. Xiaoshandegou, 5. Longchangzhen Daba, 6. Erdaoliangzi, 7. Jitan, 8. Xitai, 9. Fuhegoumen, 10. Lamadongshan, 11. Dadianzi, 12. Halihaitu, 13. Dashanqian, 14. Jinggouzi, 15. Guandongche, 16. Zhoujiadi, and 17. Xiaoheishigou. The locations of natural sediments sampled are: 1. Qiguoshan, 2. Wangxianggou, 3. Wulanaodudianzi, 4. Songshushan, 5. Reshuitang, 6. Majiagouyingzi, 7. Sidaozhangfang, 8. Baomiying, 9. Banlashan, and 10. Wudanzhen Shaolanghe.

Younger Dryas, after which climatic conditions were warmer and wetter from ca. 9000 to 4000 BCE (An et al. 2000; Zhou et al. 1999). The steppe grassland environment that characterized much of northern China during the late Pleistocene gave way to early Holocene evergreen and broadleaf deciduous forest interspersed with patches of xerophytic herbs (Yi et al. 2003).

Xinglongwa

From the data currently available for the larger region in which the Chifeng survey area is located, it seems that these warmer and wetter conditions characterized at least the earlier part of the Xinglongwa period (6000–5250 BCE) as well. Data from across northern China suggest considerably higher lake levels (An et al. 2000:747; Winkler and Wang 1993:229–233) and average temperatures some 2–4°C higher than today (Shi, Kong, and Wang 1992:7). In the Chifeng survey area, this would have meant denser vegetation and more abundant animal life. Valley floors would probably have been sufficiently humid and subject to flooding to discourage both residence and cultivation, but upland cultivation would have been more productive and reliable than it is today. According to at least one study of the Dunde ice core records, the temperature dropped twice—around 5800 BCE and 5200 BCE—and the pollen data from Jian Lake in Jiangsu Province indicate that around 5600 BCE average temperatures were about the same as present (Shi, Kong, and Wang 1992:8). A relatively dry steppe environment is also suggested by pollen samples from two localities closer to the Chifeng survey area: from natural strata at Reshuitang in Keshiketeng Banner dated to ca. 5200 BCE, and from cultural strata at the Baiyinchanghan site in Linxi County dated to ca. 5800 BCE (Jiang 1992:71–86; Song 2002:39). These cooler and drier conditions might have encouraged more cultivation of wetter valley floor locations during the second half of the Xinglongwa period.

Zhaobaogou and Early Hongshan

The time between 5200 and 4000 BCE (including the Zhaobaogou period [5250–4500 BCE] and the first part of the Hongshan period [4500–3000 BCE]) had a relatively stable climate with both temperature and precipitation well above modern levels. Evidence from glaciers and lake sediments at Qinghai Lake, in northwestern China, indicates precipitation almost double the modern average. Both the Qinghai data and pollen evidence from Huinan Gushantun in Jilin Province suggest average temperatures 2–3°C higher than today (Shen, Tang, and Xu 1992:33–39). Closer to the Chifeng survey area, pollen from cultural deposits at the Xiaoshan site in Aohan Banner indicates a mixed evergreen and broadleaf deciduous forest at ca. 5000–4800 BCE. Warm conditions are also suggested by this pollen profile, as well as by the remains of walnut and Chinese catalpa (*qiu*) found at the site (Song 2002:40).

Late Hongshan and Xiaoheyan

After ca. 4000 BCE (part way through the Hongshan period) climatic conditions were more variable. The Dunde ice core record shows several cold events, some of which are especially obvious in northern and eastern China (Peng, Zhong, and Zhao 2005:52–60; Yang, Li, and Ding 1979:264–279). These conditions are corroborated closer to the Chifeng survey area by $\delta^{13}C$ values and a $\delta^{18}O$ time series of peat cellulose from Jinchuan in Jilin Province (Hong et al. 2001). Most studies place the beginning of these fluctuations in the fourth millennium BCE, but one recent study of pollen and phytoliths from paleosol profiles in Taipusi Banner suggests colder and drier conditions only after 3000 BCE (Huang, Lisa, and Xiong 2004:1029–1040). Previously high sea levels, which had submerged the circum-Bohai coast up to 100 km inland of its present location, began to recede in response to slightly cooler conditions (Huang 1984; Yang and Xie 1984). A minor eustatic rebound in sea level prior to or about 3500 BCE (Yang and Xie 1984) suggests at least a brief return to warmer conditions in Middle to Late Hongshan. Pollen from natural strata at Sidaozhangfang, Wengniute Banner, dated at 2010±85 BCE, suggested warmer and wetter conditions than at present (Wu and Zheng 1992), as did pollen from a stratum dated to ca. 3000–1700 BCE at Wangxianggou, Aohan Banner (Li, Yin, and Zhang 2003). By 3000 BCE, broadleaf forests had returned to the grasslands of Inner Mongolia, and mean annual temperatures may have been 2–3°C higher than at present (Liu 1988).

This period is sometimes discussed in relation to a global phenomenon whose traces in northern China are seen by some in parts of the evidence just cited (Wu and Liu 2001, 2002; Xu 1998). In view of the inconsistencies in the trends observed, it is not surprising that those who find evidence of a global cool period in northern China place it at different points in time, ranging from 3000 to 1500 BCE (Li, Yin, and Zhang 2003; Peng, Zhong, and Zhao 2005; Zhang 2003; Zhang, Li, and Liu 2004). Given that the starting and ending points of this colder period (or at least this period of episodic cooling and warming) show temperatures several degrees above modern levels, it is not at all clear that, even at its coldest, the Chifeng survey area would have shown temperatures much below those observed today.

As in the case of temperature, evidence for precipitation levels fails to show clear and consistent patterns across northern China, suggesting high variability. Open forest mixed with steppe environment, typical of drier conditions, is indicated by pollen from some sites at ca. 3500–3300 BCE (Song 2002:40). Mostly, however, conditions wetter than today are indicated, as in the Jinchuan $\delta^{13}C$ and $\delta^{18}O$ values in Jilin (Hong et al. 2001) and in pollen from natural strata at Reshuitang (Jiang 1992:71–86). Pollen from the Xiaoshandegou site in Wengniute Banner also indicates a cold but humid environment at ca. 4000 BCE (Kong et al. 1991:112–119).

With so many indicators pointing in different directions, it is impossible to be very confident of any reconstruction of climatic conditions in the Chifeng survey area in the latter part of the Hongshan period. Conditions generally or episodically slightly colder than at present would not have had much negative impact on resources, and the evidence does not give a consistent indication of strong departures from modern temperatures. Wetter conditions would tend to make valley floors less suitable for cultivation, but would be favorable for upland dry farming.

Much of the evidence just discussed carries forward into the Xiaoheyan period (3000–2000 BCE). The confusing and inconsistent indications in the paleoclimatic record for the latter part of the Hongshan period may abate somewhat, and there is little to suggest that upland dry farming would be any less productive than it is today or than it was in late Hongshan times.

Lower Xiajiadian

Several kinds of evidence suggest that the early centuries of the Lower Xiajiadian period (2000–1200 BCE) were substantially wetter than the present. One study of the species represented in carbonized wood remains from Lower Xiajiadian sites indicates slightly higher temperatures and annual rainfall between 600 and 800 mm, nearly twice present levels (Li, Cui, and Hu 2003). Carbonized wood from the Dashanqian site, dated to 2000–1500 BCE and within the Chifeng survey area, supports this conclusion (Wang, Wang, and Zhu 2004) as does pollen from Lower Xiajiadian graves at the Dadianzi cemetery (Kong and Du 1981; Kong et al. 1991). On the other hand, five pollen samples from Lower Xiajiadian ash pits at the Lamadongshan site in Aohan Banner suggest warm but relatively dry conditions (Song 2002:41). Decrease in both temperature and precipitation from fifth millennium levels is indicated by pollen from a stratum dated to ca. 1700 BCE at Wang xiang gou, Aohan Banner (Li, Cui, and Hu 2003). Farther from the Chifeng survey area, relatively dry conditions (with warmer temperatures) are reconstructed for eastern Hebei on the basis of pollen from peat fields (Li and Liang 1985). Climate reconstructions commonly characterize the entire zone north of the Yellow River basin, including the Chifeng survey area, as subject to decreasing precipitation to a degree that substantially depleted subsistence resources after 1500 BCE (Kong et al. 1991; Li and Liang 1985; Li, Cui, and Hu 2003:292–293; Shi 1991; Teng 2004; Winkler and Wang 1993; Yang and Suo 2000). Pollen cores from several locations near the Chifeng survey area suggest that, after this date, pollen of arboreal species decreased and that of weedy species and grasses increased (e.g. Song 2002:40; Tang, Zhu, and Wang 2007).

The second millennium BCE, then, like the fifth, provides somewhat inconsistent indications of climatic conditions. For the Chifeng survey area, the early part of the Lower Xiajiadian period may have seen precipitation levels sufficient to make upland dry farming highly productive and less risky than at other times. This higher rainfall, though, would likely have strongly discouraged valley floor farming because of poor drainage and the risk of flooding. Later in the period, the effects of decreasing precipitation across a large zone, may have been especially noticeable locally in the form of climatic instability with periodic droughts of increasing frequency and severity. Such fluctuations would take a toll on upland farming in the Chifeng survey area, but would make the rich and better-watered valley floor soils increasingly attractive for cultivation.

Upper Xiajiadian and Zhanguo-Han

The highly variable and generally drier conditions of the latter part of the Lower Xiajiadian period appear to have continued in Upper Xiajiadian times (1200–600 BCE) as well. Increased aridity is suggested by the ratios of stable carbon isotopes in plant remains from the Jinchuan peat (Hong et al. 2001). An analysis of two dry lake cores from Dali Lake, on the western edge of the Xilamulun River basin, suggests a process of desertification beginning as early as the fourth millennium BCE and intensifying after ca. 900 BCE, in the middle of the Upper Xiajiadian period (Liu, Xu, and Cui 2002). Layers of sand deposited in the Dashuinuoer Lake (Yang and Suo 2000) support this reconstruction. A steppe-desert environment was emerging and spreading across a band 100 km and more west and north of the Chifeng survey area, but desiccation in the survey area itself was by no means this severe. While precipitation levels were dropping from earlier highs, it must be remembered that the early Lower Xiajiadian period is reconstructed as an extremely wet time. It thus seems that, despite the general drying trend, the Chifeng survey area was at least as well watered in Upper Xiajiadian times as it is today, meaning that both valley floor and upland farming could be practiced with reasonable reliability in appropriate places.

According to Suo (2003), the drying trend was accompanied by a decrease of about 3–5°C in average annual temperatures. Pollen samples from natural strata with a date of 474±75 BCE on the northern bank of the Shaolang River in Wengniute Banner, in contrast, suggest a dense steppe environment typical of a warmer climate (Jiang 1992). Similar results have also been reported from the Guandongche site in Keshiketeng Banner (Tang, Zhu, and Wang 2007).

Through much of the Zhanguo-Han period (600 BCE–200 CE), climatic conditions in the Chifeng survey area approximated those of Upper Xiajiadian, although there is some evidence of an increase in precipitation at about 1 CE (Li, Cui, and Hu 2003:292–293).

Liao

Previous conditions persisted through about the first half of the Liao period (200–1300 CE). Its second half, though, became warmer as was the case all across eastern China from around 900–1300 CE. This was part of a global event, referred to in Europe as the Medieval Warm Period (*zhongshiji nuanqi*) (Ge, Zheng, and Man 2004; Man and Zhang 1993; Wang and Gong 2000). Man and Zhang (1993) identify three temperature peaks (middle 10th, late 11th, and 13th centuries CE), separated by two relatively cold periods (early 11th and early 12th centuries CE). In the Western Liao River drainage generally, a period from the beginning of the 10th into the early 11th century CE may have been especially warm and propitious for agriculture (Han 2005). There are no specific data from the Chifeng survey area or near it to corroborate this event locally. These climatic fluctuations are, in any event, on a shorter time scale than it is possible at present to distinguish archaeologically.

3.3. Geomorphology

Gideon Shelach and Yoav Avni

The effects of post-depositional geological action on the surface visibility of remains left by prehistoric human activity are always a concern for the analysis of regional survey data. Because survey data consist of the distribution patterns of artifacts (mainly sherds) and architectural remains visible on the surface, natural processes that can either cover those remains or transport them from their original locations can affect what is seen, collected, and recorded in the field. Post-depositional processes, of course, operate everywhere, but some locations are more severely affected than others.

Three field seasons of geomorphological research were carried out by the Chifeng Project with the aim of assessing the extent of such processes in the survey area and their impact on the analysis of the archaeological data. This research combined geomorphological survey, excavation of geological profiles throughout the survey area, and dating of sediment samples from these profiles using Optically Stimulated Luminescence (OSL) and C14 methods. The geomorphological aspects of this study were conducted by Dr. Yoav Avni of the Geological Survey of Israel. Prof. Zhang Jiafu, of the College of Urban and Environmental Sciences at Peking University, collected the samples for dating that were processed by him and Prof. Zhou Liping at the Laboratory for Earth Surface Processes in the Department of Geography at Peking University. The principal results of this work insofar as archaeological interpretation is concerned are presented here. For additional detail on the work done, the complete set of OSL and C14 dates, and the full analysis of geomorphological processes see Avni et al. (2010).

Finally, the geomorphological study showed that natural processes of soil erosion and deposition had very little impact on archaeological remains in the survey area. Taking remains recorded by the survey as a reflection of the activities of ancient populations and of the locations of those activities is thus warranted. In geomorphological terms the survey region can be divided into two distinct zones: first, the mountains and uplands from which the aeolian loess soil cover is being eroded, and, second, the valley floors in which these eroded soils are deposited (Fig. 3.3). The geomorphological survey showed that, while erosional gulley formation can damage sites and archaeological remains, the size of the damaged area is usually very limited. To be sure, profiles dug into the sediments of the valley floors indicate substantial alluviation beginning as far back as the initial Holocene and perhaps even earlier periods. Several lines of evidence, however, make it clear that these very processes, which might obscure the surface visibility of archaeological remains, also would have made the valley floors extremely unattractive for human settlement before Liao times. It is, thus, extremely unlikely that the valley floors ever contained any meaningful remains of human settlement to be covered over by this alluviation.

The Effect of Erosion on Settlement Evidence in the Uplands

In 2001, geologists from Jilin University and from the Geological Survey of Israel conducted a preliminary geomorphological survey of the Chifeng Project survey area. The initial results of this work confirmed the impressions created during the archaeological survey up to that point. The uplands have, in fact, during the Holocene been subject to ongoing and quite rapid erosional gully formation. The gullies can be deep, but they are usually quite narrow and would affect only small portions of sites (Fig. 3.4). Most gullies are between 10 and 20 m deep and are only a few meters wide, with almost vertical walls. Using floral indicators (mostly trees), which grow within the gully, the rate of headward migration was estimated at approximately 1 m per year. This rate is quite fast, but not unusual in such easily eroded loess soils. A similar rate of gully headward migration was monitored during the past 17 years in the Negev desert of Israel (Avni 2005; Avni et al. 2006).

The locations of gullies in relation to fortified Lower Xiajiadian sites indicate that the formation of major gullies predates the establishment of these settlements; in several cases the gullies were incorporated into the design of defensive structures around the adjacent settlement areas. This further suggests that sites have not been extensively affected by gully erosion.

The Effect of Alluviation on Settlement in the Lowlands

These initial conclusions about the uplands were pursued by an intensive geological survey of a small drainage system, located west of the modern village of Yaowangmiao (Fig. 3.5). The main aims of this survey were to reconstruct the landscape during the Late Pleistocene-Holo-

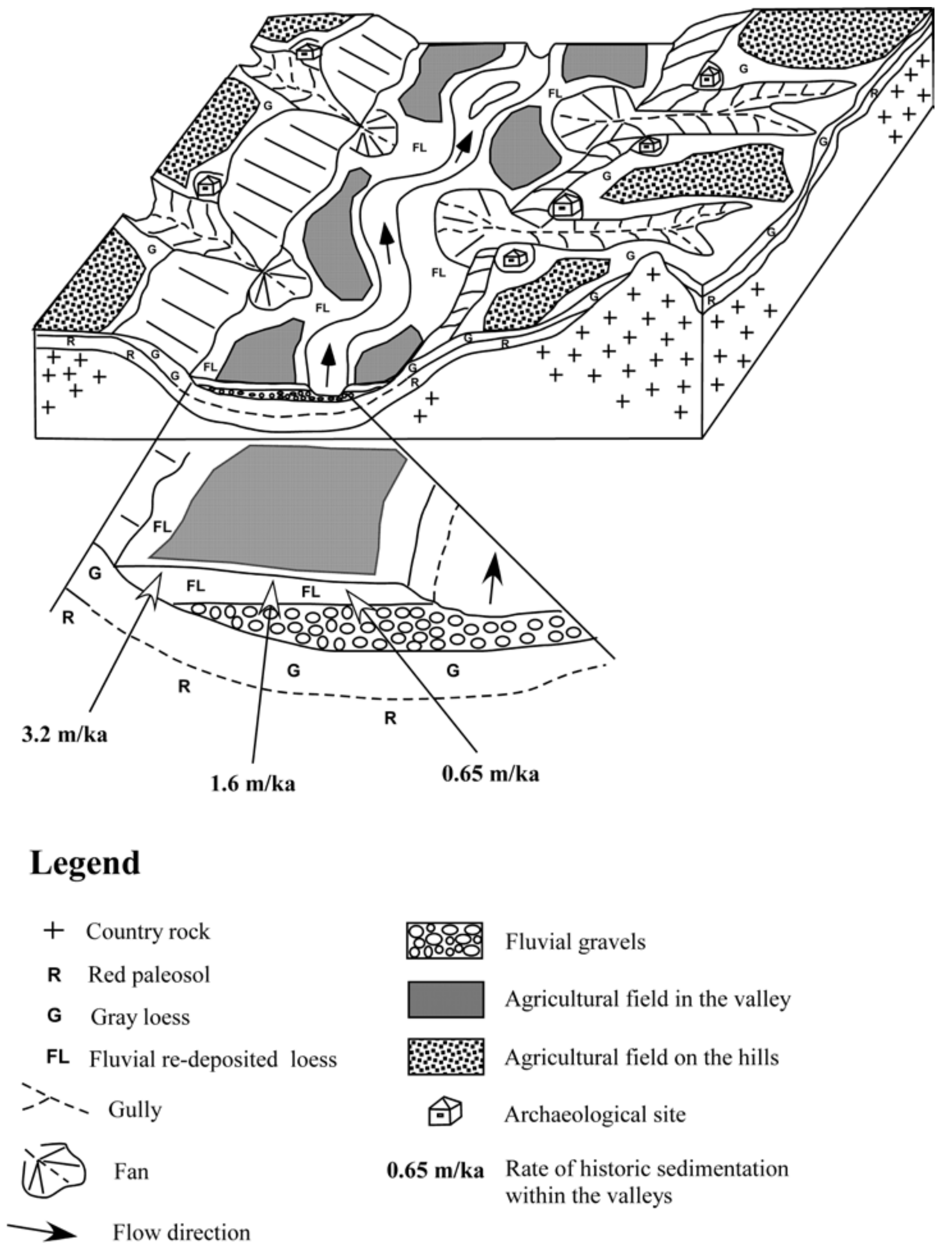


Figure 3.3. Schematic diagram of principal geomorphological features of the Chifeng region.

cene transition as the starting point for the geomorphological processes of the Holocene and to estimate the amount of material eroded from the slopes of the drainage system and washed into the larger valley during the prehistoric and historic periods of occupation. During 2001 and 2006, trenches were dug in different parts of the survey area to document the accumulation of alluvial deposition in the valley floors and to take samples for OSL and C14 dating of the soil layers. The OSL dates were used to identify the time period of the alluvial accumulation and thus to calculate the rate of deposition. Altogether 57 OSL samples and one C14 sample from 11 trenches were processed (for details see Avni et al. 2010:Table 1).

The trenches were located so as to represent different subzones within the archaeological survey area's environment (Fig. 3.6). Five trenches (trench numbers 3–7) were located in the Yaowangmiao drainage system and in the level valley floor between it and the Xibo River into which it empties. This set of trenches represents the small and middle-sized drainages and the gradients within them from points just outside the edges of the valley floor to points in the main valley's center near the course of the river (see

Figure 3.4. An active gully. (Available online in color, see Appendix B.)

also Fig. 3.5). Six additional trenches were located in different parts of the large floodplain where the modern urban zone of Chifeng is located (trench numbers 1–2 and 8–11). Because five relatively substantial rivers empty into this large flat area, the accumulation regime there is much more complicated and could not be assumed to be the same as that in the small and middle-sized valleys. The localities selected for trenching represent different subzones within this large basin in terms of their proximity to the basin edges, to high ground within the basin, and to the course of the Yingjin River, which drains the basin.

Results

The Yaowangmiao Basin and the Xibo River Valley

The basin studied is a minor drainage covering an area of about 5 km^2 located northwest of Yaowangmiao village, approximately 20 km south of urban Chifeng. The native rocks are exposed along the watercourse and on parts of the steep slopes. Some Tertiary to Quaternary conglomerates outcrop along the main channel. Most of the basin is covered by a thick deposit of Pleistocene loess, which covers most of the slopes and gentle hills. Near the outlet of the basin a young sedimentary fan was developed, composed of drifted alluvial material. The fan was fed by active gullies, which dissect the steep slopes of the basin. These gullies are active at present, continuing to contribute additional loess sediments to the major valleys farther downstream.

Two trenches (numbers 6 and 7) were excavated within the small basin. Results obtained from them are relevant to the understanding of loess accumulation during the glacial age but do not have direct bearing on the archaeology of the region. Trenches 3, 4, and 5 were located, at more or less regular intervals, along a line from the mouth of the Yaowangmiao basin to the center of the Xibo River valley. Trench 5 is the closest to the Yaowangmiao basin and is probably located on the alluvial fan that was created on the valley floor in front of it. Trench 4 is located some 400 m east of Trench 5 and some 850 m west of the river. It represents the situation midway out into the Xibo River valley. Trench 3 is located farther out into the Xibo River valley, some 500 m from the main river itself.

The rate of sediment accumulation on the alluvial fan near the edge of the Xibo valley (Trench 5) was calculated as about 3.2 m per thousand years. This is an extremely fast rate of accumulation that represents a unique situation at the mouth of the Yaowangmiao basin. Farther out in the Xibo valley, the rate was calculated at approximately 1.6 m per thousand years for Trench 4 and approximately 1 m per thousand years for Trench 3 closest to the river. Throughout the Holocene, then, an intensive erosion phase in the highlands has caused rapid accumulation of sediments within the medium-sized valleys of the archaeological survey area. Such fast rates, especially in the belt along the edges of the valleys at gully mouths, would discourage the human population of the Chifeng region from constructing permanent habitations in the flat valley floors.

Despite this discouragement, modern villages are predominantly located in just this zone, and periodic floods are indeed a constant nuisance (Figs. 3.7 and 3.8). With modern concrete foundations, however, such flooding is not the severe threat it would have been to the residential structures built of unbaked mud bricks and wattle-and-daub walls typical for the area up until Liao times. Farther out onto the floor of the Xibo valley—and presumably other valleys of similar scale as well—the rate of alluviation is somewhat slower than at the edge, but it is still quite fast. This indicates that substantial flooding at frequent intervals has been widespread in the valley floors of the archaeological survey area. Lateral migration of the river channel would have posed an even more severe threat to settlements, and numerous layers of pebbles observed in the profiles of all the trenches document substantial and frequent changes in the course of the river in the past. Main valley flooding and movement of the river channel are now much reduced by extensive earthen levees whose construction may have begun in Liao times as well as by more recent massive concrete and stone dams. It is these factors, together with the convenience and economic importance

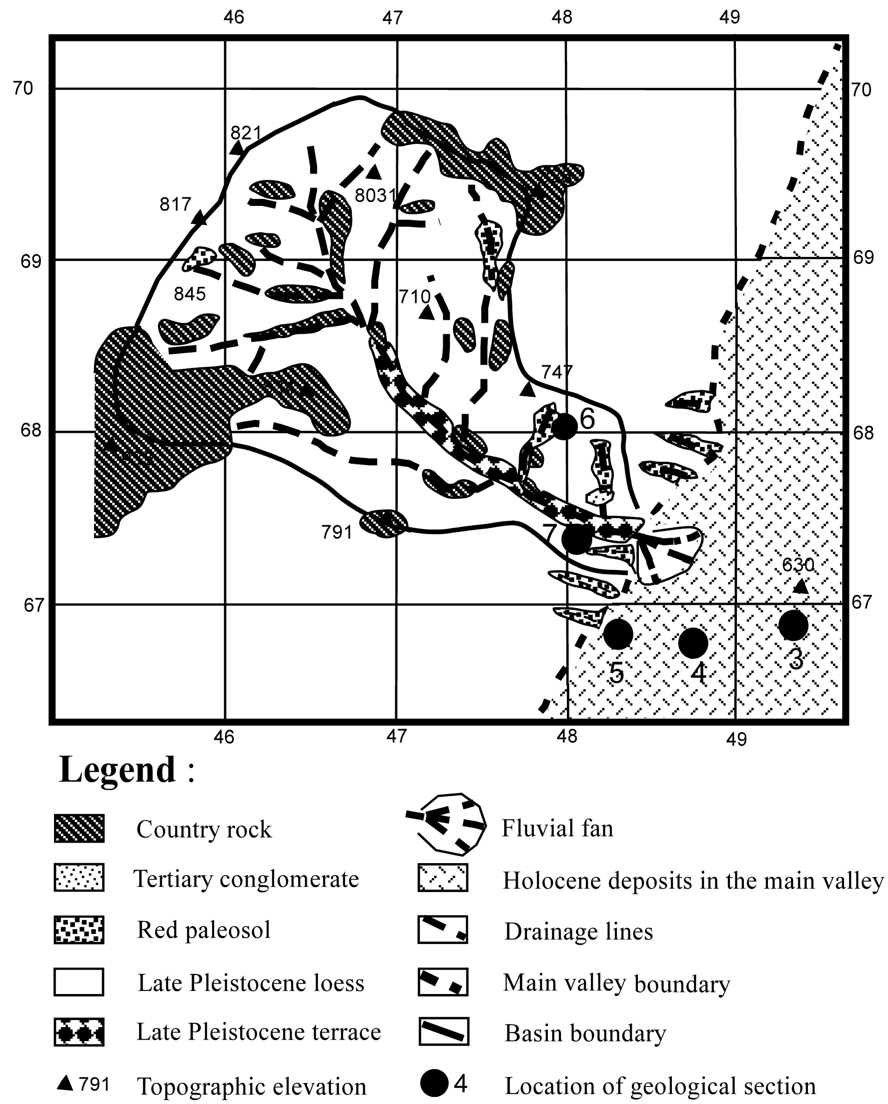


Figure 3.5. Intensive geological survey of a small drainage system west of Yaowangmiao.

of location along the roads that run at the valley edges that account for the presence of modern villages in this geologically inhospitable setting. Even for modern villages, a tendency can be observed to avoid the vicinity of the mouths of major drainage basins from the uplands.

Given the abundance of excellent settlement locations just above these flood hazards, it is extremely unlikely that any substantial settlement existed in pre-Liao times on the flat valley floors of the medium-sized rivers that drain the Chifeng Project archaeological survey area. This does not, of course, preclude the use of the valley floors for hunting, gathering, grazing, or cultivation. Indeed, as the earlier sections of this chapter have indicated, precisely such use of the valley floors seems quite likely.

The Broad Chifeng Floodplain

As mentioned previously, all the medium-sized rivers in the archaeological survey area join toward the northeast to form the wider Chifeng floodplain. This large concentration of well-watered flat land, about 120 km^2 in area, is the setting for today's main concentration of human occupation—urban Chifeng. The boundaries of the archaeological survey area were laid out to include this floodplain and adjacent uplands all around it. The geomorphological processes operating in this broad floodplain are rather more complicated than those of the medium-sized valleys. Water and sediments enter this area from different sources, and the way they spread across this large flat zone can create varied microzones where the rates of accumulation are dif-

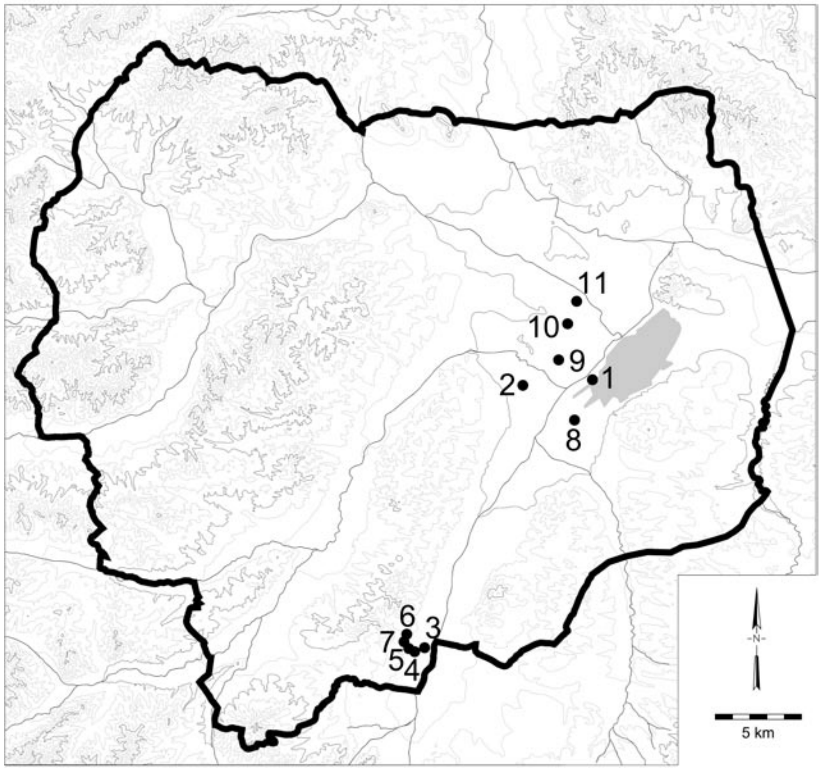


Figure 3.6. Locations of the trenches for geological sampling.

Figure 3.7. Flooding on a small tributary of the Banzhijian River, summer 2006. (Available online in color, see Appendix B.)

ficult to predict. The remains of past terraces, deposited during the glacial era and not completely eroded away, are features that play an important geomorphological role. It was easier for such terraces to escape full erosion until late during the Holocene period in the wide Chifeng floodplain than in the narrower tributary valleys.

In an attempt to understand these processes and gain a better picture of the varied local rates of erosion and sedimentation, six trenches were excavated in different parts of the Chifeng floodplain. Their locations were chosen to represent different microzones and distances from the main rivers (Fig. 3.6). This strategy sought to make possible not only estimates of the varied accumulation rates in different parts of the wide floodplain but also to detect substantial lateral movements of the river courses and the by-now buried remains of glacial era terraces.

Overall, the rates of alluvial accumulation in the broad Chifeng floodplain during the mid-to-late Holocene range from 0.5 to 1.5 m

Figure 3.8. The effects of local flooding on a small tributary of the Banzhijian River, summer 2006. (Available online in color, see Appendix B.)

per thousand years. Although in some places the rates are slower than those estimated for the medium-sized valleys, even these lower rates still show that the broad floodplain, like its tributary valleys, was subject to frequent flooding.

Levels of coarse gravel deposits were found in all of the trenches excavated in the broad Chifeng floodplain. In all but Trench 9, these ancient river channels are dated to the Holocene and in some places, such as in Trench 10, they are quite distant from the modern river courses. This pattern indicates that during most of the Holocene an unstable environment prevailed in the broad Chifeng floodplain, with frequent, and sometimes long-distance, lateral migration of the river system.

The periodic development of poorly-drained swamp conditions in some parts of the broad Chifeng floodplain is suggested by dark paleosols in Trenches 2 and 11, indicating a long period of little additional alluviation in an oxygen-depleted environment. The combination of frequent flooding, occasional episodes of major shifts in main river courses, and areas covered by swamps would have made the broad Chifeng floodplain an even more inhospitable zone for human settlement than the flat floors of its tributary valleys. As in the tributary valleys, the situation may have changed during Liao times when more moisture-resistant construction methods were used and large-scale efforts to control the flow of the main rivers began.

Only in Trench 9 was there evidence that remains of sediments deposited during the last glacial phase formed low hills that would have provided protection, at least during some prehistoric periods, from the effects of flooding. Such localities might have been suitable for settlement, but they rose so slightly above the contemporaneous floodplain that most of them are now completely buried by late Holocene sedimentation. The geomorphological trenching suggests that such localities were never abundant, but the few places in the flat valley floors where we did find some evidence for ancient occupation may be a consequence of this phenomenon.

Conclusions

In practical terms, the results of the geomorphological study meant that it would be unproductive to carry out archaeological survey all across the large Chifeng floodplain (the medium-sized valleys had already been surveyed by the time the geomorphological research was concluded). In the first place, if ancient settlement existed out in this large floodplain most of it would now have been covered by more recent alluviation and thus not be visible on the surface. More important, however, it is extremely unlikely that any substantial ancient settlement ever existed out in this broad floodplain. The broad Chifeng floodplain was thus not subjected to archaeological survey (Fig. 3.9). It is included as unoccupied territory in the analyses that appear elsewhere in this volume, because this is simply the most plausible reconstruction of where people lived in the region during the time periods those analyses cover.

During the course of fieldwork spread across nine years, there were further opportunities to check on the reliability of this conclusion. Since the fieldwork began in 1999, the urban zone of Chifeng, like many other cities throughout China, has been thoroughly transformed by large-scale construction projects within the old city limits and beyond them. Visits to many of these construction sites and conversations with local cultural heritage officials revealed no indication of archaeological remains discovered or destroyed in this massive construction effort on the broad Chifeng floodplain. The biggest segment of new construction is located west of the older urban zone in an area now called the "New City" (*Xincheng*). When the Chifeng archaeological survey began in 1999, this area was completely unurbanized and consisted almost entirely of open agricultural fields and farmhouses. It is now occupied by massive office buildings containing the entire city government, a large sports complex, very large modern upscale apartment buildings, schools, and more. On

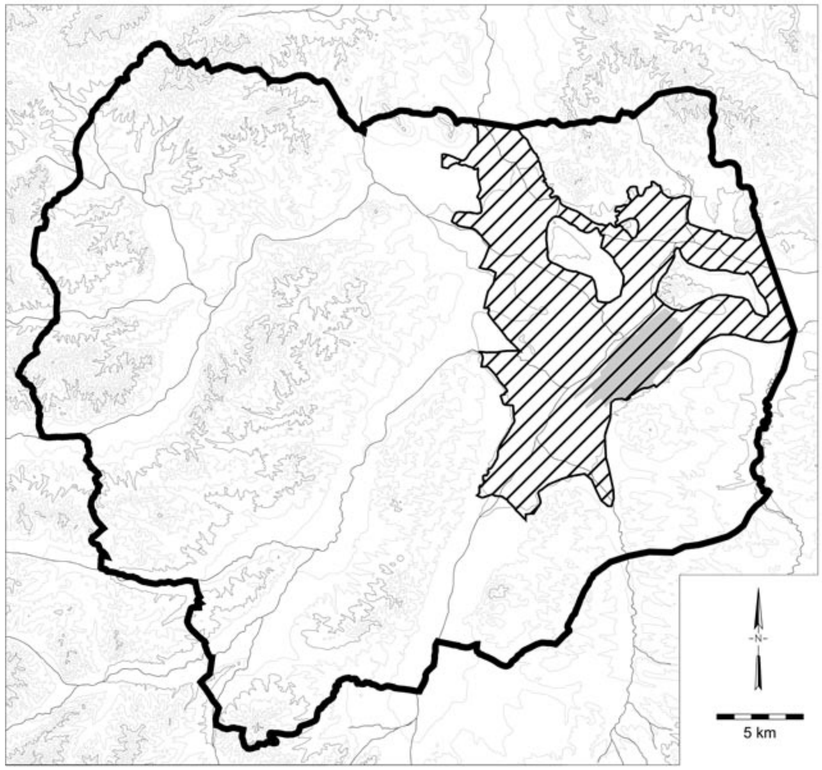


Figure 3.9. Areas of flat valley floor that were not surveyed (hatched).

the topographic maps used for the archaeological survey, which were last updated in 1977, the urban area of Chifeng and a few adjacent villages around it covered 18.65 km^2. Satellite imagery dating to the mid-1990s shows that an additional 16.70 km^2 of urban occupation had been added by then. By 2003, yet another 9.9 km^2 of built area are apparent (Fig. 3.10). The area of the New City alone covers some 4 km^2 in a satellite image from August, 2003, when it was far from finished. Our own numerous visits to this area and the collective knowledge of local cultural heritage officials reveal but a single archaeological site intruded upon by this construction work, consisting of a few small Liao period graves. This provides substantial additional support for the conclusion that the broad Chifeng floodplain had no substantial occupation before Liao times, and likely very little occupation during the Liao period either.

It may even be the case that the broad floodplain was little exploited for the variety of resources it presumably had to offer. If the broad floodplain had been an important concentration of exploited resources, then we would expect to see substantial occupations in at least some periods around its margins above the impact of flooding, river channel movement, and poor drainage. However, the maps of settlement distributions that will be presented in the following chapters consistently show sparser settlement around the broad Chifeng floodplain than along the margins of its medium-sized tributary valleys. This is especially clear in the case of two isolated hills that rise up well out into the broad floodplain: Hongshan (Red Mountain) and another hill west of it. These two localities provide an ideal place for settlement in a protected location close to the plain and whatever resources it might have offered. While both hills did contain human occupations of several periods, they are conspicuous more for their sparseness than anything else.

Another geomorphological scenario has also been suggested by Xia, Deng, and Wu (2000), who argue that in the greater Chifeng region the main rivers alternated between periods of rapid down-cutting and periods of sediment accumulation, resulting in terracing along the margins of the medium-sized valleys. According to this model, the distribution of archaeological sites would reflect mostly this terracing process, with the oldest sites located higher up on the earlier terraces and the more recent sites on the younger terraces lower down and closer to the modern level of the river.

The geomorphological analysis discussed above, however, clearly shows that, at least in the Chifeng Project survey area, the major process involved, not terracing, but narrow gully formation that transported alluvium directly from the uplands to the valley floors. This process had begun by the Middle Pleistocene and accelerated during the Holocene. No evidence for natural terracing of the valley

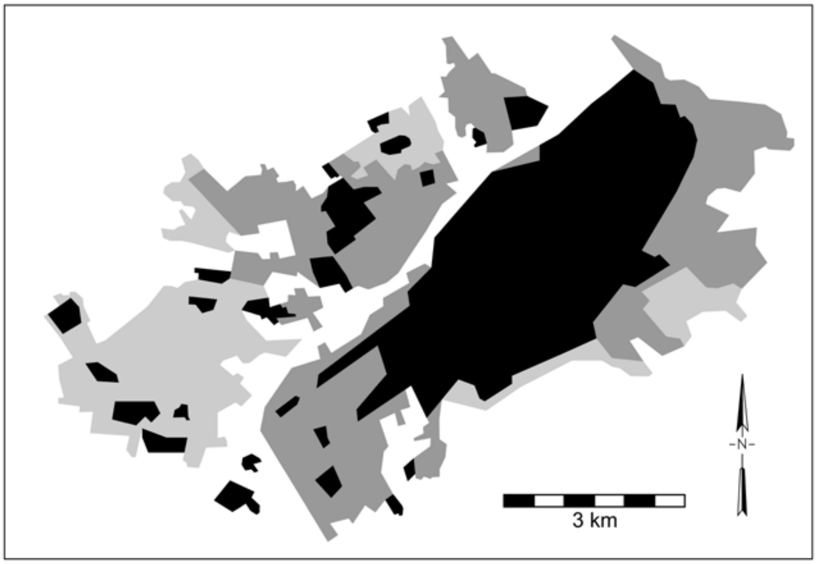


Figure 3.10. The urbanized zone of Chifeng during the 1970s (in black, based on topographic maps); by the mid-1990s (in medium gray, based on satellite imagery); and by 2003 (in light gray, based on satellite imagery).

edges was found in the Chifeng Project survey area. Moreover, the settlement distributions, discussed in Chapter 5, do not follow the pattern imagined by Xia, Deng, and Wu. It is simply not the case that older sites are most distant from the current valley edges with more recent sites progressively closer in. To the contrary, many of the earliest sites, from the Xinglongwa and Zhaobaogou periods, are located right at the valley edges. This is true, not only for places where the edges of the valley are marked by high bluffs that separate the valley floor from the uplands, but also for places where the uplands merge into the valley floor on a gentle slope.

In conclusion, geomorphological processes during the several millennia since the earliest occupation of the Chifeng Project survey area do not seem to have altered the archaeological record in such a way that the patterning of surface remains gives a seriously biased view of the distribution of ancient human settlement.

Chapter 4

Settlement Analysis

The methodology of regional settlement analysis in archaeology is considerably less standard than it is often taken to be. Collection of settlement data through field survey varies substantially from project to project in terms of how intensive and how systematic coverage is, in terms of how units of analysis are delineated, in terms of what kinds of information are recorded about those units of analysis, and in terms of how that information is recorded. Following fieldwork, different approaches to analysis and presentation of results further confound pursuit of the comparative aims that have often given rise to settlement studies in the first place. The Chifeng Project has been intent on contributing to improvements in the methodology of settlement analysis, both in field data collection and in post-field data analysis (Chifeng 2003). This chapter attempts to describe fully the field and analytical methodologies utilized. Our hope is to make it possible (1) for the reader to assess how well the data support the reconstruction of the social trajectory of the Chifeng region that appears in Chapter 5, (2) for others to use the data collected to answer other questions beyond the agenda of the Chifeng Project, and (3) for the trajectory of social change in Chifeng to be compared with those of other regions (both in China and beyond).

The first section of the chapter describes how the data were collected in the field and how the resulting dataset is structured. The second section tackles the central issue of connecting the field observation of the archaeological record to ancient demographics. Practically all settlement analysis is fundamentally demographic, since it is based on the delineation of patterns in the archaeological record that are taken to indicate how ancient populations distributed their residences and other activities across a landscape. This requires making statements, in at least relative terms, about which places in space had larger or smaller resident populations.

For some purposes it is also useful to make demographic approximations in terms of estimated numbers of inhabitants as well as in relative terms of “more” and “less.” In pursuit of such relative and absolute demographic estimates, the second section of the chapter draws on information from the Chifeng Project’s stratigraphic testing, from previously conducted large-scale site excavation, from modern population distributions, from historic and modern censuses, and other sources.

The third section of the chapter uses the results of the second to make the delineation of human communities at various scales the product of explicit analysis rather than of the assumption of a one-to-one relationship between archaeological sites, as defined in the field on survey, and ancient human communities. And the final section of the chapter begins to delve into the results of the settlement survey, viewed through the lenses of the chapter’s earlier sections. In particular, it attempts to assess the degree to which settlement distribution responded to basic environmental variables, such as those discussed in Chapter 3.

4.1. Field Survey Methods

Robert D. Drennan

The field survey methodology applied in the Chifeng region is comparable in many ways to that of other large-scale systematic regional surveys conducted in various parts of the world (see discussion in Drennan et al. 2003). Teams, each composed of about four archaeologists, systematically walked back and forth across the entire landscape, spaced about 50 m apart. Most sites were detected as surface scatters of artifacts (usually ceramics), and surface visibility of artifact scatters is generally quite good throughout the region—comparable, for example, to that encountered in the Basin of Mexico, the Valley of Oaxaca, or highland Peru and Bolivia, though perhaps not quite as good as in the dry coastal valleys of Peru or in Mesopotamia. Surface visibility in the Chifeng region is certainly good enough that it was not necessary to consider techniques such as the excavation of shovel tests that have often been applied to regional surveys in North America, the northern Andes, and other regions. Nowhere in the Chifeng region does vegetation pose challenges to regional survey even remotely comparable to those offered by the forests of both lowland and highland humid tropical zones. The natural plant community of the Chifeng region has been completely removed by human activity over several millennia. Today, intensive cultivation complemented by livestock rearing (especially sheep and pigs) leaves the entire landscape very bare except for crops.

Survey was carried out during the spring, summer, and fall (between April and October) in different years. April and May, at the end of the dry winter, present especially favorable conditions: temperatures are getting warm enough for comfortable fieldwork; wild vegetation is very sparse; and plowing and cultivation are beginning. By June, crop growth in the flat valley floors, where planting occurs first, is beginning to interfere with both surface visibility and mobility. By July and August, maize, sunflowers, wheat, millet, and a wide variety of other maturing crops make survey in the flat valley floors impossible. The later planting schedule of the uplands, together with generally less intensive cultivation, mean that surface visibility remains good into June, July, and August. High temperatures in July and August, however, dramatically reduce the productivity (not to mention the comfort) of survey teams. Conditions improve again in the fall, and by October most crops are harvested so that mobility and visibility are excellent, and temperatures are not yet cold enough to make fieldwork uncomfortable. Surface visibility seriously obscured by vegetation, then, is *not* one of the particular methodological problems we have faced in Chifeng, except in terms of scheduling fieldwork to avoid dense crop growth.

Any locale with ancient architectural remains, domestic features, graves, landscape modification, or the like was designated as a site. Identifying a place as a "site," however, implies nothing at all about the interpretation of ancient activities there. It is simply that "site numbers" were assigned to every place where information was recorded as the basic way of keeping track of those places and where they were. Where ancient anthropogenic surface features were present, these were described in writing and/or documented with sketch maps.

Since most sites, however, are only surface scatters of artifacts, the same practical question arises in all regional surveys: How substantial does a surface scatter of artifacts have to be in order for it to be worthwhile to designate it a site and record information about it? Most regional-scale surveys concerned with complex societies, for example, seem not to have called a locality in which a single sherd was found a site, although few reports are explicit on this point. Lack of explicit attention to such decisions means that they are made in very different ways in different surveys, and often even in very different ways by different survey teams in a single project. The former differences do not necessarily invalidate comparison of the results of different projects, but they can interfere with it. The latter kind of difference can be a threat to comprehensive analysis of data from a single project, even without comparison to others.

In Chifeng, as in most regions, the first indication that a survey team has encountered an archaeological site is typically that one member of the team finds a sherd on the surface. Sometimes, of course, the team may find no other sherds beyond that first one. Our rule was that, if no more sherds were found after the team had continued on its course for about 100 m beyond the point where the first sherd was found, then that sherd was discarded, the location was not given a site number, and, consequently, information about it was not recorded. If, however, a second sherd was found within 100 m, the team gathered in the area and searched more intensively for more ceramics or other artifacts. If none were found, the two sherds were discarded, and no information was recorded. If, however, three or more sherds were found, the location was given a site number, artifacts were collected, and information was recorded.

In the absence of much explicit discussion of this issue in regional survey reports, this seems to be a lower threshold for what constitutes a site than many regional surveys concerned with complex societies have applied, although perhaps comparable to that applied by Underhill et al. (1998:459–460) in the Rizhao region in Shandong Province, where designation as a site required at least one sherd that could be identified in the field as to period. In one survey in the United States Southwest, Plog, Plog, and Wait (1978:387) set the criterion for defining a site at a minimum surface density of five artifacts per m^2. This is a substantially higher surface density than occurs at most of the sites information was recorded about in Chifeng. From such a perspective, the real worry seems not so much that important information may be lost by ignoring a few sherds that occur singly or in pairs but rather that too much may be made of scatters consisting of as few as three or four sherds. It has, for example, often worried archaeologists working in China (and other parts of the world where cultivation is intensive), that small low-density surface scatters may be produced when cultivated fields are enriched with soil or compost, which may contain ancient sherds pertaining to the locations from which the fertilizer is brought. This would not, of course, increase the amount of ancient pottery in the region, but some of the ancient pottery could be displaced on the landscape, in effect creating "sites" that do not really represent ancient occupations in those locations.

In the Chifeng survey, information on small low-density scatters was recorded, because it did not occupy much time in the field and because systematically recording information about such scatters is the only way to begin empirical investigation of what they do or do not represent. In this way we hoped to keep data recording separate from analysis and interpretation, and concentrate the attention of survey crews on recording and/or collecting what they could observe rather than interpreting it. In this instance, this means recording for later analysis any concentration of as many as three artifacts and making a surface collection, rather than making a subjective decision in the field that the concentration is not meaningful and thereby losing the possibility of studying it more fully later on. As a result we hoped that interpretations would be more standardized across the survey region, irrespective of which survey crew recorded a particular site. Analysis of the Chifeng dataset shows that the number of locations that were given site numbers because they produced as few as five artifacts is quite small. Their distribution, when compared to the distribution of other contemporaneous sites or modern population and agricultural distributions, does not suggest that such small sherd scatters result principally from composting or soil movement for agricultural purposes (Drennan et al. 2003). These small, very low-density sherd scatters finally have little impact of any kind on the conclusions derived from the regional survey analysis, so questions of their exact nature and origins do not loom as an important methodological issue. Recording data about them, however, does add detail to the dataset, and it is interesting to observe that very small, low-density sherd scatters are considerably more common in some periods than in others. We will consider that observation in greater detail in Chapter 5.

The fundamental observations made about every locality that was assigned a site number concerned the area and density of the surface scatter of artifacts. For this purpose, spatial resolution was based on collection units not exceeding 1 ha. For areas of 1 ha or smaller, this meant that a single artifact collection was made. Localities where surface scatters covered areas larger than 1 ha were divided into subunits for collection. Thus each artifact collection represents a defined area of 1 ha or less in the field. The boundaries of this area were marked on photographic enlargements of satellite images carried by each survey team in the field so that each can be located and its area measured with some precision. A locality with a single site number, then, consists of one or more contiguous collection units whose areal extent includes the entire distribution of features and/or artifacts visible on the surface. This makes it possible to calculate the area of each scatter by summing the areas of the collection units that make it up. More important, it makes it possible to calculate a different occupied area for each locality during each period, since after the ceramics have been analyzed, those collection units that do not contain ceramics from a particular period can be omitted from the area calculation for that period. Similarly, different intensities of utilization and different functions that it may be possible to identify for different periods on the basis of the artifacts present, are assigned not to entire sites but to individual areas of 1 ha or less within sites. These 1-ha collection units, not sites, became the basic units of analysis, which thus moved directly from data organized by collection unit to definition of communities at various scales, largely without reference to the site as a unit of data recording or analysis.

In the Chifeng survey 20 sherds was set as the minimum sample size always sought in a collection unit. This number, like much in field archaeology, is a compromise between theoretically derived desires and real-world practicalities. A sample of 20 sherds, for example, makes it possible to estimate the proportions of sherds of different periods (or sherds of different vessel forms, etc.) with error ranges of some ±10% at about the 66% confidence level (i.e. one standard error). If ceramics of a particular period are absent altogether from a sample of 20 sherds, we can be similarly confident that they comprise less than 5% of the population of sherds from which these 20 are a sample (Drennan 2009:251–254). The Chifeng sample size criteria are stated in terms of ceramics because these are the most common artifacts on the surface; all classes of artifacts were, however, collected. A larger sample would, of course, make it possible to characterize the artifacts in the collection unit with greater precision and/or higher confidence, but we often had no choice but to work with even smaller samples when as many as 20 sherds simply could not be found on the surface, and it was not infrequently the case that, by the time we reached about 20, we were at the point of diminishing returns on the effort to increase sample size. Sometimes the samples were larger than this, and, in these cases, they produced results we can be somewhat more confident of. We did not, however, ordinarily invest much energy in collecting very large samples even when the opportunity presented itself, since the extra effort of collecting them (not to mention carrying them around all day) did not seem warranted.

"Systematic" collecting has come to refer in archaeology to the practice of carefully collecting all artifacts (or all artifacts of certain classes or with certain characteristics) within a clearly delineated area. Although such techniques have been used in many contexts, large-scale regional surveys are often carried out without systematic collection because the practice is thought to be too time-consuming to be practical on this scale. In Chifeng, however, we found making systematic collections eminently practical. To make a systematic collection, two members of a survey crew marked out a circle 3 m in diameter very quickly. One stood still holding one end of a 1.5 m rope while the other held the other end and walked around in a circle making boot marks on the ground. All artifacts within the circle were collected. If fewer than 20 sherds were found, then additional adjacent circles were collected until the minimum sample size was achieved, and the total number of circles serves as a record of the area within which the systematic collection was made so that the average number of sherds (or artifacts of any kind) per m^2 can be calculated. Survey teams informally selected random locations within the 1-ha collection units for placing systematic collection circles so as to avoid subconsciously placing them where artifacts were unusually dense.

Systematic collections could not, however, be made in all instances. In some localities surface artifacts occurred at such low density that there were not even 20 sherds visible on the surface in an entire hectare. If it appeared that the surface artifact density was so low in a collection unit that a 3 m diameter circle would not contain as many as five sherds, then teams did not attempt systematic collections, but made opportunistic general collections instead. Teams collected the first artifacts they saw in a collection unit until the minimum sample size was reached; then collecting stopped. This procedure was an effort to eliminate judgments about which artifacts to collect and which ones to leave on the ground, so as to reduce the sampling bias in favor of more noticeable, more unusual, or more interesting artifacts that has often been noted for such opportunistic collecting (e.g. Drennan 2009:86–93).

The direct result of this survey methodology, then, was a set of satellite images with the outlines of 1-ha collection units drawn on them. Individual collection unit boundaries encompassed much smaller areas than 1 ha if the total artifact scatter in a locality was truly that small. Each collection unit was identified by a unique number which connected it to the artifacts collected either in a general collection ranging all around the area of 1 ha or in a systematic collection of one or more 3-m diameter circles somewhere within it. These maps were digitized and comprised the basic result of the survey: a map of areas where traces of ancient human activities were visible on the surface. Blank spaces on this map are known to be places where survey teams looked and failed to find surface traces of ancient human activity.

The complete settlement dataset, including the individual boundaries and locations of each collection unit, as well as the counts of all ceramics collected, is available online (see Appendix B).

4.2. Methods for Regional Demographic Analysis

Robert D. Drennan and Christian E. Peterson

Settlement analysis on a regional scale is about how people distributed themselves across a regional landscape. A determination, in at least relative terms, of how many people lived where during different periods of time is at the core of the analyses presented in this volume. The fundamental assumption underlying demographic analysis at the regional scale is that when more people live for longer times in a particular place, they leave more traces on the landscape there. Architectural and other permanent remains are often among these traces and of considerable use archaeologically—more so in some regions than others and for some periods than others. But ordinary household garbage provides much more consistent and universally useful archaeological evidence of human occupation. And the most archaeologically useful component of this garbage for most places and periods since the beginning of the Neolithic consists of the sherds from broken ceramics. Sherds have three characteristics that make them especially useful. First, sherds are primarily the product of the breakage of utilitarian ceramic vessels used in the activities of daily life. Their presence and the quantities in which they are present provide good evidence of the intensity of residential use of a place, as distinct from non-residential uses, such as cemeteries and other special activity areas. Second, sherds are extremely resistant to decay and destruction, even on the surface. And third, sherds contain in themselves characteristics that make them chronologically distinctive even when not found in stratigraphic context.

Ancient Garbage and Population

Estimation of ancient population sizes for single (usually excavated) sites has been approached from a number of perspectives (Hassan 1981:63–93; Paine 2005), and such approaches are one of the starting points for estimating populations at the regional scale in settlement studies. When individual structures or rooms can be identified, it is possible to count them up and multiply by some occupancy rate to arrive at population estimates (e.g. Hill 1970 or Longacre 1970 for the southwestern United States or Xi'an 1988 or Zhao 1998 for China). Site areas have often been taken to be proportional to site populations (e.g. Adams 1965 for Mesopotamia; Drennan and Boada 2006 for northern South America; or Fang et al. 2004 for China). Total quantities of ceramics in a site have also been used to derive population estimates (e.g. Kohler 1978 for the southeastern United States). Most means of estimating populations for a few hundred square meters or perhaps a few hectares within individual excavated sites cannot simply be applied to regions covering hundreds or thousands of square kilometers, but systematic surveys do make it possible to assess the quantities of garbage left on the landscape by the ancient inhabitants of large regions and thus sustain census-like approximations of changing regional population levels. It is essential that a regional survey carry out a systematic inspection of the landscape that makes it possible to know that zones where no sites are reported are zones where sites have been looked for and not found, rather than zones of missing data resulting from a failure to look there. And, of course, in any attempt at demographic analysis, we must be prepared to deal, not in precise figures, but in rough approximations.

Starting with the assumption that, other things being equal, larger populations leave more garbage on the landscape than smaller populations do, the two principal methodological questions to be answered, then, are how equal those other things are in a particular instance, and how artifactual remains can best be quantified to reflect as accurately as possible the amount of garbage produced on a regional scale at different times. We have previously explored both questions with the Chifeng data (Drennan et al. 2003), and we continue that exploration here.

Means of assessing how much garbage was left on the landscape in a given period include counting the total number of sites showing occupation for the period, counting the total number of surface collection units producing sherds of the period, measuring the total surface area across which sherds of the period were found, and counting the total number of sherds recovered for the period. All these approaches have been used systematically in other regional settlement studies in various parts of the world. In China, for example, total occupied area has been the basis for population estimates for the Rizhao region (Fang et al. 2004). We previously found that all these ways of quantifying amounts of ancient garbage on the landscape produced broadly similar assessments of changing regional population levels for Chifeng (Drennan et al. 2003:196–198). This similarity of outcomes is especially encouraging since these four ways of quantifying ancient garbage on a landscape represent two fundamentally different approaches. One of the two approaches depends basically on the area over which ceramics of each period are distributed on the landscape (number of sites, number of collection units, or total area of collection units), but fails to take into account the differing amounts of garbage that may be accumulated in these areas. The other approach depends on quantities of ceramics recovered, but fails to take into account that the quantities recovered do not systematically reflect the quantities present, since the number of sherds collected in a survey does not relate to the total number present (either on or beneath the surface) in any consistent way. We have previously suggested that the two approaches could be combined, however, so as to take advantage of the strengths of each and eliminate their differing drawbacks (Drennan et al. 2003:156–160). This suggestion follows in the tradition established by settlement study in the Basin of Mexico, one of the most thoroughgoing attempts at regional scale demographic analysis in archaeology (Sanders, Parsons, and Santley 1979:34–52). Some version of the approach taken in the Basin of Mexico has been followed in many other regional settlement studies. In the Basin of Mexico, site areas were measured on air photos and surface densities of ceramics for different periods were estimated subjectively in a series of categories (light, light-to-moderate, moderate, etc.). These density categories were taken to be equivalent to different within-site occupational density categories in terms of numbers of inhabitants. Our own approach in Chifeng parallels that taken in the Basin of Mexico in relying on both the area across which the ceramics of a period are found and the surface density of those remains.

The utility of this kind of approach is supported by analysis of modern population patterns. Fig. 4.1 shows the distribution of modern settlements in 14 townships the Chifeng region. The highly urbanized area of modern Chifeng city in the east-central sector of the map is not included among these 14 townships, but otherwise they correspond broadly to the region of the archaeological settlement study. The modern settlements are shown in Fig. 4.1 as they appear on regional topographic maps dating to the mid-1990s; township boundaries come from China Data Online (2008). This map, of course, contains the same kind of information for contemporary times that the maps of ancient settlement distributions produced by systematic regional archaeological survey contain for ancient periods. Either one provides the information necessary to calculate the total area of occupation. For the modern settlements, in

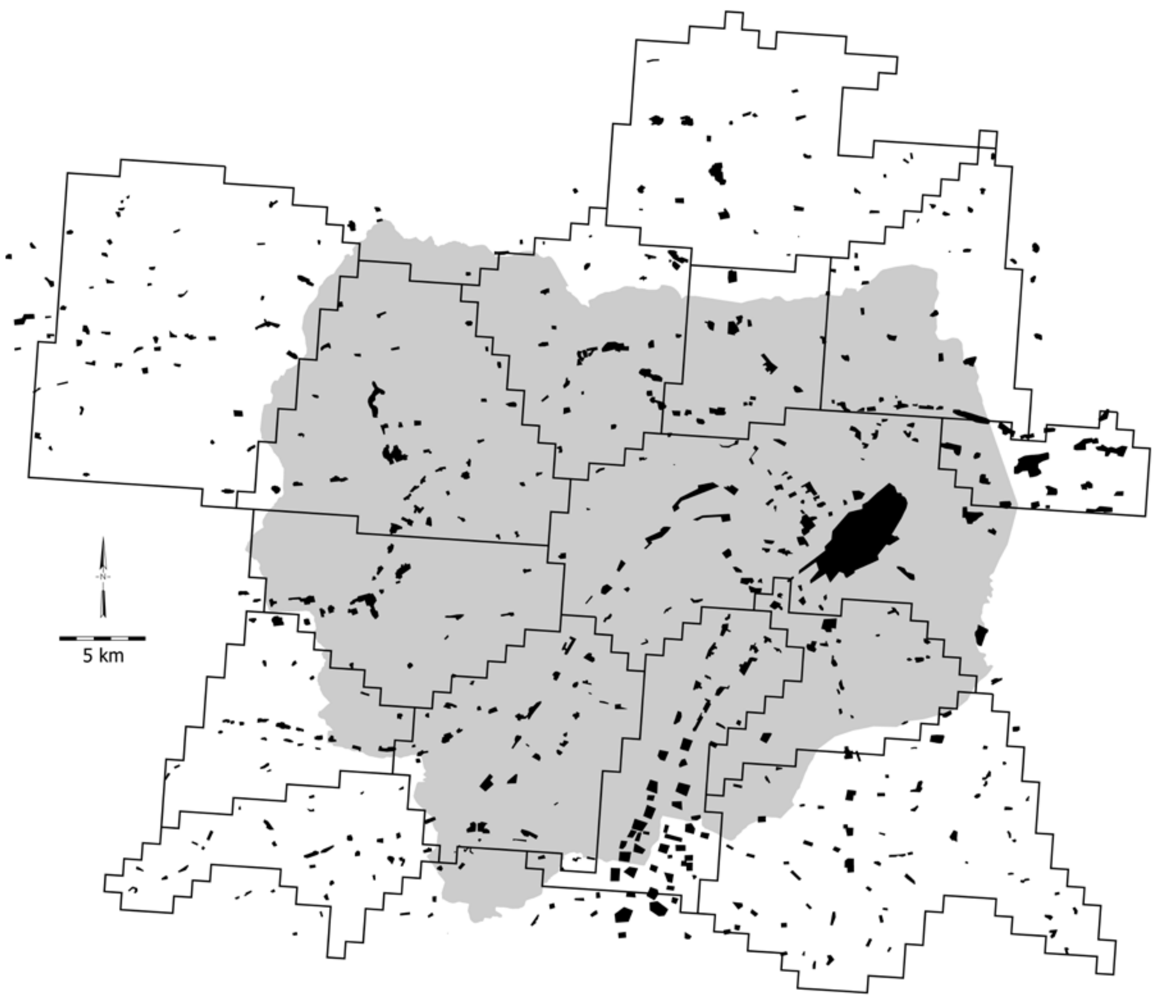


Figure 4.1. Distribution of modern occupation (black) in 14 townships corresponding approximately to the Chifeng survey area (gray). The highly urbanized area of modern Chifeng city (in the right center of the figure) is not included in the analysis.

TABLE 4.1. POPULATIONS, SETTLEMENT AREAS, AND OCCUPATIONAL DENSITIES OF MODERN COMMUNITIES BY TOWNSHIP

Township Population	Settlement Area (ha)	People per ha
7,090	589.2	12
7,897	384.3	21
9,841	387.4	25
16,216	598.6	27
6,429	224.7	29
14,271	486.0	29
11,411	323.4	35
13,318	340.1	39
12,085	299.7	40
21,209	524.2	40
43,444	964.3	45
9,122	201.9	45
14,319	279.3	51
13,754	253.8	54

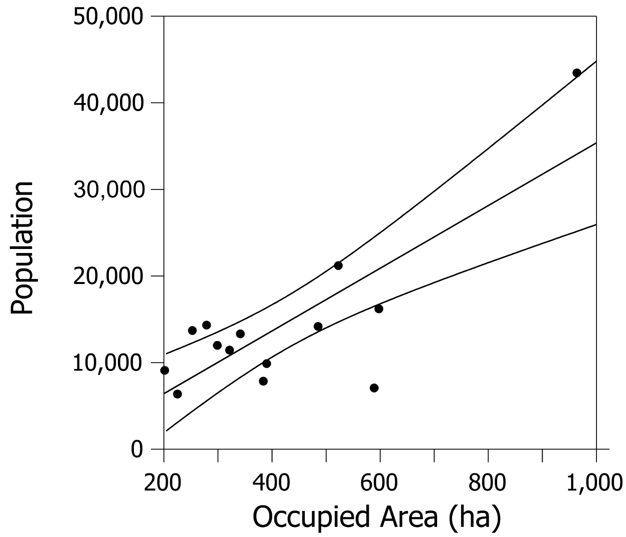


Figure 4.2. Correlation between population and total settlement area for 14 townships near Chifeng (80% confidence zone for the best-fit straight line shown).

addition, the actual counted populations are known from census taking. The data for the census carried out in 2000 are available and provided in Table 4.1—not down to the level of detail of individual villages, but at least to the level of the 14 administrative townships into which they are grouped (China Data Online 2008). Table 4.1 also provides the total area of occupation for each of the 14 townships, as determined from the map. The correlation between total area of occupation and total population according to the 2000 census is fairly strong and very highly significant (r = .794, p = .001). The total occupied area is thus a fairly good way to estimate total population by township for modern villages in the Chifeng region.

As Fig. 4.2 makes clear, however, total occupied area is by no means a perfect way to predict population. Some townships have smaller populations than we would expect, based on the total areas covered by their villages, and some have larger ones. Knowledge of the region accumulated over the course of carrying out the survey reveals one of the principal factors behind these deviations. Four townships show as low outliers in Fig. 4.2 (the four points below the limit of the 80% confidence zone) because they have fewer inhabitants than we would expect given the area covered by settlement. That is, they have low occupational densities within settlements. These are townships whose settlements are consistently small rural villages of one-story brick houses with small gardens and walled areas for keeping domestic animals and carrying out household and agricultural tasks. On the other hand, three townships are high outliers in Fig. 4.2 (the three points above the limit of the 80% confidence zone) because they have more inhabitants than we would expect based on the total areas of their villages. These are townships with an unusually large number of villages or towns where multi-story apartment blocks have been built in substantial numbers. Considerably larger numbers of inhabitants are crowded into each hectare of these latter settlements, and this produces higher populations than expected on the basis of the horizontal area they cover.

In sum, the internal occupation density within modern settlements stays within a more or less predictable range, but it is not a constant; it does vary substantially within its range. The same is true of the internal occupation density of ancient settlements, as we will explore further below. If this density variation can be systematically taken into account along with the areas that settlements cover, then a considerably better estimate of population can be made, and this is precisely the logic of the approach to archaeological population estimation pioneered in the Basin of Mexico. Archaeologically recognized occupation areas are considered to have had more inhabitants packed into them per hectare in a given period if sherds of that period occur at high densities on the surface, and assumed to have fewer inhabitants per occupied hectare if surface sherds occur at lower densities. The other principal variable affecting the density of surface artifacts, of course, is the length of time during which they accumulated. For this reason, demographic estimates based on areas and densities are an average population across the time span of the period identified. That is, 100 people living in a place through an entire period should leave an area and density of surface sherds similar to that left by 200 people living there through half the period. In either case, the average population of the place for the period is 100. Using areas and densities together thus helps allow for the effect of shifts in settlement location. If settlement locations shift frequently, the total site area is larger, but surface densities are lower. If settlement locations are very stable, the total site area is smaller, but surface densities are higher.

Surface Sherd Densities in Chifeng

The Chifeng survey methodology was designed to incorporate measures of the density of surface artifacts as well as of the areas across which these artifacts were distributed. For collection units where surface sherd densities were high enough to justify making systematic collections (see the first section of this chapter), the Chifeng dataset includes a direct assessment of the number of sherds of each period recovered per m^2 of surface area, since *all* sherds on the surface within measured circles were collected. Both the total number of sherds on the surface and the area from which they were collected are known. The density value (in sherds per m^2) from the systematic collection is taken to represent the conditions present in the entire collection unit of about 1 ha.

In principle, then, we can imagine that a systematic collection consisting of a single circle 3 m in diameter is made in the center of a collection unit covering, say, 0.8 ha. A circle 3 m in diameter has an area of 7.1 m^2, so if 15 Lower Xiajiadian sherds were found on the surface within it, then the 0.8 ha of the collection unit would be taken to have a sherd density of 2.1 sherds per m^2 representing Lower Xiajiadian occupation (15 sherds / 7.1 m^2 = 2.1 sherds per m^2). If, in addition, there were 4 Upper Xiajiadian sherds on the surface in the circle, then the 0.8 ha of the collection unit would be taken to have a sherd density of 0.6 sherds per m^2 representing Upper Xiajiadian occupation (4 sherds / 7.1 m^2 = 0.6 sherds per m^2).

In actual practice for the Chifeng regional analysis, the procedure followed was slightly more complicated because some premodern sherds that could not be securely identified to chronological period were recovered. Usually such unidentified but ancient sherds were only a very small proportion of the sherds recovered, but occasionally their numbers were more substantial. In order to avoid underestimating the surface densities for collections with unidentified but premodern sherds, the calculations began with a determination of the overall density of premodern sherds (those dating to Liao times or earlier). That overall density was then distributed among the periods represented by identified sherds according to the proportions of the identified sherds in each period. To extend the same example from the previous paragraph, we can imagine that, in addition to the 15 Lower Xiajiadian sherds and 4 Upper Xiajiadian sherds, the collection circle yielded 3 sherds that were definitely premodern but not securely identifiable to any one phase. In such a case, it is most likely that those other 3 sherds are also either Lower Xiajiadian or Upper Xiajiadian but simply too small to make it possible to distinguish

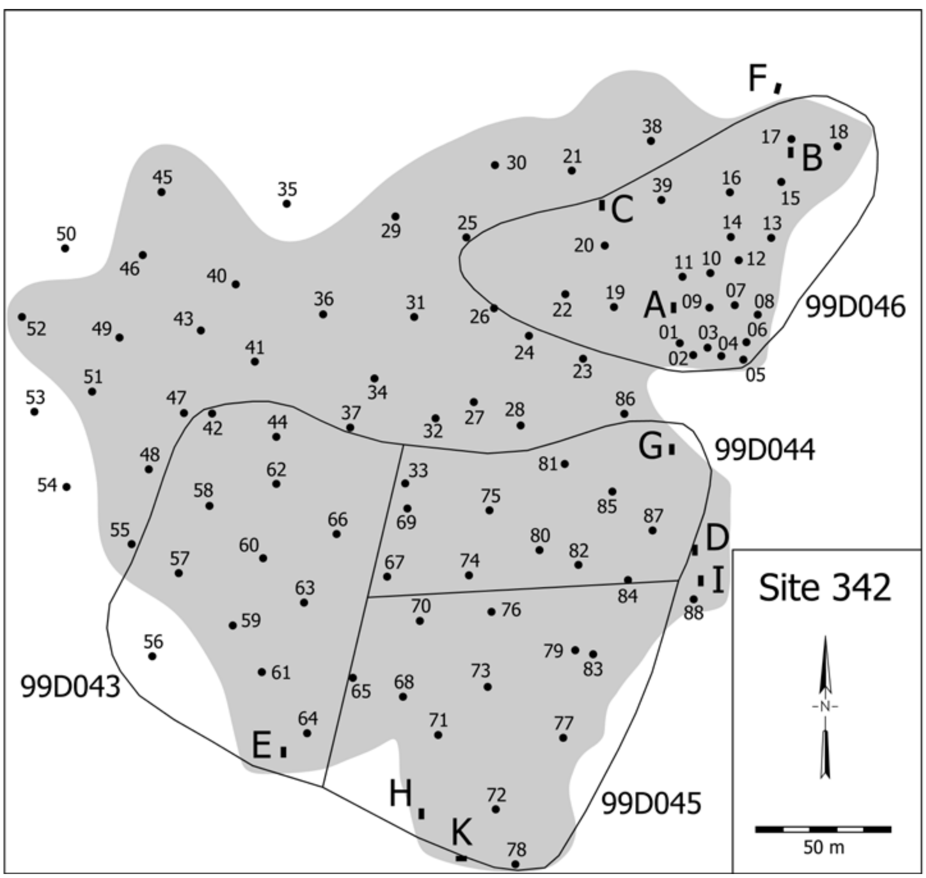


Figure 4.3. Site 342 with locations of collection lots from regional survey (99D043–99D046), numbered circles where systematic surface collections were made, and lettered rectangles where stratigraphic tests were excavated. Maximal extent of occupation (based on systematic collection circles) is shown in gray.

between the periods. The calculation of final density values for that imaginary systematic collection, then, would begin by dividing the total of 22 premodern sherds (15 Lower Xiajiadian + 4 Upper Xiajiadian + 3 unidentified but premodern = 22 sherds) by the area of the collection circle to get an overall density of 3.1 sherds per m^2 (22 sherds / 7.1 m^2 = 3.1 sherds per m^2). The overall density would then be distributed between Lower Xiajiadian and Upper Xiajiadian according to the proportional representation of those periods among the sherds identified. Of the 19 sherds identified (15 Lower Xiajiadian + 4 Upper Xiajiadian = 19 identified sherds), 79% were Lower Xiajiadian (15 / 19 = 0.79) and 21% were Upper Xiajiadian (4 / 19 = 0.21). So 79% of the 3.1 sherds per m^2 of premodern occupation would be assigned to Lower Xiajiadian and 21% to Upper Xiajiadian. The final sherd densities representing the 0.8 ha of the collection unit, then, would be 2.4 sherds per m^2 for Lower Xiajiadian (3.1 sherds per $m^2 \times 0.79 = 2.4$ sherds per m^2) and 0.7 sherds per m^2 for Upper Xiajiadian (3.1 sherds per $m^2 \times 0.21 = 0.7$ sherds per m^2). The two sherd densities, 2.4 and 0.7, sum to the overall density for premodern ceramics, 3.1 sherds per m^2, and are, as they should be, slightly greater than the densities calculated from identified sherds alone. Sherd density values for each period, then, were calculated in this way for each of the 294 systematic collections. This procedure eliminates at least some of the random noise introduced by variations between sites (or between ceramic analysts) in regard to what proportion of sherds are identifiable.

The general reliability of taking a single systematic collection of a few square meters to represent the density of surface artifacts across a collection unit of around 1 ha in size can be investigated at the two sites where stratigraphic testing was carried out (see Chapter 2.2). Both sites were initially recorded in the regional survey, and both were subjected to a much more intensive program of systematic surface collecting prior to stratigraphic testing (Figs. 4.3 and 4.4). The usual regional survey data for each, then, can be compared to the results from much more intensive and systematic surface collecting. Systematic collections were made in four of the regional survey collection units at these two sites (99D046, 00D009, 00D010, and 00D011 in Figs. 4.3 and 4.4). Two of these systematic collections produced extremely high surface sherd density values (9.3 sherds per m^2 for 99D046 and 9.8 sherds per m^2 for 00D009), placing them well above the 90th percentile among surface sherd density values for all the systematic collections from the regional survey. During the intensive surface collecting prior to stratigraphic testing, several different systematic collections were made within each of the units represented

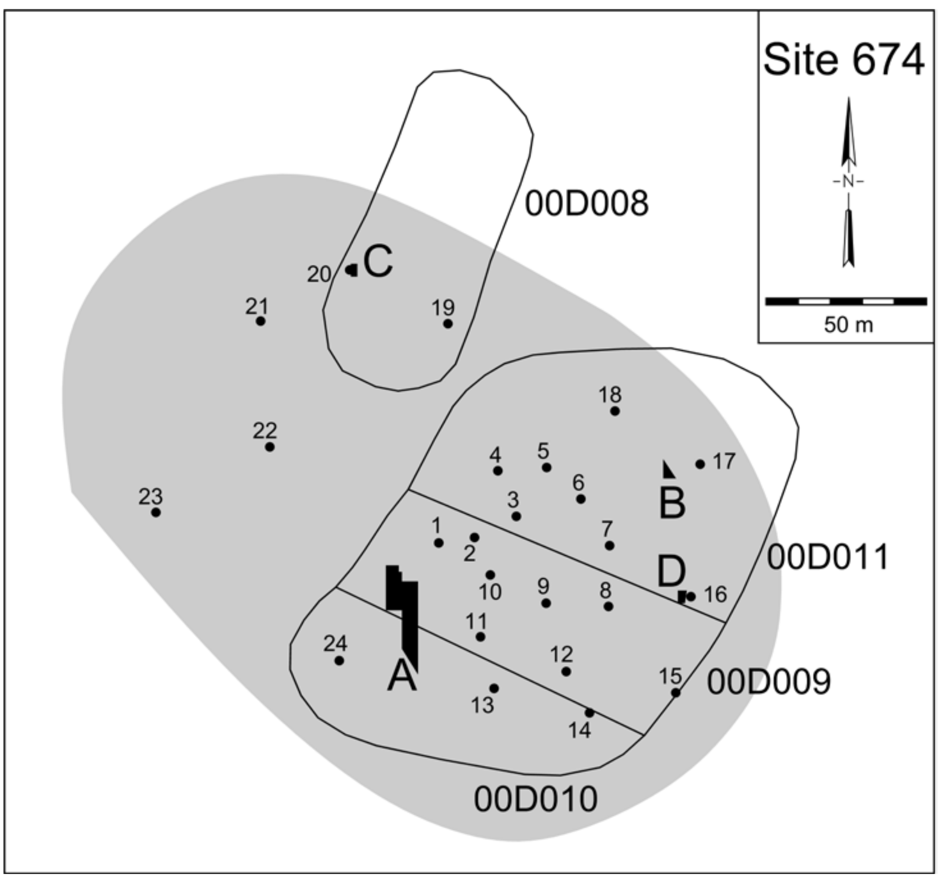


Figure 4.4. Site 674 with locations of collection lots from regional survey (00D008–00D011), numbered circles where systematic surface collections were made, and lettered areas where excavations have been carried out. Maximal extent of occupation (based on systematic collection circles) is shown in gray.

by these two collections. Their density values varied, but the means for the several collections in each unit were also extremely high (even a little higher than the systematic collections made during the regional survey at 11.3 sherds per m^2 for 99D046 and 10.9 sherds per m^2 for 00D009). For collection unit 00D010, the systematic collection made during regional survey yielded a density of 4.7 sherds per m^2, and the mean of those carried out prior to stratigraphic testing was 5.3 sherds per m^2. They thus agreed in placing 00D010 at quite a high surface sherd density level for the Chifeng region, although at a noticeably lower level than 99D046 or 00D009. Only in the case of 00D011 was there a slightly larger discrepancy between the systematic collection made during regional survey (2.3 sherds per m^2) and the mean of those carried out before stratigraphic testing (5.8 sherds per m^2). Even 2.3 sherds per m^2, however, places this collection among those with quite dense surface artifacts and thus provides a very useful indication to add to that about the areal extent of the collection unit. It would undoubtedly be more accurate to make several systematic surface collections in different parts of a 1 ha collection unit, but that would also be much more time-consuming (and thus reduce the area a survey could cover). Making single systematic surface collections in units with high surface densities, thus, does seem an efficient way to add useful precision to the characterization of surface artifact densities to the survey dataset.

Consideration of surface artifact density values for general collections is more complicated than for systematic collections. The decision to make a general collection rather than a systematic one means that surface ceramic densities were subjectively estimated to be low enough that a systematic collection circle would not yield as many as three or four sherds. This threshold works out to be about 0.5 sherds per m^2 (3.5 sherds/7.1 m^2 = 0.5 sherds per m^2), but a general collection provides no actual count of the total number of sherds on the surface within a known area. It is only to be expected that hasty subjective judgments about surface sherd densities would lead to a fair number of mistakes. Sometimes systematic collections would be made where the density turned out to be less than 0.5 sherds per m^2; and sometimes general collections would be made where the density turned out to be greater than 0.5 sherds per m^2. The first kind of mistake is, in fact, visible in the systematic collection data, since 10 of the 294 systematic collections had non-zero values less than the theoretical minimum of 0.5 sherds per m^2. (One systematic collection had a density of 0 sherds per m^2 because the sherds were lost.) There simply must have been more errors than these 10 in judging whether to make a systematic collection or not. Most of those errors surely consisted of deciding not to make one where the density really was greater than 0.5 sherds per m^2, and the number of this kind of error seems likely to be substantial. As discussed in more detail below, precisely this kind of error was made for all four of the general collections from the original survey at sites 342 and 674 where stratigraphic testing was carried out, and it is not at all difficult to understand how the decision could be strongly biased in this direction. In the first place, the subjective judgment about density is based on a quick look around. Careful collecting inevitably produces more sherds than seen in a quick look around, so any rigorous assessment of surface densities is likely to produce higher numbers than casually expected. A second factor may be that much of a general collection is already made while entering a collection unit before realizing that the density is high enough for a systematic collection; a general collection already begun creates an inertia that discourages starting over with a systematic collection.

The number of premodern sherds finally counted up from general collections in the Chifeng survey ranges from 0 to 245. The anomaly of the 90 general collections with no sherds can arise in several different ways. First, there were general collections all of whose artifacts turned out to be lithics. Second, there were general collections all of whose sherds turned out after washing and more careful examination in the laboratory not to be premodern or, in a few instances, not even to be artifacts. (The occasional rock can look remarkably like a dirty sherd in the field.) Third, a general collection unit number was occasionally assigned so as to record a location with a premodern surface feature of some kind even though no artifacts could be found on the surface. And fourth, a few bags of sherds were simply lost, either physically or through misnumbering, before their contents reached the ceramic analysis stage, and so they are finally represented by no sherds in the dataset. General collections with only a few sherds usually come from units with extremely low sherd densities, since survey teams did make an effort to recover at least 20 sherds in each collection unit. A collection with fewer than 20 sherds, then, means that a survey team spent a good while walking the surface of the collection unit without being able to find the target number of sherds, and this will happen mostly when the surface sherd density is well below 0.5 sherds per m^2, the theoretical dividing line between general and systematic collections. On occasion the enthusiasm of survey teams for collecting knows no restraint, even when the target size for a surface collection is far exceeded, and this accounts for the modest number of very large collections. Usually these larger general collections come from denser sherd scatters, since it is under these conditions that a survey team can easily make a very large collection within a 1-ha unit before they realize it. Generally such conditions will represent collection units where surface sherd densities are higher than the threshold of 0.5 sherds per m^2 that should have triggered the decision to make a systematic collection.

As a matter of principle, then, the average surface sherd density represented by a general collection should fall somewhat below the 0.5 sherds per m^2 threshold that should trigger systematic collecting. But, in reality, the density represented by a general collection with a large number of sherds is usually well above the theoretical threshold value of 0.5 sherds per m^2, and some means of assigning higher density values to such collections would improve the overall accuracy of the dataset. And the density value represented by a general collection with a very small number of sherds is usually likely to be substantially below 0.5 sherds per m^2, and some means of assigning lower density values to such collections would improve the overall accuracy of the dataset. The number of sherds in a general collection made across a collection unit of about 1 ha, though, is not a direct reflection of surface densities in the same way that a systematic collection is. That is, a general collection of, say, 10 sherds cannot be taken to indicate that there were only 10 sherds on the surface in an entire hectare. The careful examination of the surface involved in a systematic collection would unfailingly yield more sherds than a general collection would if both were practiced across the same area. A rough equivalency can nonetheless be established between the number of sherds in a general collection and the density value a systematic collection would have yielded.

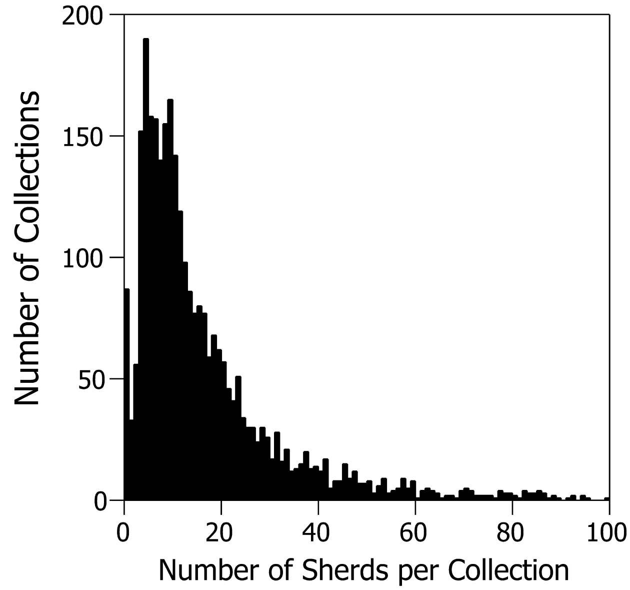


Figure 4.5. Histogram of numbers of sherds from general collections (collections containing more than 100 sherds omitted).

The frequency distribution of the total sherd count in general collections can be seen in Fig. 4.5 (general collections with 100 sherds or more were omitted so as to present the histogram at a reasonable scale). On the basis of this histogram, the distribution of sherd counts in general collections can be divided into four categories: >35 sherds, 23–35 sherds, 8–22 sherds, and 1–7 sherds. This division follows at least small suggestions of multi-modality as a rationale for the exact cut points, although the decision to break the distribution into four parts (as opposed to, say, three or five) is essentially arbitrary. The aim is simply to create a usable approximate way to deal with the variation in numbers of sherds in general collections—variation that at its extremes at least appears to reflect differing surface sherd densities in different collection units.

Different surface sherd density values can be assigned to these four different sizes of general collections. At the low end of the scale, intensive surface collection at Fushanzhuang in the northwestern sector of the Chifeng survey area (Peterson 2006) provides a guide, since Fushanzhuang's surface densities were definitely low enough that systematic collections would not be made on regional survey. At Fushanzhuang 19 grids, usually measuring 400 m^2, were subjected to multi-stage intensive collection. The surface densities calculated from the first stage of this surface collecting are comparable to those provided by the regional survey's systematic collections, and sherd density values from first-stage collecting in these 19 units ranged from 0.1 to 0.8 sherds per m^2. The lower range of these densities seems to fall near the lower limit for sites that would be regularly detectable on survey. That is, if sherds were much sparser than 0.1 per m^2, it would be possible for a survey team to walk along at the normal pedestrian pace without noticing any sherds at all. Imagine, for example, a density of 0.1 sherds per m^2 across an area of 100 by 100 m. This amounts to a total of 1,000 sherds on the surface of the entire area of 1 ha. If surveyors walk transects about 50 m apart, on average two surveyors would cross through this area. If they were able to observe carefully strips 1 m to either side of their path, they would be looking carefully at 4% of the surface area. Thus, on average, some 40 sherds would fall within their view. As the material recovered from Fushanzhuang makes clear, the vast majority of these 40 sherds would be so small as not usually to be noticed on moving pedestrian survey. Some of them would not even be noticed on the more careful examination of a general collection. It would probably take a systematic collection to register such a low density accurately, and the area of systematic collection would have to be large to perform this task at all accurately. At a density of 0.1 sherds per m^2, collection circles 3 m in diameter would average only 0.7 sherds each, so a large proportion of them would contain no sherds at all. And, of course, something would have to be noticed on initial casual examination to even alert a survey team to make a systematic collection. And since three sherds must be found within 1 ha before considering it evidence worth trying to record (see first section of this chapter), areas with surface sherd densities below 0.1 sherds per m^2 would not be detected very consistently. The exact criteria for calling something a "site" and recording information about it are often not discussed in archaeological survey reports (unfortunately), but this threshold of site detection seems lower than that applied in most regional surveys—much lower than in at least some of them. Areas with such low surface sherd densities, in any event, represent only a very ephemeral and tiny part of the ancient human occupation of the Chifeng region. This lowest point of the density range for Fushanzhuang (0.1 sherds per m^2), is thus used in the analyses presented in this volume as the minimal density value assigned to the 928 collection units where only very small general collections (1–7 sherds) were made in the regional survey.

The modal general collection yielded between 8 and 22 sherds. These "normal" general collections will usually be those where survey teams correctly made the subjective judgment not to make a systematic collection because surface densities were not high enough. The theoretical maximum density for these collections is 0.5 sherds per m^2, so most would fall somewhere below that—perhaps at half this value, or 0.25 sherds per m^2. The densities in the Fushanzhuang intensive collection grids (which would get general collections on regional survey) were often higher than this, but those densities were for special concentrations of artifacts in immediate household areas. Densities for entire regional survey collection units of 1 ha would average out to lower values than for the household concentrations. The 1,318 general collections with 8–22 sherds, then, have been assigned an overall density of 0.25 sherds per m^2 (that is, half the theoretical maximum). General collections that yielded 23–35 sherds are most likely to be closer to the theoretical maximum for general collections, and so this density value (0.5 sherds per m^2) has been used for these 326 collections.

A yet higher density value, then, should be assigned to general collections with still larger numbers of sherds. Determination of this value can be pursued through additional comparison of the regional survey data for sites 342 and 674 with the results of systematic surface collecting carried out prior to stratigraphic testing. Four of the eight collection units comprising the original regional survey data for these two sites are represented by systematic surface collections, and these were discussed above. The other four units (99D043, 99D044, 99D045, and 00D008 in Figs. 4.3 and 4.4) are represented by general collections. Theoretically, then, these collection units would have surface sherd densities of about 0.5 sherds per m^2 or less, or else systematic collections would have been made. The mean sherd densities for the systematic collections made in these areas before stratigraphic testing began, however, are, as previously mentioned, higher than the theoretical maximum of 0.5 sherds per m^2 for a general collection. They range from 2.4 to 5.3 sherds per m^2, so the subjective judgments made by the survey teams about surface densities in these four collection units were substantial underestimates. These two sites, however, had among the very highest surface sherd densities recorded for anywhere in the Chifeng region. Thus underestimates of surface densities that resulted in making general collections where systematic collections would have been warranted would not often have been this severe. A somewhat more conservative overall density value of 2.0 sherds per m^2 has thus been assigned to the 322 general collections with more than 35 sherds.

Once density values had been assigned to general collections, based on how many premodern sherds had been collected (including premodern sherds not assignable to a specific period), the overall densities were divided between periods according to the proportions of sherds of different periods among all the identified premodern sherds. That is, the assigned overall density values (0.1, 0.25, 0.5, or 2.0 sherds per m^2) were treated just as the calculated overall density values from systematic collections were. For example, imagine that the hypothetical collection discussed above with 15 Lower Xiajiadian, 4 Upper Xiajiadian, and 3 unidentified premodern sherds had been a general collection from all across the 0.8 ha collection unit instead of a systematic one in a single circle 3 m across. Since its number of sherds falls in the 8–22 group, it would have been assigned an overall density of 0.25 sherds per m^2. Since 79% of the identified premodern sherds were Lower Xiajiadian, 79% of this density of 0.25 sherds per m^2 would be assigned to Lower Xiajiadian (0.25 × 0.79 = 0.20 sherds per m^2) and the remainder (21%) to Upper Xiajiadian (0.25 × 0.21 = 0.05 sherds per m^2).

An Area-Density Index for Greater Precision

Once density values were determined by this procedure for each period of occupation in each of over 3,000 collection units in the survey region, it remained only to combine them with the measured areas of the collection units. This was done by simply multiplying the area of each collection unit (in hectares) by the surface sherd density within it (in sherds per m^2) to arrive at an area-density index. The actual results from collection unit 00D009 can be used as an example. A systematic collection in a single circle 3 m in diameter produced 66 sherds, for a surface sherd density of 9.43 sherds per m^2. Of the sherds identified to period, 6.2% were Lower Xiajiadian, 76.6% were Upper Xiajiadian, and 17.2% were Zhanguo-Han. Thus, 6.2% of the 9.43 sherds per m^2, or 0.59 sherds per m^2, would be attributable to Lower Xiajiadian; 76.6%, or 7.22 sherds per m^2 to Upper Xiajiadian; and 17.2%, or 1.62 sherds per m^2 to Zhanguo-Han. (Logically, the period-by-period surface sherd densities add up to the total sherd density [0.59 + 7.22 + 1.62 = 9.43].)

The area of the collection unit is 1.36 ha (slightly over the target maximum size in this instance), so, taking the systematic collection to represent the ceramics in this area means we count 1.36 ha of Lower Xiajiadian occupation at 0.59 sherds per m^2, 1.36 ha of Upper Xiajiadian occupation at 7.22 sherds per m^2, and 1.36 ha of Zhanguo-Han occupation at 1.62 sherds per m^2. Surely this means substantially more Zhanguo-Han population than Lower Xiajiadian and much more Upper Xiajiadian occupation than either of the other two periods. If we multiply the density for each period by the area of the collection unit, we arrive at an index that reflects this: 0.802 for Lower Xiajiadian; 9.819 for Upper Xiajiadian; and 2.203 for Zhanguo-Han. The units of this index are equivalent to hectares of occupation at a density of 1 sherd per m^2. That is, a value of 1.000 means 1 ha of occupation at 1 sherd per m^2 (or 0.5 ha of occupation at 2 sherds per m^2, or 0.1 ha of occupation at 10 sherds per m^2, etc.).

This area-density index, then, utilizes information on the specific area of each collection unit, avoiding the difficulties inherent in just counting either sites or collection units without regard to the fact that some are much bigger than others. It utilizes information on the quantities of sherds of each period recovered in each collection unit, but in a way that avoids the problems inherent in just adding up the total number of sherds recovered for each period. That is, the ceramics collected from each unit are taken to represent only the proportions of different types in that single unit; the total quantity of ceramics the unit represents is quantified independently via the separate measurements of area and surface density. Thus it does not matter at all that the sherds collected from a site with very high surface densities comprise a smaller proportion of the sherds at the site than in the case of a site with very low surface densities. Quantifying the garbage left on the landscape in this way allows for differing densities of occupation at different collection units and/or in different periods, based on the assumption that higher densities of occupation will be reflected in higher densities of surface ceramics. It avoids the complexities of assessing occupation spans and contemporaneity of occupations, based on the assumption that longer occupations will be reflected in higher densities of surface ceramics. Thus, a given number of people living in a place throughout a ceramic period are assumed to leave a higher density and/or a larger area of garbage (or both) than a smaller number of people living in a place throughout the period or the same number of people living in a place through only part of the period. It makes no difference to the area-density index whether the impact of longer occupation or of occupation by larger numbers of people is reflected primarily in larger areas of garbage or in higher densities of garbage. When densities are multiplied by areas, the two things are rolled together into a single index that reflects both processes.

Area-density values, however, will be affected by the differing lengths of the periods in the sequence we are working with, and this must be taken into account when comparing area-density values for one period to those of another period. Since what these numbers provide is a way of quantifying the total amount of garbage left on the landscape in each period (as recognized through ceramics), we must allow for the fact that the same number of people will leave a larger total amount of garbage in the region during a long period than during a short period. It does not matter whether this occurs as a greater density of garbage accumulates in one place, or as the garbage of a settlement gradually spreads over a larger area, or both. This issue does not affect analyses of single periods, since it applies equally to all of a single period's occupied areas. We have allowed for this effect, though, in the area-density values used for comparisons between periods by dividing them by the number of centuries in the period to which they pertain. Thus the area-density values for short periods are enlarged, relative to those of longer periods. The final units would be called something like sherd-hectares per m^2 per century. That is, a final value of 1.000 now represents 100 years of occupation over 1 ha at a density sufficient to leave 1 sherd per m^2 on the surface. An occupation of 200 years over 0.5 ha at the same density would also produce a value of 1.000, as would an occupation of 100 years over 2 ha at half the density, etc. The numbers of centuries corresponding to each period follow the basic chronological scheme established in Chapter 2.3 (Xinglongwa, 7.5 centuries; Zhaobaogou, 7.5 centuries; Hongshan, 15 centuries; Xiaoheyan, 10 centuries; Lower Xiajiadian, 8 centuries; Upper Xiajiadian, 6 centuries; Zhanguo-Han, 6 centuries; Liao, 9 centuries).

Assessing Occupations by Regional Survey, Intensive Surface Collection, and Stratigraphic Testing

As is usual in archaeology, it is useful to compare this approach to reconstructing ancient demographic patterns to other lines of evidence that bear in one way or another on the same subject. The record of what can be learned (and actually has been learned on various continents) from archaeological surface remains is quite clear after four or five decades of accomplishment, but doubts about conclusions based on surface evidence remain deeply entrenched among skeptics. It is easy to agree that evidence from surface remains does not provide absolute certainty in reconstructing patterns of ancient activities. In precisely the same sense, *no* archaeological evidence of *any* kind provides absolute certainty in reconstructing patterns of ancient activities. This is no more and no less true of surface evidence than of evidence from excavations. The interpretation of either is complicated and subject to various kinds of error. We do not, then, regard subsurface evidence as some sort of "gold standard" against which surface evidence can be compared to test its validity. If both surface and subsurface evidence provide support for the same kinds of conclusions about ancient activities, however, then not only the conclusions but also both these means of arriving at them gain credibility. In pursuit of such an end, it is enlightening to compare the conclusions that can be made about ancient occupations at sites 342 and 674 from regional survey, intensive surface collection, and the stratigraphic testing described in Chapter 2.2.

It is easiest to begin with Site 674, since its occupation is smaller, less complex, and involves only three periods. No materials dating to Xiaoheyan, Hongshan, or Zhaobaogou times were recovered in regional survey, intensive surface collection, or stratigraphic testing. One Liao sherd came from a regional survey surface collection, but none were encountered in intensive surface collection or stratigraphic testing. Clearly this late material occurs at the site but in trivial quantity. One stratigraphic test yielded 10 Xinglongwa sherds, but no Xinglongwa material appeared in

Figure 4.6. Regional survey collection units with Zhanguo-Han ceramics at Site 674 (darker gray indicates higher densities).

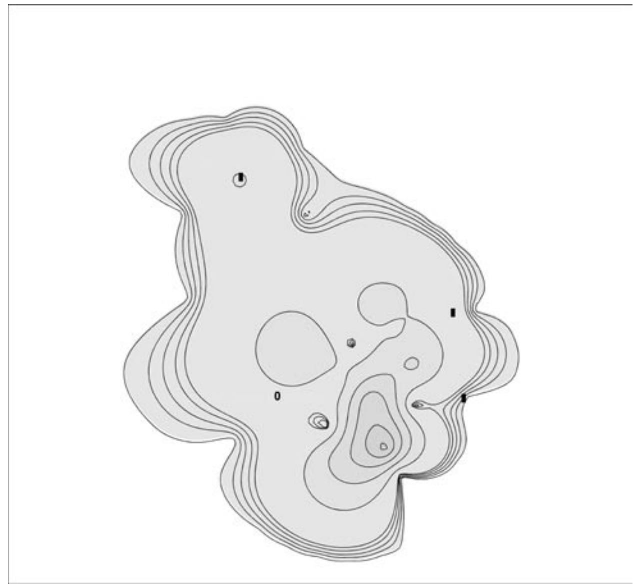


Figure 4.7. Density surface for Zhanguo-Han occupation at Site 674 based on systematic surface collections (darker gray indicates higher densities; black rectangles are stratigraphic tests with modest amounts of Zhanguo-Han ceramics; 0 is a test with no Zhanguo-Han ceramics).

either set of surface collections. It is sometimes argued that since earlier materials lie stratigraphically buried by later ones it is unlikely that they will be found in surface collections. This superficially seductive argument, however, does not really apply well in this case, since none of the Xinglongwa sherds from Test C was found *in situ* in a deeply buried undisturbed Xinglongwa deposit covered over by later layers. Rather the sherds were scattered through several stratigraphically superposed strata of Lower and Upper Xiajiadian date. Their absence from surface collections is actually better seen as an accurate representation of their very low proportion in the ceramic assemblage of the site. These 10 Xinglongwa sherds were out of the total of 4,192 sherds from the three full stratigraphic tests (B, C, and D—see Chapter 2.2 and online data, Appendix B). They thus comprise only 0.2% of the excavated sherds. At this rate, one would expect, on average, to find only 0.3 Xinglongwa sherds among the 122 collected in the regional survey, so the most likely result would be just what happened—to find none. The inclusion of Xinglongwa sherds among the 1,206 from the intensive surface collections would be more likely, although far from certain on purely statistical grounds. The calculation of 0.2% Xinglongwa sherds among those recovered from stratigraphic testing is based on a sample of three tests (B, C, and D), so it comes with a wide error range if it is treated as an estimate of the proportion of Xinglongwa sherds at the site. On this basis we would estimate the proportion of Xinglongwa sherds at Site 674 to be 0.2% ± 0.6% at the 90% confidence level. If this is what the population of sherds at Site 674 is like, then selecting a sample from it by making surface collections totaling 1,206 sherds (as the intensive surface collecting program in fact did) would result by pure statistical chance in a sample with less than one Xinglongwa sherd nearly 25% of the time. We thus cannot be at all confident that the failure to find Xinglongwa sherds even in the intensive surface collections reflects anything more than just the vagaries of sampling.

The comparison of substantial occupations can begin with the most recent, during Zhanguo-Han times. These remains are stratigraphically closest to the surface, so surface materials might be expected to be most similar to excavation results. In Fig. 4.6, the regional survey collection units that yielded Zhanguo-Han sherds in moderate density are indicated in medium gray. This survey result would suggest a Zhanguo-Han occupation of moderate density covering some 1.1 ha. Results from the intensive surface collection prior to stratigraphic testing are shown as a density surface in Fig. 4.7. This also would be interpreted as a Zhanguo-Han occupation of moderate density, although the view from intensive surface collection would suggest an area 20–30% larger than the regional survey result. Three of the stratigraphic tests yielded moderate amounts of Zhanguo-Han ceramics, and the fourth (Test A, see Chapter 2.2 and online data, Appendix B) might have as well in its unexplored upper layers (Fig. 4.7). None of the Zhanguo-Han material recovered was in undisturbed stratigraphic context as a consequence of the extensive disturbance of upper layers of the site by modern agricultural activities, but its quantity unmistakably indicates a moderate Zhanguo-Han occupation at the site. Its areal extent is not readily measured from four stratigraphic tests, but all four are in areas where the intensive surface collection indicates Zhanguo-Han occupation. One, however, is outside the area where

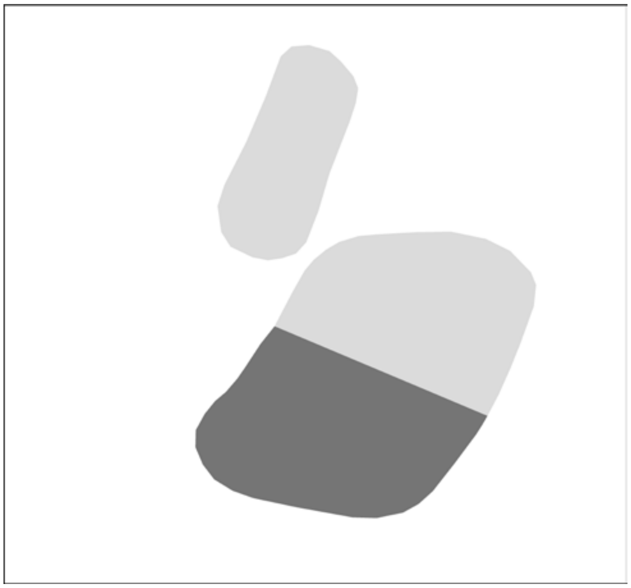


Figure 4.8. Regional survey collection units with Upper Xiajiadian ceramics at Site 674 (darker gray indicates higher densities).

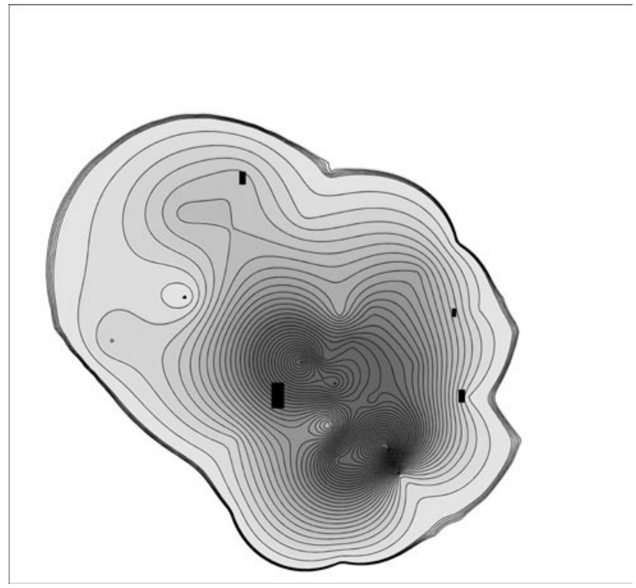


Figure 4.9. Density surface for Upper Xiajiadian occupation at Site 674 based on systematic surface collections (darker gray indicates higher densities; small black rectangle is a stratigraphic test with a modest accumulation of Upper Xiajiadian deposits; medium black rectangles are tests with moderate accumulation of Upper Xiajiadian deposits; large black rectangle is a test with substantial accumulation of Upper Xiajiadian deposits).

regional survey registered Zhanguo-Han occupation. For this latest period of occupation, then, the correspondence between regional survey results, intensive surface collection results, and the implications of stratigraphic testing are very similar although not identical.

Before Zhanguo-Han times there was an Upper Xiajiadian occupation at Site 674. Fig. 4.8 shows the nature of this occupation suggested by the regional survey results. The area covered by the Upper Xiajiadian occupation, as indicated by the regional survey, was about 1.8 ha, with roughly the northern half representing moderate density occupation and the southern half representing very high density occupation. Once again the intensive surface collection (Fig. 4.9) suggests an occupation covering some 20–30% more area. Within the occupied area, remains occurred in moderate density, with a substantial concentration in the south-central sector. This concentration, then, is much like the one observed in the regional survey data, although not positioned in exactly the same place. The four stratigraphic tests are quite consistent with the intensive surface collection results (Fig. 4.9). One (Test B) had only moderate amounts of Upper Xiajiadian deposition, in an area of surface remains of moderate density. Two other tests had somewhat larger amounts of Upper Xiajiadian occupation, and they were located in the edges of the concentration of occupation indicated by the intensive surface collection. One test had extremely large amounts of Upper Xiajiadian material (with deposits 4 m deep or more), and it was located more toward the center of the concentration of Upper Xiajiadian occupation indicated by the intensive surface collection, as well as within the higher density occupation area suggested by regional survey. It may come as a surprise that both regional survey and intensive surface collection data matched excavation data even more closely for Upper Xiajiadian than was the case for the subsequent Zhanguo-Han occupation.

In yet earlier times, Site 674 had a Lower Xiajiadian occupation. The regional survey indicates that it covered some 1.8 ha, mostly at moderate density, with a zone of somewhat higher density remains near the southern edge (Fig. 4.10). The Lower Xiajiadian surface densities did not reach the levels attained by the Upper Xiajiadian densities. This general characterization of the occupation applies equally well to the results of intensive surface collection, although, once again the intensive surface collection suggests a somewhat larger area (Fig. 4.11). The densest concentration indicated by intensive surface collection is not at the southern edge of the occupied area, but toward the northwest instead. Tests B, C, and D all produced substantial amounts of Lower Xiajiadian material, and it is possible that Lower Xiajiadian material lies below the thick Upper Xiajiadian layers at the location of Test A (Fig. 4.11). Only in Test B did the amount of Lower Xiajiadian deposition exceed that for Upper Xiajiadian. In no test did the Lower Xiajiadian strata accumulate as deeply as the Upper Xiajiadian strata did in Test A. Even for this earliest substantial occupation at the site, then, regional survey, intensive surface collection, and stratigraphic testing give a mutually consistent picture of an occupation that, while

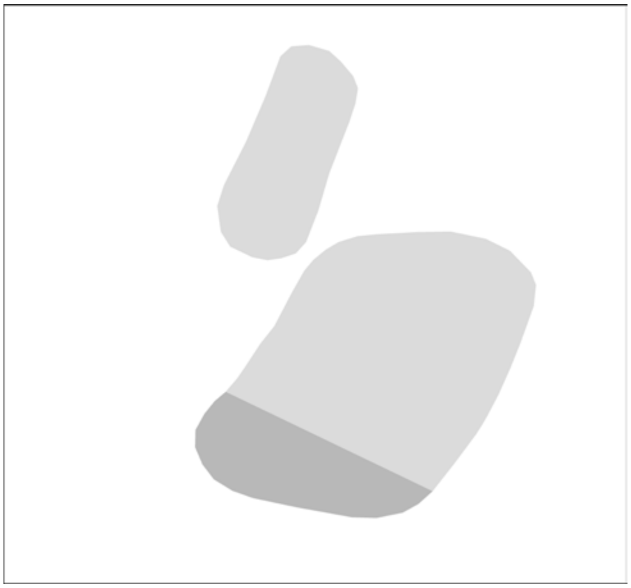


Figure 4.10. Regional survey collection units with Lower Xiajiadian ceramics at Site 674 (darker gray indicates higher densities).

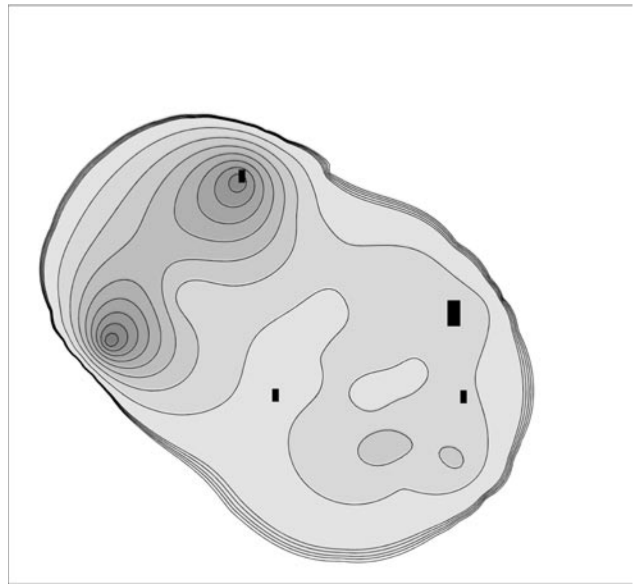


Figure 4.11. Density surface for Lower Xiajiadian occupation at Site 674 based on systematic surface collections (darker gray indicates higher densities; small black rectangles are stratigraphic tests with modest accumulations of Lower Xiajiadian deposits; large black rectangle is a test with substantial accumulation of Lower Xiajiadian deposits).

substantial, was still of considerably less magnitude than the subsequent Upper Xiajiadian one.

If we described the sequence of occupation at Site 674 as suggested by stratigraphic testing, then, it would begin with some indeterminate but ephemeral utilization of the location during Xinglongwa times. The first substantial occupation occurred in Lower Xiajiadian times, with stratigraphic deposits accumulating up to 1 m or so in at least one location and evidencing a fair amount of architectural investment. Massive construction in at least one location and more modest deposits in other places reflect even more intensive utilization of the location in Upper Xiajiadian times, following which the site was occupied considerably less intensively in Zhanguo-Han times. Either regional survey or intensive surface collection would lead to a fairly similar description of the sequence of occupation. The first substantial occupation of the site was in Lower Xiajiadian times, covering around 2 ha, with an area-density index from regional survey of 0.173. In Upper Xiajiadian times, the occupation covered about the same area, but packed in considerably more intensive occupation as reflected in surface sherd density. The regional survey area-density index is 0.695, which would suggest a population perhaps three or four times that of Lower Xiajiadian. In Zhanguo-Han times occupation continued but shrank to only slightly over 1 ha. The intensity of utilization of the occupied area also diminished, resulting in an area-density index of 0.219. The broad picture of the history of human occupation at Site 674 provided by test excavations is similar to that provided by either intensive surface collection or regional survey. The Zhanguo-Han occupation may be somewhat over-rated and the Lower Xiajiadian one underrated by surface collection compared to the implications of stratigraphic testing, and this is the effect one might logically suspect from surface remains—over-representation of more recent periods and under-representation of earlier and stratigraphically lower ones. If this effect is consistent in surface remains, then there exists the possibility of assessing its magnitude and incorporating a correction for it into demographic analysis.

This thought can be pursued immediately by extending the same sort of comparison of stratigraphic testing, intensive surface collection, and regional survey to Chifeng Site 342, where all three were also carried out. Altogether 10 tests were dug at Site 342. Their locations were concentrated along the eastern margins of the site, and thus do not provide the broad representative view into its buried strata that would most facilitate comparison to surface collections, but consistency between the two can nonetheless be checked. Liao is the only period for which there were no sherds at all from Site 342 from regional survey, from intensive surface collecting, or from stratigraphic testing. One Xiaoheyan sherd came from regional survey and one from stratigraphic testing but none from intensive surface collecting. Given the interpretive complexities associated with Xiaoheyan that are discussed elsewhere in this volume, this period can contribute little to the present comparison. Contradicting the superficial logic of early periods being poorly represented in surface collections, the first two periods in the sequence were most abundantly present in the regional survey collections, which included four Xinglongwa sherds and one Zhaobaogou sherd. The only other sherd of either period recovered was a single Xing-

Figure 4.12. Regional survey collection units with Zhanguo-Han ceramics at Site 342 (darker gray indicates higher densities).

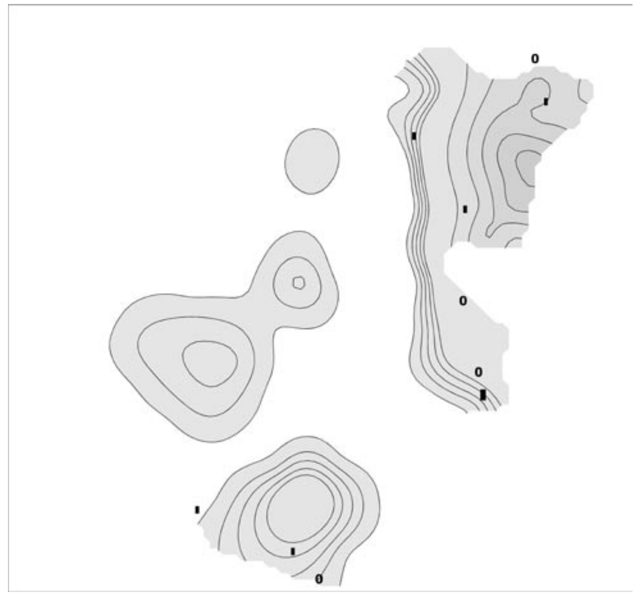


Figure 4.13. Density surface for Zhanguo-Han occupation at Site 342 based on systematic surface collections (darker gray indicates higher densities; larger black rectangle is a stratigraphic test with a moderate amount of Zhanguo-Han ceramics; smaller black rectangles are tests with modest amounts of Zhanguo-Han ceramics; 0's are tests with no Zhanguo-Han ceramics).

longwa sherd from a stratigraphic test. As with the Xinglongwa sherds from a test at Site 674, this sherd was not encountered in an undisturbed deposit deeply buried below subsequent strata but had been redeposited in a layer of Lower Xiajiadian date. Whatever utilization of the site in Xinglongwa and Zhaobaogou times these few sherds may indicate, it was certainly very small scale and ephemeral. Nonetheless, despite more substantial occupation in four subsequent periods, it is the regional survey collections in which the two earliest periods are most abundantly represented at Site 342. This thoroughly confounds the expectation that very early occupation at such sites would be undetectable on the surface and that its recognition would require excavation.

The most recent substantial occupation at Site 342, as at Site 674, dates to Zhanguo-Han times. The regional survey indicates an occupation of fairly low density in the southern part of the site, separated by a gap from a somewhat higher density occupation in the northeast (Fig. 4.12). These two parts of the occupation would total 2.7 ha. This conclusion is very similar to that from intensive surface collection, which suggests a somewhat patchy occupation of modest density, totaling about the same area and reaching its greatest concentration in the northeastern corner of the locality (Fig. 4.13). As at Site 674, very little in the way of undisturbed Zhanguo-Han strata were encountered, but three stratigraphic tests in the northeastern part of the site produced the largest amounts of Zhanguo-Han ceramics (Fig. 4.13). Four others, mostly toward the south, where surface densities were lower, produced very small amounts; and two, near gaps in the surface distribution produced none. In all cases, however, the quantities of Zhanguo-Han materials were much lower in stratigraphic excavations than those of other periods. Thus no real contradiction is seen between the indications from stratigraphic testing and surface collection.

The next earlier occupation dates to Upper Xiajiadian times. The regional survey indicates that it was both larger (about 3.5 ha) and denser, although once again the highest surface densities occurred toward the northeast (Fig. 4.14). As was the case for the Zhanguo-Han occupation, the intensive surface collection indicates very much the same thing (Fig. 4.15). The four stratigraphic tests that indicated the largest amounts of Upper Xiajiadian deposition were also toward the northeast (Fig. 4.15). Smaller amounts (or none) generally came from farther south and west. Consistent with the impression gained from surface collection, the amounts of Upper Xiajiadian material from stratigraphic tests were substantially larger than the amounts from Zhanguo-Han times. Again no contradiction is seen between surface and subsurface indications of occupation size and intensity.

Moving back in time again, the Lower Xiajiadian occupation is represented by the largest occupied area recorded by the regional survey (5.1 ha). Lower Xiajiadian surface sherd densities were also substantially higher across the board than the Upper Xiajiadian values (Fig. 4.16). The occupation was strongly concentrated toward the eastern margins of the site and especially toward the northeastern and southeastern corners. Precisely the same can be said of the indications from intensive surface collection (Fig. 4.17). Quite large amounts of Lower Xiajiadian deposition were registered in three stratigraphic tests, two in the

Figure 4.14. Regional survey collection units with Upper Xiajiadian ceramics at Site 342 (darker gray indicates higher densities).

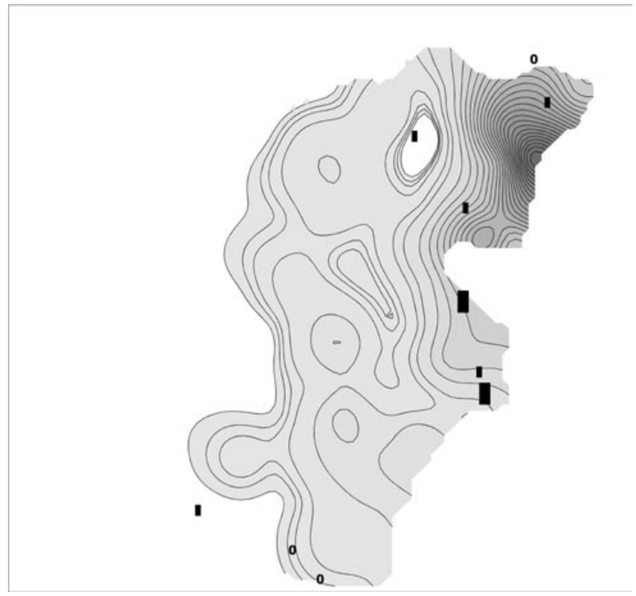


Figure 4.15. Density surface for Upper Xiajiadian occupation at Site 342 based on systematic surface collections (darker gray indicates higher densities; large black rectangles are stratigraphic tests with deep accumulations of Upper Xiajiadian deposits; small black rectangles are tests with modest amounts of Upper Xiajiadian ceramics; 0's are tests with no Upper Xiajiadian ceramics).

northeastern corner of the site and one toward the southeast where Lower Xiajiadian surface densities were highest (Fig. 4.17). Smaller amounts of Lower Xiajiadian occupation were registered in tests between these two principal concentrations and farther west, where surface densities were lower. Yet again, no contradiction can be found between surface and subsurface indications.

Site 342 also has one still earlier occupation that provides enough material for comparison. According to the regional survey results, Hongshan surface sherd densities were low, roughly in the same range as average surface densities for the most recent occupation in Zhanguo-Han times (Fig. 4.18). The area of the Hongshan occupation suggested by regional survey, at 2.3 ha, was less than that for Zhanguo-Han. Intensive surface collecting also suggests a low-density occupation, covering about the same total area (Fig. 4.19). With the greater detail provided by the large number of intensive collection circles, though, the area of occupation shows up as patchier with gaps between its several parts. Hongshan ceramics also appeared in several, but not all, of the stratigraphic tests (Fig. 4.19). The Hongshan material never occurred in large quantity and was never in undisturbed context; it always consisted of a small number of sherds redeposited with later material. Some tests with Hongshan ceramics occurred where both regional survey and intensive surface collecting suggested Hongshan occupation; some, where only regional survey did; some, where only intensive surface collecting did; and some, where surface remains did not produce Hongshan sherds. All three datasets, though, are in agreement in suggesting a rather widespread low-density utilization of the locality in Hongshan times. Finally, then, even for this very early occupation, there is no contradiction between the demographic implications of regional survey data, intensive surface collection data, and stratigraphic testing data.

Looking at the entire sequence of occupation at Site 342, then, as suggested by stratigraphic testing, begins with whatever ephemeral activity the lone Xinglongwa sherd would suggest and no indication of utilization during Zhaobaogou times. A small but scattered Hongshan occupation would give way to a very much larger and denser Lower Xiajiadian one, with up to about 5 m of accumulated deposits and massive construction in the northeastern sector of the site. Upper Xiajiadian occupation was not as dense as in Lower Xiajiadian times, but the largest amounts of material recovered from stratigraphic tests continued to be in the northeast. And finally, the accumulation of Zhanguo-Han deposits, while still concentrated toward the northeast, was much less than for either of the two preceding periods. Stratigraphic testing does, nonetheless, suggest that the Zhanguo-Han occupation was more substantial than the much earlier Hongshan one. The picture of the occupational sequence of Site 342, as given by regional survey alone, would show indeterminate but very small-scale utilization of the locality in both Xinglongwa and Zhaobaogou times. These would be reflected in very small area-density indexes for the two periods: 0.015 and 0.005, respectively. The first substantial occupation, dating to Hongshan times, seems more widespread but of low density, with an only slightly greater area-density index of 0.028. Lower Xiajiadian occupation covered the largest area of any (5.1 ha) and at the highest density, reflected in an area-density index of

Figure 4.16. Regional survey collection units with Lower Xiajiadian ceramics at Site 342 (darker gray indicates higher densities).

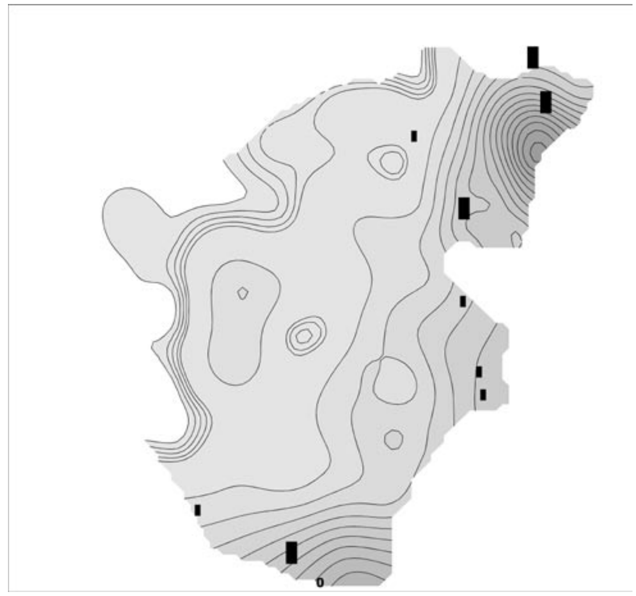


Figure 4.17. Density surface for Lower Xiajiadian occupation at Site 342 based on systematic surface collections (darker gray indicates higher densities; large black rectangles are stratigraphic tests with deep accumulations of Lower Xiajiadian deposits; small black rectangles are tests with modest amounts of Lower Xiajiadian ceramics; 0 is a test with no Lower Xiajiadian ceramics.)

1.228. Upper Xiajiadian occupation was both smaller and somewhat less dense, with an area-density index of 1.083. And finally a much smaller and sparser Zhanguo-Han occupation finished the ancient occupation sequence with an area-density index of 0.072—not as low as the index for Hongshan times, but much lower than for any of the intervening periods.

For Site 342, then, the agreement between the indications of ancient occupation provided by surface and subsurface remains is strikingly good. The biggest difference is in the representation of the two earliest periods, but, perhaps surprisingly, it is the regional survey dataset in which these periods are more abundantly represented, not the excavation results. The numbers of sherds involved are so small that we cannot conclude from this that regional survey is more effective at producing evidence of these earlier occupations, any more than we could conclude from the small numbers of Xinglongwa sherds at Site 674 that regional survey necessarily performed less well at this task than stratigraphic testing. Comparisons at these two sites have, however, utterly failed to document any consistent under-representation of the two earliest periods in regional survey collections. The Hongshan occupation at Site 342 is also very early, and again some discrepancies between the three datasets can be noted. Hongshan activities do not always show up most strongly in exactly the same places within the site, according to the three different representations. At this intra-site scale, then, the surface remains do not necessarily reflect the patterning of Hongshan occupation accurately. (Of course, neither do the excavated remains, since they consist entirely of sherds redeposited hundreds or thousands of years after Hongshan times.) It is not the intra-site scale of spatial distribution that matters to regional settlement study, however, but rather the much larger scale patterning of activities and occupations across the landscape. What matters at this scale is assessing the overall magnitude of occupation in this locality, and this registers very similarly in all three datasets. Regional settlement analyses all are based, in one way or another, on aggregating such assessments for very large numbers of sites spread across very large regions. Paralleling a number of other researchers, such as Simmons (1998) or Navazo and Díez (2008), we reach the conclusion that surface remains provide reliable indications of regional-scale phenomena. Based on comparisons at these two sites of three approaches to recovering archaeological information about the overall magnitude of ancient occupations at a locality, the rapid methodology of regional survey appears to do about as well as either of the other vastly more time consuming methods. There is no clear indication, for example, that regional settlement analyses based on surface remains need to incorporate any correction for under-representation of early periods.

Approximating the Number of Inhabitants

All the above discussion of demographic analysis has concerned relative estimates, based on the simple assumption that more ancient garbage on the landscape means more ancient inhabitants of that landscape. That is, a higher

Figure 4.18. Regional survey collection units with Hongshan ceramics at Site 342 (darker gray indicates higher densities).

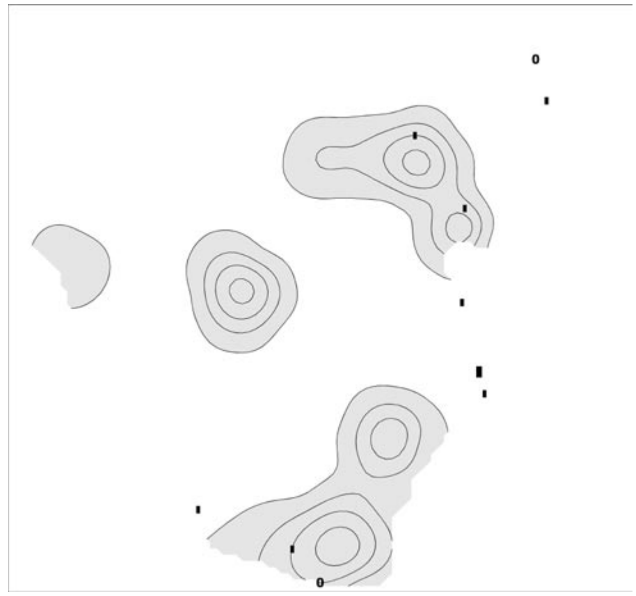


Figure 4.19. Density surface for Hongshan occupation at Site 342 based on systematic surface collections (darker gray indicates higher densities; larger black rectangle is a stratigraphic test with moderate amounts of Hongshan ceramics; small black rectangles are tests with modest amounts of Hongshan ceramics; 0's are tests with no Hongshan ceramics).

value of the area-density index is taken to indicate a higher population, and a much higher value to indicate a much higher population. This does not, however, tell us how many people lived in the surveyed region or in any part of it at a particular point in time. For most of the analyses presented in this volume, estimating the absolute number of inhabitants is not necessary; it is sufficient simply to use the area-density index as a relative indication that more people lived in this place and fewer in that place during a given period. Even archaeologists engaged in regional settlement analysis sometimes hold back from making actual population estimates because they fear their very approximate nature. Finally, however, we see no real alternative but to charge ahead into this difficult arena. If we are to be able to say anything meaningful at all about the nature of ancient human communities we simply must have some idea of their demographic scale. It is folly to try to talk about ancient social organization without even thinking explicitly about whether the community in question consisted of 100 people, 1,000 people, or 10,000 people. This folly is abundantly exemplified in the published work of archaeologists who implicitly imagine settlements of tens of thousands of inhabitants and use terms like "city" or "urban" to refer to communities that cannot possibly have had more than a few hundred inhabitants at most. The best way to avoid this kind of mistake is to dedicate some explicit attention and methodological ingenuity to making estimates of numbers of inhabitants. These estimates will always be very, very approximate. We make no pretense of being able to make a reliable distinction between an ancient settlement of, say, 300 people and one of 400 people—for most purposes we do not need to. It is possible, however, to say with a good degree of confidence, based on explicit analysis of systematically collected archaeological data, whether the population of a given ancient settlement was more like 300 or 1,000, and even such a very approximate distinction is useful and far more precise than can be achieved by simply refusing to engage in making population estimates.

The area-density index is eminently suitable for conversion into precisely this kind of very approximate absolute estimate. It simply needs to be multiplied by a figure approximating how many people are required to leave a density of surface remains averaging 1 sherd per m^2 across an area of 1 ha in a century. Various kinds of information can be useful in approximating this figure. For example, where a large area has been exposed by excavation, population estimates can be made from actual counts of residential structures. Such estimates can form the basis for relating the area-density index to approximate numbers of inhabitants in different periods. We have previously explored this possibility (Drennan et al. 2003), and here we continue that exploration by adding data from additional sites to enlarge the sample.

Table 4.2 provides information on areas and numbers of residential structures for various sites from the Chifeng region and elsewhere in northern China that have been extensively excavated. Clearly, in the case of an excavated site, the area of surface sherds prior to excavation would have extended beyond the area of features excavated. For each site with a known number of houses we have made an approximation of the corresponding area of sherd scatter that would be seen on surface survey. We have estimated conservatively that artifact distributions would extend at least 25 m out beyond the limits of known features (houses,

TABLE 4.2 . OCCUPIED AREAS AND POPULATION ESTIMATES FOR EXCAVATED SITES

Period	Site	Area (ha)	Houses	Persons/ha	Source
Neolithic					
Hongshan	Baiyinchanghan	4.5	18	12-24	Neimenggu 2004
Zhaobaogou	Zhaobaogou	7.2	77	32-64	Zhongguo 1997
Xinglongwa	Baiyinchanghan	4.8	53	33-67	Neimenggu 2004
Hongshan	6384	3.0	50	50-100	Li 2008
cf. Hongshan	Jiangzhai	2.8	60	64-129	Xi'an 1988
Early Bronze Age					
cf. Lower Xiajiadian	Laohushan	4.7	70	45-89	Neimenggu 2000
Lower Xiajiadian	Sanzuodian	2.5	65	78-156	Neimenggu 2007
Lower Xiajiadian	1902	1.6	62	113-227	Shelach 1999; Chifeng survey
Lower Xiajiadian	1729	0.2	20	333-667	Shelach 1999; Chifeng survey
Lower Xiajiadian	1665	0.3	40	387-774	Shelach 1999; Chifeng survey

pits, graves, etc.). On each site map, then, we have drawn a line enclosing an area that includes all known features, plus the estimated additional 25 m. We have made an exception where very steep slopes, erosion, or other topographic features clearly put limits to what would now be recognized as a surface scatter. Some parts of the sites we are examining have been destroyed by erosion. This will have reduced the number of houses identified through excavation, but it will also have reduced the corresponding estimated surface scatter in a similar way, and will thus have little effect on the present effort to establish approximate correspondence between the two. In counting house structures every effort has been made to avoid double counting by not including structures that were not actually contemporaneous. It should be emphasized that both the estimated surface scatter area and the count of houses are very approximate numbers. As a consequence, they will be used only in very approximate ways toward the estimation of regional populations, and modest changes in any of these numbers would have little impact on the final (very approximate) population estimates.

The small Neolithic and Early Bronze Age residential structures in northern China are usually thought of as nuclear-family houses. In making population estimates in various parts of the world, archaeologists have applied ethnographically derived estimates of somewhere around five as the average number of people represented by each nuclear family. Compared to houses in a number of these other regions, however, the Neolithic and Early Bronze Age house structures of northern China seem extremely small—sometimes on the order of 10 m^2, as opposed to the 20 to 30 m^2 or more that nuclear family houses elsewhere may cover. Many of the regions with larger houses, however, have much milder climates, and it may be that very small houses in northern China were a response to the need for keeping their inhabitants warm through the extremely harsh winters. It may also be that average family size was small. In the 2000 census (for whatever this comparison may be worth, given the policy of one child per family and other incompatibilities of ancient and modern life) households in the Chifeng region average about 3.5 persons (China Data Online 2008). For present purposes, the Neolithic and Early Bronze age houses have been taken to represent somewhere between 3 and 6 inhabitants on average, slightly lower figures than often used elsewhere, reflecting the small size of the structures. Minimum and maximum populations for each excavated site area, then, were determined by multiplying the number of residential structures first by 3 and then by 6. In calculating settlement areas, we included open spaces without structures (such as plazas, for example, where they occurred) since such areas would be included in site areas as determined by surface artifact scatters in regional survey. Finally the estimated minimum and maximum populations were divided by the settlement areas to make minimum and maximum estimates (in persons per ha) of the occupational densities within the settlements, and these are presented in Table 4.2.

We have relied on four Neolithic sites where individual house structures can be counted as a basis for residential density estimates. Two periods of occupation are represented at Baiyinchanghan, in eastern Inner Mongolia (Neimenggu 2004), so there are actually five separate observations for the Neolithic in Table 4.2. The earlier Xinglongwa occupation at Baiyinchanghan consists of two clusters of houses surrounded by circular ditches (Fig. 4.20). The entire area inside the two circular ditches was excavated and revealed 54 Xinglongwa period structures. Two of these overlapped, and thus could not be contemporaneous, so the total was reduced to 53. The area of surface sherds was estimated to extend about 25 m beyond the ditches and beyond the graves at the south. The edge of the estimated surface scatter cuts slightly closer to features on the west and southeast where steep gully banks put an end to the site and extends a little farther beyond features on the east where a slightly larger expanse of level ground stretches out to a steep slope. A separate cemetery area located atop a hill more than 100 m to the west is not included as part of the site for present purposes. The area of the surface scatter shown in Fig. 4.20 is 4.8 ha.

For the Hongshan occupation at Baiyinchanghan, we have relied on the distribution of houses, pits, graves, and other features, since the two circular ditches appear not to

Figure 4.20. Estimated Xinglongwa period surface scatter at Baiyinchanghan. Excavated Xinglongwa period houses are shown in gray, ringed by two ditches; excavated Xinglongwa period graves are shown in black in the cemetery area at the extreme south.

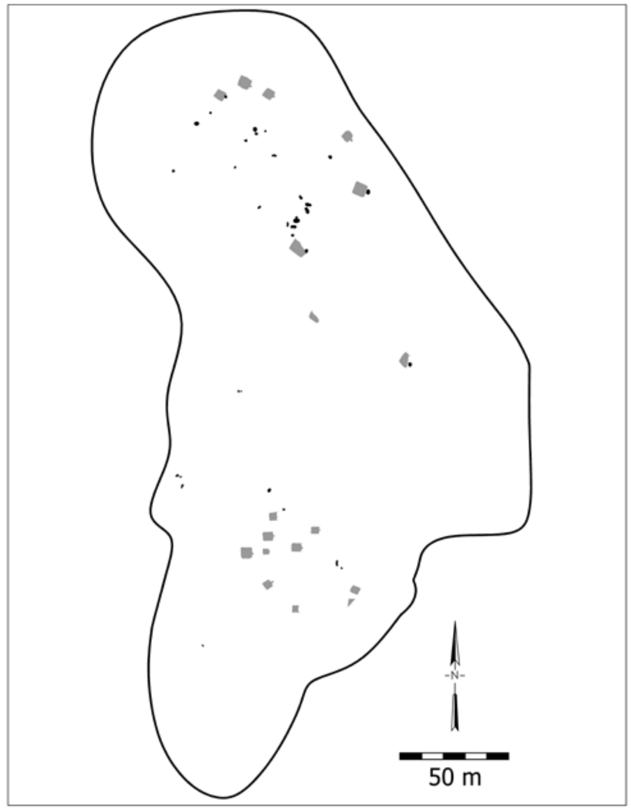


Figure 4.21. Estimated Hongshan period surface scatter at Baiyinchanghan. Excavated Hongshan period houses are shown in gray; excavated Hongshan pits and graves are shown in black.

pertain to this period. The distribution of houses is somewhat sparser than the linear arrangements of closely spaced houses from Xinglongwa times (Fig. 4.21). The estimated Hongshan surface scatter does not extend as far to the west as the Xinglongwa one did, but it does reach northwards beyond the Xinglongwa ditch. We have included the entire excavated cemetery area on the hill at the extreme south of the site since there were Hongshan remains there. In this area of 4.5 ha there were 18 non-overlapping Hongshan period houses.

The Zhaobaogou type-site in eastern Inner Mongolia has been extensively excavated (Zhongguo 1997a). The areas designated I, II, and JS1 are shown in Fig. 4.22; there were no Zhaobaougou period remains in Area III, and so it is not included here. Eighty-two ashy surface features were identified in Area I. Thirteen of these were excavated; two turned out to be pit features, but eleven (85%) were residential structures. If 85% of all features in Area I were houses, this would amount to a total of about 70. Area II was excavated in its entirety revealing six houses, and one additional isolated house was excavated in the space between Areas I and II. The total number of Zhaobaogou period houses at the site is thus put at 77. The estimated area of Zhaobaogou sherd scatter on the surface extends about 25 m beyond the distribution of these features (including both surface and excavated features). It also includes area JS1, where Zhaobaogou period remains were found, although no residential structures were encountered. The area of this estimated surface scatter, as shown in Fig. 4.22, is 7.2 ha.

Site 6384 in the Lower Bang River valley (Li 2008) southeast of Chifeng, while it was not actually excavated, preserves on its surface the remains of Hongshan period houses in the form of ashy circles. According to the text there are 49, but 51 appear on the map (Fig. 4.23); we have averaged out this minor discrepancy and used 50 houses for our approximation. Li provides an area of 3 ha for the surface scatter, and we have used his figure rather than estimate a surface scatter as we have done above for sites where this information was not recorded in the field.

Jiangzhai, in Shaanxi province, is another excavated Neolithic site (Xi'an, Shaanxisheng, and Lingtongxian 1988). Although it is outside the distribution of Hongshan ceramics, its Early Yangshao date would place it near the beginning of the Hongshan period. Seventy structures were excavated and appear on the site plan (Fig. 4.24). Two of these have been eliminated as they cannot be contemporaneous with the others. (F39 overlaps with F90 and almost

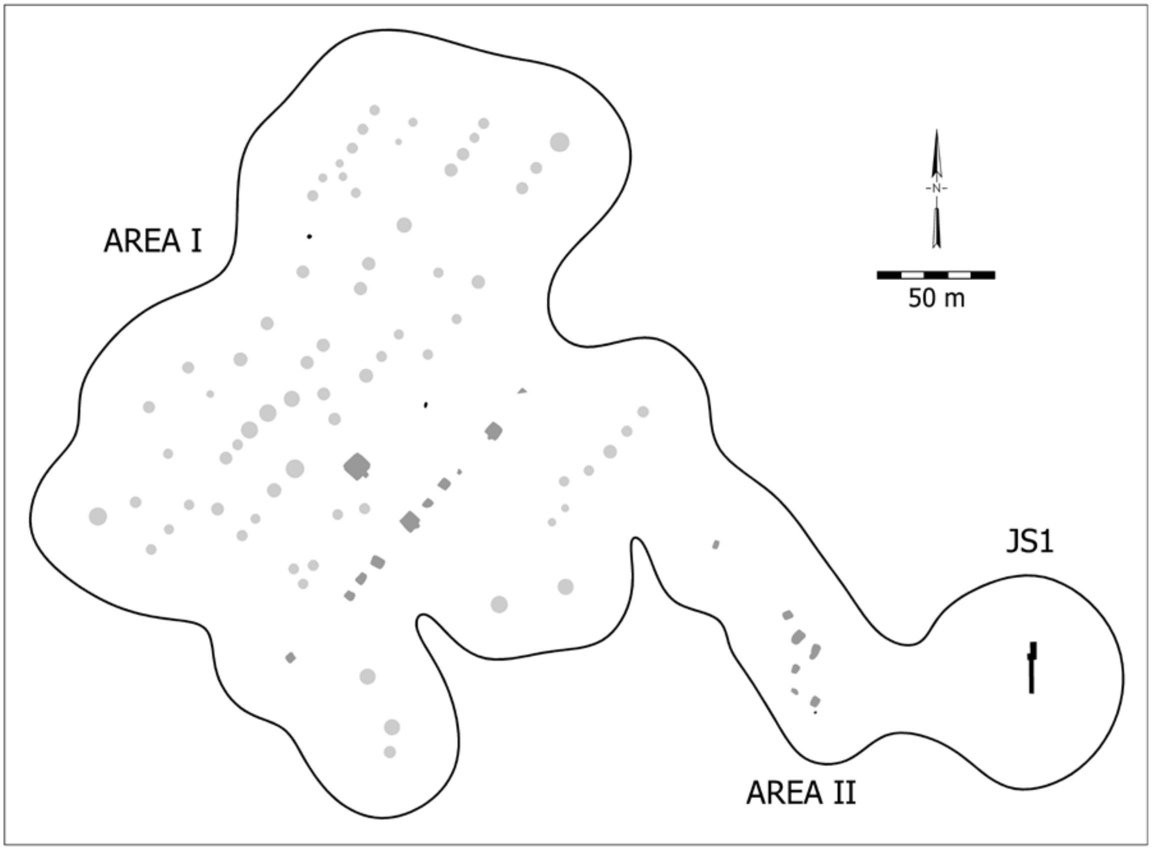


Figure 4.22. Estimated Zhaobaogou period surface scatter at Zhaobaogou. Unexcavated ashy surface features are shown in light gray; excavated Zhaobaogou period houses are shown in dark gray; excavated Zhaobaogou period pit features and the JS1 trench are shown in black.

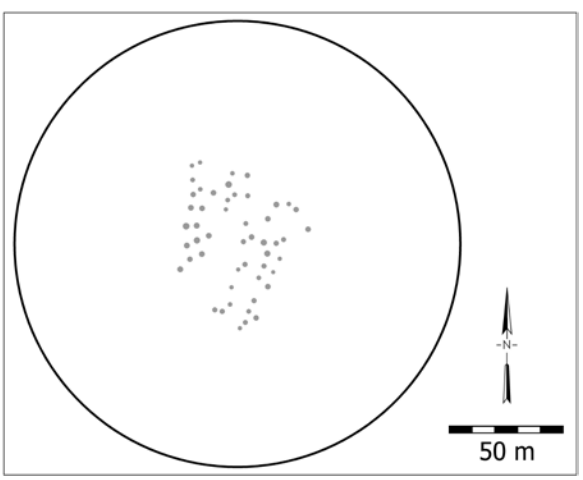


Figure 4.23. Estimated Hongshan period surface scatter at Site 6384. Unexcavated ashy surface features are shown in gray; the circle provides a schematic representation of the 3 ha surface scatter recorded in the field.

with F79 as well, and F38 blocks the entrance to F41.) Five extremely large structures (F1, F47, F53, F74, and F103) are often taken as public buildings, so we have not included them as residences for estimating population. And three at 4 m^2 or less (F104, F119, and F138) seem entirely too small for residential use as well. This leaves us with an estimate of 68 contemporaneous residences. Since several areas within the enclosing ditch have not been excavated, it is likely that Jiangzhai contained more houses than this. Fortunately, we do not need to guess how many, since our aim is not to determine the overall size of the Jiangzhai village. We have taken the more direct and less risky course of estimating the area of the sherd scatter that would correspond to the excavated portions of the site, disregarding both unexcavated houses and the surface scatter that would correspond to them. We have included the cemetery area outside the ditch to the east and surrounded the excavated part of the site with a surface scatter extending about 25 m beyond it except on the southwest, where erosion ends the site and the present surface scatter. The estimated surface scatter area, as indicated in Fig. 4.24, is 2.8 ha.

There are also five observations in Table 4.2 for Early Bronze Age sites where individual residential structures can be counted. The Laohushan site in south-central Inner Mongolia (Neimenggu 2000) lies outside the distribution

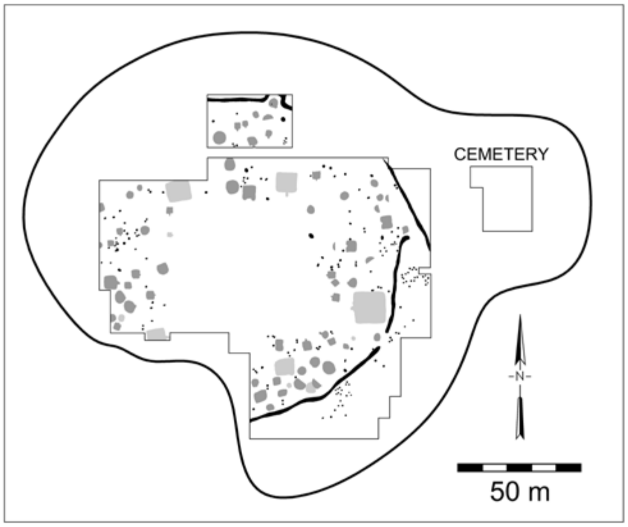


Figure 4.24. Estimated surface scatter corresponding to the excavated portions of Jiangzhai (contemporaneous with Hongshan). Contemporaneous houses are shown in dark gray; overlapping houses, large structures, and small structures that were eliminated are shown in light gray; pit features and burials not in the cemetery area are shown in black.

of ceramic complexes present in the Chifeng region, but its dates (2500–2300 BCE) place it in Xiaoheyan times. A dispersed scatter of houses (some excavated, others visible on the surface) was partially surrounded by a wall (Fig. 4.25). The excavators identified 70 structures; a few overlapped, and a few additional ones may not have been visible on the surface, so we have used 70 as the total. The estimated surface scatter shown in Fig. 4.25 covers 4.7 ha.

Sanzuodian is a hilltop fortified Lower Xiajiadian site within the Chifeng survey area. Only a portion of the site remains intact, and our estimates are based on that portion, which has been completely excavated (Neimenggu 2007). The structural remains within the defensive walls are very complex; the excavators of the site count 65 houses, and we have used that number in our estimates. The estimated surface scatter shown in Fig. 4.26 extends beyond the edges of the site where these are well preserved, but is cut off at the limits of the preserved remains along the northern and eastern edges where the site has been destroyed. It totals 2.5 ha.

Lower Xiajiadian sites 1902, 1729, and 1665 were recorded in the Chifeng survey. They have not been excavated, but remains of architecture are extraordinarily well preserved on the surface. Shelach (1999) carefully counted the circular stone foundations of residential structures at each site, and these are the numbers of houses that appear in Table 4.2. The eastern portion of site 1902 (collection units 4P092 and 4P093) corresponds to site 8 in Shelach's initial survey. It contains the remains of 62 structures. Site 1729 (Shelach's site 42) contains 20 structures; and site 1665 (Shelach's site 33), 40 structures. Since the surface scatters of these sites were actually measured according to the Chifeng survey methodology it is not necessary to approximate them. Their actual measured areas appear in Table 4.2.

Table 4.2 thus uses the archaeological evidence just discussed to arrive at estimated occupational densities within sites. Despite a series of obvious incompatibilities, it is interesting to compare these occupational density figures estimated for ancient settlements with those from the 2000 census. The lowest occupational densities for modern townships (Table 4.1) are only very slightly above the bottom of the archaeological scale. The highest modern township occupation density values still lie fairly low on

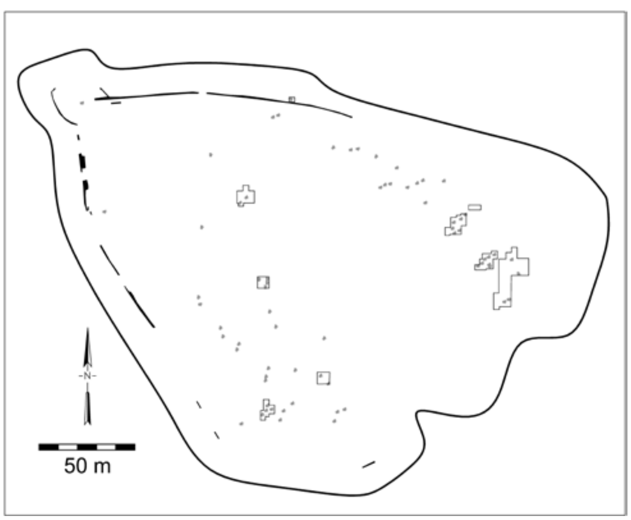


Figure Fig. 4.25. Estimated surface scatter at Laohushan (contemporaneous with Xiaoheyan). Houses are shown in gray, including those uncovered within excavated areas and those visible on the surface.

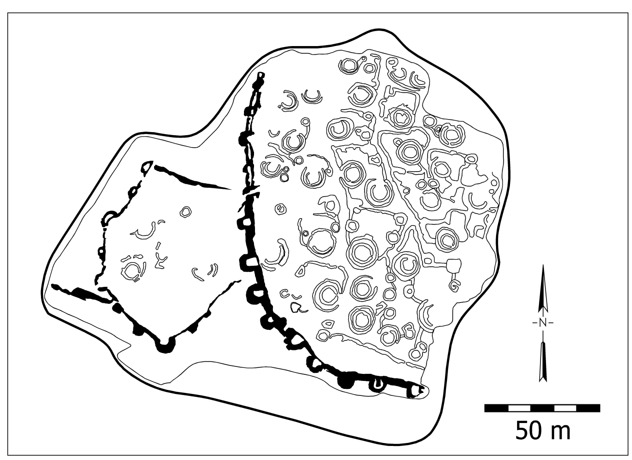


Figure 4.26. Estimated Lower Xiajiadian surface scatter at Sanzuodian. Structures are shown inside the defensive walls within the excavated area.

that scale; even that for modern Chifeng city (at about 200 persons per ha) falls below some of the excavated Lower Xiajiadian sites. This may seem surprising, since we have the general impression that modern cities, with their multi-story apartment blocks and sometimes quite tall buildings, have attained extraordinarily high occupational densities. Chifeng city's occupational density is indeed substantially higher than that of any of the less urbanized townships around it. That the occupational density for Chifeng city is not as high as some of those estimated for ancient settlements, though, is less surprising after digging into the comparison a little farther. In the first place, the average family's apartment in Chifeng, while small by some standards, is luxuriously large by comparison with what are customarily taken to be nuclear family houses in Neolithic and Early Bronze Age sites. A family's quarters, then, occupied less horizontal space in an ancient settlement, even allowing for the fact that modern ones are often stacked up several stories high. In the second place, Chifeng city has broad open boulevards, squares, and parks that increase its area. The Early Bronze Age settlements that had the highest occupational densities, in contrast, have residential structures tightly packed together with very little open space in between. And third, the area calculated for Chifeng city includes commercial and industrial areas without substantial occupation—a way of using space not seen in the tightly packed Early Bronze Age settlements whose occupational densities have been estimated as higher than Chifeng city's. The estimates of ancient occupational density thus seem broadly consistent with those that can be calculated for modern settlement in the region.

If we knew what the surface densities of sherds of different periods were at the excavated sites before the excavations were carried out, then direct comparison of surface densities and excavation results would be possible. Unfortunately this information is simply not available. We can, however, align the range of occupational densities seen for the Neolithic and Early Bronze Age sites in Table 4.2, with the range of surface sherd densities observed for the same periods in Chifeng. As illustrated in Fig. 4.27, the effective minimum surface sherd density registered in the Chifeng survey was about 0.1 sherds per m^2 for all periods. It seems likely that the lowest occupational densities registered in excavated sites (as in the Hongshan occupation at Baiyinchanghan in Table 4.2) correspond to such minimal surface sherd densities. We have set 0.1 sherds per m^2 as the surface sherd density that corresponds to a minimal occupational density of 5–10 persons per ha, and this closely matches the very low occupational density aligned with the bottom of the surface sherd density scale in a number of regional settlement analyses (cf. Sanders, Parsons, and Santley 1979; Drennan, ed., 2006).

The upper end of the surface density scale is different for different periods in the Chifeng survey data. Outliers created by unusual circumstances extend these ranges on to higher values, but the lines in Fig. 4.27 represent the limits of the main bunch of density values for each period. The highest Neolithic occupational density observed among the sites in Table 4.2 is the value of around 100 persons per occupied ha at Jiangzhai, and we have aligned this value with the highest Hongshan surface sherd density values in Chifeng. Intermediate Neolithic and Early Bronze Age values, such as the 50–75 persons per ha at Zhaobaogou, the Xinglongwa occupation at Baiyinchanghan, Site 6384, or Laohushan, would fall slightly lower on the scale of Hongshan surface densities (Fig. 4.27). And the sometimes much higher occupational densities of 150–500 encountered at some Lower Xiajiadian sites would correspond to the upper part of the Lower Xiajiadian surface sherd density range.

The Minimum and Maximum Population Estimate scales in Fig. 4.27 are drawn in such a way as to correspond to the occupational density estimates from excavated sites, as these have been positioned on the surface sherd density ranges for different periods. This rough alignment of scales can then be translated into a mathematical conversion. If the sherd density values on the vertical scale in Fig. 4.27 are multiplied by 500, they are translated into the values on the Minimum Population Estimate scale. If they are multiplied by 1,000, they are translated into the values on the Maximum Population Estimate scale. If there were more sites dating to more different periods with large excavated areas and systematic quantification of pre-excavation surface sherd densities, then this process of aligning estimated minimum and maximum population estimate scales to surface sherd density values could be more thoroughly evaluated and done with greater precision and confidence. Even without such additional information, we can apply these minimum and maximum population estimate factors to the area-density index from the Chifeng survey and see to what extent the results make sense and fit with population assessments derived from other lines of evidence.

One such opportunity is provided by the two sites where stratigraphic testing produced conclusions about the nature and intensity of occupation that agreed well with conclusions based on intensive surface collection and regional survey data. The area-density index of 0.173 for the Lower Xiajiadian occupation at Site 674 would yield a population estimate of around 100 inhabitants or somewhat more (a calculated minimum of 87 and maximum of 173), which, in an occupied area of 1.8 ha, means an occupational density of around 75 persons per ha (that is, between 48 and 96). This would make it a relatively modest Lower Xiajiadian village with moderate occupational density, and this seems broadly consistent with the nature of the stratigraphic evidence. That is, the architectural remains and up to 1 m of stratigraphic accumulation seem broadly consistent with the assessment that this was a village of around 100 or somewhat more inhabitants occupied through the 800 years of the Lower Xiajiadian period. There is, of course, also the possibility that the same amount of remains could accumulate as the result of around 200 people living in this locality through half the period, and then moving somewhere else. This is automatically allowed for in the area-

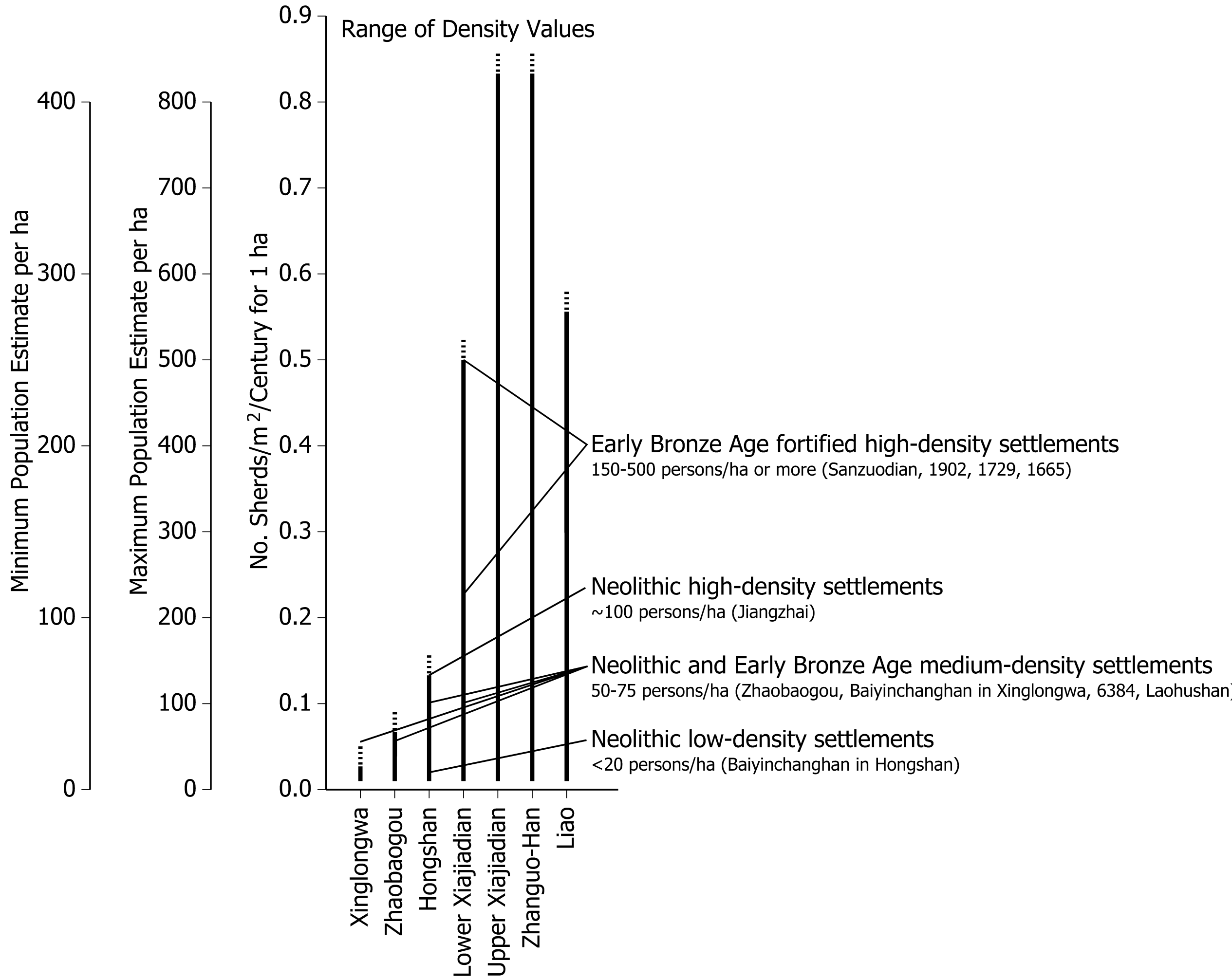


Figure 4.27. Alignment of occupational density ranges from excavated sites with surface sherd density ranges from Chifeng survey to arrive at approximate maximum and minimum population scales for corresponding surface density values.

density calculations, though, and would not affect the total population estimate. That is, those 200 people living here for half the period would be counted as if they had been 100 living here for the entire period. But then they (or actually their descendants) living somewhere else for the rest of the period would also be counted in regional survey as another 100 people living somewhere else through the entire period. The net result, then, would be 200 people living in the region through the entire period, just as it should be. The area-density index of 0.695 for the Upper Xiajiadian occupation at Site 674 would yield a population estimate of around 500 people (calculated as 348–695), in 1.8 ha, for an occupational density around 300 per ha (that is, 192–384). This is a very concentrated occupation, and entirely consistent with the massive construction and stratigraphic accumulation in at least part of the occupied area. By Zhanguo-Han times, the area-density index for Site 674 is back down to 0.219, for a population estimate of around 150 (that is, 110–219), and this is again consistent with the much smaller amount of accumulated material.

At Site 342, the very low area-density index of 0.015 for Xinglongwa times translates to about a dozen inhabitants (that is, 8–15), and the even lower Zhaobaogou index of 0.005 translates to only 3 or 4 (that is, 2–5). These two occupations, then, would amount to only two or three families at most if they had lived at this locality through the entire time, or perhaps a few more who lived there for only portions of this time. The Hongshan area-density index of 0.028 suggests a population of about 20 (that is, 14–28) in 2.3 ha for an occupational density of only 10 or so persons per ha. Again these remains could represent a somewhat larger village that existed for part of the period. Such a small and sparse occupation would in any event leave such a modest stratigraphic accumulation that very little of it would be likely to survive intact through the subsequent much more intensive utilization of the locality. There might well be very little in the way of undisturbed Hongshan deposits left to find at the site, but the unmistakable evidence that there was a Hongshan occupation is present in the form of redeposited and, especially, surface sherds. The Lower Xiajiadian area-density index of 1.228

indicates an occupation of nearly 1,000 inhabitants, or perhaps even somewhat over 1,000 (that is, 614–1,228). In 5.1 ha, the overall occupational density would be close to 200 persons per ha (that is, 121–242). Such an occupation seems consistent with the accumulation of several meters of Lower Xiajiadian stratigraphic deposits in the parts of the locality that were most intensively occupied. The Lower Xiajiadian community at Site 342, then, would represent an occupational density more or less similar to that of an excavated site like Sanzuodian and, with its larger area, an even larger population. For Upper Xiajiadian times the only slightly lower area-density index of 1.083 yields an estimated population of perhaps 800 (that is, 541–1,083), again in 5.1 ha for about 150 persons per ha (that is, 107–214) and substantial amounts of material dating to the period. The Zhanguo-Han index of 0.072 means a dramatic reduction to only around 50 people (that is, 36–72) in 2.7 ha (or 13–27 persons per ha).

Conversion of the area-density index into rough population estimates for Sites 342 and 674, then, provides the sense of demographic scale that is needed to even begin to think about the nature of the human communities whose material remains these archaeological sites are. The population estimates are broadly consistent with what we know of occupational densities in human communities in general and at Neolithic and Bronze Age sites with extensive excavations in particular. They demonstrate the important contribution that data on the surface densities of ceramics can make to distinguishing between very high and very low occupational densities. This last may be especially important with regard to assessing the evidence of the earliest periods as accurately as possible. It is reasonable to expect agriculture and other activities to expand the areas of surface distribution of ancient artifacts. This process has been going on for a longer time with older remains. The area of occupation apparent in surface remains, then, would give an inflated idea of the demographic dimensions of a community, and this would be especially true for a very early occupation. As the area of surface distribution is expanded, however, the density of materials must go down. Navazo and Díez (2008) have demonstrated this entire process experimentally, and we have seen it in action, for example, in the case of the Hongshan remains at Site 342. The area-density index allows for this process since, as area increases and density declines, the product of area times density remains fairly constant. Demographic analysis in archaeology, then, that incorporates both areas and densities of surface scatters, as the area-density index we use here does, should give more accurate and reliable results than analysis that relies on area alone.

The Hongshan site of Fushanzhuang in the Chifeng region provides an opportunity for a final comparison. The area-density index for the Hongshan occupation in the intensively surveyed core of the site is 0.174, which yields a population estimate of something over 100 inhabitants (that is, 87–174 or an occupational density of about 10–20 persons per ha in this central 8.5 ha of the community). Intensive surface collection of this site core (Peterson 2006) revealed about 30 distinct concentrations of surface artifacts interpreted as individual households. At 3–6 persons per household, this yields an overall population estimate of 90–180, undoubtedly much closer to the regional survey estimate than it has any right to be.

Conclusion

Continued comparisons of the implications of different lines of evidence related to ancient population sizes are warranted, and offer the possibility of continuing to improve our ability to make estimates of the sizes of ancient populations. One assumption involved in the area-density index that remains little explored for want of relevant information is that the amount of garbage (i.e. ceramic sherds) produced per person per year is approximately the same for different periods in the sequence. Whether this is true or not can best be investigated through extensive excavations, which offer the possibility of assessing occupation spans more precisely than from surface collection and of estimating populations on some other basis, such as remains of dwellings, and thus of comparing these estimates to quantities of ceramics. As we have noted before (Drennan et al. 2003), if the amount of broken pottery produced per person per year appears to differ from period to period, it is easy enough to add another variable to the calculation of the index that recognizes this difference. The principal obstacle along this path is the lack of appropriate quantitative information about the broken artifactual remains associated with the substantial number of residential structures that have been excavated for the various periods in the Chifeng sequence.

In sum, more work could be done to give greater precision and reliability to demographic analysis based on the settlement data from Chifeng and other regions, both within China and outside it. Precisely the same could, of course, be said with equal validity of practically any other kind of analysis engaged in by archaeologists. The approximations that can be based on the area-density index now are nonetheless sufficiently precise and reliable to be very useful for many purposes. The area-density index is thus the basis of all the analyses in this volume that are founded on a relative assessment of how many people lived where. And its conversion into approximate numbers of inhabitants, as described in this section, is the basis of all statements of demographic scale that appear elsewhere in this volume.

4.3. Methods for Delineating Community Patterns

Christian E. Peterson and Robert D. Drennan

Communities are constituted in the patterned interactions between households, which are central to everyday life in many societies in all parts of the world. It is in this matrix of interaction that the forces that produce social change are generated, and the qualitative social changes often studied by archaeologists can be viewed as the emergence of new ways of structuring interaction in communities. In the absence of modern technologies of transportation and communication, the costs and inconvenience of interaction increase substantially with distance. Economic practicality is not the only basis on which households make their decisions, but facilitating daily patterns of activities is among their chief concerns in deciding where to locate their residences. To the extent that daily interactions are important, then, households can be expected to locate their residences close to those of other households with whom they frequently interact. It is reasonable to expect that, especially in premodern contexts, patterns of interaction, and thus social communities, will be broadly reflected in patterns of spatial distribution of residence.

Murdock's (1949) focus on daily face-to-face interaction provides a logical point of departure for the archaeological identification of social interaction communities, although the existence of such small local communities cannot simply be assumed. Rather, their presence must always be demonstrated. When they are present, they are entities within which variations in the nature of households and in household activities and interactions can be investigated, and much that has been labeled "household archaeology" consists of precisely such investigation. At the same time, small-scale communities become the units of analysis at a larger scale, where study can focus on variations in the nature of communities and the patterns of interactions between them. These patterns may permit the identification of yet larger social communities—entities to which we are accustomed to applying terms such as "district," "polity," etc., but which exist in fact, like small local communities, in the patterns of interaction between smaller units. In considering districts or polities, we approach the spatial scale of regional settlement study.

The notion of community, then, as we use it here, is not strictly bound to a particular spatial scale between that of the household and the region. Its essence, rather, is in patterns of intensity of interaction across space. These patterns of interaction come into focus at different scales to reveal specific structures that exist simultaneously in a given region. This is not to say, however, that there is any standard set of scales at which such structures must exist everywhere. Indeed, the very process of discovering the scales at which community structures of interaction form in different times and places makes a major contribution to the comparative study of complex societies and their formation.

Although it has not been framed in quite this way, such familiar analytical tools in regional settlement analysis as rank-size graphs and site-size histograms are really aimed at studying the variety of communities and the nature of their interactions. These and other such analyses make sense only if the units of analysis can be meaningfully thought of as human social communities. It is common practice to take archaeological sites as the basic units for such analyses. To do so is to assume a one-for-one correspondence between archaeological sites and human communities, but this is not always the case. An archaeological site cannot automatically be taken to represent a community. The delineation of interaction communities is a question of how people distribute themselves across the landscape, as best reflected archaeologically in how their material remains are distributed across the landscape.

In a pre-industrial agrarian society one aspect of economic practicality can consistently be expected to spread households broadly across the landscape: the labor demands of cultivation. Considering only this factor, households might reasonably be expected to place their residences directly on the land that they farm so as to minimize the effort involved in traveling from their homes to their fields (Drennan 1988; Stone 1993). Pulling in the opposite direction are the economic practicalities of interactions with other households, which are facilitated if the interacting households are located in close proximity to each other. This is true regardless of the precise nature of these interactions. They may have an economic character, such as specialized production and exchange, or coordination of agricultural labor if this is not organized entirely at the household level. They may involve participation in religious ritual or other public ceremonies. They may have political implications, or they may be in the most direct sense social—maintaining the bonds of kinship, finding mates, exchanging information, etc. We have this broad range of activities of diverse kinds in mind when we refer, loosely, to social interaction. A local community is formed when this range of social interactions is intensely concentrated within a single well-defined group of households that interact only much less intensely with households outside the group. Such a pattern of interactions would encourage all households in the group to locate their residences in close proximity, forming a spatial cluster separate from other such clusters across a region. Such clusters would be recognizable in the archaeological record as a series of clusters of material remains of habitation. In some regions such clusters may correspond well to what archaeologists are accustomed to defining as "sites." In other regions such clusters may correspond very poorly to the way archaeologists define sites for convenience in the field. In still other regions, such clustering may not exist at all (even though archaeologists will almost certainly talk about "sites"). The only way to explore such possibilities is to make the delineation of communities a question for explicit analysis.

Local and Supra-Local Communities

The delineation of such clusters for the Chifeng survey region followed the methodology proposed by Peterson and Drennan (2005). For each archaeological period, the region's collection units and their associated area-density index values discussed in the preceding section were rasterized into a grid of z-values at a resolution of 1 ha (100 m by 100 m) GIS cells. More than one collection unit may enter into a single 1-ha cell in the regular grid of a GIS layer. The z-value, then, for each square 100-m cell in these grids is the sum of the different surface sherd densities present by collection unit, each multiplied by the fraction of the 1-ha cell that its collection unit covers. All 1-ha cells without any occupation for a given period received z-values of 0.0. The importance of assigning zero *z*-values to grid squares *without* collection units cannot be stressed enough—a practice which differs markedly from the way the same analytical tools are used in the production of topographic maps. The latter are typically produced from an irregularly spaced set of measurements, and the spaces between measurements do not have zero elevation values. These spaces must be filled by interpolation. In contrast, a settlement dataset from systematic survey records both the presence and absence of evidence of human occupation across an entire landscape. Grid squares where systematic survey yields no evidence of occupation can and must be treated as areas where occupation is absent and not as missing data to be replaced by values interpolated from nearby measurements. This GIS layer of 1-ha grid cells (represented visually as a surface of varying elevation) was the basis for the clustering that delineated small local communities for each period in the Chifeng survey results. Clustering to delineate larger-scale (supra-local) communities was based on a mathematical smoothing of this grid which brings this larger-scale spatial structure into clearer focus. The values in the original grid of surface sherd densities for each period for the entire survey area were smoothed mathematically by assigning a new value to each cell in the grid that corresponds to the weighted average of all the z-values in the grid, where the weights are equal to one over the distance between z-values raised to some power (i.e. 1/distance^n). Cells that are closer to the cell for which a new z-value is being calculated weigh more heavily in the calculation than those located farther from that cell, since the weight is inversely proportional to some power of distance. The greater the power, the less is the effect of distant values. Powers greater than four represent almost no smoothing. Conversely, the lower the power, the greater the smoothing. As this power approaches zero, the values of each cell become increasingly similar, until, at zero, they are uniformly the same (all individual cell values are simply the mean of all the cell values). The power of zero therefore represents the complete mathematical smoothing of any dataset, and when visually displayed, is a completely flat and level surface.

The surfaces produced for each period of occupation in the Chifeng region (and their corresponding powers) are presented in Chapter 5. Concentrations of occupation appear at two different scales for each period as peaks or domes rising from a flat unoccupied or less occupied plane. These peaks or domes, when represented as a contour map, show as sets of closely spaced, often roughly circular, concentric contours against a near featureless background. Selecting a low contour level as a cut-off results in a line demarcating the base of each peak. Within each of these lines, would be one or more collection units where sherds of a given archaeological period were found. This way of looking at these surfaces, then, amounts to a systematic means of clustering collection units into groupings (cf. Cherry 1983:395).

When this procedure is carried out on an unsmoothed surface, it is very small-scale structure that is conspicuous and the communities defined by the clustering are local communities. Fig. 4.28 provides an example of an unsmoothed occupation surface showing eight compact nucleated Late Classic Hohokam local communities, of roughly similar sizes, in the Marana region of the U.S. Southwest. The unsmoothed occupation surface in Fig. 4.29, for the Middle Formative Valley of Oaxaca, Mexico, shows compact local communities of highly varied sizes. The largest and densest village (toward the north, in the background of Fig. 4.29) numbered over 500 inhabitants and several somewhat smaller local communities clustered tightly around it. Other local communities were smaller, ranging down to the isolated farmsteads of individual households, represented by the very small scattered bumps on the occupation surface. Yet a different kind of community pattern is represented in Fig. 4.30, an unsmoothed occupation surface for the Alto Magdalena, Colombia, during Formative 2 times. As displayed in Fig. 4.30, with a vertical scale roughly comparable in demographic terms to those of Figs. 4.28 and 4.29, this surface reveals a large number of very small bumps with no tall peaks standing out at all. Each of these bumps represents a single farmstead or tiny hamlet consisting of, at most, two or three households. In some parts of the region they cluster more closely together,

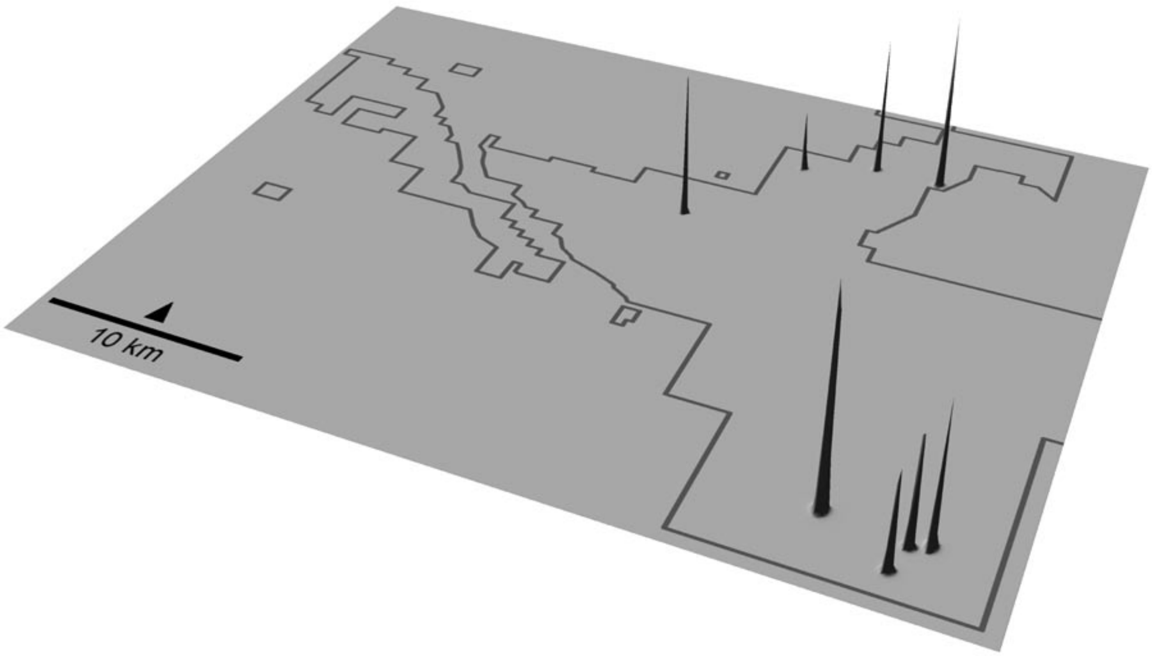


Figure 4.28. An unsmoothed occupation surface showing compact nucleated local communities.

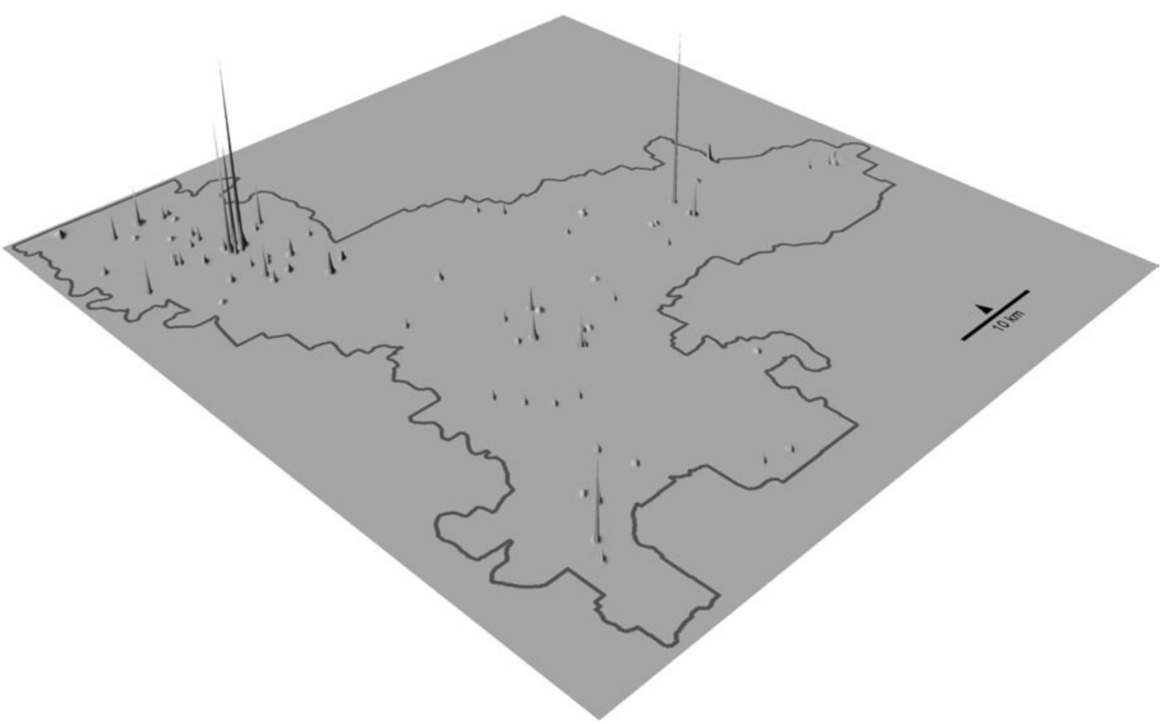


Figure 4.29. An unsmoothed occupation surface showing compact nucleated local communities of highly variable sizes.

Figure 4.30. An unsmoothed occupation surface showing numerous dispersed farmsteads.

but even in these places, there is still so much open space between them that it is clear that a very different spatial pattern of settlement distribution at the very local scale is represented. The dispersal of residences is so extreme that it is not appropriate to call anything in the pattern a nucleated local village community. These, then, are examples of some of the kinds of patterns that might be found in the unsmoothed surfaces representing the Chifeng settlement distributions during different periods. These surfaces appear in Chapter 5, where we will also explore their implications for change in the face-to-face interaction patterns that constitute local communities.

When the occupation density surface is mathematically smoothed, as noted above, small local communities are often seen to group into larger regional-scale communities or districts or polities. Of particular importance at this larger scale, the structure that is revealed depends not just on separation distance between collection units or local communities, but also reflects the higher levels of interaction produced by larger concentrated populations. This happens because larger areas of higher density occupation produce higher, broader peaks, which more readily "capture" smaller, less densely occupied outlying units. Fig. 4.31 shows a smoothed occupation surface for the Late Formative Valley of Oaxaca, Mexico, in which a single very large compact local community completely dominates the regional-scale demographic landscape. Archaeological evidence in the form of residential and public architecture, mortuary remains, sculpture, and inscriptions abundantly demonstrates that this was a period during which a single political capital established hegemony over the smaller local communities across the entire region. The occupation surface in Fig. 4.32 is a smoothed version of the same one that appears unsmoothed in Fig. 4.30. It demonstrates that, even when nucleated local communities are not present at all in a landscape of scattered farmsteads, larger-scale clustering reflecting regionally centralized communities may nonetheless appear. Two such clusters, each perhaps 10 km across, are apparent, and portions of others may appear at the fringes of the survey area. These two regional-scale communities are of similar size, and the separation of the two demographic peaks suggests two separate and independent polities. The smoothed occupation surfaces for different periods in the Chifeng survey area will also be discussed in Chapter 5 with a view toward delineating regional-scale interaction patterns reflecting changes in community structure at the supra-local scale of districts or polities.

Communities of Different Sizes

The analysis of community structure presented in Chapter 5 also examines the frequency distributions of local communities by size categories. These frequency distributions are illustrated in histograms showing the number of local communities in different estimated demographic size ranges. The histogram for Upper Xiajiadian times in Fig. 4.33 serves as an example, showing that, although the vast majority of Upper Xiajiadian communities are quite small (less than about 25–50 inhabitants), several are quite substantially larger—ranging up to 10,000 inhabitants or more. A second histogram for each period illustrates the proportional distribution of population across local communities of different sizes. Again, Upper Xiajiadian serves

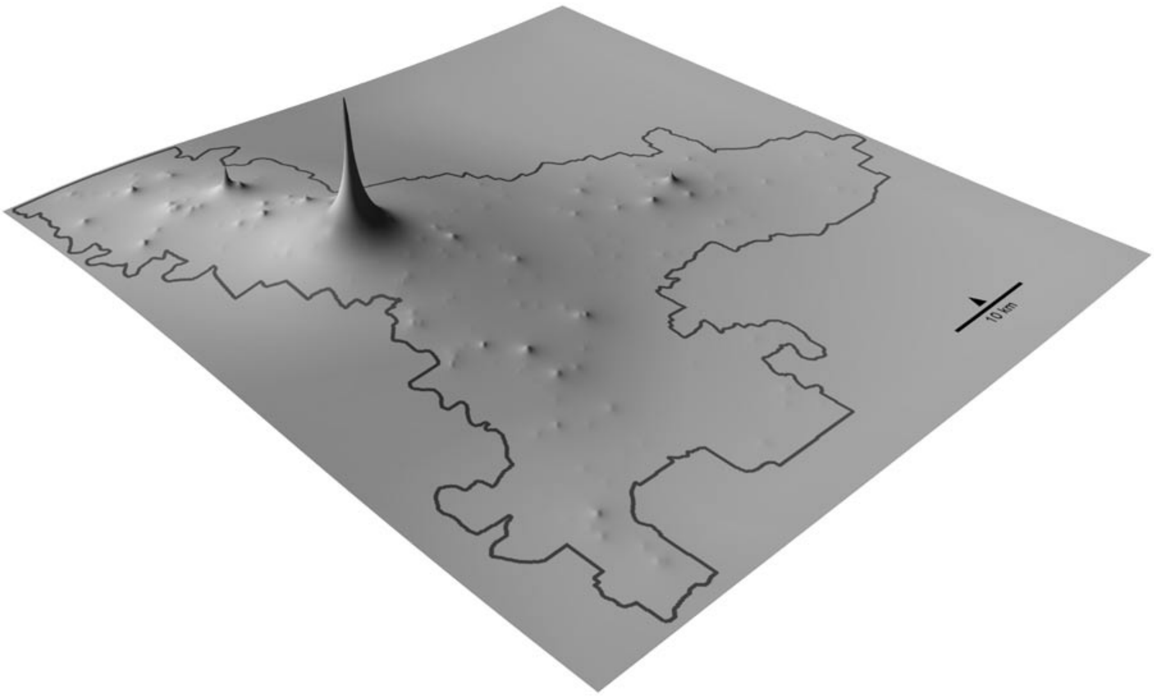


Figure 4.31. A smoothed occupation surface showing a single very centralized supra-local community.

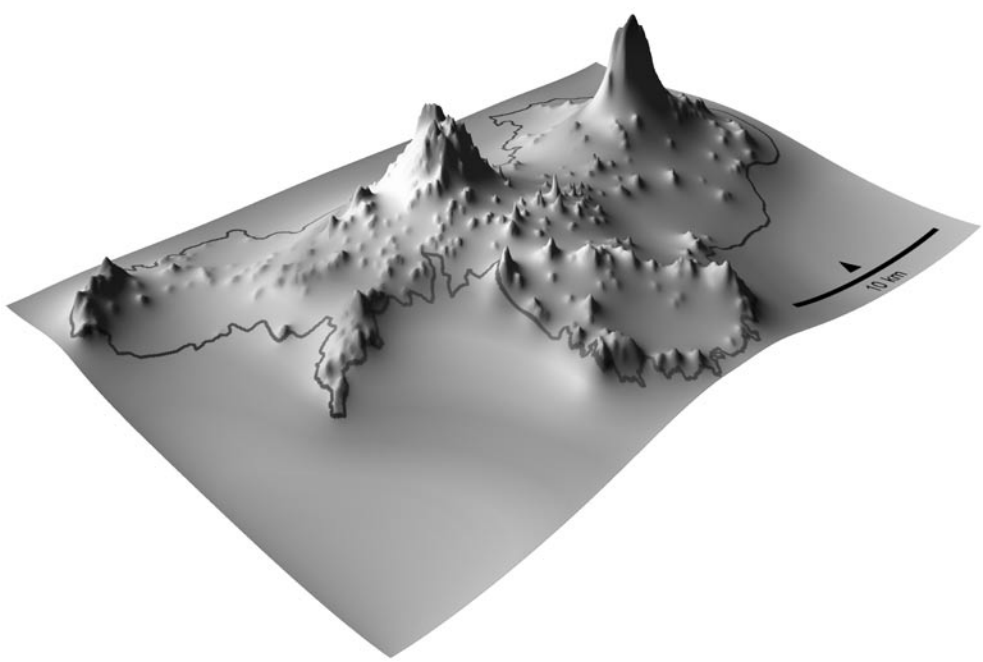


Figure 4.32. A smoothed occupation surface showing several centralized supra-local communities consisting of dispersed farmsteads.

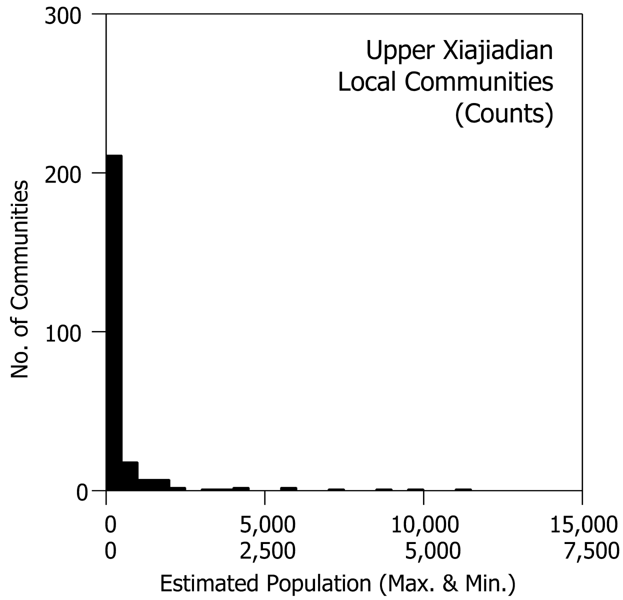


Figure 4.33. A histogram representing the number of local communities in different population size ranges.

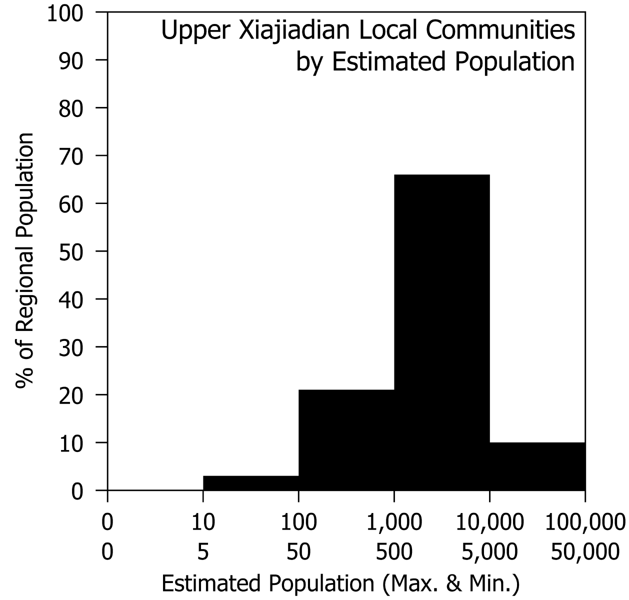


Figure 4.34. A histogram representing the estimated proportions of the regional population living in local communities of different population size ranges.

as an example. Fig. 4.34 shows that, even though the vast majority of Upper Xiajiadian communities are rather small, it is only a miniscule proportion of the population (some 3%) who live in communities with fewer than 50–100 inhabitants. A larger proportion lives in communities with populations over 5,000–10,000, and the norm for Upper Xiajiadian times is to live in local communities with perhaps a few thousand other people.

Settlement Hierarchy and Regional Centralization

Since archaeological "site-size histograms" are commonly used in a somewhat different way, we emphasize that the histograms in Chapter 5 are intended only to illustrate the frequency distributions, both of local communities and estimated populations, across local communities in different size ranges. They differ from the more traditional site-size histograms found in regional settlement studies in two main ways. First, the units in the histograms are not "sites;" they are local communities delineated in an explicit clustering analysis as discussed above. This analysis often groups together into a single local community, several spatially discontinuous entities that were initially called "sites" in the field for convenience. (Although it did not work out this way with the Chifeng data, it is also possible for such analysis to split a single large spatially continuous "site" into separate social units.) And second, our aim is not to find tiers in a settlement hierarchy in these histograms. Such identification of tiers has loomed large in some settlement analyses as providing a criterion for distinguishing between different societal types, such as chief-

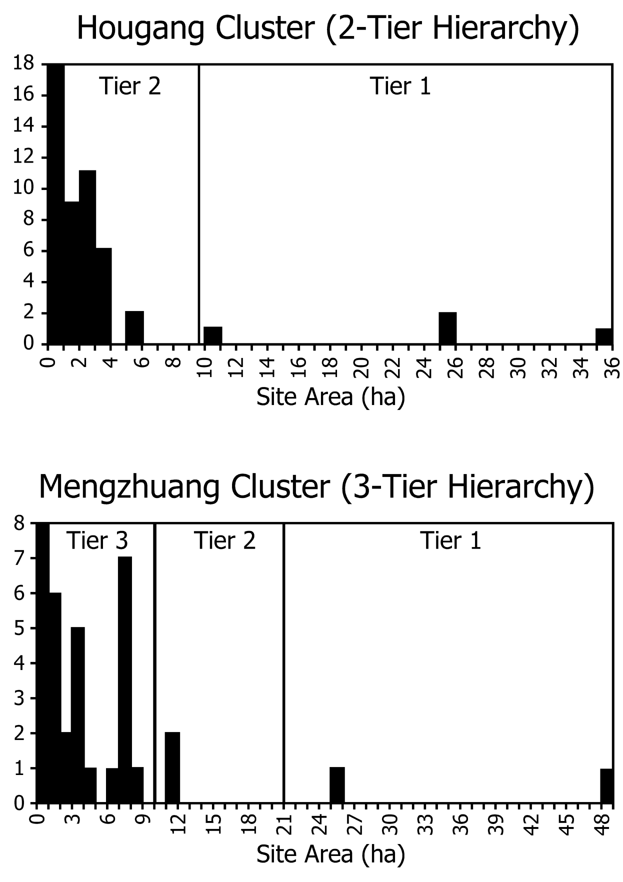


Figure 4.35. Interpretation of two site-size histograms to indicate the tiers of a settlement hierarchy. Either histogram could have been interpreted with equal plausibility to indicate two, three, or four tiers.

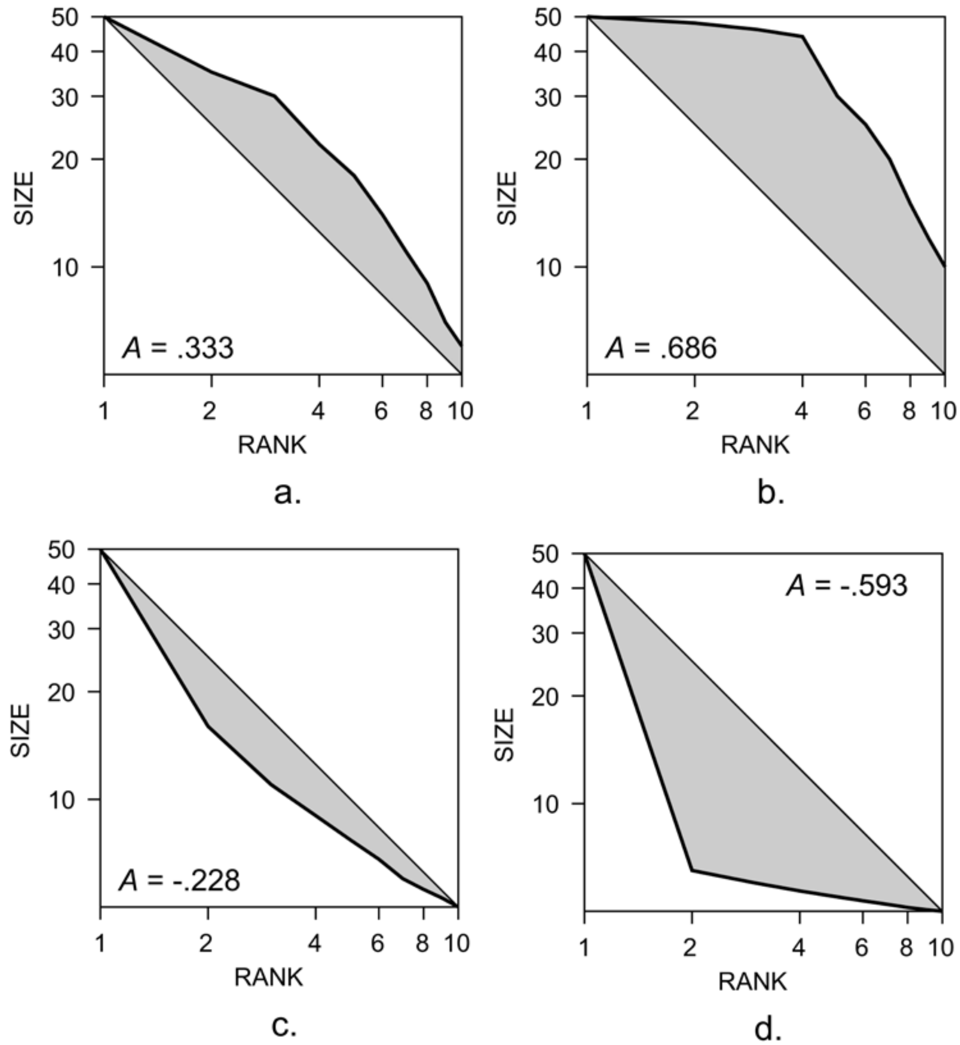


Figure 4.36. Different shapes to be observed in rank-size graphs: a. convex; b. more strongly convex; c. concave; d. more strongly concave, or primate.

doms and states, with states thought to possess a settlement hierarchy with more tiers than chiefdoms. Identifying how many tiers a settlement hierarchy has by finding multiple "modes" in site-size histograms is, however, a very slippery business, as Fig. 4.35 shows. These two site-size histograms for Longshan settlement in China's Central Plain have been interpreted as showing, respectively, a two- and a three-tiered settlement hierarchy (Liu 1996:257–259), as indicated in Fig. 4.35. Three tiers, however, could just as readily be found in the Hougang histogram by placing divisions at about 5 ha and 20 ha. This treatment would be more consistent with the manner in which the Mengzhuang histogram was interpreted. Conversely, the Mengzhuang histogram could readily be treated as showing only two tiers by simply removing the division at 10 ha. Worse yet, either one could just as convincingly be divided into four tiers by placing divisions at 2, 5, and 20 ha in the Hougang histogram and at 5, 10 and 30 ha in the Mengzhuang one. In sum, it is easy to see however many tiers the analyst is looking for in site-size histograms, which usually show a number of small sites and a few larger ones straggling off toward the upper end of the scale. We are thus *not* looking for the tiers of a settlement hierarchy in the histograms that appear in Chapter 5.

Instead, Chapter 5 approaches the issue of settlement hierarchy or ranking with rank-size graphs. Rank-size graphs have long been used in archaeological settlement analysis, so their fundamental principles are familiar. The graph itself is a plot of settlement size against rank order of settlement size, both on logarithmic scales. Fig. 4.36 illustrates four such rank-size plots. In each one the heavy line starts at the upper left corner of the graph with the size measurement for the largest (rank 1) settlement, and continues down the rankings with progressively smaller settlements, reaching the smallest somewhere near the lower right corner. The lighter line in each graph is the "log-normal" line against which the observed pattern is customarily compared. The log-normal line represents the pattern, sometimes taken to

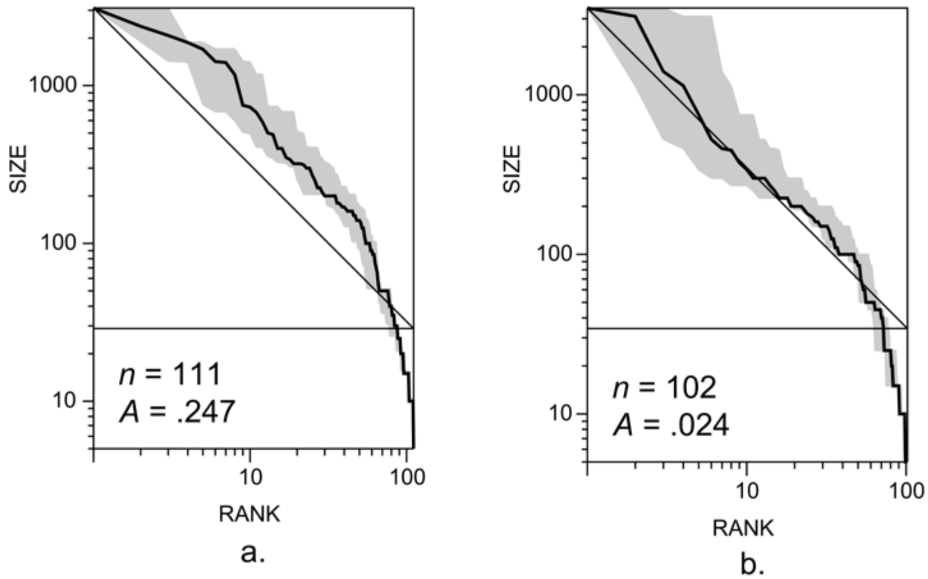


Figure 4.37. Rank-size graphs with error zones for 90% confidence: a. more than 90% confidence in identifying a departure from the log-normal pattern; b. less than 90% confidence in identifying a departure from the log-normal pattern.

be "normal" for a well-integrated centralized settlement system, in which the second-ranked settlement is half the size of the largest, the third-ranked settlement is one-third the size of the largest, and so on. The pattern seen in Fig. 4.36a, often labeled "convex," is usually taken to suggest an only loosely integrated system at best, since settlements ranking below 1 are larger than "expected." The even more convex pattern in Fig. 4.36b suggests the presence of several separate systems rather than a single integrated one, since the second, third, and fourth ranked settlements are almost as large as the largest.

The degree of convexity is quantified in the *A* coefficient as suggested by Drennan and Peterson (2004a), which appears in each graph. The value of *A* is based on the area between the observed rank-size line and the log-normal line (shaded in the graphs in Fig. 4.36). Positive values of *A* generally indicate convex patterns, and larger positive values of *A* indicate stronger convex patterns, as can be seen in Figs. 4.36a and 4.36b. When the observed rank-size line falls below the log-normal line, especially at the left side of the graph as in Fig. 4.36c, the customary interpretation is of very strongly integrated systems with a heavily dominant central settlement. Extreme presentations of this pattern (as in Fig. 4.36d) are sometimes labeled "primate," with a central settlement quite considerably larger than even the second ranked settlement. Such patterns are indicated by negative values for the *A* coefficient.

Use of the *A* coefficient facilitates assessing the significance of departures from the log-normal pattern as well as of the difference between two observed patterns. In Chapter 5, this is presented graphically as well, in the form of 90% confidence zones around the observed rank-size lines, produced as suggested by Drennan and Peterson (2004a). Fig. 4.37 shows two rank-size patterns with their 90% confidence zones. The fact that the log-normal line in Fig. 4.37a lies well outside the gray 90% confidence zone around the observed pattern tells us that we can identify this rank-size pattern as convex with 90% confidence. That is, the sample is large enough for us to have a high degree of statistical confidence in this observation. The reverse is true of the pattern in Fig. 4.37b. Much of the observed pattern lies above the log-normal line, although it does not stray as far from it as the observed pattern in Fig. 4.37a. This weaker tendency toward convexity is reflected in the much lower, but still positive, value of *A*. In Fig. 4.37b, in addition, the 90% confidence zone comfortably includes much of the log-normal line, giving us considerably less confidence in even identifying this pattern as convex.

Unlike the rank-size graphs most commonly seen in archaeology, the rank-size graphs in Chapter 5 do not take archaeological sites as the units of analysis. Like the histograms just discussed, the units of analysis are local communities—products of the explicit analysis described at the beginning of this section. Their sizes, then, are not the areas of archaeological sites but rather the populations of these local communities as estimated on the basis of both area and surface artifact density. There is, in Chapter 5, a rank-size graph that includes all the local communities in the Chifeng survey area for each period. For periods where supra-local communities, or districts, are identifiable, there are also rank-size graphs illustrating the degree of integration or centralization within these districts separately.

4.4. The Environmental Basis of Settlement Distribution

Gideon Shelach and Teng Mingyu

Basic Considerations

Correlating environmental variables to patterns of settlement distribution has two purposes. The first is to reconstruct patterns of resource use and other environmental factors in deciding where to live. This analysis is related to our understandings about how ancient populations in the Chifeng region utilized resources in their immediate environments and how other related considerations went into decisions about where to locate their habitation. The second purpose is to lay the groundwork for an understanding of sociopolitical patterns and processes addressed in Chapter 5. The environmental data used in the analysis presented in this section are available in detail online (see Appendix B).

In other words, we ask what about the settlement patterns observed in the Chifeng survey area is related to environmental conditions, including such issues as proximity to favorable resources (water, arable land, etc.) or avoidance of disasters (such as floods). When we find such correlations they can be used to formulate a model about the economic behavior of the ancient population. However, when such a correlation is not found, or when it is not as strong as we might expect, it suggests that other factors such as political forces affected decision-making about where to locate habitation. To give a hypothetical example, in a society with strong political centralization, people may choose (or be forced) to reside near the political center even when the arable land there is of lesser quality than elsewhere in the same region. No good correlation between arable land and population concentration is found in this hypothetical example, so we must look for explanations that are more political or social in nature.

This analytical framework requires that we formulate hypothetical models (or expectations) against which to compare the results of our analysis. On the most fundamental level such a model can simply be the expectation that the proportion of the estimated regional population residing in an environmental zone will be similar to the proportion of the total area of the region covered by that zone. If a larger than expected proportion of the estimated regional population lives in a zone, then a preference for that zone over others is suggested. The potential reasons for this preference can then be explored. This basic expectation is represented below in all of our analyses and the figures that represent them.

Advanced models, which deviate from the basic correlation of population to the size of each environmental zone, can be based on assumptions regarding human behavior and resource management. For example, in the analysis above we proposed that because people were deterred from living on the valley floors (see Chapter 3.3), in most periods they would prefer to settle outside and above them where they would be protected from floods while remaining as close as possible so as to maximize access to water and potentially arable land. Divergence from this pattern, as is suggested during the Upper Xiajiadian period, may suggest that additional considerations such as control over grazing land affected choice of habitation location.

Observation of current patterns of occupation in the survey region provide another source for hypothetical expectations for location of human habitation. Apart from Chifeng city itself, which represents a sociopolitical phenomenon that did not exist during prehistoric times, all other human occupation localities today are agricultural villages and small towns, not unlike what is seen in the archaeological data. While those villages are different from prehistoric ones in technological knowledge and in broader political formation, using the current occupation patterns to build hypotheses on human behavior in the Chifeng area and observing their congruence with or deviation from this model can be illuminating. In much the same way we use data on current land use not to automatically project modern patterns onto the prehistoric past but rather heuristically to suggest possible categorization of the land and to observe changing patterns of utilization.

Population estimates for different environmental zones are produced for each period by summing up the estimated populations of all settlements in each zone for each period. These population estimates are derived as discussed in Chapter 4.2. In some analyses, the total area of occupation for each period in each zone is compared to the total estimated population to indicate differences between zones in relation to how tightly nucleated the settlements were.

The environmental variables used in and the results of each analysis are described below. Each of these environmental variables formed a layer in the GIS analysis upon which the population densities and the occupation area layers were overlaid. For three periods this standard analysis was compared to another one conducted only on a portion of the population. For Upper Xiajiadian the largest towns (see Chapter 5) were removed from the second analysis, and for Liao the very large town of Songshanzhou (see Chapter 5) was removed. In both cases the aim was to test whether the patterns observed in the first analysis were caused by dynamics such as the political and/or economic pull of those large communities.

The third period for which population analyses were repeated was Lower Xiajiadian, for which a second analysis included only fortified sites. Here the aim was to test whether placement of such forts was different from that of non-fortified communities, perhaps because forts were used differently or because their construction required different materials. During the survey, the presence of stone walls was recorded but not which collection units were enclosed within them. Thus measurements of populations and areas were not used for this analysis. Instead, the analysis was based simply on the proportion of forts in each category for the environmental variables utilized, irrespective of the sizes or artifact densities of the fortified locations.

Distance from Rivers and Valley Floors

In Chapter 3.3 it was argued that the flat valley floors of the Chifeng survey area were not suitable for human occupation during the pre-Liao periods. We therefore marked the area of the valley floors on the maps of the different analysis as a separate category and expect that few if any traces of human occupation be found there. In this first analysis a GIS layer was created that consisted of nested 500 m buffers measured outward from the edges of the flat valley floors, or from the rivers themselves where no flat valley floor existed (Fig. 4.38). This layer was the principal basis for studying the distribution of settlement with respect to distance from valley floors/rivers and their resources. It seemed likely that the first buffer (within 500 m of valley floor edge or river) would be strongly favored for occupation since it provided both ready access to the rich resources of the valley floor and protection from flooding. If this were the case, then we would consistently find that the proportion of the survey area's population within this buffer would exceed the 15.4% of the survey area that it covers, and that, correspondingly, buffers further back from the valley floors would contain lower proportions of the survey area population than expected based on their size alone.

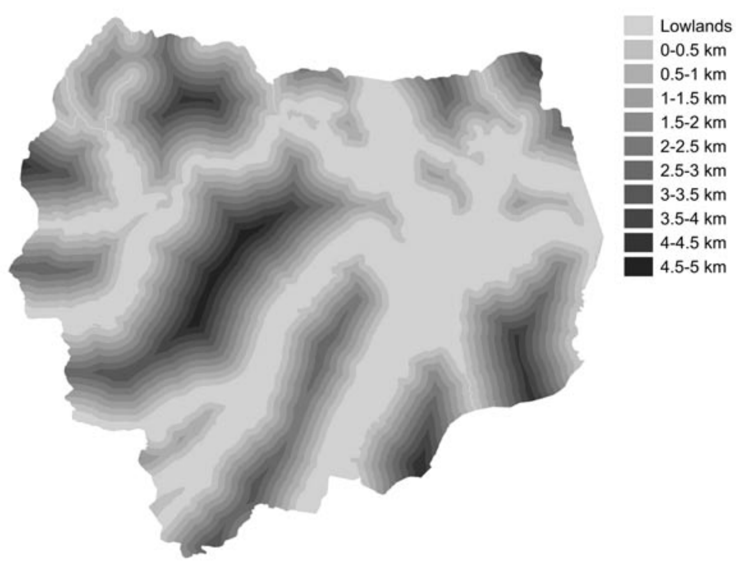
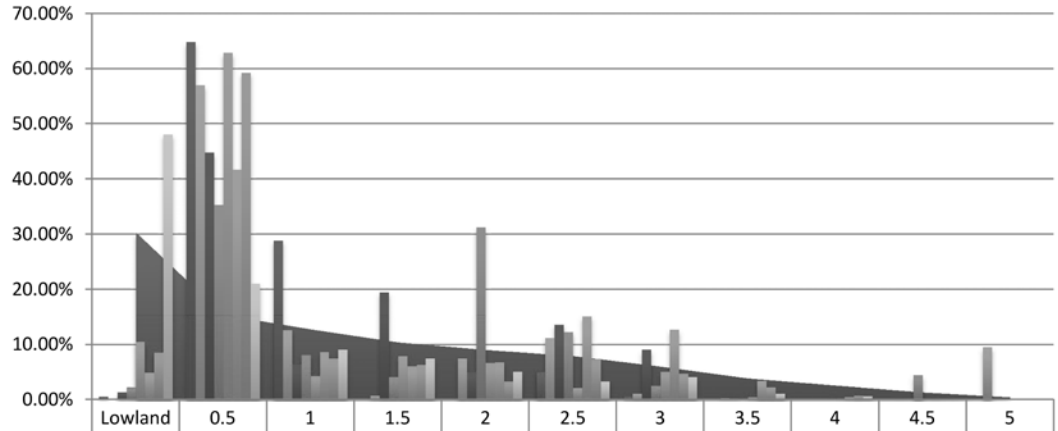


Figure 4.38. Buffers of 0.5 km around lowlands. (Available online in color, see Appendix B.)

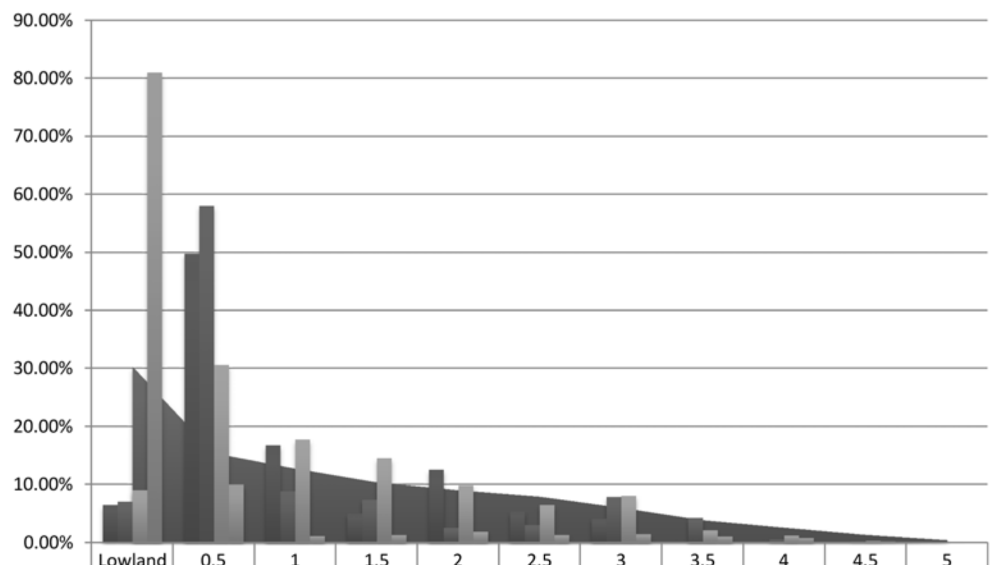
As can be seen in Fig. 4.39, in most cases the distribution of occupation fits well with the above expectations. In all periods, except for Liao, the proportion of people living on the lowlands is far below the relative size of this category (30.4% of the entire survey area). The large concentration of population on or near the valley floors during the Liao period can be attributed to improvement of construction techniques, especially the intensive use of fired bricks which are not known in this region in earlier periods but are found in large quantities at Liao sites. As can be seen in Fig. 4.40, much of the occupation in the valley floor during this period is attributed to one very large Liao town found inside the survey area and identified as Songshanzhou. Thus, the process of urbanization may contribute to this shift in settlement pattern. Today, as can be clearly seen in Fig. 4.40, more than 80% of the village population in the survey region resides inside the lowland area.

In accordance with our expectation, the first buffer (within 500 m of valley floor edge or river) is strongly favored for occupation. During all periods, the percentage of the regional population exceeded the expected 15.4%, and in all but the Liao period it was more than double this mark. Most notably, during the Xinglongwa and the Lower Xiajiadian periods more than 60% of the population resided inside this buffer, or more than four times the amount predicted by its size. During Xinglongwa and Zhaobaogou the regional population density was very low and competition over resources must have been minimal, so selecting the locations with the best access to resources is predictable. However, it is interesting that the same pattern occurred during Lower Xiajiadian when population density was at one of its highest peaks. More than 62% of the population chose to crowd into this buffer area and less than 5% resided in the second buffer (between 0.5 and 1 km from the lowlands). Such distribution is a strong indication of the economic and perhaps strategic defensive advantages of this location. Interestingly, the placement of Lower Xiajiadian forts, which in many cases utilized the cliffs that separated the valley floors from the highlands as a natural defense, do not as strongly favor this location as do unfortified Lower Xiajiadian sites (Figure 4.39). As will be discussed below, while proximity to cliffs was one factor



	Lowland	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
Expected	30.36%	15.39%	12.76%	10.39%	9.02%	7.92%	5.99%	3.85%	2.56%	1.33%	0.43%
XLW	0.55%	64.81%	28.86%	0.00%	0.00%	5.10%	0.68%	0.00%	0.00%	0.00%	0.00%
ZBG	0.00%	57.03%	12.59%	0.72%	7.50%	11.22%	1.05%	0.33%	0.00%	0.07%	9.48%
HS	1.32%	44.80%	6.43%	19.46%	5.03%	13.62%	9.03%	0.31%	0.00%	0.00%	0.00%
XHY	2.24%	35.28%	8.08%	4.07%	31.19%	12.25%	2.48%	0.00%	0.00%	4.42%	0.00%
LXJD	10.48%	62.87%	4.30%	7.91%	6.63%	2.18%	5.11%	0.47%	0.02%	0.03%	0%
UXJD	4.89%	41.73%	8.63%	6.08%	6.79%	15.11%	12.69%	3.40%	0.44%	0.15%	0.09%
ZG-Han	8.55%	59.28%	7.48%	6.31%	3.31%	7.38%	4.70%	2.20%	0.74%	0.00%	0.06%
Liao	48.12%	21.04%	9.06%	7.43%	5.05%	3.31%	4.13%	1.06%	0.62%	0.16%	0.00%

Figure 4.39. Proportion of the regional population in buffers of 0.5 km around the lowlands. (Available online in color, see Appendix B.)



	Lowland	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
Expected	30.36%	15.39%	12.76%	10.39%	9.02%	7.92%	5.99%	3.85%	2.56%	1.33%	0.43%
LXJD fortifications	6.45%	49.83%	16.77%	4.98%	12.54%	5.31%	4.12%	0.00%	0.00%	0.00%	0.00%
Small UXJD	7.05%	58.04%	8.90%	7.38%	2.51%	2.99%	7.90%	4.26%	0.57%	0.24%	0.15%
Small Liao	9.03%	30.60%	17.74%	14.55%	9.89%	6.47%	8.08%	2.08%	1.22%	0.32%	0.00%
Modern villages	80.99%	9.99%	1.16%	1.31%	1.85%	1.26%	1.45%	1.02%	0.78%	0.18%	0.00%

Figure 4.40. Proportion of population in buffers of 0.5 km around the lowlands for fortified Lower Xiajiadian sites, for Upper Xiajiadian sites excluding the larger towns, and for Liao excluding the Songshanzhou site. (Available online in color, see Appendix B.)

dictating the location of such forts, other factors, such as the availability of suitable stone resources, was also important.

Areas further away from the lowlands are in general less densely populated than would be expected based on their relative size, but two periods stand out because of over population of some buffer areas: Xiaoheyan and Upper Xiajiadian. Because the Xiaoheyan period is not well defined, this pattern could be the result of our poor identification of its pottery. However, the Upper Xiajiadian pattern deserves special attention as it relates to the economic adaptation and political organization of one of the more populated periods in this region.

In the two buffers between 2 km and 3 km away from the valley floors, 27.8% of the Upper Xiajiadian population is concentrated on 13.9% of the land. The total area of the collection units in these two buffers is 19.7% of the total area of all Upper Xiajiadian collection units, suggesting that those sites were relatively crowded. Such data suggest a shift in occupation preferences away from the valley floor, in comparison to the previous Lower Xiajiadian period, and more intensive exploitation of areas in the highlands. It is possible that some of this trend is the result of the pull exerted by the few larger and more populated Upper Xiajiadian settlements (or "towns"). The desire to live close to these sociopolitical and economic centers can offset other considerations and cause people to reside in areas with less than optimal environmental conditions. When the five major population concentrations of the Upper Xiajiadian period were removed from the analysis (Figure 4.40), the pattern indeed became more similar to that of Lower Xiajiadian with 58% of the rural population residing in the first buffer. However, we still have higher than expected values of population in the buffer between 2.5 and 3 km away from the valley floors (7.9% compared to 6% of the land) and relatively high values in the next buffer as well.

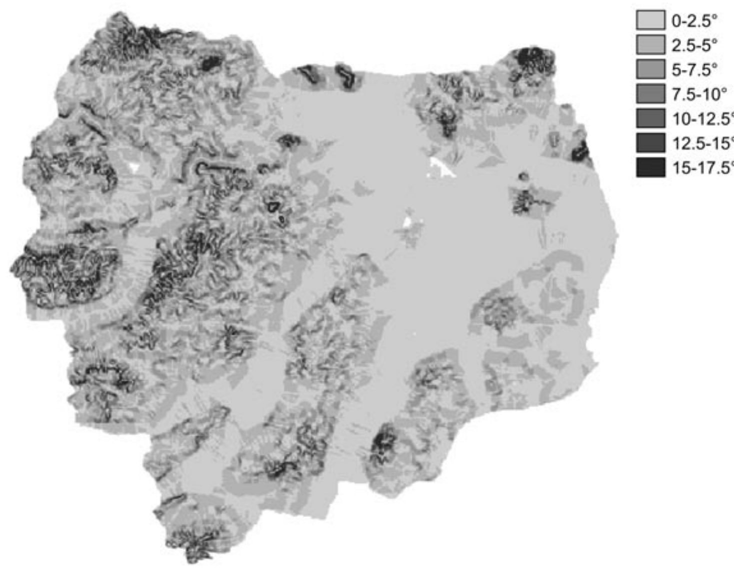


Figure 4.41. Slopes. (Available online in color, see Appendix B.)

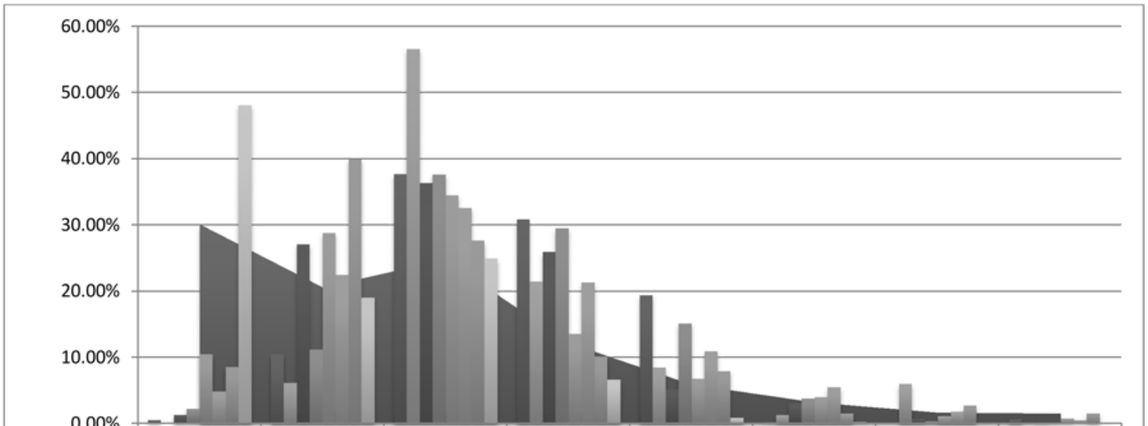
Slopes

From the digital topographic map used during the survey (digitized from a 1:50,000 map last updated in 1977) a Digital Elevation Model (DEM) was created from which we calculated the slope for each pixel of 100×100 m. This map was used to test on what kind of terrain—flat or steep—ancient populations placed their habitations. To simplify our analysis we used categories of steepness, rather than the exact angle of the slope of each pixel. Each category represents 2.5° (i.e. 0–2.5°, 2.5–5°, 5–7.5°, etc.) (Figure 4.41). The same analysis was repeated on a selected portion of the population, as described for the buffer analysis above.

The basic assumption underlying this analysis is that human beings prefer to locate their houses on flat land. Since the amount of land in slopes of 0–2.5° and 2.5–5° is 44.9% and 29.4% respectively, this assumption predicts that more than 75% of the ancient population of each period will be located there. Such a preference can clearly be seen in the distribution of modern villages and towns in the survey area, where 91.0% of the region's population resides on flat or near flat land (Figure 4.42). However, since much of the flat land is located in the valley floors, which as discussed above were not suitable for habitation during most premodern times, it makes sense that the second category (2.5–5°) will actually be the one most densely occupied.

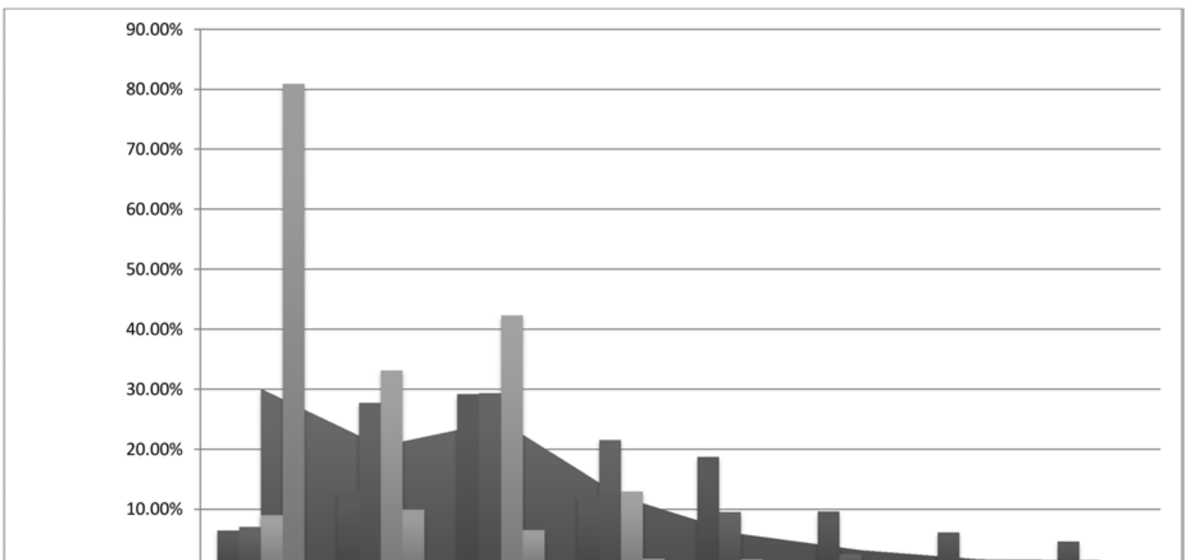
The outcome of the analysis of population density in relation to the steepness of the ground is surprising. Contrary to our expectations above, it seems that during most periods the relatively flat land was not more attractive, and sometimes it was even less attractive, than steeper slopes. Liao is the only period when clear preference for flat land is found, but according to the buffer-zone analysis above this is attributed to the location of the Songshanzhou town on the flat lowland. When this town is taken out of the analysis (Figure 4.43), the preferences of the Liao rural population are not very different from those of other periods.

During a few periods, the proportion of population residing on slopes of 2.5–5° exceeded the 20.6% predicted by the relative area of this kind of land. However, only during the Zhanguo-Han period, when 39.9% of the population is located on slopes of this angle is the difference between the expected and the actual density very large. This could indicate habitation and architectural changes that began during the Zhanguo-Han period, and may be a result of the intrusion of dynastic Chinese models into this region that began in this time and culminated during Liao and later periods.



	Lowland	2.5	5	7.5	10	12.5	15	17.5
Expected	30.13%	20.58%	24.78%	12.19%	5.91%	3.22%	1.68%	1.52%
XLW	0.55%	10.50%	37.69%	30.87%	19.40%	0.29%	0.00%	0.70%
ZBG	0.00%	6.16%	56.57%	21.49%	8.49%	1.30%	6.00%	0.00%
HS	1.32%	27.12%	36.36%	25.93%	5.20%	3.10%	0.77%	0.19%
XHY	2.24%	11.23%	37.65%	29.52%	15.16%	3.79%	0.42%	0.00%
LXJD	10.48%	28.83%	34.47%	13.54%	6.78%	4.02%	1.14%	0.75%
UXJD	4.89%	22.43%	32.60%	21.32%	10.90%	5.52%	1.83%	0.52%
ZG-Han	8.55%	39.92%	27.66%	10.14%	7.94%	1.50%	2.75%	1.55%
Liao	48.12%	19.04%	24.92%	6.68%	0.86%	0.24%	0.03%	0.11%

Figure 4.42. Proportion of regional population on slopes of different steepness. (Available online in color, see Appendix B.)



	Lowland	2.5	5	7.5	10	12.5	15	17.5
Expected	30.13%	20.58%	24.78%	12.19%	5.91%	3.22%	1.68%	1.52%
LXJD fortifications	6.45%	12.96%	29.23%	12.15%	18.80%	9.64%	6.15%	4.63%
Small UXJD	7.05%	27.82%	29.39%	21.60%	9.56%	2.55%	1.60%	0.42%
Small Liao	9.03%	33.20%	42.33%	13.01%	1.68%	0.48%	0.05%	0.22%
Modern villages	80.99%	9.96%	6.53%	1.82%	0.54%	0.16%	0.01%	0.00%

Figure 4.43. Proportion of population on slopes of different steepness for fortified Lower Xiajiadian sites, for Upper Xiajiadian population excluding the larger towns, and for Liao population excluding Songshanzhou. (Available online in color, see Appendix B.)

During all periods, apart from Liao, the population density on lands that slope between 5 and 12.5° exceeded the 42.9% predicted for the area of this land type. During the Zhanguo-Han period the small difference between the predicted and the real population proportion of 45.7% can be explained. The relatively large area of flat land, mostly located in the valley floors, was under-occupied. However, during most periods the difference is more substantial. For example, during the most populated periods, Lower and Upper Xiajiadian, those steep areas were populated by 54.7% and 64.8% of the population respectively. These settlements appear to be intentionally located on or near steep slopes. Defense considerations may have driven such a preference. This can be seen most clearly in the Lower Xiajiadian fortifications that are intentionally located on or near steep slopes of 7.5° and above (Figure 4.43).

Aspects

Using the same method as applied to slopes, a map representing the direction to which the slope of each pixel is facing was produced from the DEM layer. The aspects were divided into eight categories rather than using the exact direction of each pixel: north, northeast, east, southeast, south, southwest, west, and northwest (Figure 4.44). The range of each category is centered on the exact direction it represents, so, for example, pixels included in the north category are those with values from 337.5 to 360° and from 0 to 22.5°. Areas located on the flat land were excluded from this analysis because if the ground is flat or nearly flat the direction of the slope is meaningless.

As in previous analyses the area of occupation and the percentage of population in each of the categories were calculated and compared to the percentage of the area assigned to this category (Figure 4.45). The predicting model is that in northern latitudes, such as that of the Chifeng region, people would prefer to locate their houses on slopes which face south or southeast so as to receive more daily hours of sunshine. This is clearly the case when we look at the distribution of the collections from all premodern periods. There is a clear preference for locating settlements and larger numbers of people on the south, southeast, and east facing slopes and less preference for either the north or the west. Allowing for the fact that the proportion in the lowlands is inflated by the large Liao period Songshanzhou settlement, all other categories are under-occupied (Figure 4.46). Divergence from this pattern in any period would indicate that other considerations influenced the decisions of individuals and communities during this period. Such considerations might be political, as described above, or related to different kinds of interaction with the local environment. For example, the direction of the slope is much less relevant for people residing on a flat or nearly flat area because the exposure to the sun there is the same for all points and is not obstructed by high mountains. This situation can be seen from the analysis of the location of the modern villages and towns, most of which are indeed located on flat areas inside the valley floors (Figure 4.47)

The occupation of most periods is more or less in accordance with the prediction, suggesting that exposure to sunlight was indeed an important factor in the selection of habitation during premodern periods across the survey region. Slight divergence from the model can be seen during the Zhaobaogou period when more people than expected lived on slopes facing northeast; or in the Hongshan period when more people than expected reside on slopes facing north; or during the Zhanguo-Han period when more people than expected lived on slopes facing southwest. Those minor divergences cannot mask the overall pattern of consistency with the model.

Vegetation and Current Land Use

This map (Fig. 4.48) was digitized from a 1:500,000 map of the vegetation of the greater Chifeng region published in 1988 (Neimenggu 1988). The main categories are: irrigated fields, non-irrigated fields, mixed dry fields and grasslands, grasslands, human planted forests, and natural forests and shrubs. The lowland area is, again, defined as a separate category.

While we do not expect the same patterns of modern land use or of the natural vegetation to hold true for prehistoric periods, these are seen as heuristic categories that may relate to the intrinsic quality of the land. For example, we assume that areas that are today defined as grass lands held less moisture or are less suitable for agriculture than lands used today for dry agriculture.

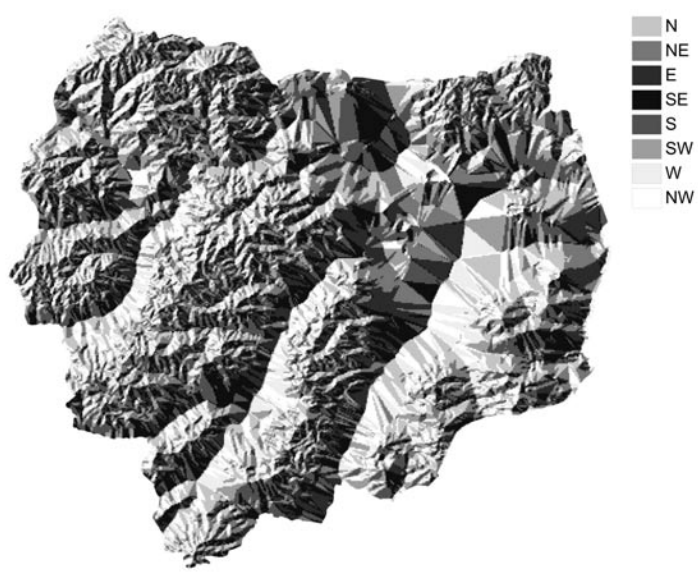
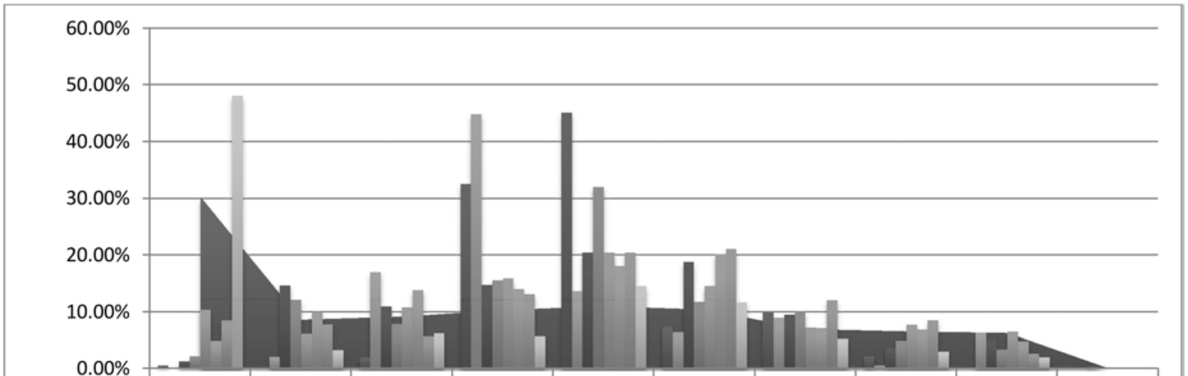


Figure 4.44. Aspects. (Available online in color, see Appendix B.)



	Lowlands	North	North east	East	South east	South	South west	West	North west	No slope
Expected	30.36%	8.64%	9.18%	10.33%	11.04%	10.42%	7.01%	6.59%	6.32%	0.10%
XLW	0.55%	0.00%	1.99%	32.56%	45.11%	7.47%	9.89%	2.32%	0.11%	0.00%
ZBG	0.00%	2.08%	17.01%	44.86%	13.71%	6.49%	8.96%	0.55%	6.34%	0.00%
HS	1.32%	14.66%	11.01%	14.74%	20.47%	18.88%	9.55%	3.67%	5.19%	0.50%
XHY	2.24%	12.12%	7.91%	15.61%	32.05%	11.80%	10.04%	4.89%	3.34%	0.00%
LXJD	10.48%	6.18%	10.82%	15.94%	20.45%	14.56%	7.27%	7.76%	6.53%	0.00%
UXJD	4.89%	9.94%	13.86%	14.08%	18.11%	20.19%	7.17%	6.91%	4.84%	0.00%
ZG-Han	8.55%	7.82%	5.72%	13.10%	20.48%	21.08%	12.05%	8.50%	2.71%	0.00%
Liao	48.12%	3.29%	6.24%	5.71%	14.59%	11.70%	5.28%	3.01%	2.06%	0.01%

Figure 4.45. Proportion of regional population on slopes of different aspects. (Available online in color, see Appendix B.)

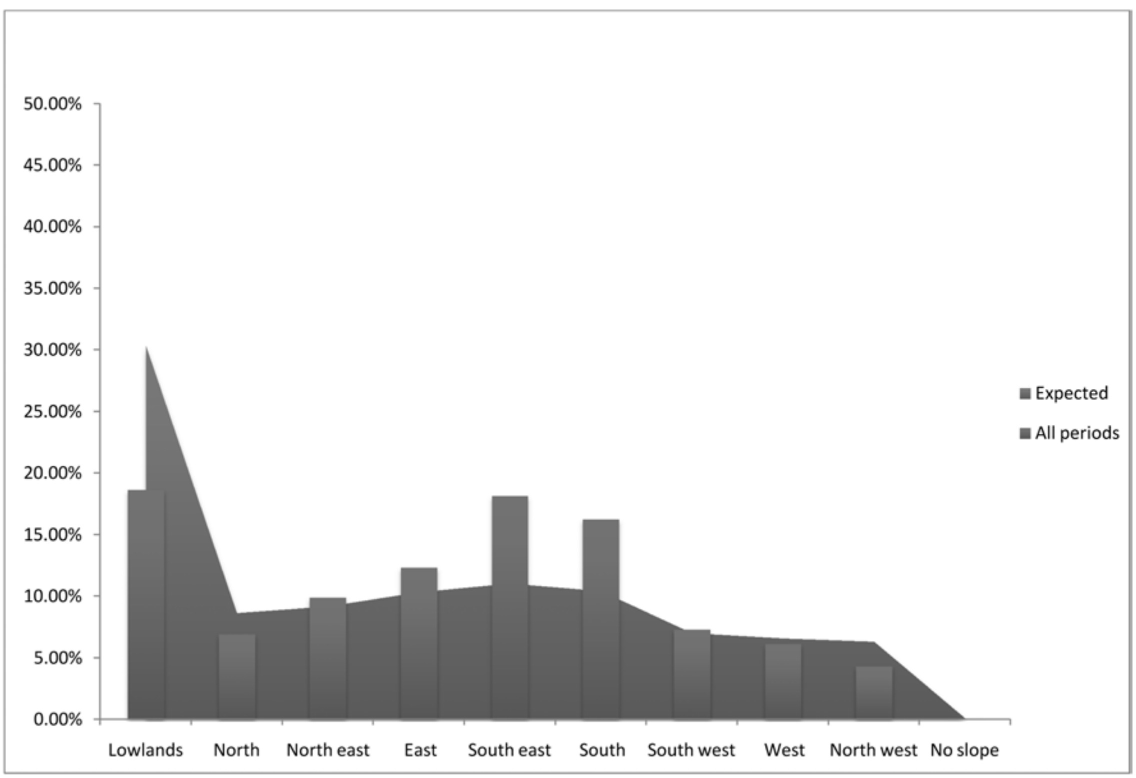
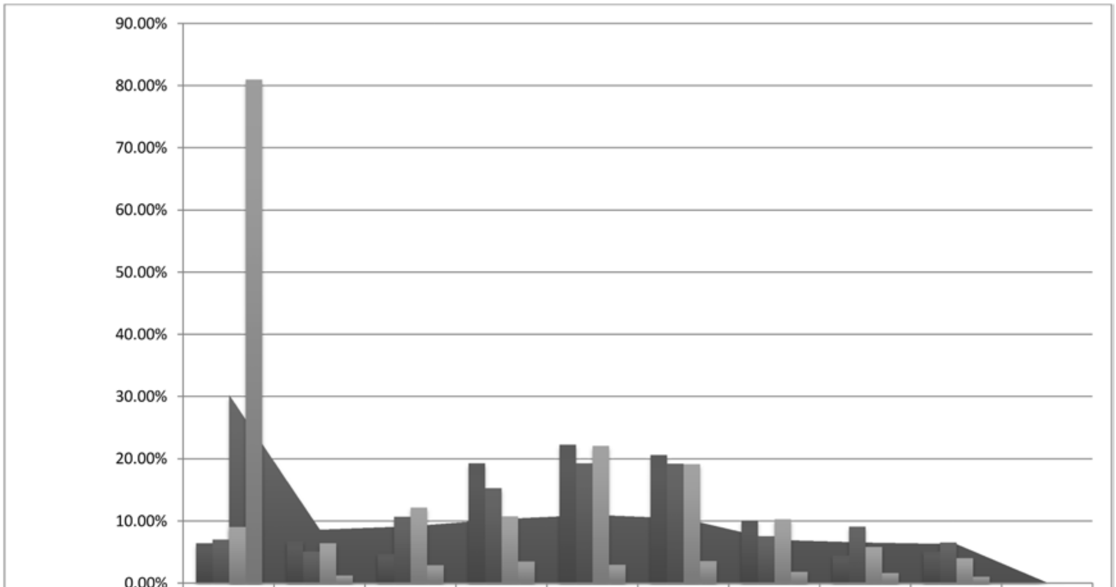


Figure 4.46. Proportion of regional population for all periods on slopes of different aspects. (Available online in color, see Appendix B.)



	Lowlands	North	North east	East	South east	South	South west	West	North west	No slope
Expected	30.36%	8.64%	9.18%	10.33%	11.04%	10.42%	7.01%	6.59%	6.32%	0.10%
LXJD fortifications	6.45%	6.80%	4.75%	19.28%	22.28%	20.67%	10.15%	4.49%	5.14%	0.00%
Small UXJD	7.05%	5.10%	10.73%	15.30%	19.29%	19.21%	7.58%	9.15%	6.60%	0.00%
Small Liao	9.03%	6.45%	12.21%	10.82%	22.10%	19.17%	10.30%	5.89%	4.03%	0.01%
Modern villages	80.99%	1.27%	2.94%	3.50%	3.02%	3.61%	1.90%	1.69%	1.08%	0.00%

Figure 4.47. Proportion of population on slopes of different aspects for fortified Lower Xiajiadian sites, for Upper Xiajiadian sites excluding the larger towns, and for Liao excluding the Songshanzhou site. (Available online in color, see Appendix B.)

Variability from period to period is greater in this analysis than it is in any other analysis (Fig. 4.49). Xinglongwa and Lower Xiajiadian are the two periods in which preference for lands used today for agriculture is greater. Altogether 58.2% of the Xinglongwa and 42.5% of the Lower Xiajiadian population resided on 9.3% of the area comprised of irrigated and non-irrigated agricultural fields. While the overall population density during the Xinglongwa period was low, the crowding of the much denser Lower Xiajiadian population into such a small portion of the regional land is significant.

On the other end of the spectrum are the population distributions of the Xiaoheyan and Upper Xiajiadian periods. They are the only periods in which a significant, and higher than expected, portion of the population resided in the grassland areas. During Upper Xiajiadian only 27.5% of the population lived in areas that are today used as irrigated and non-irrigated agricultural fields, while 67.7% of the population resided in grassland areas and ones of mixed dry fields and grass land (the combined area of these two categories is 59.5%). In between those two extremes are the Hongshan and Zhanguo-Han periods where population is especially dense on the mixed dry fields and grass land areas.

When the five major population concentrations of the Upper Xiajiadian period are removed from the

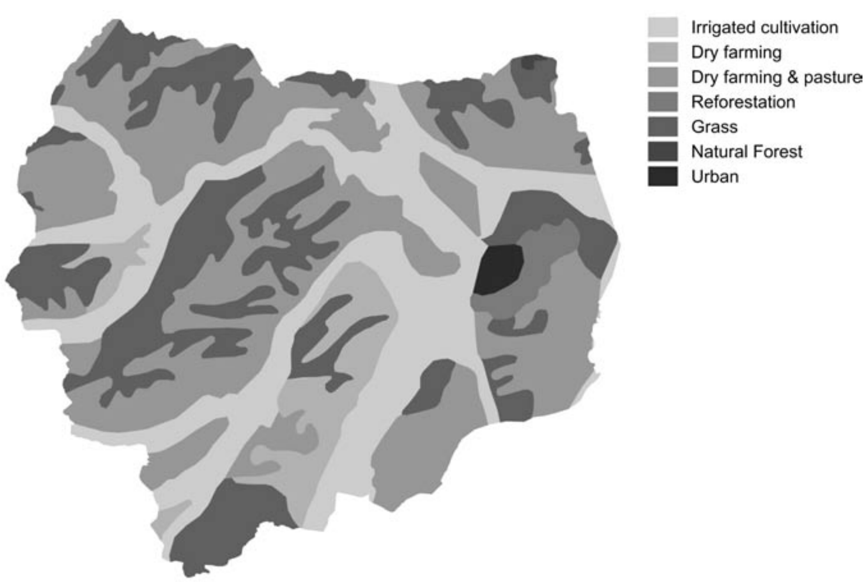
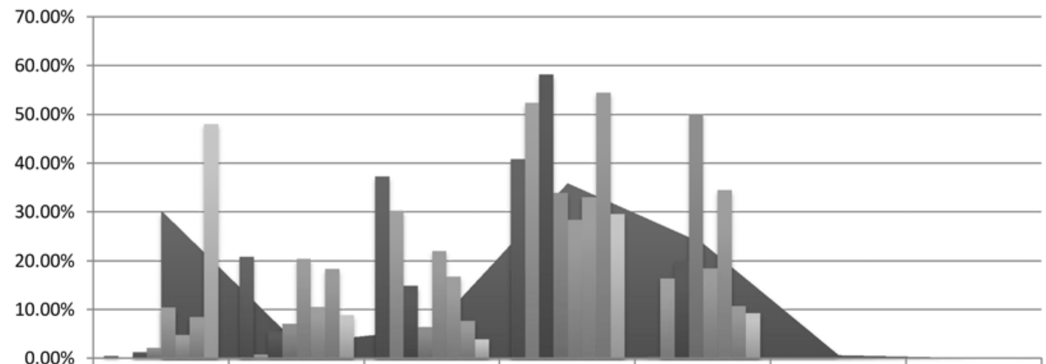
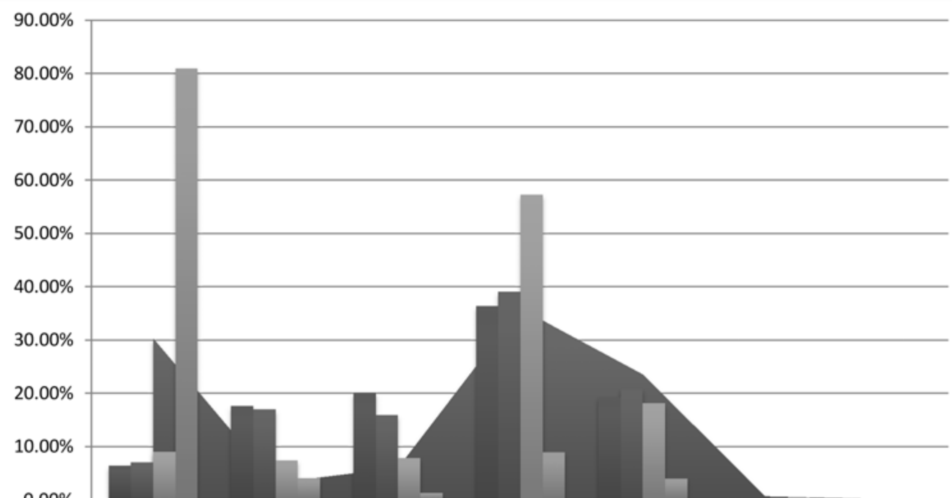


Figure 4.48. Modern land use zones. (Available online in color, see Appendix B.)



	Lowlands	Irrigated fields	Non irrigated fields	Mixed dry field and grass land	Grasslands	Human planted forests	Natural forests and Shrubs
Expected	30.36%	3.23%	6.05%	35.96%	23.58%	0.71%	0.10%
XLW	0.55%	20.87%	37.30%	40.86%	0.42%	0.00%	0.00%
ZBG	0.00%	0.80%	30.33%	52.41%	16.46%	0.00%	0.00%
HS	1.32%	5.56%	14.90%	58.21%	20.02%	0.00%	0.00%
XHY	2.24%	7.15%	6.44%	34.00%	50.17%	0.00%	0.00%
LXJD	10.48%	20.41%	22.06%	28.49%	18.54%	0.02%	0.00%
UXJD	4.89%	10.63%	16.83%	33.12%	34.53%	0.00%	0.00%
ZG-Han	8.55%	18.38%	7.73%	54.53%	10.82%	0.00%	0.00%
Liao	48.13%	8.90%	4.04%	29.62%	9.30%	0.00%	0.02%

Figure 4.49. Proportion of regional population on different modern land use zones. (Available online in color, see Appendix B.)



	Lowlands	Irrigated fields	Non irrigated fields	Mixed dry field and grass land	Grasslands	Human planted forests	Natural forests and Shrubs
Expected	30.36%	3.23%	6.05%	35.96%	23.58%	0.71%	0.10%
LXJD fortifications	6.45%	17.65%	20.15%	36.39%	19.32%	0.00%	0.00%
Small UXJD	7.06%	17.03%	16.00%	39.06%	20.85%	0.00%	0.00%
Small Liao	9.04%	7.49%	7.90%	57.32%	18.21%	0.00%	0.03%
Modern villages	80.99%	4.10%	1.38%	9.01%	4.06%	0.45%	0.00%

Figure 4.50. Proportion of population on modern land use zones for fortified Lower Xiajiadian sites, for Upper Xiajiadian sites excluding the larger towns, and for Liao excluding the Songshanzhou site. (Available online in color, see Appendix B.)

analysis (Fig. 4.50), the preference for grassland environment becomes less pronounced. However, even after such manipulation, 59.9% of the Upper Xiajiadian 'rural' population resided in grassland areas and ones of mixed dry fields and grassland, as compared to 47.0% of the population that lived in the same areas during the Lower Xiajiadian period. Such a comparison suggests that the differences in the environmental preferences between the Upper and the Lower Xiajiadian periods are not just an artifact of the pull of the large Upper Xiajiadian towns. It is also interesting to note that when Songshanzhou was taken out of the analysis of the Liao population, the preference of the Liao rural population is clearly for areas of mixed dry fields and grass land.

Geology

This layer is based on a 1:100,000 scale digitized map produced by the Inner Mongolian Institute for Computer Sciences. The main categories of this layer are 102 Holocene alluvium (mostly water-transported alluvium including gravel and scree), 104 Pleistocene alluvium (mostly aeolian loess but also sand and lake sediments), 105 Tertiary sandstone and mudstone, 106 Cretaceous sandstone and mudstone, 107 Cretaceous volcanic rock, 108 Jurassic volcanic rock, 119 Archaean (pre-Cambrian) metamorphic rock, 124 Jurassic porphyry, 125 Jurassic granite, and 126 Jurassic porphyry. The analysis based on this layer is focused on human utilization of rock, especially for the building of fortifications. Because of this human-oriented analysis it seems that the geological period of formation is less important than rock qualities. Therefore, in the analysis those categories are combined: 105+106 (sandstone and mudstone); 107+108 (volcanic rock); 124+126 (porphyry) (Fig. 4.51). Because we concluded that the valley floors were covered with alluvium and therefore rock was not exposed there for human collection, the map of the valley floors was overlaid on the geological map to exclude this area from the calculations of the relative size of each zone.

Analysis of the percentage of settled area and of the population in each geological category was used to suggest important activities that are otherwise not visible, such as the procurement of stone for construction. This is especially relevant for our understanding of Lower Xiajiadian fortifications whose walls were partly built of collected stone (Shelach, Raphael, and Jaffe 2011). A clear association was expected between these sites and certain kinds of stones, suggesting that the motivation for selection of certain locations had to do with proximity to favorable raw materials.

As can be expected during most periods the preferred locations are those of Holocene and Pleistocene alluvium (categories 102 and 104), or the best arable lands (Fig. 4.52). Also expected is the association between Lower Xiajiadian fortification and outcrops of rock; 41.3% of these sites are found in areas with volcanic rock (category 107+108 which takes up 20.5% of the survey area) and 18.5% in areas with mudstones (categories 105+106; taking up just 4.6% of the survey area) (Fig. 4.53). It is possible that those stones were most suitable for the construction of the fortifications and therefore proximity to them was an important consideration.

In contrast to all other periods in the Chifeng sequence, the settlement of the Xiaoheyan and Upper Xiajiadian periods does not favor alluvial soils. Only 25.0% of the Upper Xiajiadian population is located on Pleistocene alluvium and an additional 6.5% is located on Holocene alluvium, as compared to 40.0% and 9.7%, respectively, during the

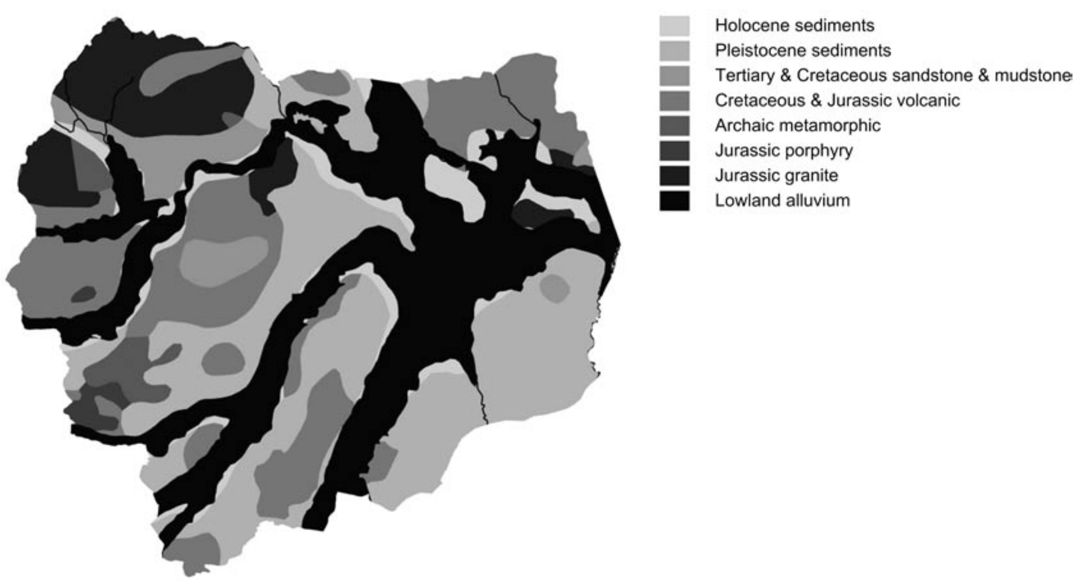
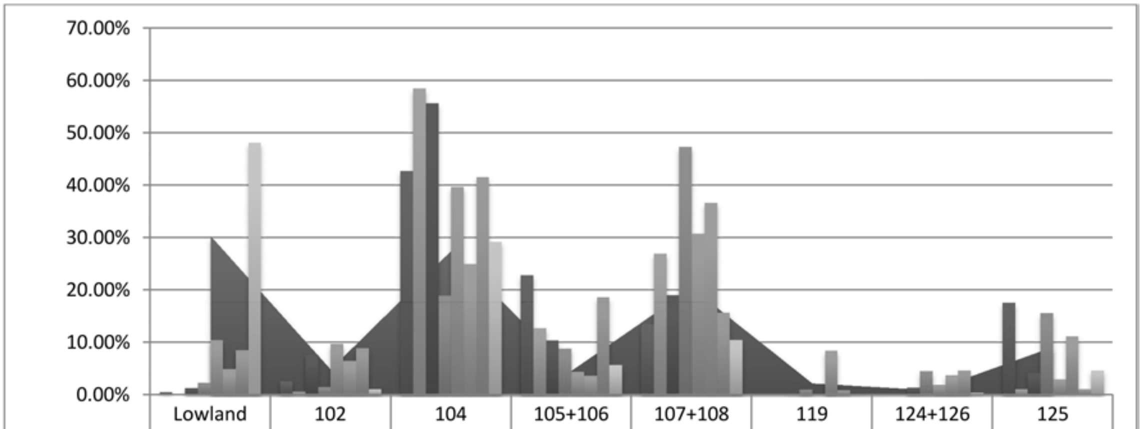
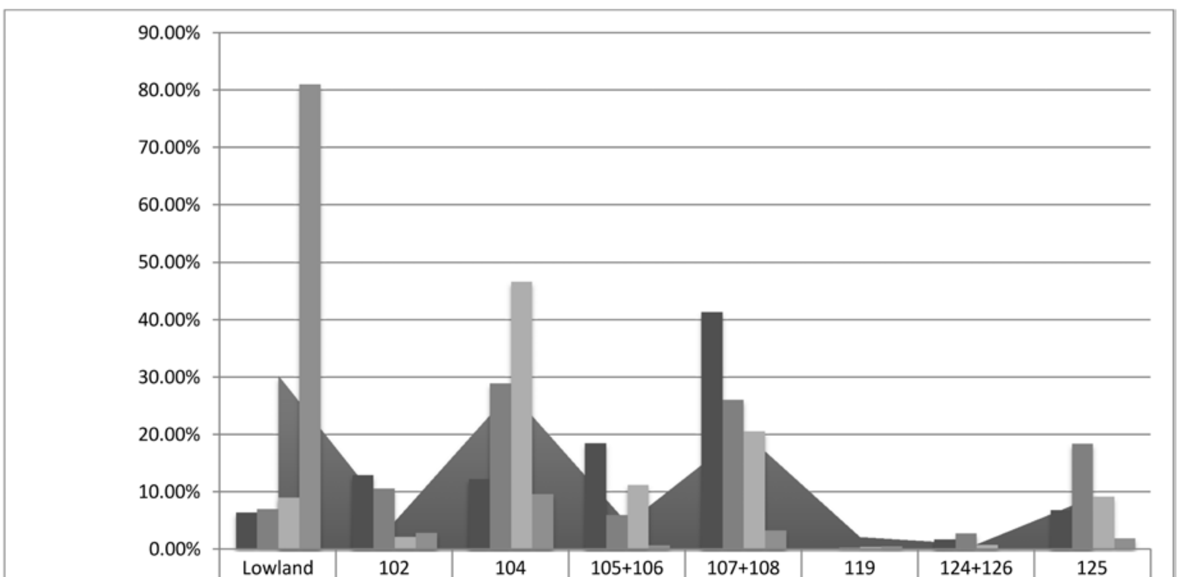


Figure 4.51. Geology. (Available online in color, see Appendix B.)



	Lowland	102	104	105+106	107+108	119	124+126	125
Expected	30.38%	4.85%	27.48%	4.59%	20.48%	2.17%	0.90%	9.15%
XLW	0.55%	2.68%	42.78%	22.89%	13.54%	0%	0.00%	17.56%
ZBG	0.00%	0.65%	58.50%	12.80%	26.96%	0.00%	0.00%	1.09%
HS	1.32%	7.64%	55.71%	10.42%	19.00%	0.33%	1.37%	4.21%
XHY	2.24%	1.54%	18.90%	8.88%	47.30%	1.00%	4.53%	15.60%
LXJD	10.48%	9.69%	39.68%	4.46%	30.75%	0.06%	1.88%	3.00%
UXJD	4.89%	6.46%	24.98%	3.68%	36.65%	8.44%	3.74%	11.23%
ZG-Han	8.55%	8.91%	41.59%	18.59%	15.73%	0.91%	4.59%	1.13%
Liao	48.12%	1.10%	29.24%	5.70%	10.52%	0.23%	0.41%	4.68%

Figure 4.52. Proportion of regional population on different geological zones. 102=Holocene alluvium; 104=Pleistocene alluvium; 105+106=Tertiary and Cretaceous sandstone and mudstone; 107+108=Cretaceous and Jurassic volcanic rock; 119=Archaean (pre-Cambrian) metamorphic rock; 124+126=Jurassic porphyry; 125=Jurassic granite. (Available online in color, see Appendix B.)



	Lowland	102	104	105+106	107+108	119	124+126	125
Expected	30.38%	4.85%	27.48%	4.59%	20.48%	2.17%	0.90%	9.15%
LXJD fortifications	6.45%	12.93%	12.21%	18.52%	41.29%	0.00%	1.70%	6.89%
Small UXJD	7.05%	10.57%	28.89%	6.01%	26.01%	0.32%	2.76%	18.38%
Small Liao	9.03%	2.15%	46.65%	11.17%	20.59%	0.44%	0.80%	9.17%
Modern villages.	80.99%	2.89%	9.65%	0.68%	3.30%	0.50%	0.11%	1.88%

Figure 4.53. Proportion of population on different geological zones for fortified Lower Xiajiadian sites, for Upper Xiajiadian sites excluding the larger towns, and for Liao excluding the Songshanzhou site. (Available online in color, see Appendix B.)

Lower Xiajiadian period. The most favored environments, during this period are ones with volcanic rock (category 107+108; 36.6% of the settlement density on 20.5% of the land), Archaean metamorphic rock (category 119; 8.4% of the population on 2.2% of the land), and porphyry (category 124+126; 3.7% of the population on 0.9% of the land) (Figure 4.4.10). This rock was used for the construction of Upper Xiajiadian graves. However, the burden of such work is not as heavy as the burden imposed by the construction of defensive walls during Lower Xiajiadian, so this association cannot be used to explain the observed pattern. However, when the five large Upper Xiajiadian towns are taken out of the analysis the patterns are quite different and show preferences for alluvial soils, volcanic rock, and Jurassic granite rock (Figure 4.53). Again, the location of the large towns would seem to pull the Upper Xiajiadian settlements away from the best arable land and into the rocky mountainous areas.

Chapter 5

Sequence of Social Change

Regional settlement analysis can only be brought to its conclusion by placing the broad patterns of settlement distribution as they change through time into context with other classes of archaeological information—classes of information that come from other kinds of fieldwork such as the excavation of public and residential structures, burials, etc. This chapter follows the classic pattern of pursuing that effort through the entire sequence from the earliest Neolithic remains to the relatively recent historic period with which the Chifeng Project ended its collection of settlement data.

Xinglongwa (6000–5250 BCE)

Remains dating to Xinglongwa times were not abundant; no one location produced more than a few Xinglongwa sherds. Collection units with Xinglongwa material were, nonetheless, found close to the northern, eastern, southern, and western extremes of the study area, as well as through its central sector (Fig. 5.1). Bluff edge locations just above sections of valley floor are clearly favored, especially southeastward-facing ones. This is certainly a favorable location for agriculture, warmth, and shelter from wind, but it would also probably have been favorable for hunting and plant gathering.

Some Xinglongwa collection units occur singly, representing only a very few sherds far from the nearest other collection unit with contemporaneous material. Such collection units probably do not represent local communities of much size at all, but more likely single-family homesteads or only a very few families living together, not necessarily throughout the entire time span of the period. In a few locations, several collection units with Xinglongwa sherds can be clustered together into small local communities, based on the peaks seen in the unsmoothed density surface (Figs. 5.2 and 5.3). Two of these clusters (one in the northeastern corner of the study area and one in the northwestern corner) extend across a distance of around 2 km, which is large for a community described as "local." These could be divided into subunits, but given the large empty spaces that surround them; it is this level of clustering that most strongly calls out for attention. At approximately 2 km across, and with apparently quite small populations and no nearby neighbors, it seems more accurate to identify these as dispersed local communities rather than supra-local communities or districts. Elsewhere in the study area there are a few pairs of noncontiguous but nearby occupation areas that have been clustered together as small local communities, and a slightly more inclusive clustering criterion (that is, a lower cutoff contour) would have caused another one or two such clusters to form. As the clustering is shown in (Fig. 5.3), there is a total of 19 settlement units, probably ranging from single-family homesteads up to a few very small dispersed hamlets (Fig. 5.4). The largest of these has an estimated population of 25–50, so the entire population of the survey area lived in very small local communities—ones that might be labeled hamlets at most—although it is possible that some of these communities might represent slightly more populous settlements lasting for only a part of the time span of the period. The overwhelming majority of the Xinglongwa population appears to have lived in local communities consisting of a few families (Fig. 5.5). If a lower cutoff contour had been chosen for clustering, the total number of settlement units would have decreased by only one or two, and they would still range from single-family homesteads up to a very few small dispersed hamlets; the overall patterns in the histograms in Figs. 5.4 and 5.5 would not have changed appreciably. The total Xinglongwa population of the survey area is estimated at 100–200. Since this is an estimate of the average momentary population during Xinglongwa times, the real population at some moments during the period would have been higher and at others, lower.

No convincing clustering at the regional scale defines supra-local communities for Xinglongwa. The several small clusters of collection units definable from the unsmoothed surface are more like dispersed small local communities than districts, as noted above. The smoothed density surface (Fig. 5.6) for the most part does not suggest any additional clustering of settlement units. The only possibility would be to delineate a three-peaked cluster in the southern part of the survey zone, composed of one small local cluster of two occupation areas and two small contiguous zones of occupation. These very small settlement units, however, are so distant from each other that to group them in this way would seem very artificial. Not surpris-

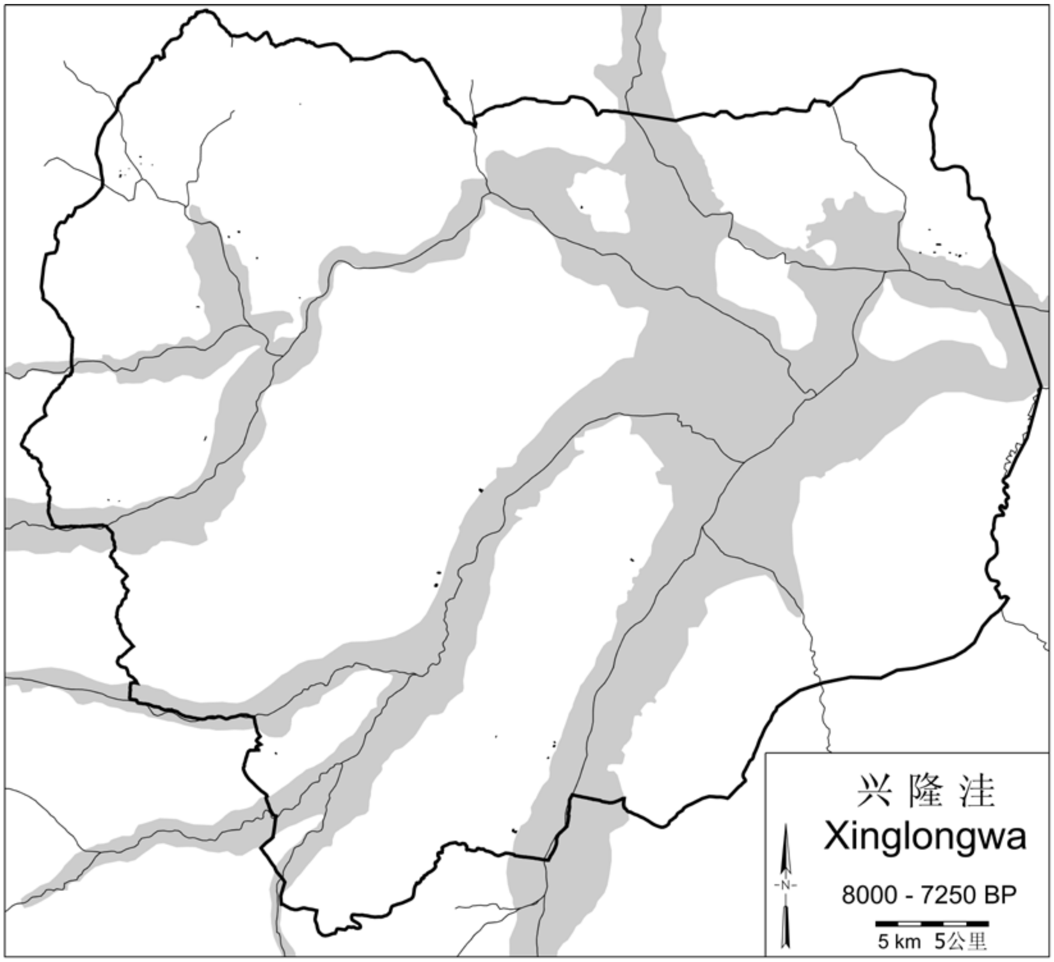


Figure 5.1. Distribution of Xinglongwa period ceramics in the Chifeng survey area. (Available online in color, see Appendix B.)

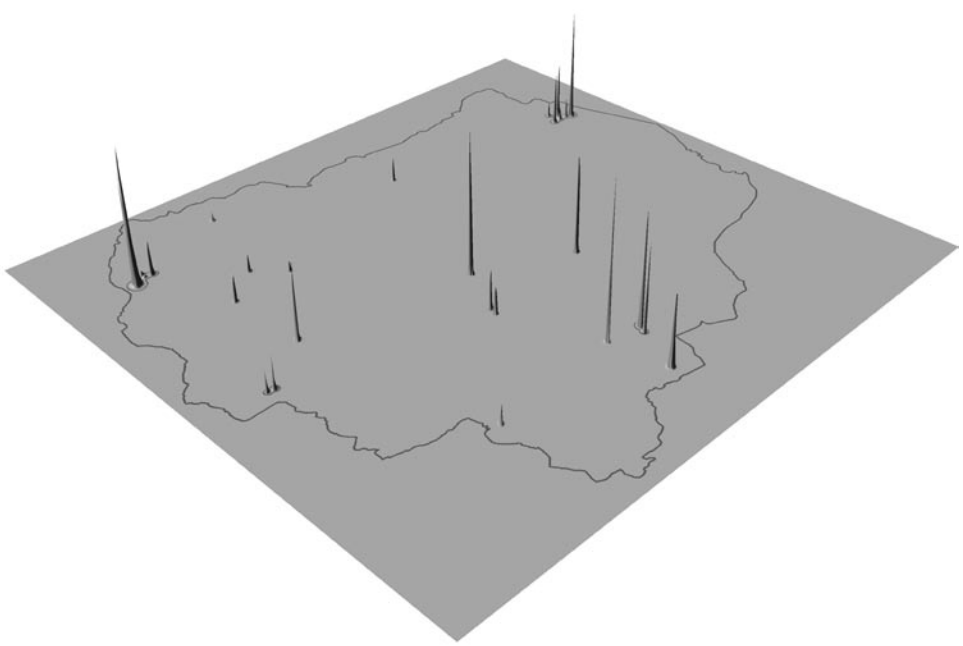


Figure 5.2. Unsmoothed density surface for Xinglongwa occupation. (Available online in color, see Appendix B.)

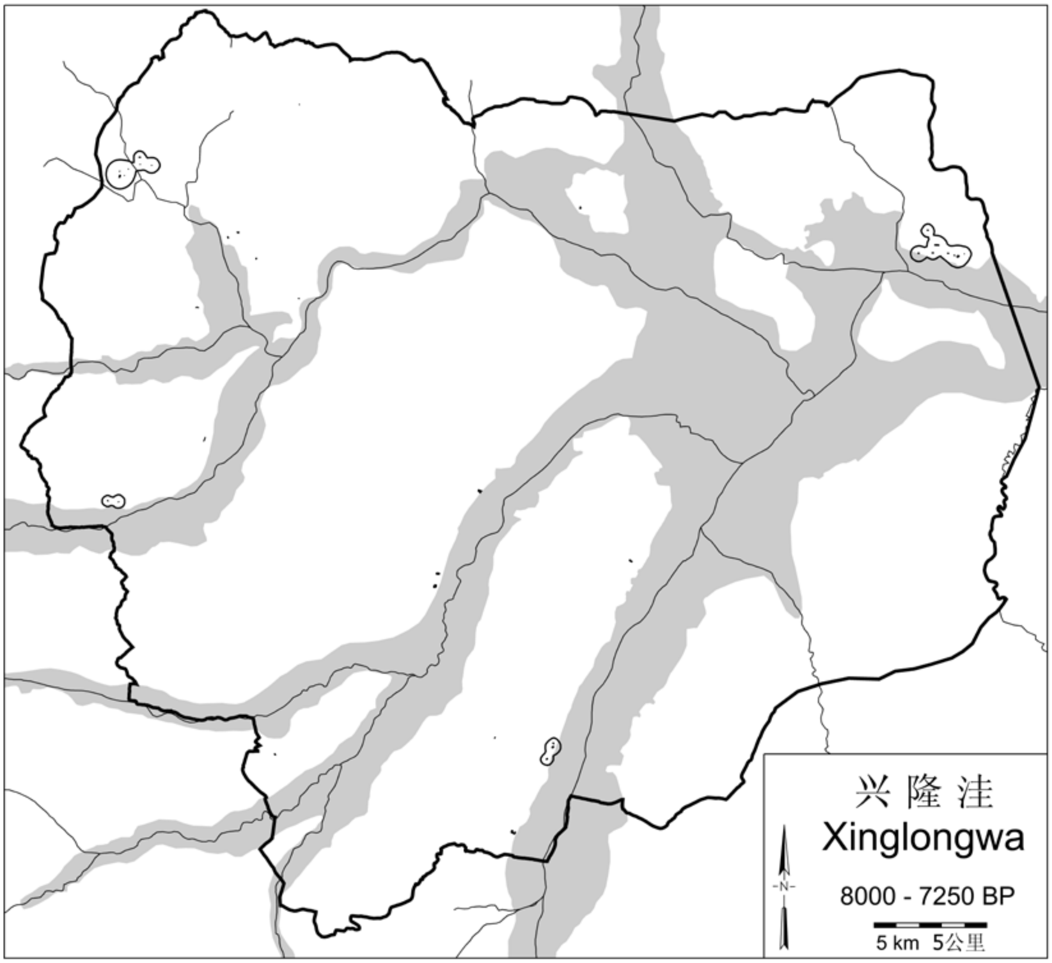


Figure 5.3. Delineation of Xinglongwa local communities by cutoff contour from the unsmoothed density surface (Fig. 5.2). (Available online in color, see Appendix B.)

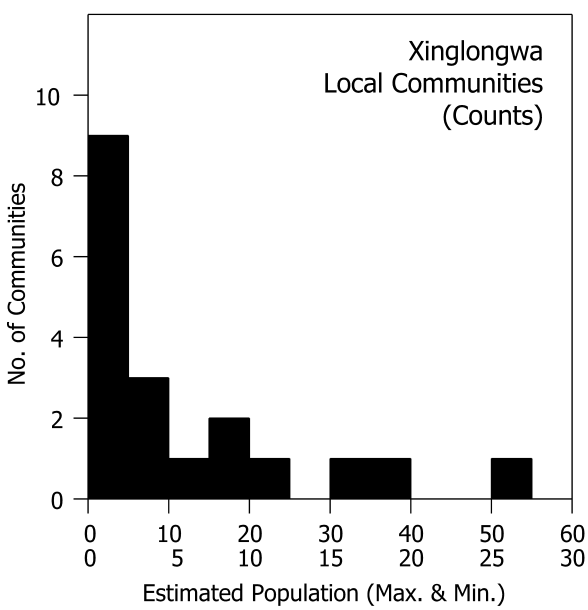


Figure 5.4. Histogram of Xinglongwa local communities by number of communities in each population range.

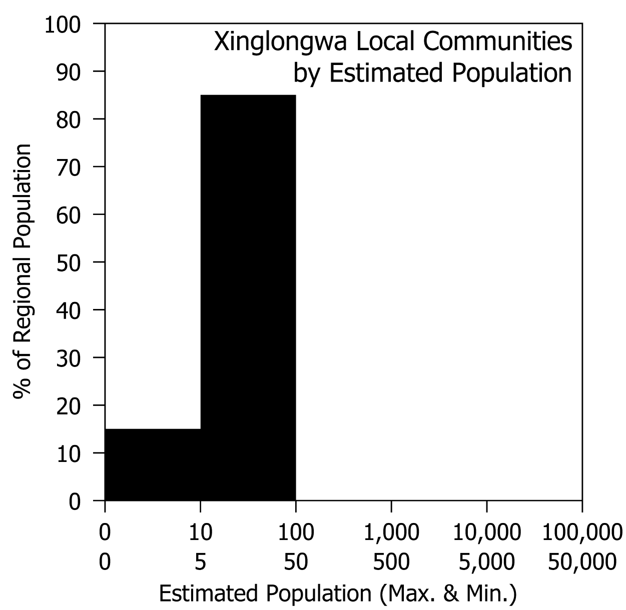


Figure 5.5. Histogram of Xinglongwa local communities by percent of regional population in each population range.

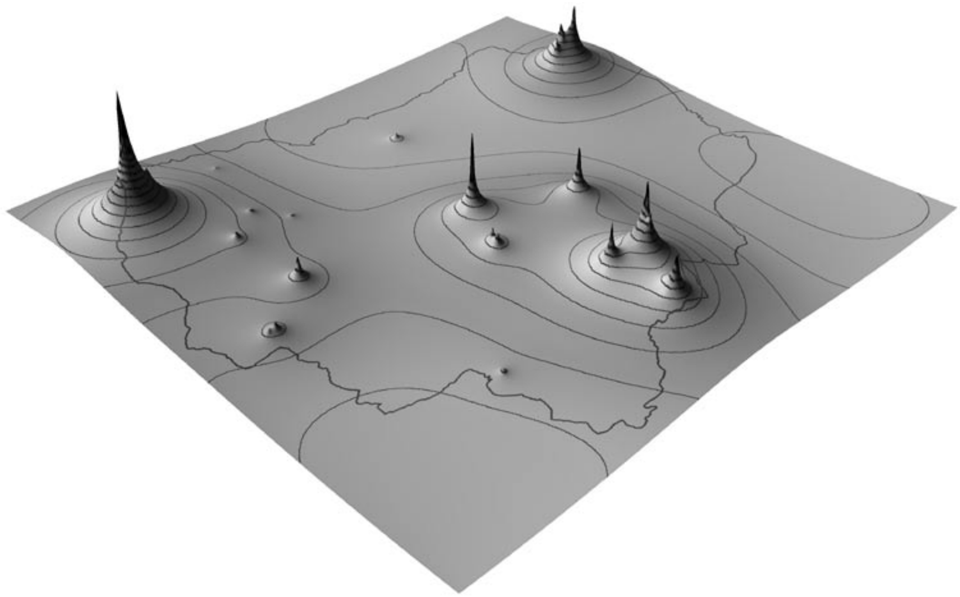


Figure 5.6. Smoothed density surface for Xinglongwa occupation. (Available online in color, see Appendix B.)

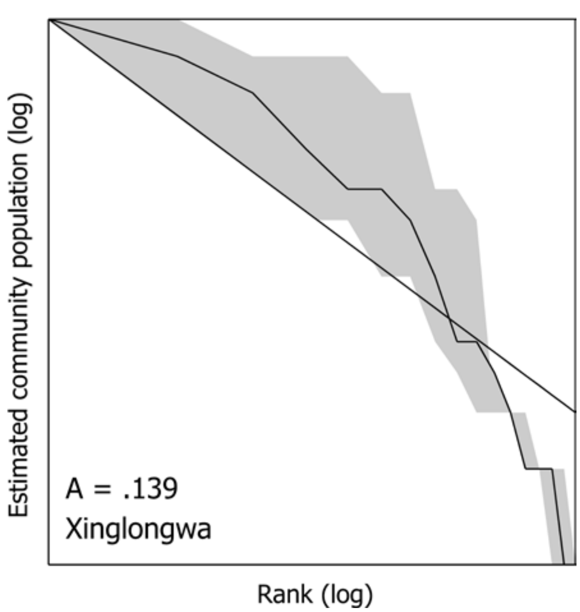


Figure 5.7. Rank-size graph for Xinglongwa local communities (error range for 90% confidence).

ingly, the rank-size plot for Xinglongwa local communities is convex (*A* = .139, Fig. 5.7), as one would expect for a period in which communities dispersed through a region were certainly in contact with each other but not politically or economically centralized or integrated.

During the earlier part of the Xinglongwa period, conditions were warmer and substantially wetter than at present, with temperatures averaging 2–4°C higher than today (Chapter 3.2). At the beginning of the period, then, the valley floors would have been especially inhospitable for settlement because they would not have been as well drained as they are now and flooding would have been a more severe concern. Wild plant and animal resources of these wetter valley floors might have been rich, but the wetter conditions might have discouraged valley floor cultivation. The uplands would have been forested, with substantial wild resources. They would also have provided the most attractive locations for cultivation, once forest vegetation was cleared. Wetter conditions would have meant less risk of upland crop failure from drought than today. After 5800–5600 BCE, a cooling and drying trend brought temperature and precipitation closer to modern conditions, and valley floors might have been more hospitable to human use.

Systematic analysis of the distribution of Xinglongwa settlement with respect to environmental variables (Chapter 4.4) confirms the initial observation that valley-margin locations were strongly favored, especially ones facing east and southeast. Since population levels were so very low and occupation was so dispersed, Xinglongwa inhabitants of the survey area would have enjoyed great abundance of resources, and would have had a wide range of options for settlement location, unconstrained by the choices others had made about where to live. The overwhelming majority of Xinglongwa occupations are located on land today largely used for agriculture. As noted above, however, wetter conditions during much of the Xinglongwa period would have made cultivation of lower-lying land less feasible, and the wild resources of these zones may have been the main attraction. Excavated Xinglongwa sites have previously suggested a pattern of sedentary village life, with reliance on domesticated and wild resources. The importance of hunting is indicated by the abundance of wild animal bones, especially deer and boar (Zhongguo 1997b), found on the floors of Xinglongwa houses and in storage/refuse pits. Direct evidence for the cultivation and consumption of domesticated common millet (*Panicum miliaceum*) has recently been excavated from the Xinglonggou site (Fuller, Harvey, and Qin 2007:326; Zhao 2004). The collecting of wild plants likely continued alongside the cultivation of domesticated ones, although detailed data on Xinglongwa period plant remains have not yet been published. The distribution of Xinglongwa settlement in the Chifeng region is entirely consistent with this picture of a subsistence strategy focused on a mix of domesticated plants and animals to which wild plant collecting and hunting still made substantial contributions. Some quite large village communities are known from Xinglongwa times, such as Baiyinchanghan, Nantaizi, Xinglonggou, and Chahai (Liaoningsheng 1988, 1994; Neimenggu 1993, 1997; Yang and Liu 1997; Zhongguo 1997b), but the absence of any sizable compact village settlements in the Chifeng survey area shows that much of the Xinglongwa population lived in very small hamlets or even single-family homesteads.

Zhaobaogou (5250–4500 BCE)

Zhaobaogou ceramics are considerably more abundant in the Chifeng survey area than Xinglongwa ones. They occur at more different locations and at higher densities. The total average momentary population of the survey area is estimated at 700–1,300 inhabitants (some seven times the Xinglongwa population estimate). The population trend, then, in a long-term average sense, was clearly upward. The result was a substantially larger number of people living in the Chifeng survey area, although the period of time involved was so long that no population "explosion" need be imagined. Despite this demographic growth, the Zhaobaogou population was still very small and scattered, probably representing a regional density of 1 person per km^2 or less. Although occupation is again widespread across the survey area (Fig. 5.8), a good bit of shifting has occurred. Zhaobaogou remains are especially abundant in the central sector of the survey zone, where very little Xinglongwa material occurred. Bluff edge locations just above sections of valley floor are still favored, especially southeastward-facing ones, and upland locations relatively far from the valley floor edges also seem more used than before.

The unsmoothed density surface suggests clustering only a very few nearby pairs of Zhaobaogou collection units into single local communities (Figs. 5.9 and 5.10). There is no indication of the kind of dispersed groupings identified for Xinglongwa. Local communities in Zhaobaogou times were apparently more nucleated and demographically larger. The largest is estimated at 150–300 inhabitants; several may have been in the 50–100 range (Fig. 5.11). The smallest were probably still only single-family homesteads. Altogether there were about 28 settlement units. The trend in the survey area, then, is toward living in larger local communities—ones that might now be labeled villages. Most of the population lived in these villages (Fig. 5.12).

As in Xinglongwa, there is no convincing clustering in the smoothed density surface to define supra-local communities for Zhaobaogou (Fig. 5.13). The rank-size plot for Zhaobaogou local communities is basically convex (A = .025, Fig. 5.14) although not as strongly different from log-normal as in Xinglongwa times. This is largely the result of a single larger village in the east-central sector of the survey area, but there is no sign that smaller communities are drawn toward this village, as we would expect if its greater size reflected a role in regional centralization. Patterns of community organization, then, did not change dramatically from Xinglongwa to Zhaobaogou times. More people lived in somewhat larger and more numerous villages than before. The inhabitants of these villages were, of course, in contact with each other and shared the same culture, but nothing indicates the emergence of centralized patterns of regional-scale organization.

Zhaobaogou communities in the Chifeng survey area existed under climatic conditions much like those established during the latter part of the Xinglongwa period (Chapter 3.2). It was substantially warmer and wetter than it is today. As in early Xinglongwa times, the valley floors would have been inhospitable for settlement or cultivation but rich in wild plant and animal resources. Upland forests provided wild resources and could have been cleared for cultivation at considerably less risk from drought than today.

Systematic analysis of the distribution of Zhaobaogou settlement with respect to environmental variables (Chapter 4.4) confirms the initial observation that valley-margin locations were strongly favored, especially ones facing east. Population levels were still far below the number of people who could easily have been supported on the region's agricultural and wild food resources. Zhaobaogou inhabitants of the Chifeng region, then, continued to enjoy considerable subsistence abundance, and their options for settlement location continued to be quite open. As in Xinglongwa times, the overwhelming majority of Zhaobaogou occupations were located on land today largely used for agriculture, although the lower-lying farmland in particular was less favored. This makes good sense in light of the climatic observation above that continued high precipitation levels would have made this low-lying land much less suitable for cultivation than it is today. An increased amount of occupation in upland locations up to

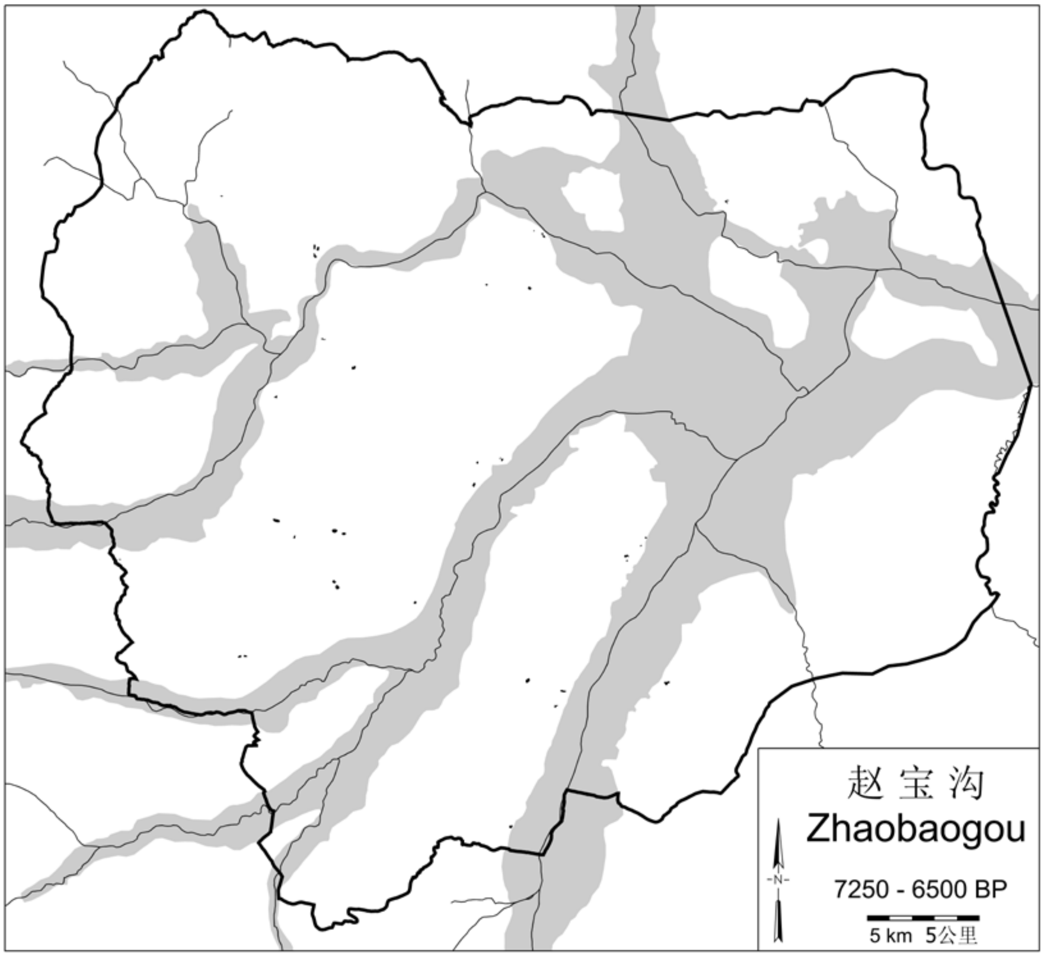


Figure 5.8. Distribution of Zhaobaogou period ceramics in the Chifeng survey area. (Available online in color, see Appendix B.)

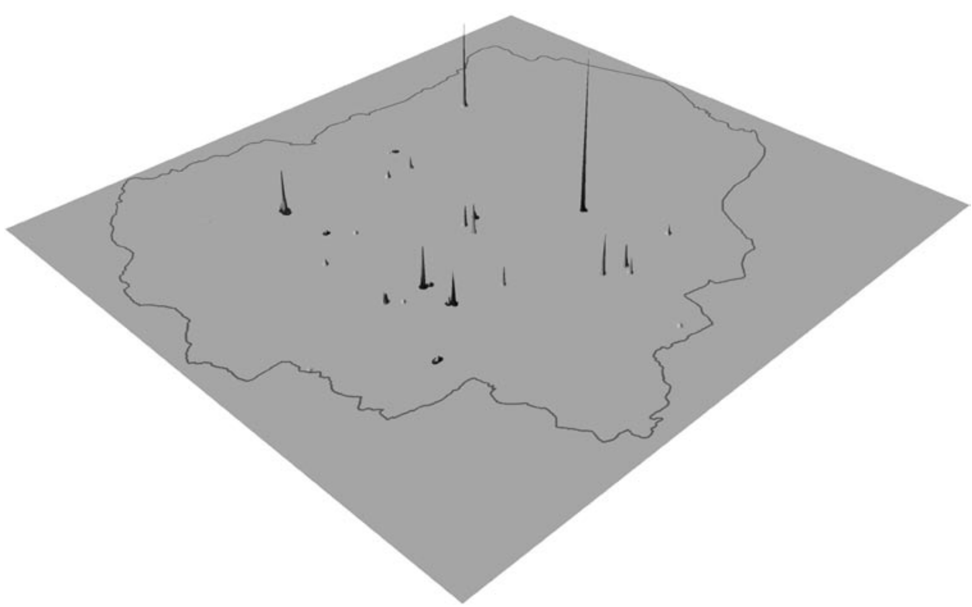


Figure 5.9. Unsmoothed density surface for Zhaobaogou occupation. (Available online in color, see Appendix B.)

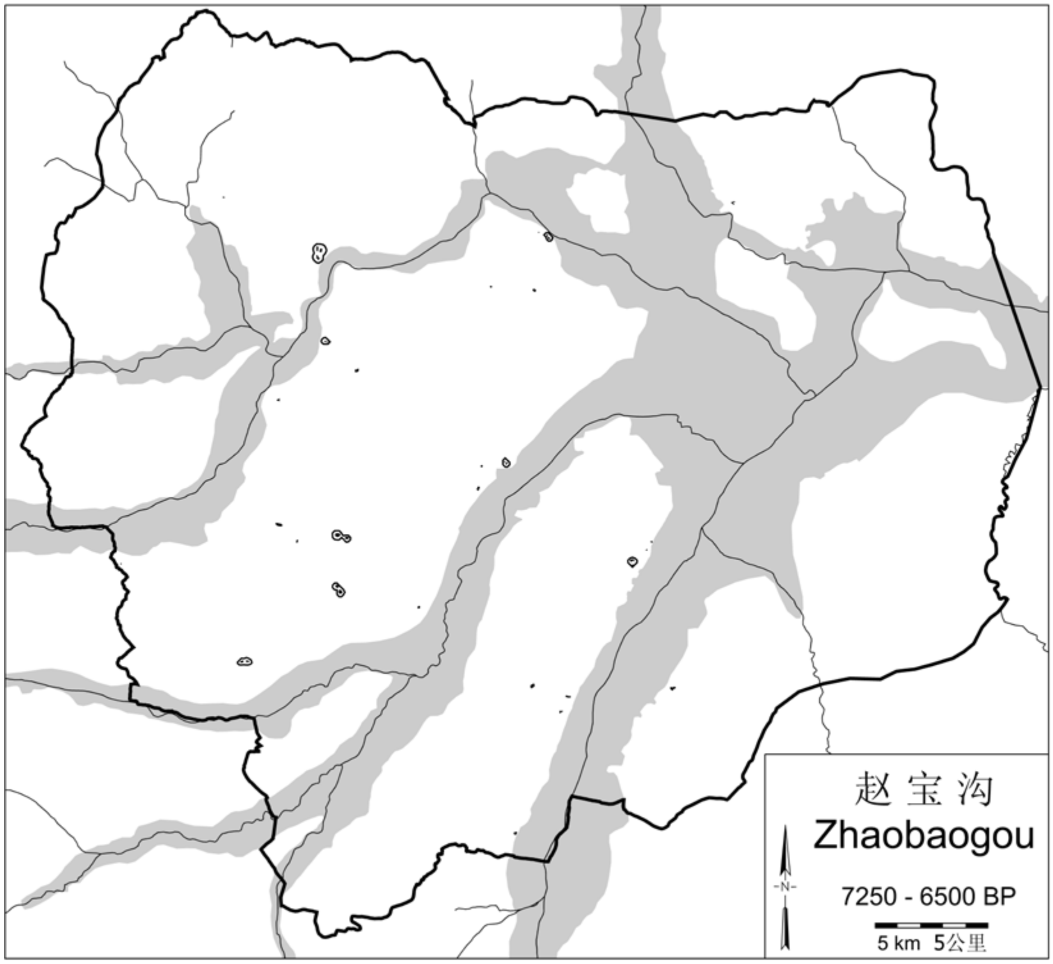


Figure 5.10. Delineation of Zhaobaogou local communities by cutoff contour from the unsmoothed density surface (Fig. 5.9). (Available online in color, see Appendix B.)

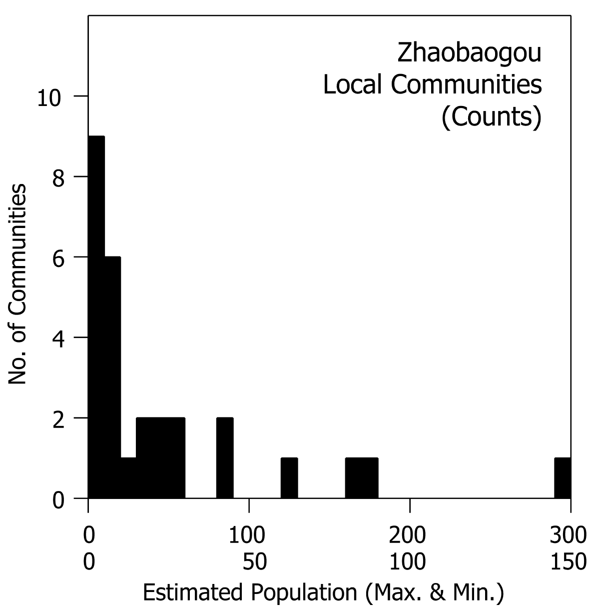


Figure 5.11. Histogram of Zhaobaogou local communities by number of communities in each population range.

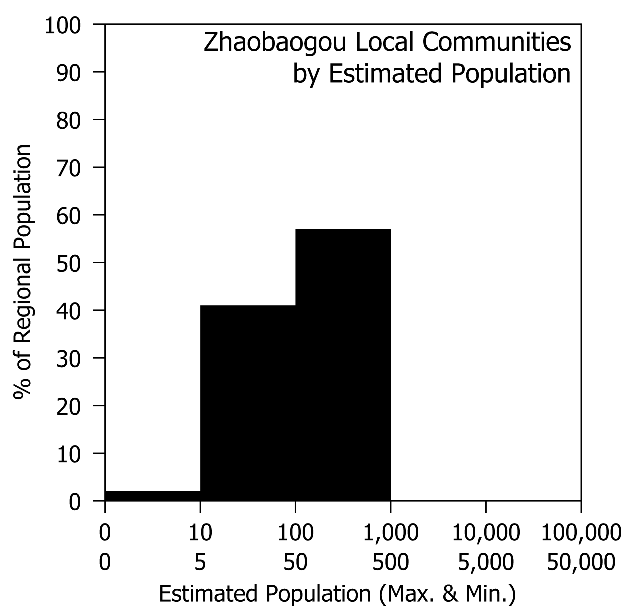


Figure 5.12. Histogram of Zhaobaogou local communities by percent of regional population in each population range.

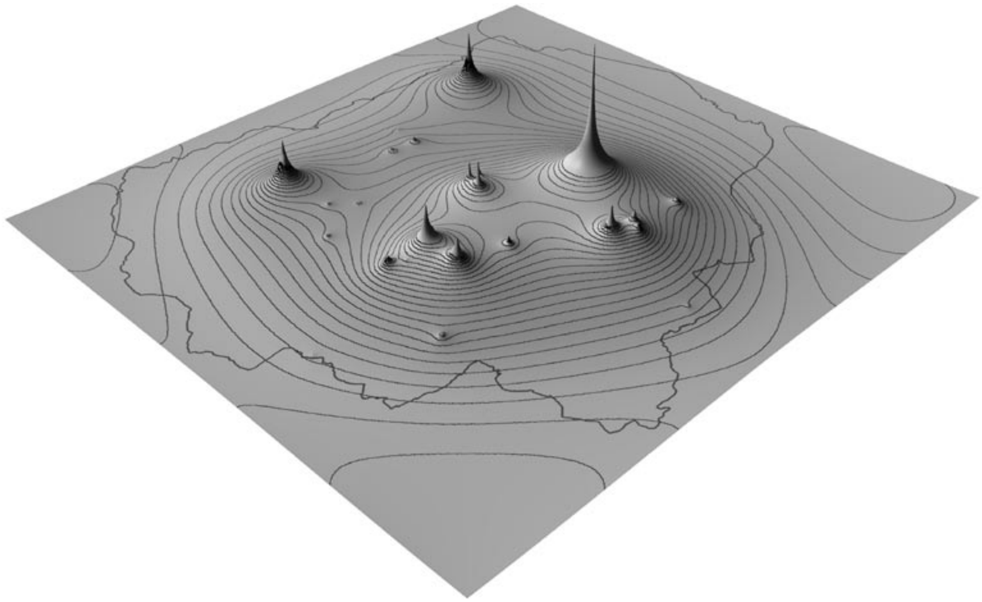


Figure 5.13. Smoothed density surface for Zhaobaogou occupation. (Available online in color, see Appendix B.)

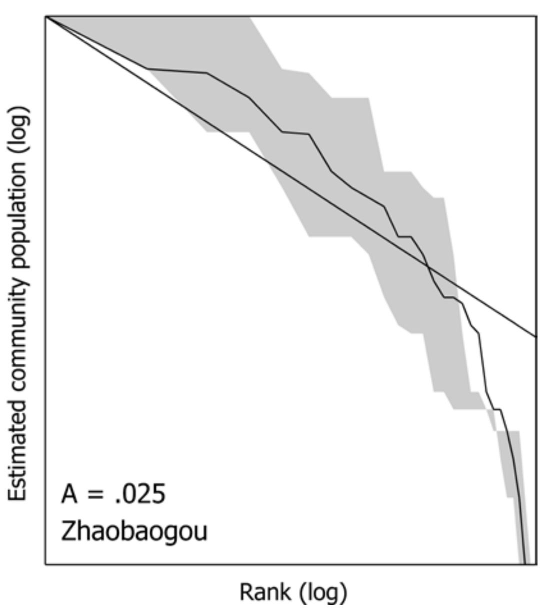


Figure 5.14. Rank-size graph for Zhaobaogou local communities (error range for 90% confidence).

several kilometers from the valley floors would have been greatly facilitated by the higher precipitation levels, which would have made access to water better in such locations, enhanced the reliability of cultivation, and enriched wild resources well back from the valley as well. Excavated Zhaobaogou sites have previously suggested a pattern of sedentary village life, with reliance on domesticated animals (especially pigs) and grains as well as wild resources (Shelach 2000; Zhongguo 1997a). The distribution of Zhaobaogou settlement in the Chifeng region is entirely consistent with this picture of a subsistence strategy still focused on a mix of domesticated plants and animals to which wild plant collecting and hunting made substantial contributions. The Chifeng survey results now include several substantial, fairly compact local communities similar to the Zhaobaogou village site and others that have been excavated (Shelach 2006; Zhongguo 1997a). While tiny hamlets and single-family homesteads apparently continued to exist, the kind of village life seen at the small number of sites that have been excavated extensively had become the norm by Zhaobaogou times. Small stone sculptures, ceramic figurines, ceramics decorated with fantastic animal motifs, and remains of structures taken to be of ritual use, all from excavated sites dating to Zhaobaogou times, testify to religious activities (Chengde 1994:61–63; Shelach 2000:389–394; Zhongguo 1987, 1997a:127).

Hongshan (4500–3000 BCE)

Hongshan sherds are found at many more locations than Zhaobaogou materials are in the Chifeng survey area (Fig. 5.15). The total Hongshan population of the survey area is estimated at 2,300–4,600 (some three times the

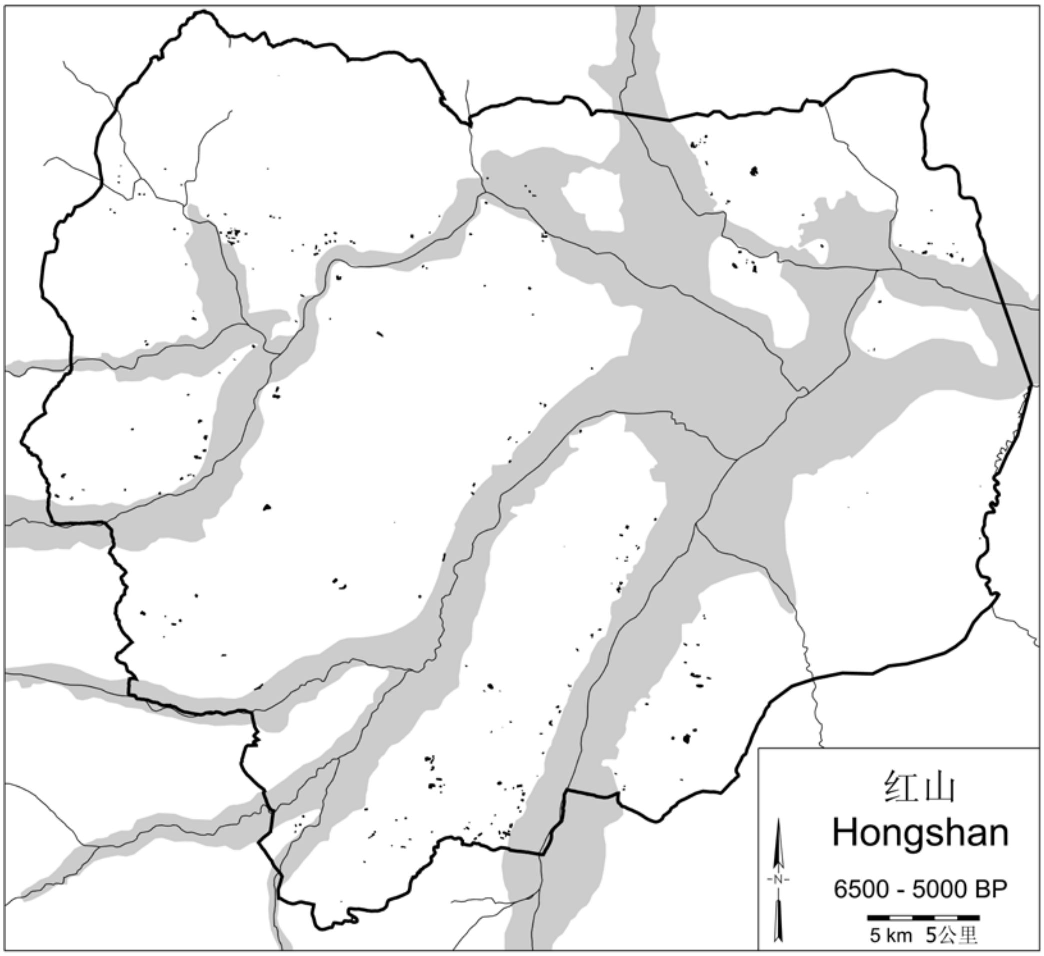


Figure 5.15. Distribution of Hongshan period ceramics in the Chifeng survey area. (Available online in color, see Appendix B.)

Zhaobaogou population). The most intensively studied set of Hongshan period ceramics for the region (those from Fushanzhuang [Peterson 2006]) appear to date mostly to the middle and late phases of the period, as do excavated Hongshan sites close to the Chifeng study area. This suggests that population levels may have remained rather low through the early part of the Hongshan period and increased in middle to late Hongshan times, although early and late Hongshan materials were not distinguished in analysis of the survey collections. Since the population estimates average the occupation found across the entire duration of the period, the maximum Hongshan population (perhaps at the end of the period) was probably higher than this momentary average estimate. Settlement distribution is again throughout the survey area. Bluff edge locations (especially southeast-facing ones) just above sections of valley floor are still favored, along with upland locations. Uplands adjacent to the linear river valleys are popular, as are the northern margins of the large Chifeng basin in the east-central sector of the survey area. These northern margins seem especially settled in Hongshan times, compared to several other periods when they see little occupation.

Local community structure is strong in the unsmoothed density surface (Figs. 5.16 and 5.17). A number of tall population peaks represent tight clusters of collection units with high densities of Hongshan period sherds. These clusters are usually only a few hundred meters across at most, a scale at which the classic definition of a local community composed of residents in face-to-face interaction on a daily basis seems quite applicable. Of the 156 local communities, about three-quarters may consist of only one or two families. Of the one-quarter that are larger than one- or two-family homesteads, about half are villages in the range of 50–100 inhabitants or more (Fig. 5.18). The largest local community is estimated at 200–400, which, although larger than earlier settlements known for the Chifeng survey area, is within the range estimated for Xinglongwa and Zhaobaogou villages elsewhere in northeast China as well as Early Yangshao villages in the middle Yellow River valley. Very early Neolithic villages are often in this size range or larger, even when little evidence of social hierarchy is present (as in the Levant and the U.S. Southwest). Within the Chifeng survey area, though, Hongshan local communities continue a trend toward living in larger local communities. Even though villages are somewhat larger than

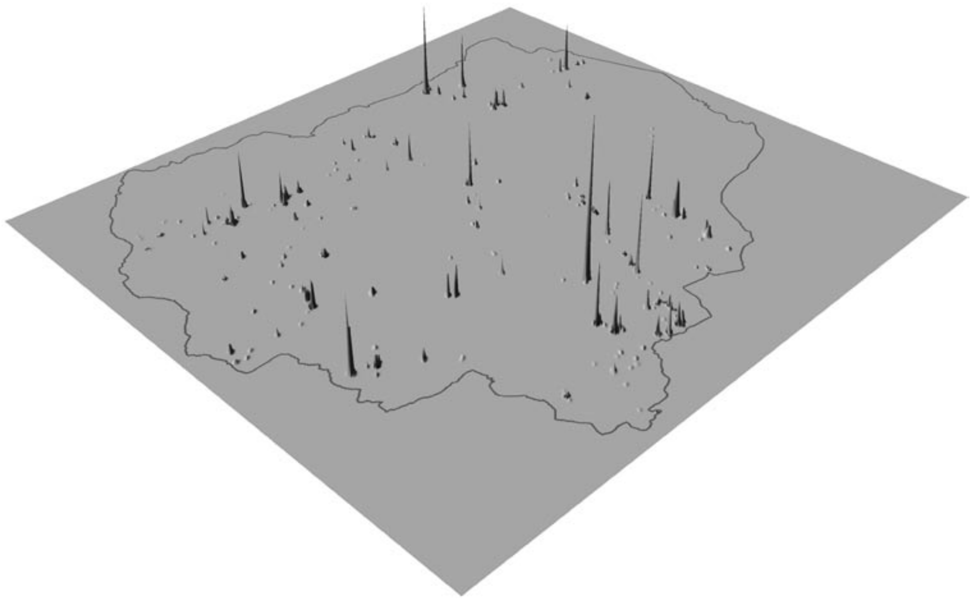


Figure 5.16. Unsmoothed density surface for Hongshan occupation. (Available online in color, see Appendix B.)

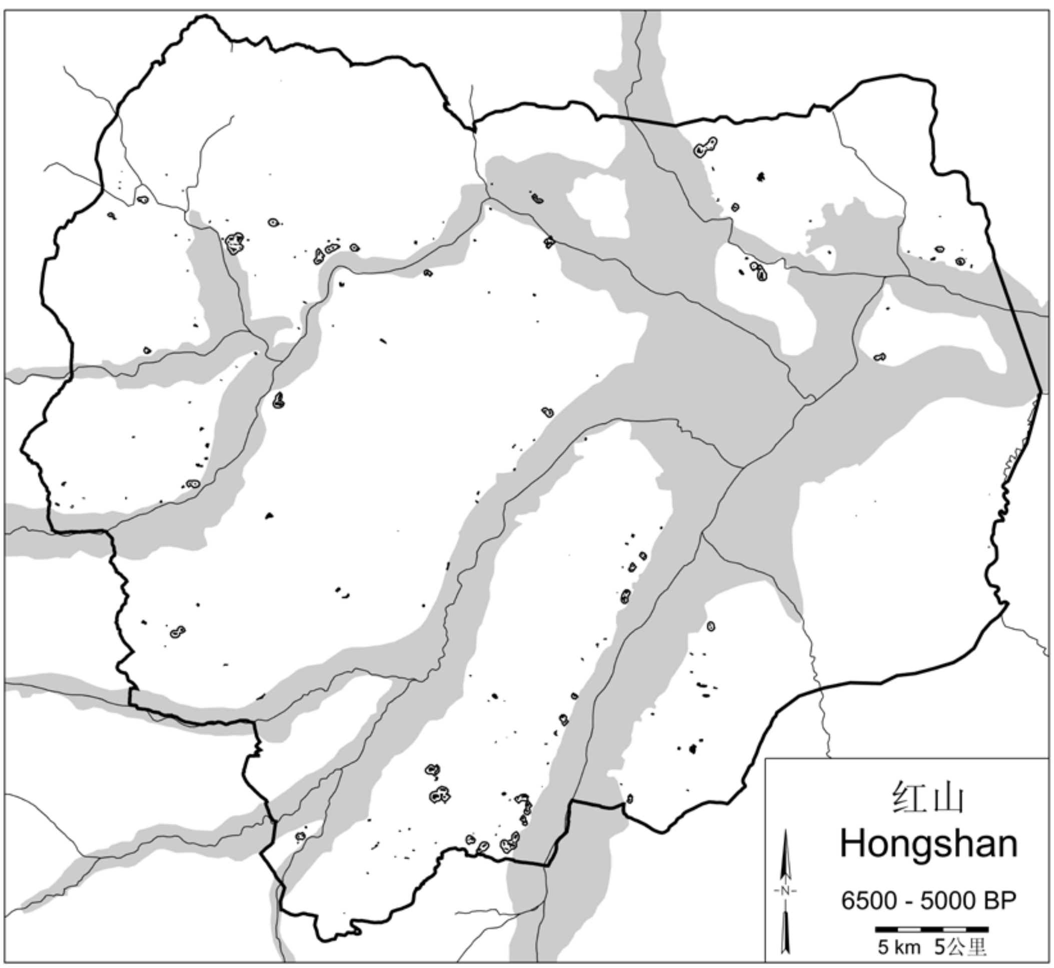


Figure 5.17. Delineation of Hongshan local communities by cutoff contour from the unsmoothed density surface (Fig. 5.16). (Available online in color, see Appendix B.)

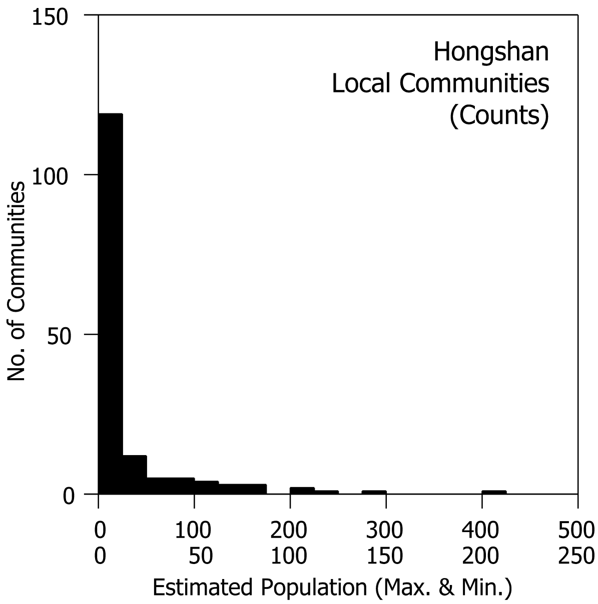


Figure 5.18. Histogram of Hongshan local communities by number of communities in each population range.

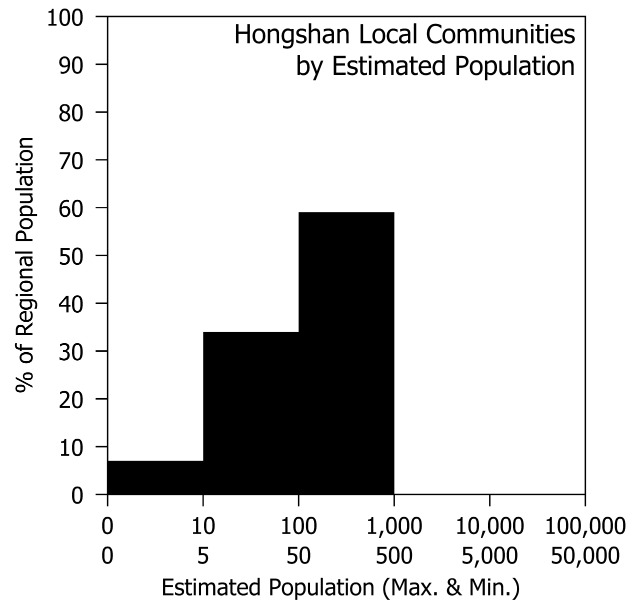


Figure 5.19. Histogram of Hongshan local communities by percent of regional population in each population range.

before in Chifeng, the distribution of Hongshan population across communities of varying size remains very similar to that seen in the Zhaobaogou period (Fig. 5.19).

For the first time in the Chifeng sequence there is an indication in the smoothed density surface of some degree of supra-local centralization. Larger villages seem to be central places toward which occupation is drawn, forming clusters set off from other centrally focused clusters by more sparsely settled territory. These appear as peaks in the smoothed density surface (Fig. 5.20). The tallest peaks are no longer single local communities as they had been in Xinglongwa and Zhaobaogou times, but now encompass clusters of smaller local communities gathered near a large village. The supra-local communities, or districts, which these clusters appear to represent, are easily delineated in the contours of the smoothed surface (Fig. 5.21). A low cutoff contour on the smoothed surface puts a boundary around a number of separate districts, as in the west-central sector of the survey area. In other cases, two or more districts run together within such a cutoff contour. This pattern is most pronounced toward the southeast of the survey area. In these instances there is still, however, a clear separation between the clusters that form around different peaks, a separation manifest in occupational density "valleys" between clusters. These individual clusters, then, can still be distinguished by lines drawn along the density valleys. The end result is the delineation of clusters of communities at a supra-local scale; the lines that provide this delineation should not necessarily be taken as boundaries of geographic territories but only as an indication of which settlement units cluster with which other settlement units. In a few cases, small occupation zones are clustered with a central village on the opposite side of a river. This seems plausible, since the small rivers of the survey zone are not usually major obstacles to communication. In any event, however, keeping such small settlement units apart from the clusters they have joined across rivers would have only trivial impact on the interpretation of interaction patterns and community structure in the region.

Hongshan districts are small, both spatially and demographically. The largest ones are 6 or 7 km across for a total area around 30 km^2, containing populations never much more than about 400. Some 18 such districts can be defined. Not surprisingly, at the low end of the scale, these districts grade off into single villages of similar populations. Numerous small isolated Hongshan settlements exist that do not combine into any of the clusters, although these unclustered local communities represent less than 20% of the regional population. The rank-size pattern for the survey area as a whole is strongly and very significantly convex (A = .249, Fig. 5.22), suggesting little political or economic integration at the scale of the entire survey area. Rank-size patterns within the districts, however, are very strongly primate. The mean A value for the five districts with six or more separate local communities is −.986 (Fig. 5.23). Within individual districts, then, political and/or economic organization seems strongly centralized.

Most of the larger Hongshan villages are in zones that are today under intensive cultivation and no longer show surface remains of ancient architecture. Surface remains are best preserved in the drier northwestern part of the survey area, where cultivation in the uplands is less intensive. In the Hongshan district farthest toward the northwest, the central village represented by the Fushanzhuang site (Peterson 2006) has the remains of four large and three small stone-faced platforms. The four largest define the corners

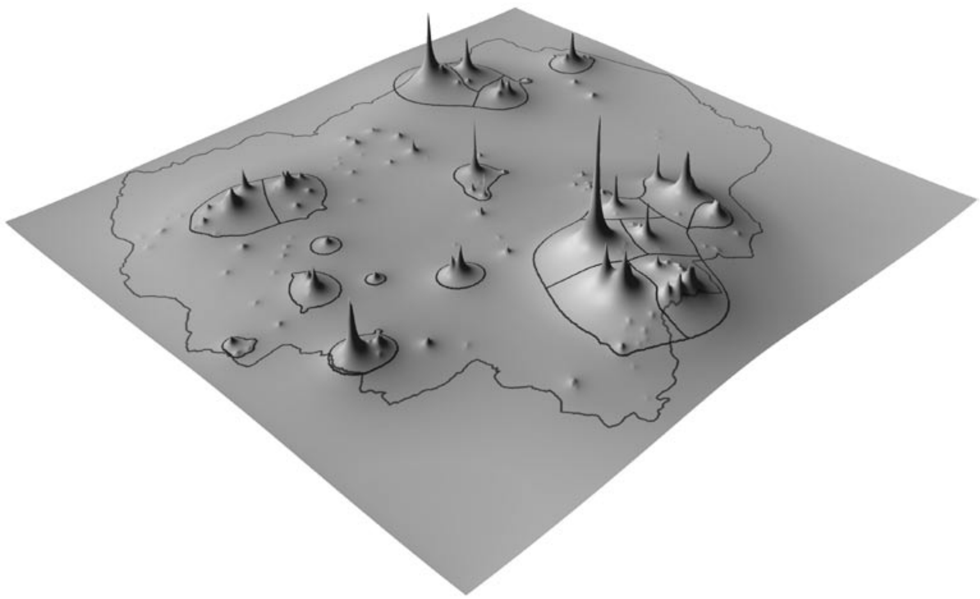


Figure 5.20. Smoothed density surface for Hongshan occupation. (Available online in color, see Appendix B.)

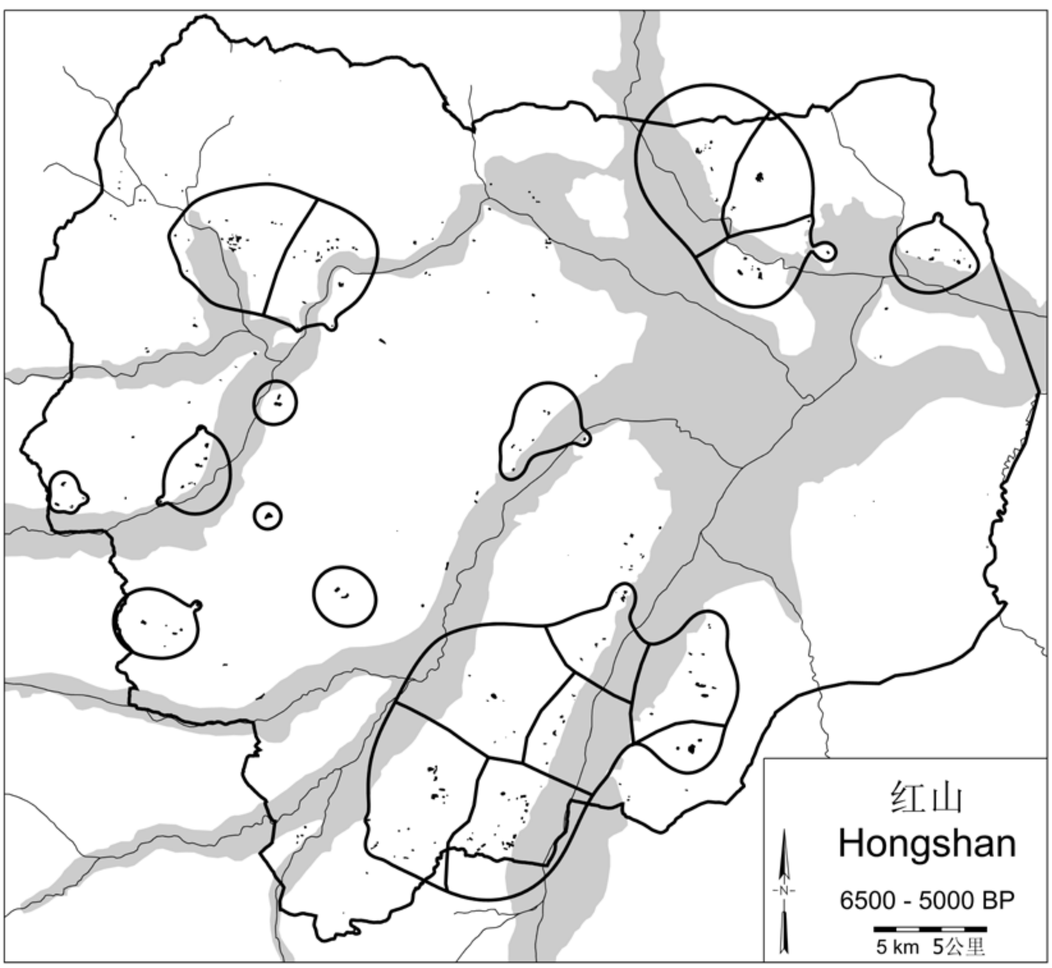


Figure 5.21. Delineation of Hongshan supra-local communities or districts based on the smoothed density surface (Fig. 5.20). (Available online in color, see Appendix B.)

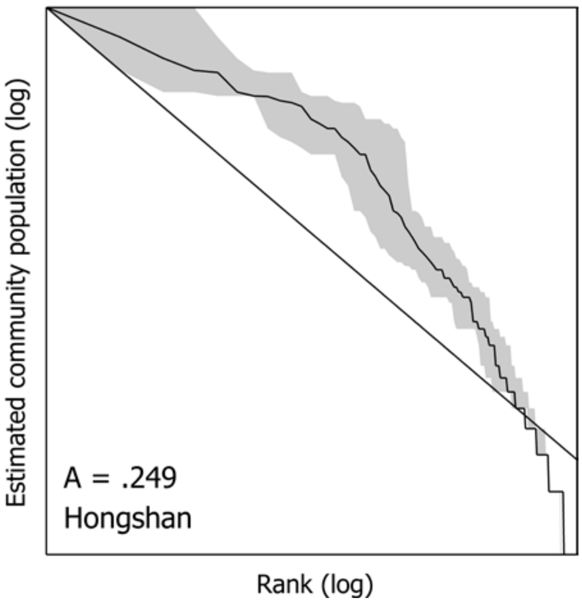


Figure 5.22. Rank-size graph for Hongshan local communities (error range for 90% confidence).

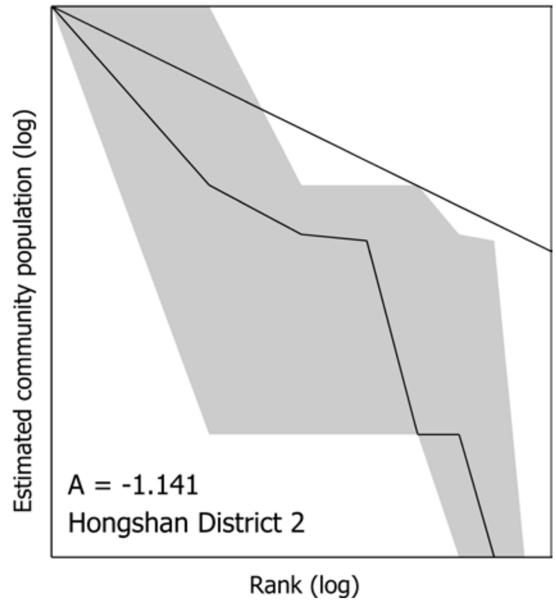


Figure 5.23. Rank-size graph for local communities in a typical Hongshan district (error range for 90% confidence).

of an open plaza about 50 by 100 m. Three of these four large platforms are littered with the sherds of the bottomless painted ceramic cylinders known to be used in substantial numbers in Hongshan mortuary structures. The ritual and ceremonial activities indicated by these remains undoubtedly played a major role in the centripetal forces that drew rural populations toward the central village. The Hongshan period, then, represents the first clear indication in the Chifeng sequence of social centralization that transcends the purely local scale. It is noteworthy that this occurs at such low regional population density levels (5 persons per km^2 or less) that pressure on subsistence resources is out of the question. There is also no evidence of fortifications or of any particular preference for defensible locations in settlement location.

During the first third of the Hongshan period, inhabitants of the Chifeng survey area would have enjoyed the same climatic conditions that prevailed during Zhaobaogou times with higher temperatures and precipitation than today (Chapter 3.2). Conditions during the latter two thirds of the Hongshan period may have been less stable, with several colder periods, although it is not clear that temperatures were low enough to interfere with subsistence production. Precipitation may have been variable through late Hongshan as well. During drier intervals, risk of crop failure from drought would have increased, although not to levels seen today, and during these drier intervals valley floor cultivation, always at less risk from drought than the uplands, might have been more attractive because of better drainage and less flooding. In wetter periods, upland dry farming would have been especially attractive as the risk of loss from drought would have been less than it is today. Many Hongshan communities were located at the interface between uplands and valley floors, where the resource possibilities of both zones could be easily exploited.

Systematic analysis of the distribution of Hongshan settlement with respect to environmental variables (Chapter 4.4) again confirms the initial observation that valley-margin locations were favored, especially ones facing south and southeast. The increase in use of locations farther back from the valley margins, noted for Zhaobaogou times, continued into Hongshan as well. This could be interpreted as a reflection of some degree of pressure on resources, leading some local communities to choose less-than-optimal locations for farming. As already alluded to, however, overall regional population levels still seem far below the numbers the region could support with the available relatively simple subsistence technology. Given the wetter conditions of Hongshan times, the increased numbers of residents back from the river valleys may well have simply been responding to the fact that dry farming in the uplands was a more productive and reliable strategy than it is today, especially compared to farming lowland fields more subject to flooding and with poorer drainage than at present. As before, the overwhelming majority of Hongshan occupations were located on land today largely used for agriculture, although the lower-lying farmland in particular was less favored (consistent with the observation that locations farther back from the valley floor into the uplands were more utilized). Locations in zones today classified as mixed farm fields and grasslands were especially favored by Hongshan local communities. Given the higher precipitation levels of Hongshan times, these zones were probably more productive farmland than they are today. Increasing utilization of such zones under the wetter conditions prevalent for much of the Hongshan period would be consistent with consolidation of an agricultural subsistence system and increasing reliance on domesticates. Evidence for millet cultivation is more conspicuous than for previous periods, with remains of domesticated grains found at several sites including Zhizhushan, Sifendi, and Xinglonggou (An 1989; Li 2008; Ren 1986). Excavated storage pits associated with Hongshan dwellings are numerous (Neimenggu 1994b, 1997, 2004; Zhongguo 1982). Flaked, ground, and microlithic stone tools appear to have been used in farming and animal husbandry, as well as in hunting (Balinyouqi 1987; Guo 1995; Hamada and Mizuno 1938; Li 1984; Neimenggu 1994a, 1994b, 1997, 2004; Zhongguo 1979, 1982), reflecting an increase in the importance of agriculture during Hongshan times (Yi 2006). Domesticated pigs and sheep, as well as hunted game like deer, were likely a substantial component of the Hongshan diet (Guo 1995:30; Hamada and Mizuno 1938).

Some excavated Hongshan residential sites may have had occupational densities higher than those in the Chifeng survey area, as at Baiyinchanghan (Neimenggu 2004) or Site 6384 in the lower Bang valley (Li 2008). Most excavated Hongshan house structures are quite small, as at Hongshanhou, Zhizhushan, Xishuiquan, Xinglonggou, Baiyinchanghan, Nantaizi, Nasitai, and Erdaoliang (Balinyouqi 1987; Hamada and Mizuno 1938; Neimenggu 1994a, 1994b, 1997, 2004; Zhongguo 1979, 1982, 2004). A few larger structures—up to 100 m^2—are known, however, at Xishuiquan and Baiyinchanghan and might have been the residences of higher status families. The development of such social differentiation is, of course, often thought to accompany the emergence of larger-scale supra-local communities like those apparent in the Chifeng survey results. Public and ceremonial architecture has attracted considerable attention at excavated sites to the southeast of the Chifeng region like Niuheliang (Chaoyangshi and Liaoningsheng 2004; Li 1986; Liaoningsheng 1986, 1997) and Dongshanzui (Guo and Zhang 1984), and such architecture is also clearly part of the same package of new elements of social organization. In its most abundant manifestation this public architecture consists of stone-faced earth and rubble platforms over 20 m across composed of multiple circular and/or square tiers, and often lined with hundreds of large painted pottery cylinders. Within the platforms are often found burials in stone cysts with elaborate jade carvings of apparently symbolic and religious importance. Although no architectural complexes as large or elaborate as that at

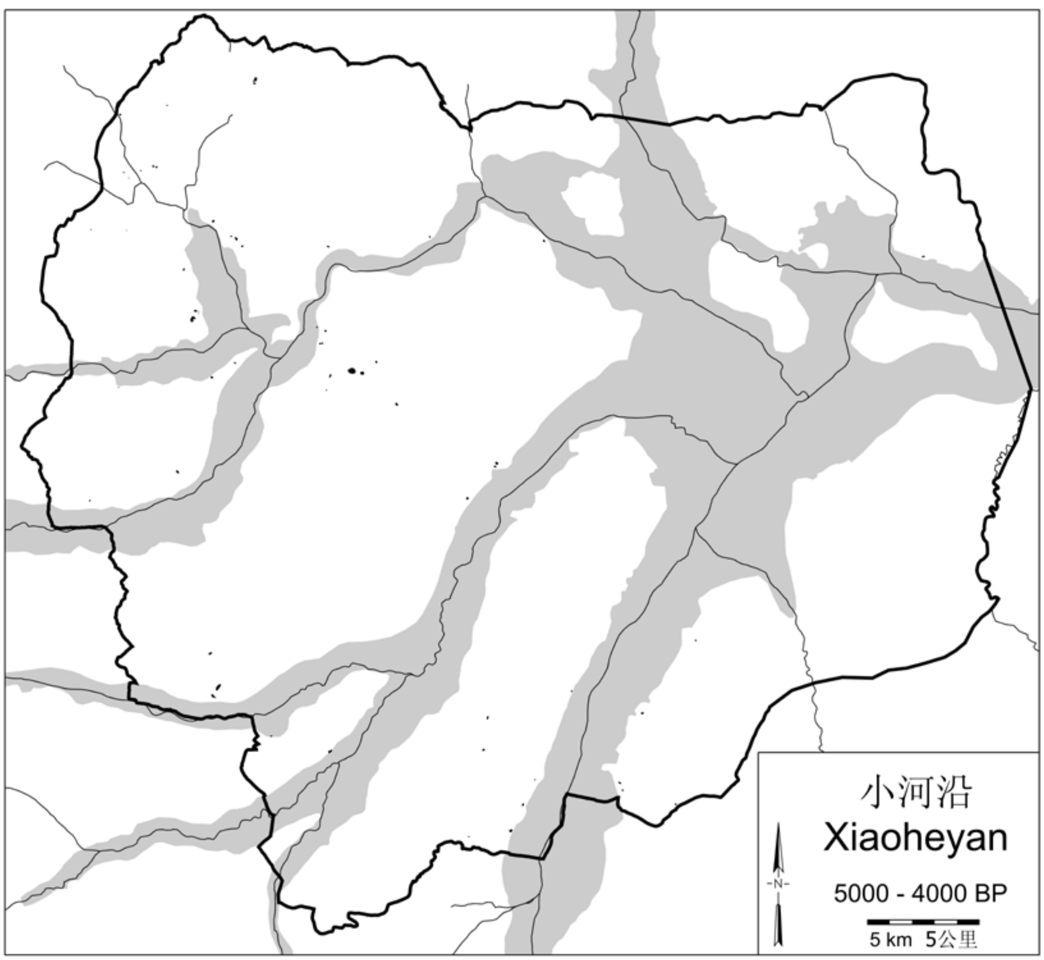


Figure 5.24. Distribution of Xiaoheyan period ceramics in the Chifeng survey area. (Available online in color, see Appendix B.)

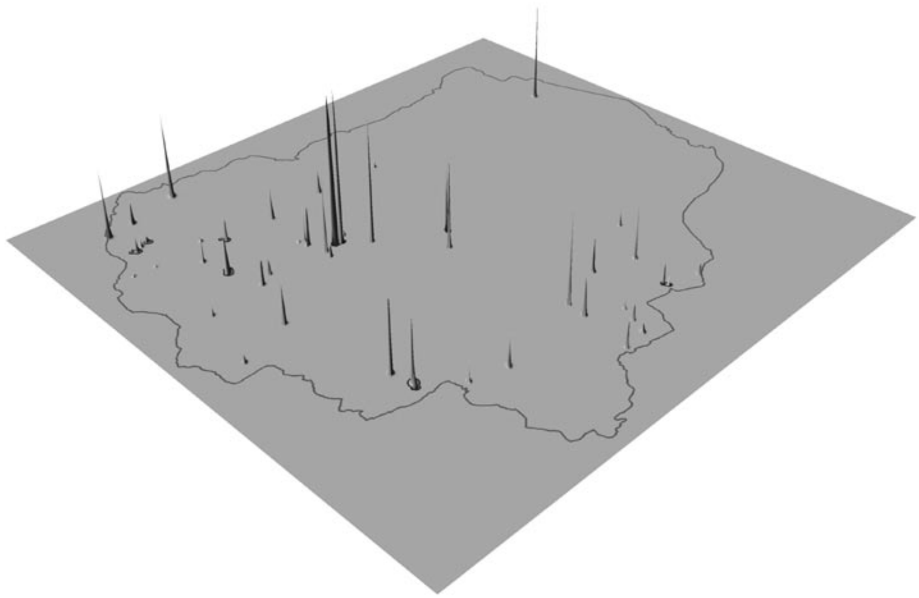


Figure 5.25. Unsmoothed density surface for Xiaoheyan occupation. (Available online in color, see Appendix B.)

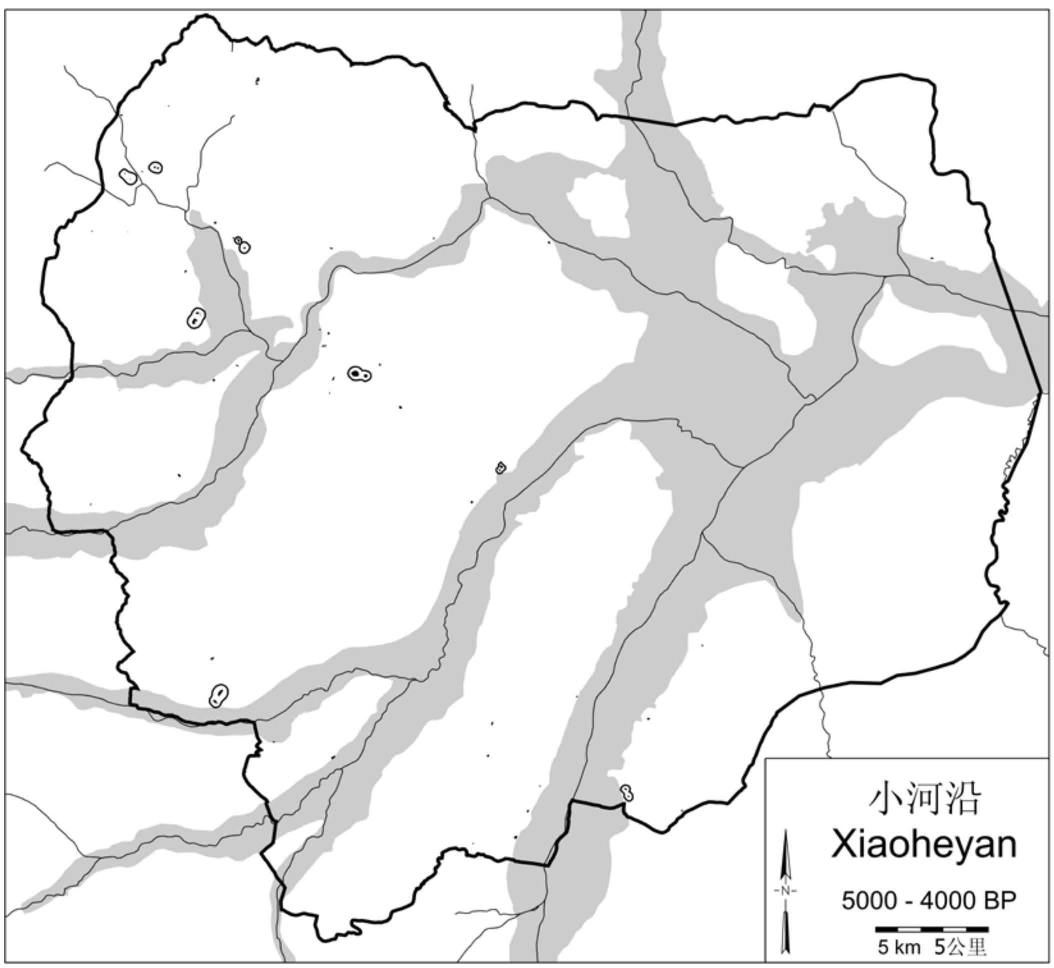


Figure 5.26. Delineation of Xiaoheyan local communities by cutoff contour from the unsmoothed density surface (Fig. 5.25). (Available online in color, see Appendix B.)

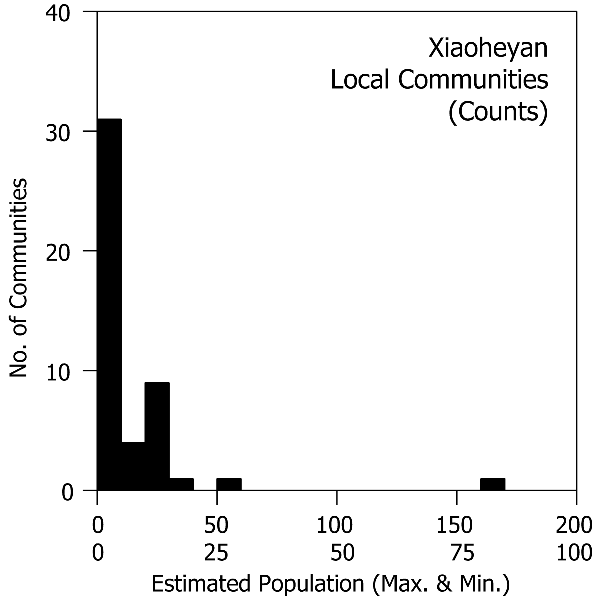


Figure 5.27. Histogram of Xiaoheyan local communities by number of communities in each population range.

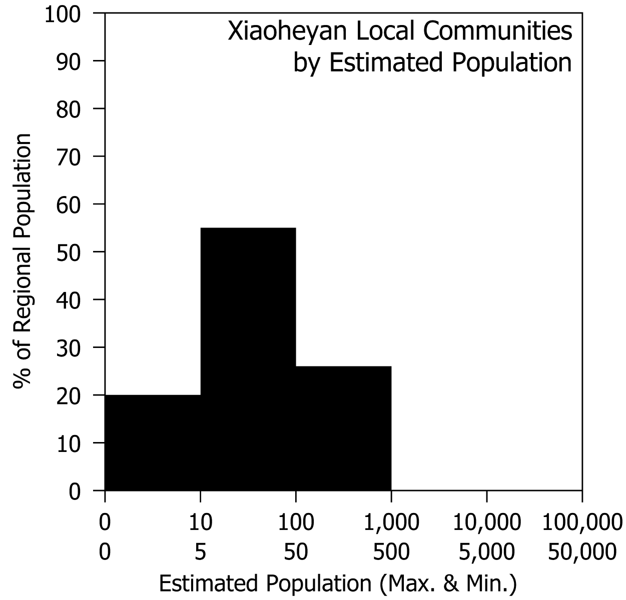


Figure 5.28. Histogram of Xiaoheyan local communities by percent of regional population in each population range.

Niuheliang are known from Chifeng, the central villages of the Chifeng Hongshan supra-local communities, such as Fushanzhuang, at least sometimes had such ritual facilities. This provides further basis to the suggestion that ceremonial activities may have been important among the functions of these early central places in Chifeng, and suggests the possibility that more elaborate architectural complexes farther southeast might also have served such roles in the emergence of supra-local communities there.

Xiaoheyan (3000–2000 BCE)

Xiaoheyan materials are much less abundant in the Chifeng survey area than those of the Hongshan period, so much lower as to suggest either a radical population decline or incomplete knowledge of the chronology and ceramics of this part of the period. Taking the quantity and distribution of identified Xiaoheyan remains at face value, however, the total population of the survey area would be

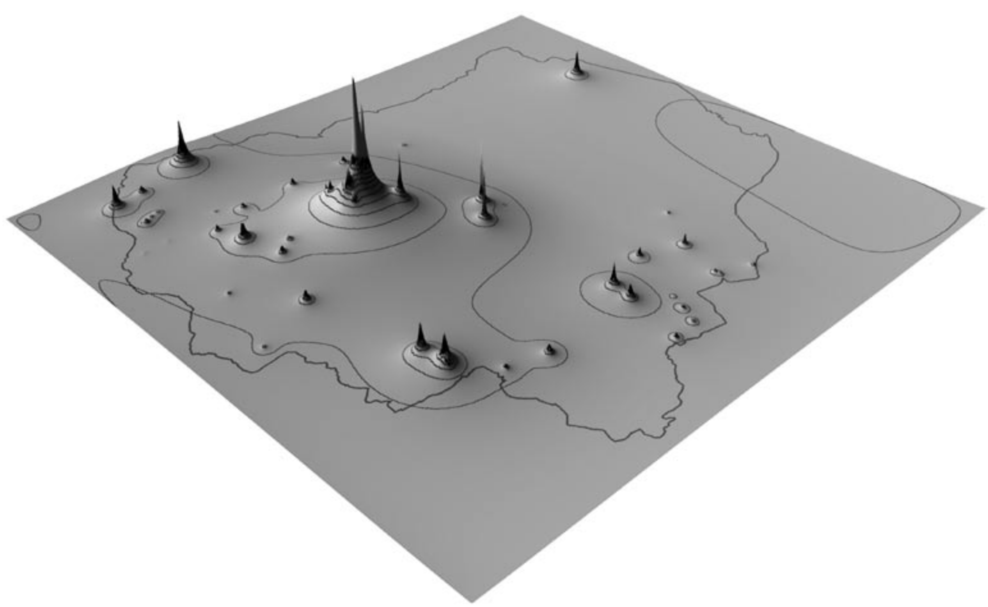


Figure 5.29. Smoothed density surface for Xiaoheyan occupation. (Available online in color, see Appendix B.)

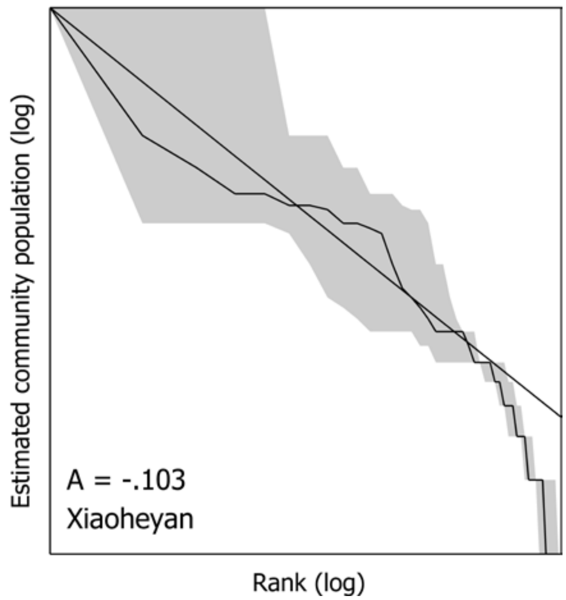


Figure 5.30. Rank-size graph for Xiaoheyan local communities (error range for 90% confidence).

estimated at 300–600 (a low level not seen for two millennia or more). The Xiaoheyan distribution is very broad and sparse, although it is almost entirely absent in the eastern portion of the survey area (Fig. 5.24). Bluff edge locations are utilized, although not nearly as favored as they were earlier.

Most collections are fairly isolated from other collections, although there are a few nearby collections that a cutoff contour from the unsmoothed density surface combines into single local communities (Figs. 5.25 and 5.26). The interaction structure is that of small local communities, although the small quantity of materials recovered suggests such tiny populations that it is doubtful that any of these should even be called "communities." There are only 47 settlement units, of which only about a dozen represent more than one or two families (Fig. 5.27). The population of the largest local community is estimated at only 80–160, and this estimate is more than three times higher than that for the next largest local community. A higher proportion of the Xiaoheyan regional population lived in smaller communities than had been the case in either Hongshan or Zhaobaogou times (Fig. 5.28).

There is no real indication of supra-local communities in the scattered Xiaoheyan distribution (Fig. 5.29). A single major occupation peak in the west-central portion of the survey area stands out strongly. The flanks of this single peak taper off in all directions, and probably define a cluster of smaller settlements drawn towards this largest one. The rank-size pattern does not differ much from log-normal ($A = -.103$, Fig. 5.30). Given the tiny population levels the quantities of Xiaoheyan materials suggest, however, it is not at all plausible to see a centralized community encompassing hundreds of square kilometers. The clustering around this largest (but still rather small) village may represent a district similar in scale to those of Hongshan times.

The very low levels of occupation evidenced for Xiaoheyan times occurred during more stable climatic conditions than seen during the latter part of the Hongshan period (Chapter 3.2). Long-term averages were not so different from Hongshan times, with temperatures still warmer and precipitation somewhat greater than at present. Wild plant and animal resources and conditions for cultivation would thus have been largely the same as before with the exception of the greater reliability arising from less fluctuation in temperature and precipitation.

The very sparse remains identifiable to Xiaoheyan times in Chifeng make interpretation, finally, extremely difficult. Adding to the mystery, the Chifeng region is not unusual in this regard. Across a much larger area of northeastern China, remains dating between 3000 and 2000 BCE are extremely difficult to find. Taken at face value, this would imply a population decline of catastrophic proportions. Precisely this has been built into the suggestion that a long period of drastically drier conditions devastated the Hongshan population and led to the disappearance of the supra-local communities that had appeared. Our best efforts to correlate the records of climatic change with cultural sequences, however, do not suggest drastically drier conditions for Xiaoheyan times. In fact, slightly better conditions for agriculture are indicated than those observable at present. The fact that evidence of Xiaoheyan occupation is found somewhat more in locations far removed from the river valleys than during earlier periods is also not consistent with the idea of devastating drought conditions. An altogether different interpretation, also at least logically possible, is that our knowledge of the ceramics of the period between 2000 and 3000 BCE is as yet incomplete, with the result that at least some of the materials currently classified as belonging to the periods preceding and following Xiaoheyan might actually pertain to this time period. The idea that the Xiaoheyan ceramic complex simply might not exist as a definable set of ceramics distinct from Hongshan or Lower Xiajiadian is, however, contradicted by the existence of at least one excavated cemetery site that yielded a "pure" Xiaoheyan ceramic assemblage. This cemetery, known as Danangou, is located in Wengniute Banner, north of the Chifeng survey area (Liaoningsheng 1998). Four houses dated to this period have been excavated at the Nantaidi site, in Aohan Banner, south of our survey area (Zhao 2003:256–258). Excavated data are thus currently too scarce to address patterns of economic and social organization associated with identifiable Xiaoheyan ceramics.

The very small number of radiocarbon dates associated with both Xiaoheyan and Hongshan ceramics (Chapter 2.3) makes it difficult to be highly confident of our ability to place the boundary between these two periods confidently. The overlap between the most recent Xiaoheyan dates and the earliest of the substantial sample of Lower Xiajiadian dates, might eventually be resolved more in fa-

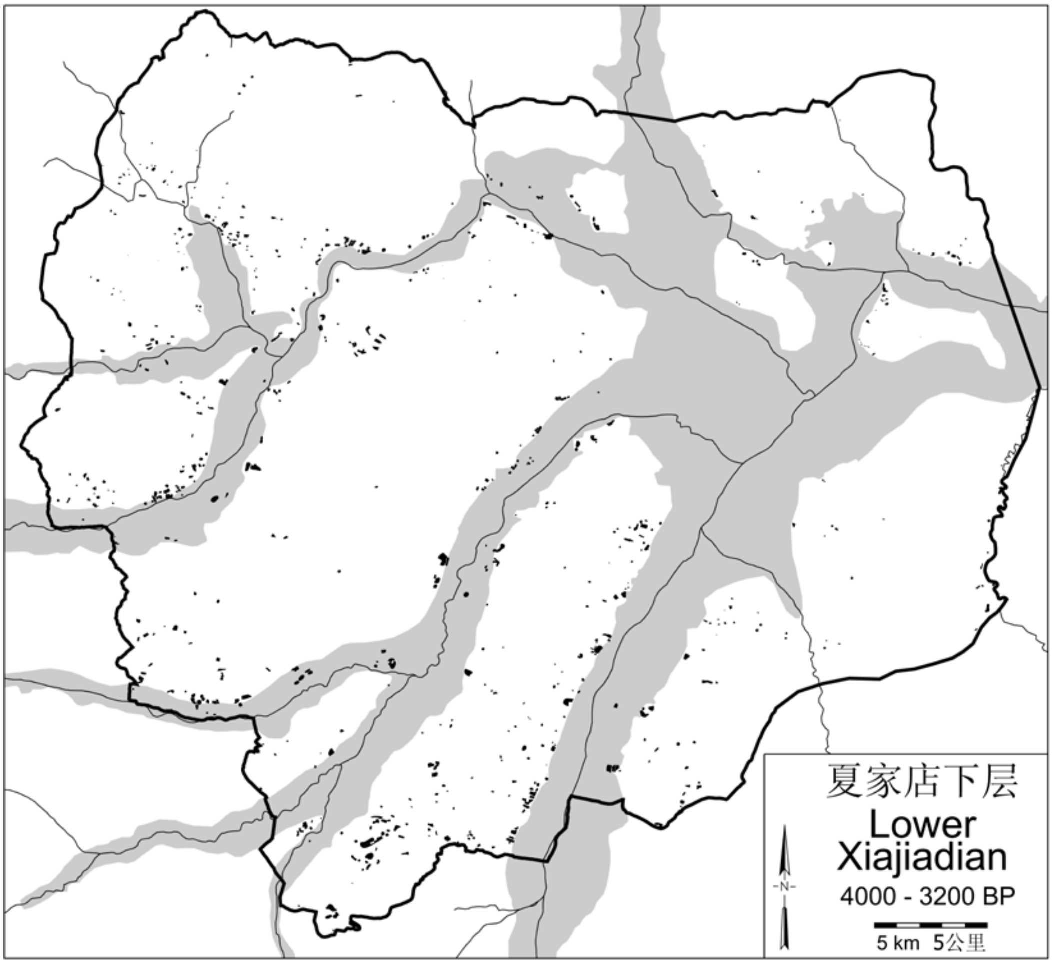


Figure 5.31. Distribution of Lower Xiajiadian period ceramics in the Chifeng survey area. (Available online in color, see Appendix B.)

vor of the Lower Xiajiadian dates that begin around 2500 BCE than in favor of the Xiaoheyan dates that end around 2000 BCE. Such a result would considerably shorten the Xiaoheyan period, but it remains speculation. In the presence of so many uncertainties and such sparse evidence, it is impossible to say anything even remotely conclusive about subsistence, settlement, and social organization in Xiaoheyan times.

Lower Xiajiadian (2000–1200 BCE)

Lower Xiajiadian materials were recovered from a substantially larger total surface area than those of any preceding period. Total population of the survey area is estimated at 40,000–80,000 (some 20 times higher than ever before, meaning 30–60 persons per km^2). Distribution of occupation is widespread through the survey area, including the area in the east around the Chifeng basin, although occupation in the western part of the survey area has increased especially strongly (Fig. 5.31). The southeastward-facing bluff edge locations along the margins of the valley floor are again strongly favored, but the edge of the uplands adjacent to the valley floor is, in general, a prime settlement location, even where the transition between valley floor and uplands is quite gentle. This pattern, and its consistency from the substantial occupation of Hongshan times to the even more substantial Lower Xiajiadian occupation, suggests that earlier valley-margin occupations were not being steadily covered over by additional deposition of sediment. This consistency of pattern is observable both along the higher smaller river valleys toward the south and west as well as around the large Chifeng basin in the northeast where slopes are gentlest. The use of these valley-margin locations is conspicuous as far back as Xinglongwa times. This settlement patterning in and of itself provides another indication that geological processes have not drastically obscured zones of occupation in the valley floors from even very early times (see Chapter 3.3).

Local community structure is again strong; there is even more clustering of closely spaced occupation zones into larger local communities than before (Figs. 5.32 and 5.33). The cutoff contour that produces this clustering works quite well all across the survey area on the unsmoothed occupation surface, satisfactorily combining nearby collection units and creating only one or two local communi-

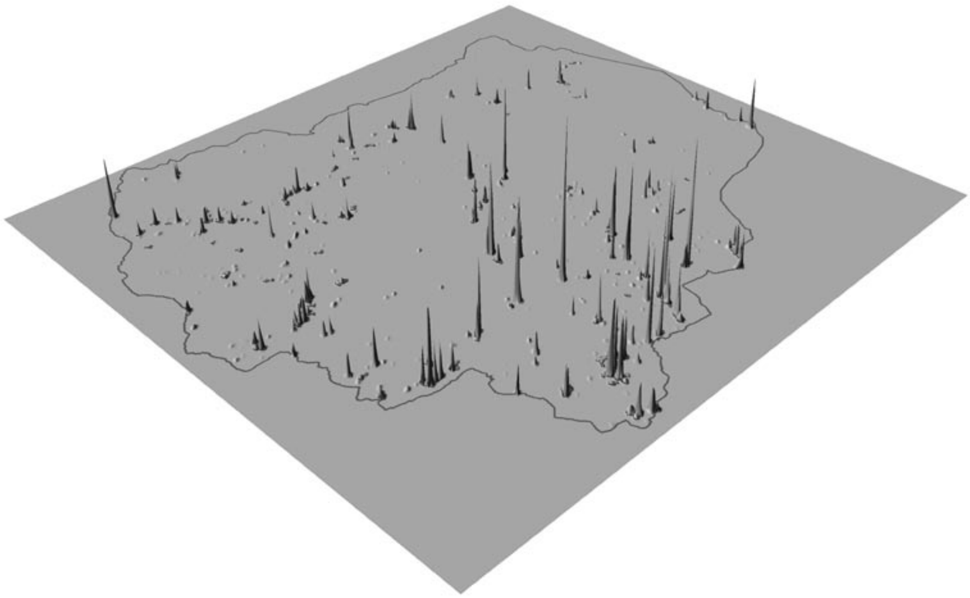


Figure 5.32. Unsmoothed density surface for Lower Xiajiadian occupation. (Available online in color, see Appendix B.)

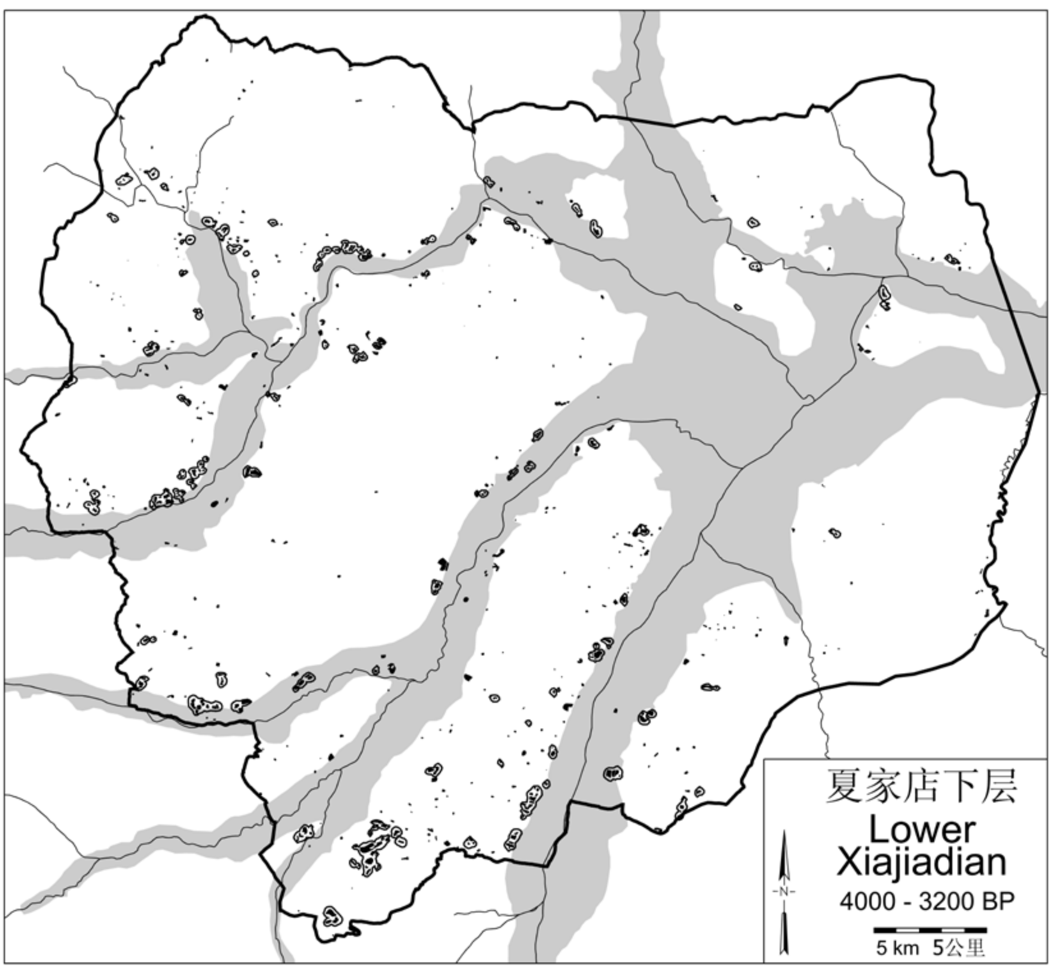


Figure 5.33. Delineation of Lower Xiajiadian local communities by cutoff contour from the unsmoothed density surface (Fig. 5.32). (Available online in color, see Appendix B.)

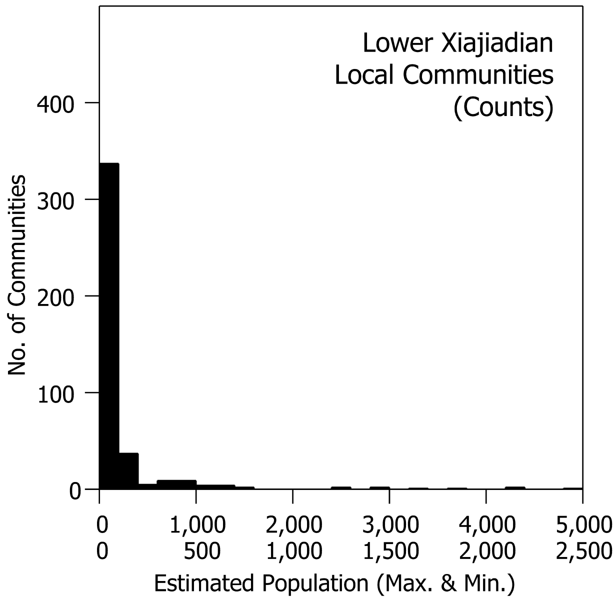


Figure 5.34. Histogram of Lower Xiajiadian local communities by number of communities in each population range.

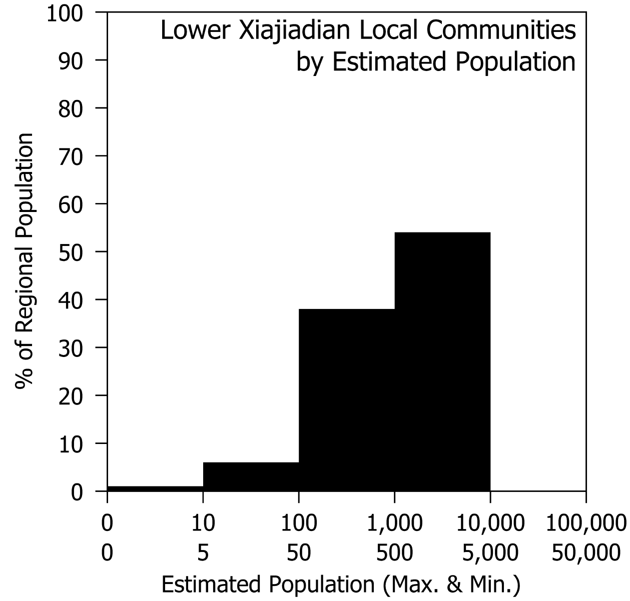


Figure 5.35. Histogram of Lower Xiajiadian local communities by percent of regional population in each population range.

ties that sprawl over somewhat large areas. Altogether 416 local communities are identified in this way. Although the vast majority of local communities are quite small (with populations estimated at less than 100–200 inhabitants, Fig. 5.34), the Lower Xiajiadian population is much less rural than ever before in the Chifeng sequence. The proportion of inhabitants living in one- or two-family homesteads is probably less than 2% (Fig. 5.35). The remaining 98% live in settlements with populations ranging up to an estimated 2,500–5,000. At least 15 local communities probably had populations numbering over 1,000 inhabitants; more than half the region's population lived in communities of 500–1,000 or more. The emergence of these towns was entirely new, since no earlier local community in Chifeng had contained this many people. A pattern of living focused on villages and homesteads had given way to a very town-centered one, as such large local communities proliferated across the Chifeng survey area. Many of these towns were very densely packed, heavily fortified settlements.

Multiple districts of roughly uniform size show clearly in the Lower Xiajiadian smoothed surface (Figs. 5.36 and 5.37). The well-defined districts are heavily concentrated toward the southwest of the survey area, where they are usually centered on a compact high-density town as central place. A few districts are more spread out without such a readily visible or compact central community. The districts outlined toward the north in the survey area are less distinct and represent lower populations and population densities. Other possible districts not outlined are suggested by settlement clusters at the extreme edges of the survey area toward the northwest, the southeast, and the extreme south. Small Lower Xiajiadian settlements are also dispersed in the northern and eastern sectors of the survey area, where there are not convincing indications of supra-local community structure. The overall pattern, with a fair number of roughly similar-sized tall peaks, does not suggest political centralization but rather separate small polities. This interpretation receives considerable support from the rank-size pattern, which is very strongly and significantly convex ($A = .242$, Fig. 5.38).

The presence of often massive fortification works suggests that these small polities were in a more or less constant state of hostilities with each other. Some areas of dense occupation, usually at the margins of the valley floors, were heavily fortified. In other instances fortified localities have only sparse occupational debris, suggesting either that they were not occupied for long periods of time or that they were only sporadically occupied, and may have served as refuges from attack. Some of these are in especially remote hilltop locations. Fig. 5.39 shows the locations of at least some of the Lower Xiajiadian fortifications, based on preserved surface remains of defensive works recorded on survey. Others also undoubtedly existed, but their surface traces have been destroyed by extensive modern modification of the landscape. Fortifications preserved on the surface are heavily concentrated toward the west and especially the northwest of the survey area. Lower Xiajiadian sites overall, like those of other periods, are concentrated on alluvial soils, but preserved fortifications occur especially on volcanic rocks, sandstones, and mudstones, which provided good raw materials for their construction. The steep rocky slopes of the western part of the survey area lend themselves especially well to the practice of fortifying hilltops with stone walls. In the east and southeast, slopes are less steep and soils often deep, even in the uplands, and fortifications more often take the

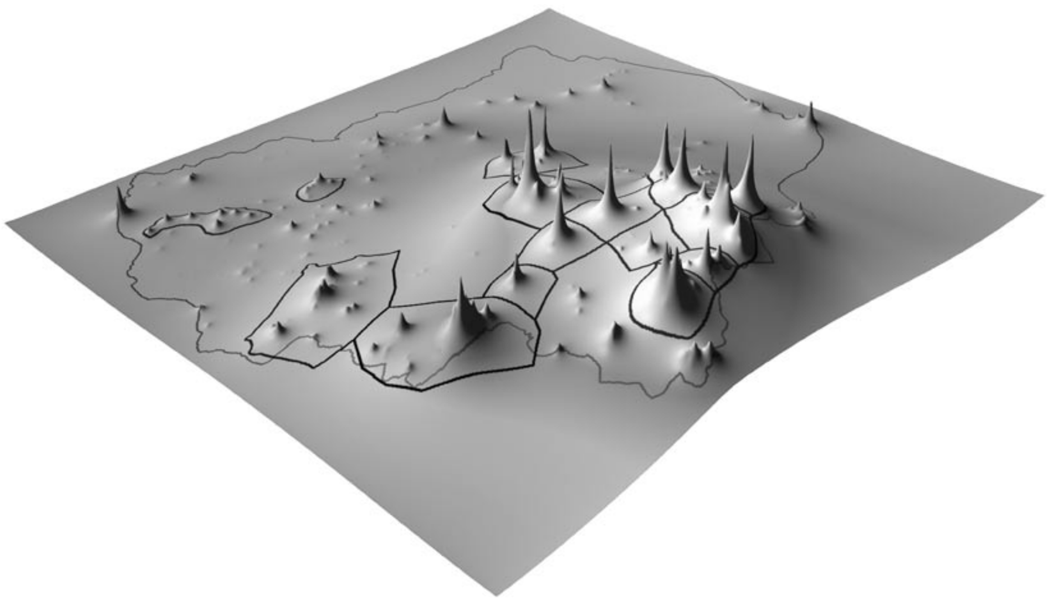


Figure 5.36. Smoothed density surface for Lower Xiajiadian occupation. (Available online in color, see Appendix B.)

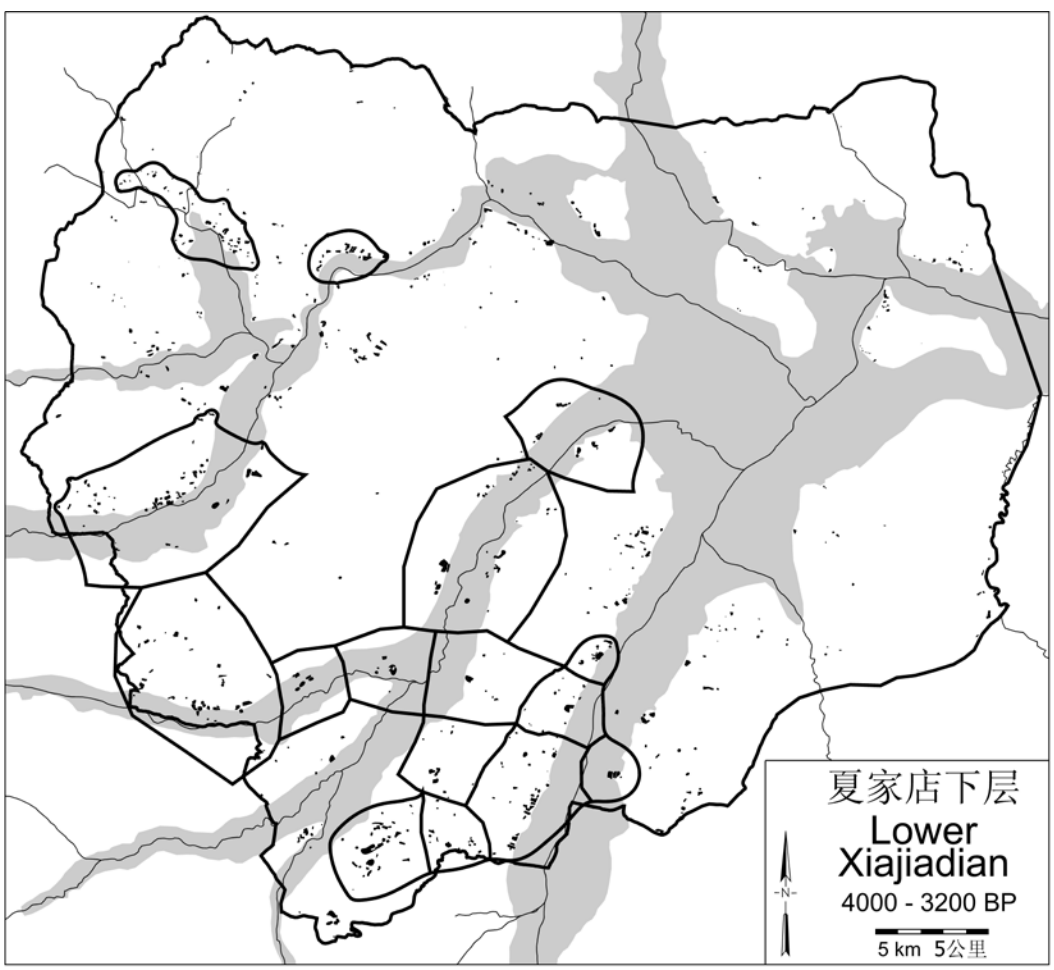


Figure 5.37. Delineation of Lower Xiajiadian supra-local communities or districts based on the smoothed density surface (Fig. 5.36). (Available online in color, see Appendix B.)

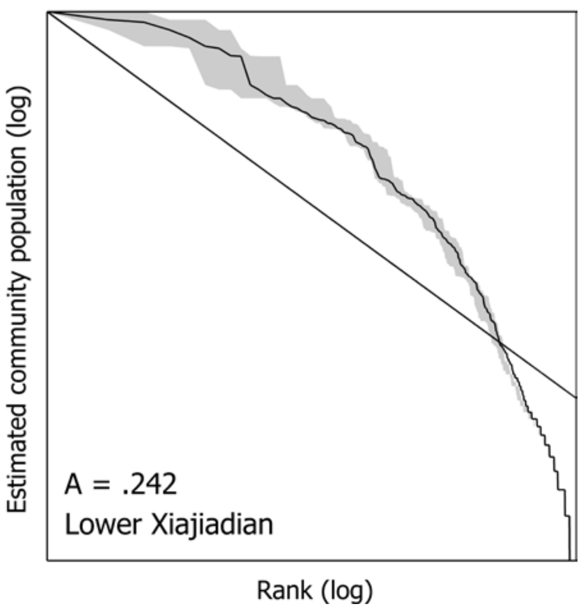


Figure 5.38. Rank-size graph for Lower Xiajiadian local communities (error range for 90% confidence).

form of ditches and earth-built walls. This sort of construction has endured less well, especially since modern land modification has also been most intense in the eastern part of the survey area.

Sixteen supra-local communities, or polities, were recognized in the analysis, ranging from as little as around 1,000 inhabitants up to a maximum of about 7,000. Another four or five single local communities fall into the lower portion of this size range and might well be considered small polities by themselves, consisting of a single town. This pattern of small roughly co-equal districts or polities recalls the pattern that emerged in Hongshan times. The Lower Xiajiadian districts are similar in spatial scale to the Hongshan districts, but their populations are around an order of magnitude greater. Like the Hongshan districts, their internal organization is very strongly centralized, usually showing primate rank-size distributions, with an average *A* value for the 11 Lower Xiajiadian districts composed of six separate local communities or more of −.977 (cf. Fig. 5.40). Some 25% of the Lower Xiajiadian regional population lived in local communities that do not seem to be part of any such cluster.

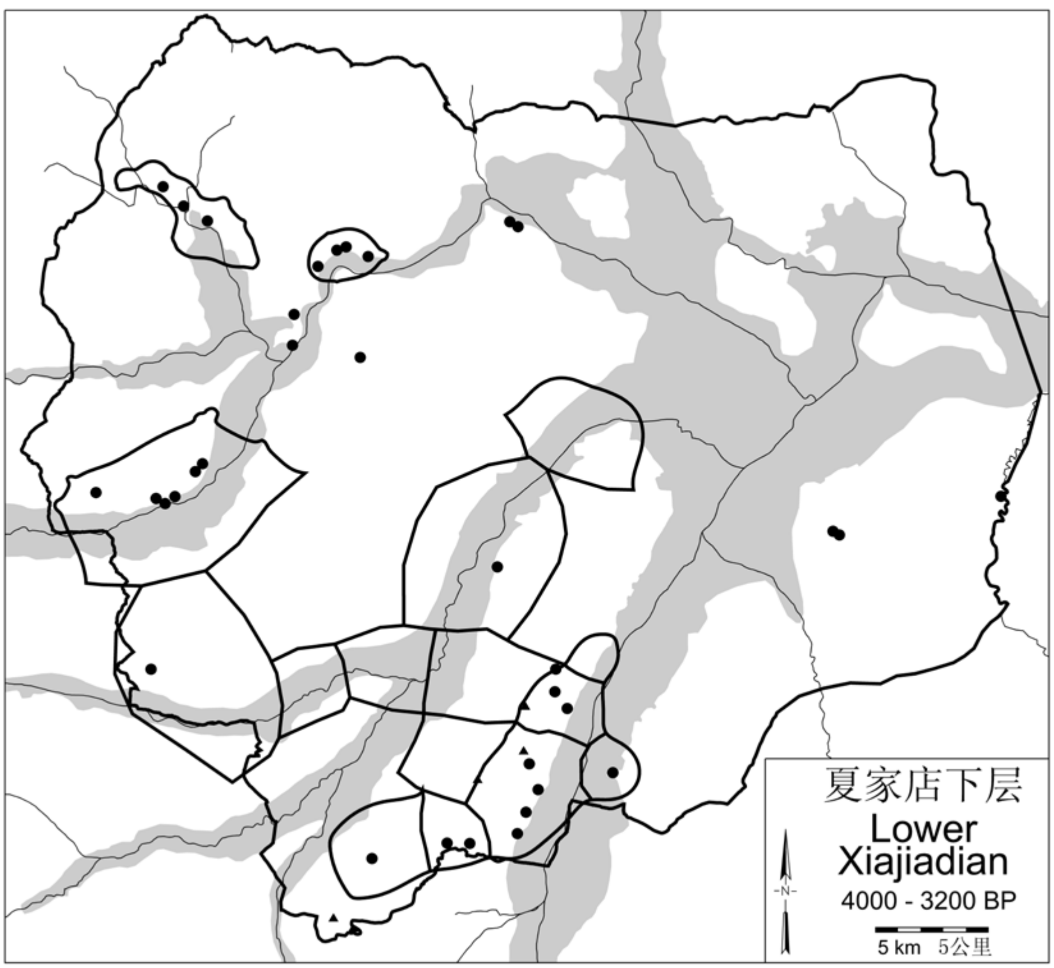


Figure 5.39. Locations of Lower Xiajiadian fortifications that are still well preserved on the surface. Triangles represent fortified hilltops in especially remote locations that have only sparse distributions of surface artifacts. (Available online in color, see Appendix B.)

The larger local communities in Chifeng during Lower Xiajiadian times are similar in size to the much earlier Late Yangshao settlements along the middle Yellow River. Longshan local communities in the middle and lower Yellow River valley, which also predate Lower Xiajiadian times, were much larger than Lower Xiajiadian towns, and Erlitou, which falls in the time period occupied by Lower Xiajiadian, had a population estimated to number in the tens of thousands. In broader global perspective, some societies often labeled “chiefdoms” were substantially smaller. The San José Mogote chiefdom in the Valley of Oaxaca, Mexico, for example, did not include more than about 1,500 inhabitants in total. Others, such as the Regional Classic period chiefdoms of the Alto Magdalena, Colombia, were about the size of the larger Lower Xiajiadian polities. The Mississippian Cahokia chiefdom of the southeastern United States had a substantially larger population than even the largest of the Lower Xiajiadian polities in Chifeng.

The much higher population levels of Lower Xiajiadian times occurred, at least initially, under wetter conditions (Chapter 3.2). The subsistence strategy most favored by higher levels of precipitation would have been upland dry farming, which was likely considerably more productive and dependable than it is today. Valley floor farming would, on the other hand, have been considerably inhibited because of poor drainage and risk of flooding. In sum, though, climatic conditions made it relatively easy to support this unprecedentedly large regional population. Later in the period, however, the Chifeng survey area may have experienced droughts of increasing frequency and severity as part of the larger picture of drying conditions across northern China. Risks to non-irrigated upland cultivation would have been comparable to those seen at present, and

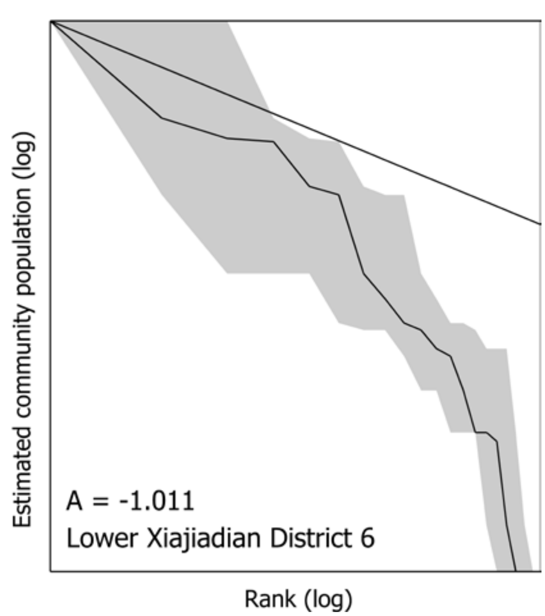


Figure 5.40. Rank-size graph for local communities in a typical Lower Xiajiadian district (error range for 90% confidence).

periodically possibly even more severe. Valley floor cultivation would have continued to mirror the impacts felt by upland cultivation, as droughts would reduce excessively wet conditions in this zone. General climatic instability during the later part of the Lower Xiajiadian period, however, might have, paradoxically, meant increased risk of flood damage to crops in the valley floor, even as conditions on average became drier. The decline in proportions of arboreal pollen and increases in weedy species observed near the Chifeng survey area might have been produced either by increasingly dry conditions or by increased forest clearance for farming by the larger regional population. In combination, the higher population levels and drier conditions made subsistence production riskier for Chifeng’s inhabitants in the latter part of Lower Xiajiadian times. These two factors, acting in concert, could have exacerbated the evident conflict between Lower Xiajiadian supra-local communities.

Systematic analysis of the distribution of Lower Xiajiadian settlement with respect to environmental variables (Chapter 4.4) again confirms the initial observation that valley-margin locations were favored, especially ones facing south and southeast. The proportion of the population living in the first 500 m back from the valley floor was now over 60%—higher than in any earlier (or later) period. An additional 10% were settled actually on the valley floor (primarily on slightly higher ground just below the beginning of the uplands), completing a very sharp focus on this upland–lowland ecotone. This location would certainly have been a very practical one for intensive (possibly irrigation-assisted) cultivation of the valley floors, which are today the most agriculturally productive land in the region. Over 20% of the Lower Xiajiadian population is situated in zones classified as irrigated agriculture, which only account for 3% of the territory in the survey area on the land-use maps. The valley-margin location is also within 2–3 km of practically the entire upland zone, and this is a distance frequently walked daily for subsistence activities by people in many parts of the world. This means that residents of most Lower Xiajiadian settlements had excellent access not only to the region’s prime irrigable farmland, but also to its less productive, but also less flood-prone, rainfall agricultural land in the uplands. Reliance by most local communities on cultivation in both uplands and valley floors, then, was likely at the core of a stable subsistence system. The parts of the uplands where soils are thinner and slopes steeper could also have been easily exploited as grazing territory for sheep, goats, and/or cattle herded there on a daily basis from villages strung out along the margins of the valley floor.

The valley margin locations, then, which had always been favored settlement locations and which reached a new peak of popularity in Lower Xiajiadian times, were optimally situated both for access to the Chifeng region’s prime agricultural resources and for exploitation of the widest possible range of land uses. Results from stratigraphic excavation at sites 342 and 674 clearly demonstrate the importance of agriculture to the economy of the Lower Xiajiadian communities in the Chifeng survey area. Of the 9821 identified plant specimens recovered by flotation from Lower Xiajiadian strata at these two sites, 73% were millet. The faunal remains from these stratigraphic tests also reflect an importance for domesticated grazing animals in Lower Xiajiadian times. Altogether, the major domesticated food species (cattle, sheep, goats, and pigs) make up 78% of the 192 identified food-source animal bones recovered from unmixed Lower Xiajiadian deposits. Within this group of major domesticated species, cattle are 7% (*n* = 10); and sheep and goats, 26% (*n* = 39). Pigs make up 67% (*n* = 101) of these bones, however, and this is consistent with a pattern of fully settled village life based on a mixed subsistence economy of plant cultivation and animal husbandry that made both intensive and extensive use of the full range of subsistence resources offered by the region to support a much higher population than had been there before. The larger faunal assemblage from Lower Xiajiadian deposits at the Dashanqian site, located within the Chifeng survey region, is more or less similar. The major domesticated food species represent 76% of the 2145 identified animal bones; only 1% are of wild species. Among the major food domesticates, cattle are 32% (*n* = 521); sheep/goat, 5% (*n* = 80); and pigs, 63% (*n* = 1034) (Wang 2004:256). Only pigs (64% of the bones) and dogs (36% of the bones) were included as offerings in the Lower Xiajiadian burials at the Dadianzi cemetery (Zhongguo 1996:362–409), constituting a ritual faunal assemblage rather different from those composed of subsistence remains, as might well be expected.

Results from recent excavations at the Lower Xiajiadian fortified site of Sanzuodian within the Chifeng survey area (Neimenggu 2007) and at the Kangjiatun site near Beipiao in western Liaoning Province (Liaoningsheng 2001a) also fit well with conclusions based on regional settlement analysis. The planned layout of those sites, the construction techniques of their defense walls, and the scale of the construction all suggest societies capable of well-organized mobilization of labor and resources. The sort of social hierarchy suggested by analysis of data from Lower Xiajiadian cemeteries (Flad 2001; Shelach 2001), even though less developed than one might expect from a state-level society, is consistent with such organized mobilization. Large-scale regional political integration is not implied, since a single local community of the size seen in Lower Xiajiadian times in the Chifeng survey area, or at most a single supra-local community, could easily have

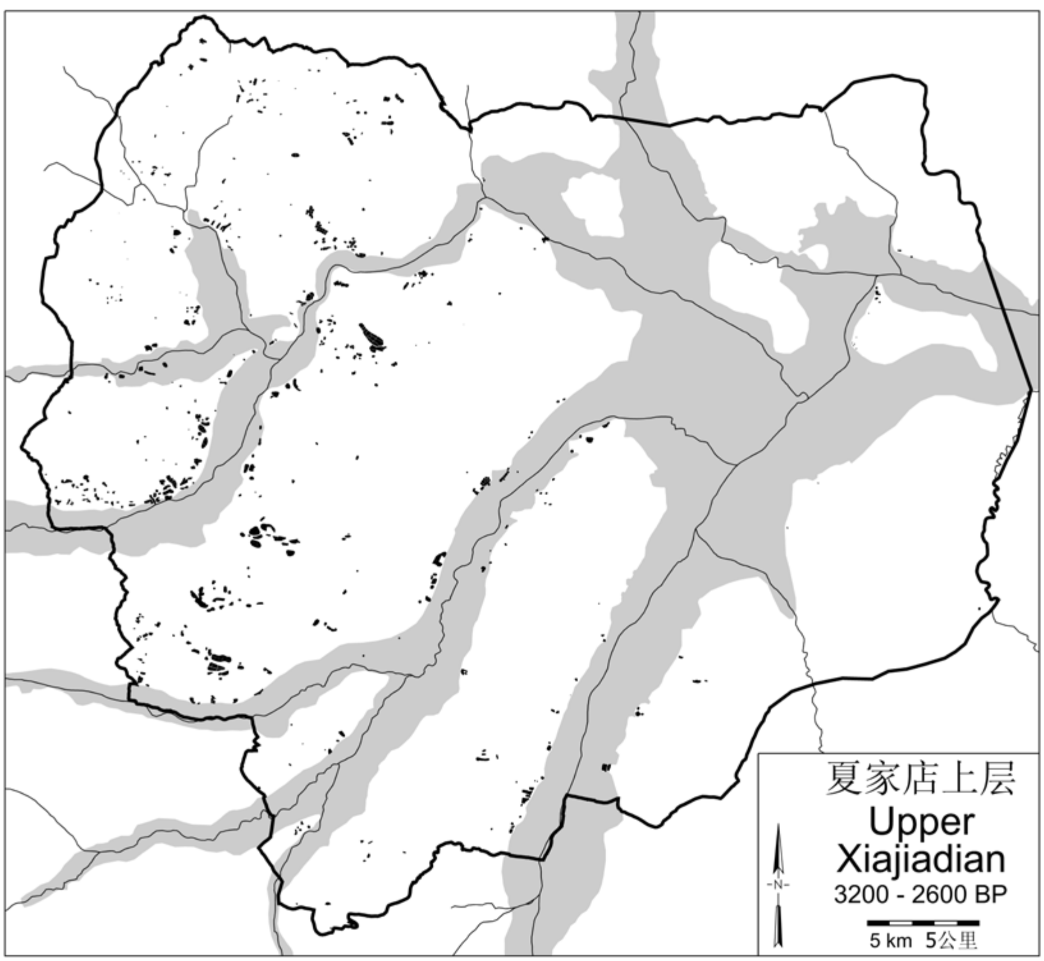


Figure 5.41. Distribution of Upper Xiajiadian period ceramics in the Chifeng survey area. (Available online in color, see Appendix B.)

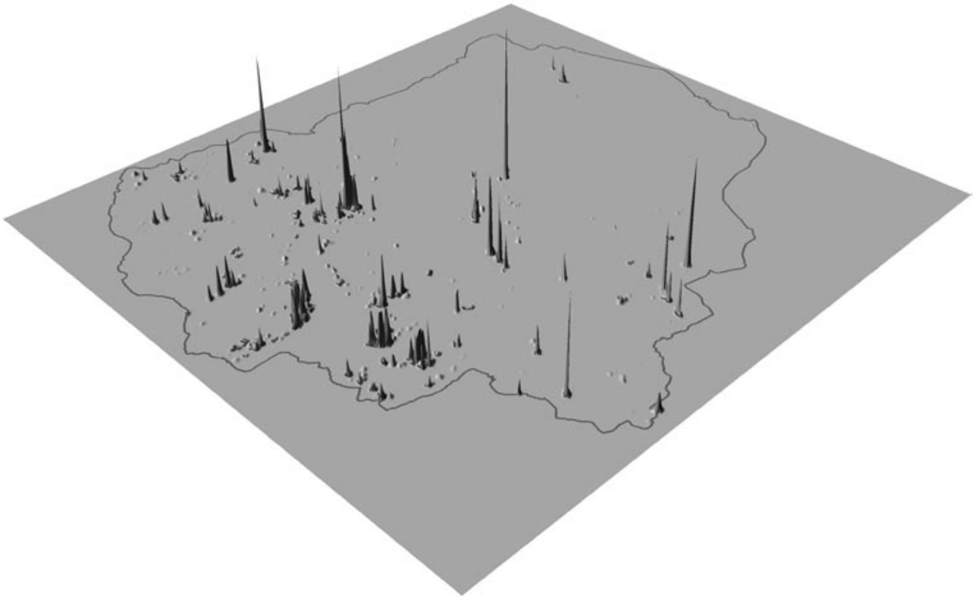


Figure 5.42. Unsmoothed density surface for Upper Xiajiadian occupation. (Available online in color, see Appendix B.)

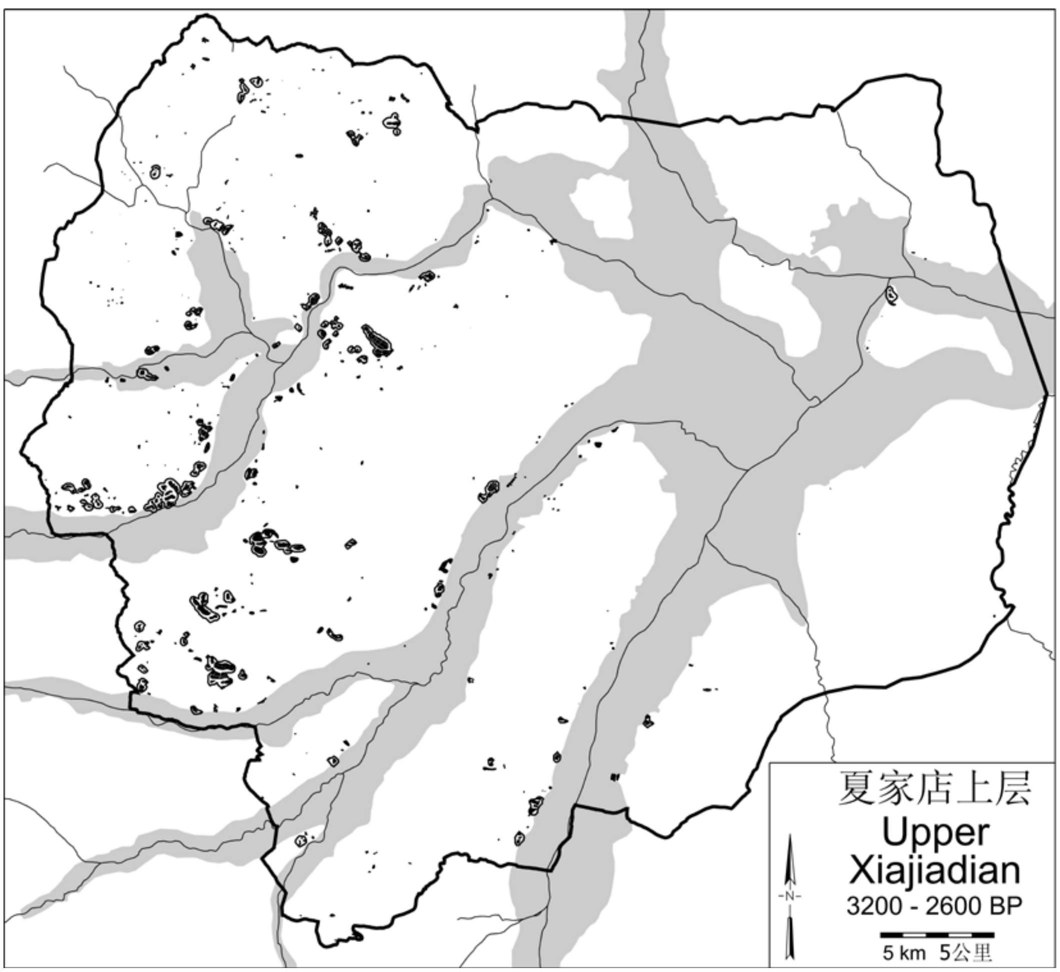


Figure 5.43. Delineation of Upper Xiajiadian local communities by cutoff contour from the unsmoothed density surface (Fig. 5.42). (Available online in color, see Appendix B.)

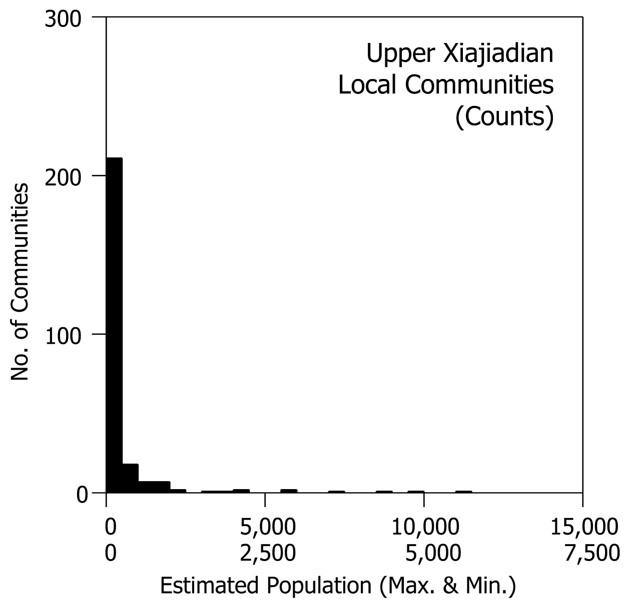


Figure 5.44. Histogram of Upper Xiajiadian local communities by number of communities in each population range.

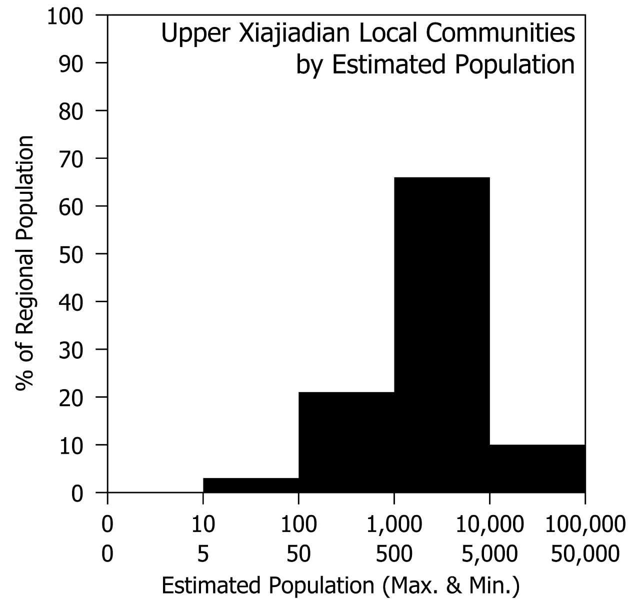


Figure 5.45. Histogram of Upper Xiajiadian local communities by percent of regional population in each population range.

provided a labor force sufficient for the task (Shelach, Raphael, and Jaffe 2011).

Upper Xiajiadian (1200–600 BCE)

The total Upper Xiajiadian population of the survey area is estimated at 60,000–120,000 (some 50% higher than the Lower Xiajiadian population). This represents the largest population estimated for any period in the Chifeng sequence, and population density would have been 50–100 persons per km^2. Southeastward-facing bluff edge locations continue to be very popular, along with upland locations (Fig. 5.41). Upper Xiajiadian materials were extremely sparse across the entire eastern half of the survey area, with substantial concentration toward the west and north. If such a distribution had been observed for an early period, it would raise concern that much evidence of occupation in the flatter and lower eastern sector of the survey area had been obscured by subsequent sedimentation. It is in the earlier periods when more occupation is detected in the lower eastern sector, however—precisely the opposite of the sequence likely to be produced by geomorphological processes progressively obscuring early occupations (cf. Chapter 3.3).

Interaction is still strongly structured by local communities (Figs. 5.42 and 5.43). In the more heavily occupied western part of the survey area, though, there are several large patches of contiguous occupation stretching across distances up to 2 or 3 km. These distances are large for the face-to-face interaction on a daily basis that provides the usual criterion for local communities. Even so, occupational densities within these very large local communities are sometimes extremely high, and can form multiple very high-density occupational nuclei within what is identified in Fig. 5.43 as a single local community. Defined in this way, local communities reach a demographic scale unknown in earlier times, with the largest single example estimated at 6,000–12,000 inhabitants and at least three others having larger populations than the largest Lower Xiajiadian local community (Fig. 5.44). Nearly 30 local communities appear to have populations of 1,000 or more. The 255 local communities delineated in the analysis do include one- or two-family homesteads, but only around 0.5% of the population appears to have lived in this way (Fig. 5.45). Fully 80% of the regional population lived in settlements of over 500–1,000 (compared to only around 60% in Lower Xiajiadian). The pattern of town dwelling that was established in Lower Xiajiadian times, then, further intensifies in Upper Xiajiadian. The Upper Xiajiadian towns are demographically larger and more numerous, and a larger proportion of the regional population lives in them.

Multiple supra-local communities appear clearly in the Upper Xiajiadian distribution, as in Hongshan and Lower Xiajiadian times (Figs. 5.46 and 5.47). Four, of approximately the same spatial and demographic scale, are crowded closely together in the uplands at the west side of the survey area. A fifth district forms the tallest single demographic peak in the distribution (with a district population probably between 10,000 and 20,000 people). The rank-size pattern for Upper Xiajiadian, looked at in isolation, would suggest a single integrated political or economic system for the survey area ($A = -.638$, Fig. 5.48). The problem with this interpretation, however, would be that this fifth community, far from being in the more or less central loca-

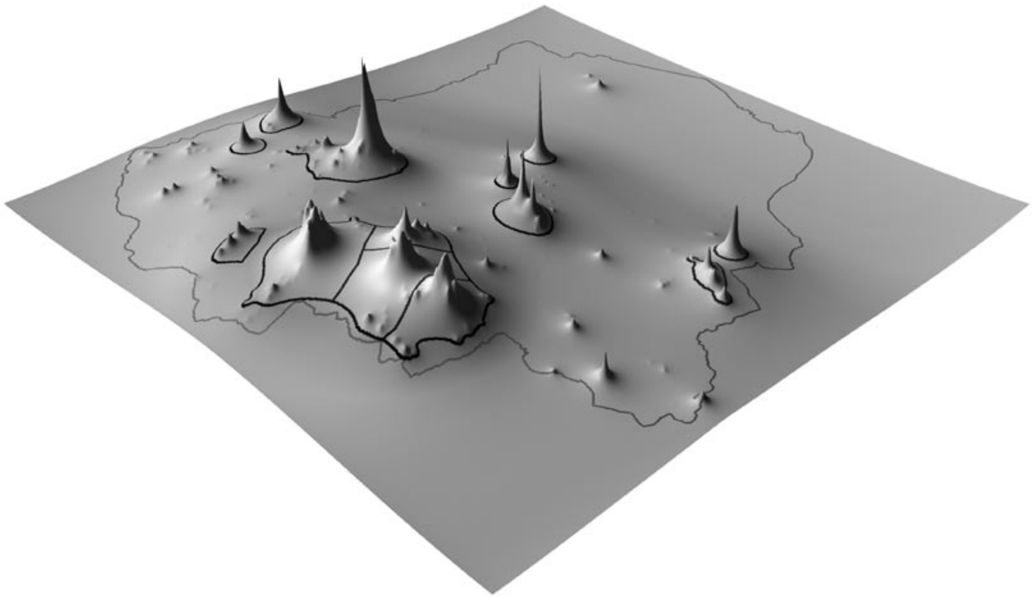


Figure 5.46. Smoothed density surface for Upper Xiajiadian occupation. (Available online in color, see Appendix B.)

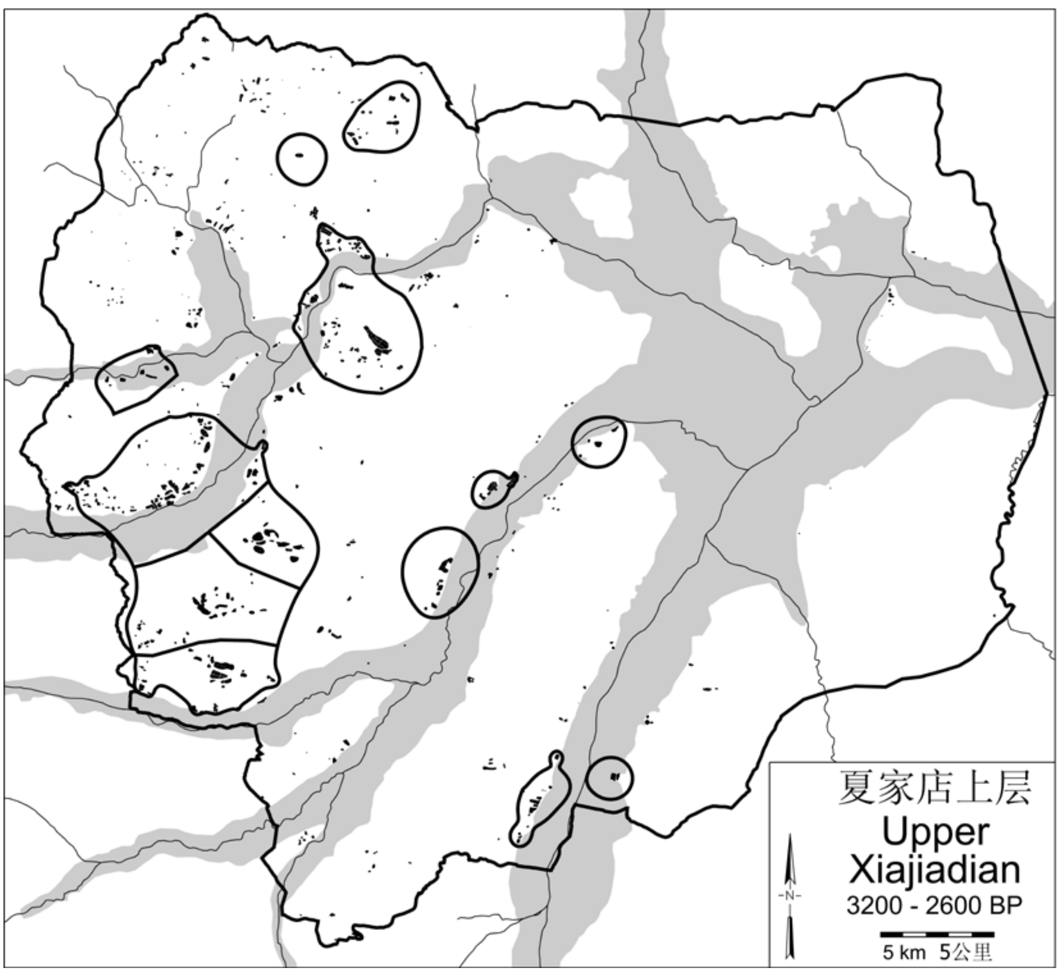


Figure 5.47. Delineation of Upper Xiajiadian supra-local communities or districts based on the smoothed density surface (Fig. 5.46). (Available online in color, see Appendix B.)

tion expected of such political organization, is quite separated spatially from the other four, off to the northeast, surrounded by a large buffer zone that separates it from other communities and districts. It is much more plausibly interpreted, then, as just another in a series of separate major Upper Xiajiadian supra-local communities or polities, not as a capital or other sort of center that integrates them all. Some eight other supra-local communities making smaller demographic peaks are scattered across the survey area, although still decidedly toward the west. These smallest of the districts delineated in this analysis have populations of only 2,000 or 3,000 people. And there are yet smaller peaks that one could go on defining as supra-local clusters as well, but they represent very small populations. These districts consistently show rank-size patterns suggesting strongly centralized internal organization, with an average *A* value for the six Upper Xiajiadian districts composed of six or more separate local communities of −1.377 (Fig. 5.49). The small polities centered on the Upper Xiajiadian towns, then, are highly variable demographically, but some have exceeded the maximum size seen in Lower Xiajiadian times, and these districts are, on average, even more strongly centralized than in Lower Xiajiadian times.

In sum, then, the pattern of numerous relatively small but supra-local polities established in Hongshan times, that intensified in Lower Xiajiadian times, has intensified yet further in Upper Xiajiadian. The number of polities has decreased slightly, and the demographic size of the largest ones has increased somewhat. The polities are still centered on densely occupied towns that have left us substantial accumulations of architectural remains, although fortification works are no longer conspicuous as they had been during Lower Xiajiadian.

The inhabitants of the Chifeng survey area during Upper Xiajiadian times experienced continued climatic fluctuations and drier conditions than those of early Lower Xiajiadian times (Chapter 3.2). At the maximum of this drying trend, precipitation may have dropped close to its modern average level. Upland farming might thus have been somewhat riskier than valley floor farming, but both could have been highly productive, as they are today.

Systematic analysis of the distribution of Upper Xiajiadian settlement with respect to environmental variables (Chapter 4.4) yet again confirms the initial observation that valley-margin locations were favored, although the proportion of the population in the valley floor itself and within 500 m of it has dropped back below 50%—similar to the level in Hongshan times and below that for Lower Xiajiadian. The proportion of the population well back in the uplands, at 2–3 km from the edge of the valley floor, is nearly twice what would be expected on the basis of the amount of territory in the survey area that fits this description. Quite a lot of the population at this distance from the valley margins consisted of the residents of the several large towns located toward the western side of the survey area. If these towns are removed from the analysis, then this specific distance from the valley margins contains roughly the expected proportion of the population (still a higher proportion than in Lower Xiajiadian times and similar to the Hongshan situation). In the analysis that excludes the towns, the proportion of the population on the flat valley floor or within 500 m of it is very similar to what was seen for Lower Xiajiadian. In terms of the modern land-use maps, the grassland category now contains a higher-than-expected proportion of the population for the first time (except for the very sparsely documented Xiaoheyan period).

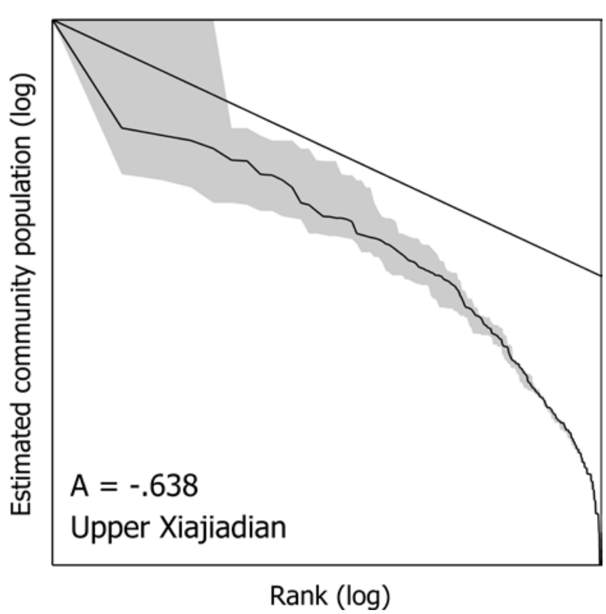


Figure 5.48. Rank-size graph for Upper Xiajiadian local communities (error range for 90% confidence).

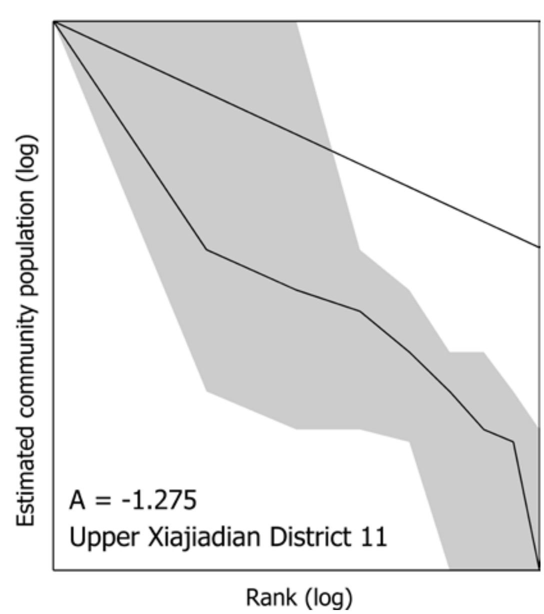


Figure 5.49. Rank-size graph for local communities in a typical Upper Xiajiadian district (error range for 90% confidence).

Again, a substantial part of this population represents the residents of the several large towns toward the west of the survey area. It is possible that the importance of grazing animals in the subsistence economy increased, and this fits superficially with the drier climatic conditions of Upper Xiajiadian times. Since lack of water is, and always has been, a major limitation for agricultural production in the Chifeng region, it is easy to conjure a vision of agricultural production dropping from lack of rainfall and Chifeng populations turning more toward herding (along the lines of the mobile herding adaptations so well documented in historical sources and the ethnographic literature for Mongolia).

There are, however, a number of problems with such an interpretation for the Chifeng region. First, there can be no question about the fully sedentary nature of Upper Xiajiadian settlement in Chifeng; communities are larger than ever before, and occupation is dense and produces substantial stratigraphic accumulations of debris from construction and refuse. Second, climatic conditions during Upper Xiajiadian times, although drier than in Lower Xiajiadian, were still at least slightly wetter than at present, and upland dry farming thrives today, in a subsistence economy where grazing animals are present but play a far smaller role than plant cultivation. Third, populations pressed toward herding because their agricultural systems were under stress from a drying climate would not leave the eastern half of the Chifeng survey area (where streams are larger and water most abundant) largely unoccupied and crowd together into several relatively closely spaced sizable towns in the west. Such a shift in distribution would have made it especially difficult to increase production from herding cattle, sheep, or goats. Fourth, the proportions of species in faunal remains recovered from stratigraphic excavations at sites 342 and 674 change only slightly, and the direction of the shift suggests, not an increase in the importance of herded animals, but a decrease. There are no unmixed Upper Xiajiadian contexts to compare with the Lower Xiajiadian ones cited above, but there is material from contexts that represent debris from Lower Xiajiadian times mixed with substantial amounts of Upper Xiajiadian debris, which should show the nature of change from Lower to Upper Xiajiadian in attenuated form at least. In this material, sheep and goat bones have dropped from the 26% share of major food domesticates in unmixed Lower Xiajiadian deposits to 19% (n = 22). Both cattle and pig bones are up, at 11% and 70% (n = 12 and 79), respectively, but the total for grazing animals is actually down a little. Unmixed Upper Xiajiadian deposits at Dashanqian yielded a faunal assemblage perhaps more directly indicative of Upper Xiajiadian food sources in the Chifeng region (Wang 2004:257). Of the major food domesticate remains, 14% (n = 19) are cattle; 15% (n = 21) are sheep/goat; and 71% (n = 97) are pigs. And finally, of the 825 identified plant specimens recovered by flotation from mixed Upper and Lower Xiajiadian contexts at sites 342 and 647, 60% were millet. Millet thus does appear to decrease somewhat in Upper Xiajiadian times, although it continues to constitute the clear majority of recovered plant remains in these mixed deposits. The increase in wild plants might reflect more intensive utilization of field weeds and other gathered wild resources; they might also have been deposited within residential areas in animal manure.

In sum, the intensified mixed economy suggested by the Lower Xiajiadian settlement distribution seems to have continued into Upper Xiajiadian times in Chifeng. Still further intensification may well be suggested since population levels were higher, and especially since this population choose not to distribute itself broadly across the region, but instead to concentrate very heavily in the western half of the survey area. If this western sector intensified production from a wide array of resources in part from demographic pressure, the pressure does not seem accurately described as a product of a growing overall regional population finally approaching limits on potential productivity. Instead, whatever pressure existed in the western half of the region was largely a product of the choice to leave the eastern half sparsely settled and presumably underexploited. The choice to locate the large densely-settled towns mostly at 2–3 km from the valley floor edge may have had more to do with the desire to keep these occupation zones from interfering with cultivation of the most productive agricultural lands, while at the same time remaining very accessible to them. The population shift to the west is very difficult to understand; it may have to do with political and economic patterns on a larger scale than can be seen in the Chifeng survey area.

The Upper Xiajiadian way of life has sometimes been described as a highly mobile pastoral adaptation. This is quite clearly not what the archaeological remains of the Chifeng survey area indicate. This does not necessarily present any contradiction to reconstructions that attribute greater subsistence importance to sheep and goats at sites like Guandongcha in Keshiketeng Banner to the west of the Chifeng survey area (Zhu 2004), much less at sites still farther west beyond the margins of the distribution of Upper Xiajiadian ceramics in central Inner Mongolia or Gansu Province (Shelach 2009:52–54). There is no particular reason to believe that all communities using Lower Xiajiadian ceramics across the extremely large area of their distribution would necessarily follow the same subsistence strategies. It may well be the case that, for some inhabitants of the "northern zone" during the late second and early first millennia BCE, residence patterns became much more mobile and subsistence strategies focused more heavily on sheep and goats. This does not, however, appear to be the case in Chifeng, where all the evidence suggests an intensified mixed economy based on farming and sedentary animal husbandry.

One of the best-known archaeological phenomena associated with Upper Xiajiadian times is the development of a bronze industry of substantial scale. Large quantities of knives, daggers, ornaments, and other objects made of bronze and decorated with realistic animal motifs are

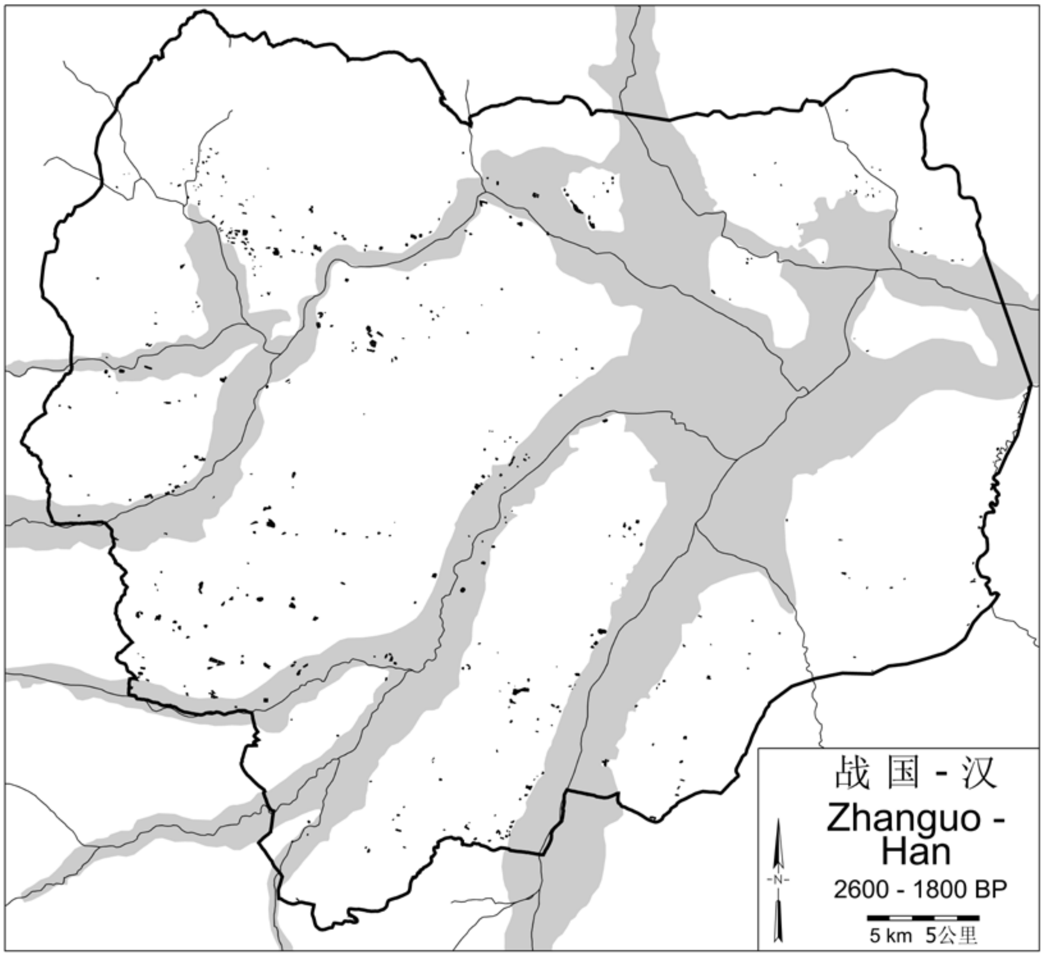


Figure 5.50. Distribution of Zhanguo-Han period ceramics in the Chifeng survey area. (Available online in color, see Appendix B.)

found in Upper Xiajiadian graves (Linduff 1997:67–73). While casting molds as well as evidence for copper mining suggest that these artifacts were produced within the Upper Xiajiadian area (Li and Zhu 2003; Wang 1994; Zhu 1987), their style and especially the ubiquitous use of animal motifs associate them with animal-style art found throughout the northern zone and in regions farther to the north and west in northern Mongolia, southern Siberia and central Asia (Linduff 1997; Shelach 2009:126–133). Many of those objects would have been used in highly visible ways (attached to clothing or hung on necklaces and belts), suggesting that they functioned to project the identity of their owners in daily interactions and death ceremonies (Shelach 2009:81–86). This art style has usually been interpreted as reflecting the importance of animals in a mobile pastoral adaptation. The Chifeng evidence provides no particular reason to doubt such an interpretation, but it does underscore the observation that the symbolic expression of identity is a different activity from subsistence pursuits. The Upper Xiajiadian inhabitants of the Chifeng survey area appear to have participated in the expression of the cultural identity broadly associated with animal-style art even though their settlement patterns were not mobile, and their subsistence economy, while certainly involving grazing animals, cannot accurately be described as pastoral.

Zhanguo-Han (600 BCE–200 CE)

The amount of Zhanguo-Han material recovered in the Chifeng survey is much smaller than for Upper Xiajiadian. Total population of the survey area is estimated at 15,000–30,000 (only one-fourth the levels estimated for Upper Xiajiadian and below Lower Xiajiadian population levels as well). Regional population density was back down to some 10–20 inhabitants per km^2. Distribution is all across the survey area, but the west is still more heavily occupied than the east. In this respect, though, the imbalance is not as lopsided as it was in Upper Xiajiadian times (Fig. 5.50).

Interaction is still strongly structured by local communities (Figs. 5.51 and 5.52), and it is easy to identify a cutoff contour that satisfactorily combines nearby lots across most of the unsmoothed occupation surface. The 316 local communities defined are more numerous than those of Upper Xiajiadian, and the obvious implication of

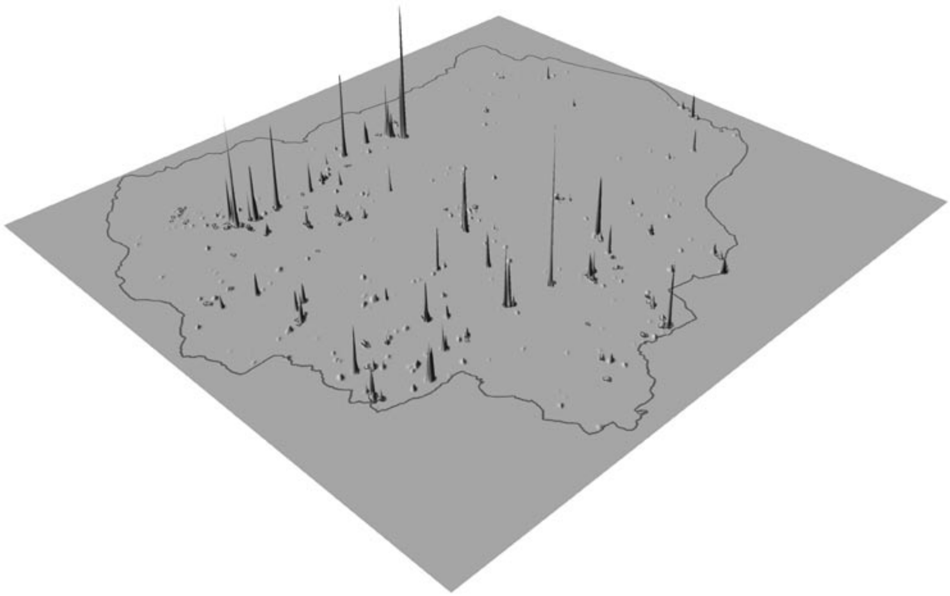


Figure 5.51. Unsmoothed density surface for Zhanguo-Han occupation. (Available online in color, see Appendix B.)

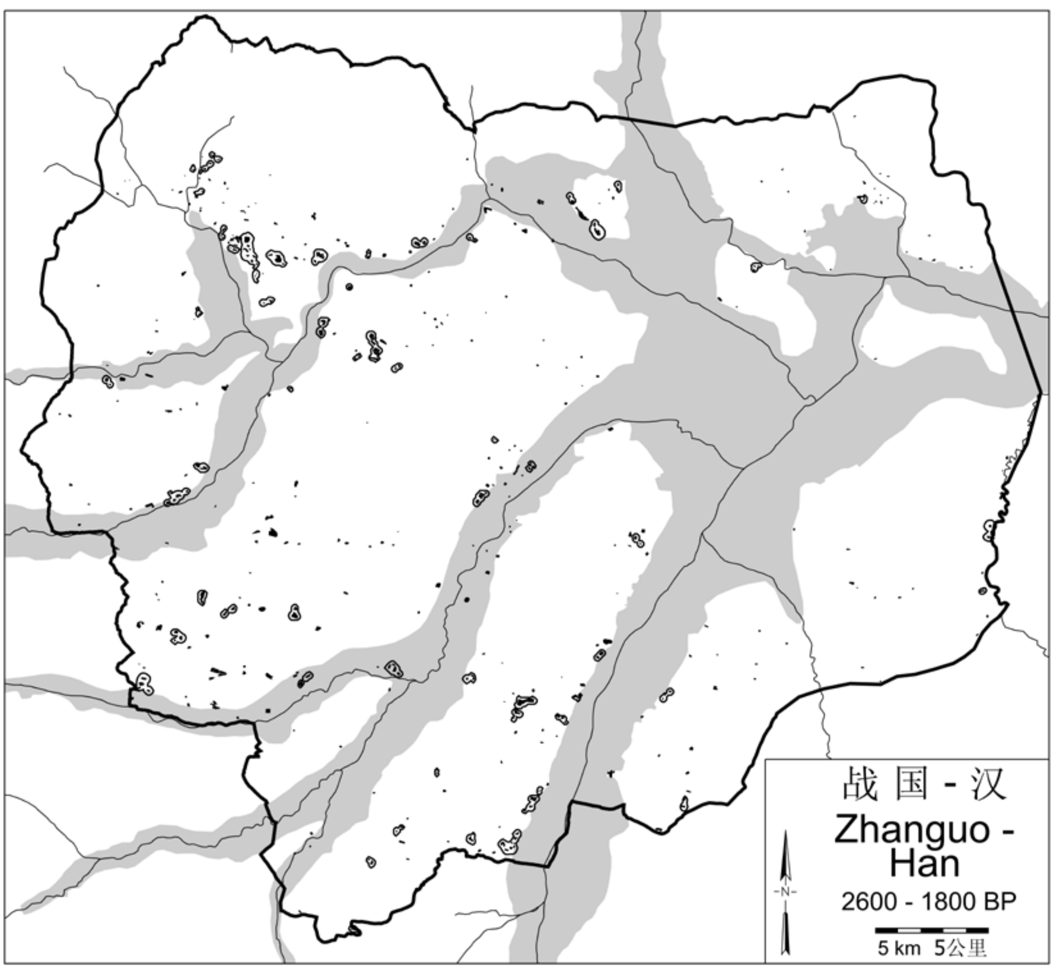


Figure 5.52. Delineation of Zhanguo-Han local communities by cutoff contour from the unsmoothed density surface (Fig. 5.51). (Available online in color, see Appendix B.)

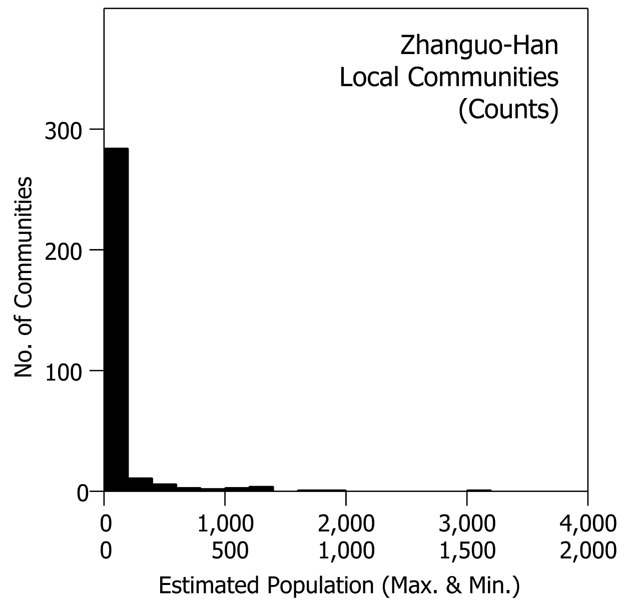


Figure 5.53. Histogram of Zhanguo-Han local communities by number of communities in each population range.

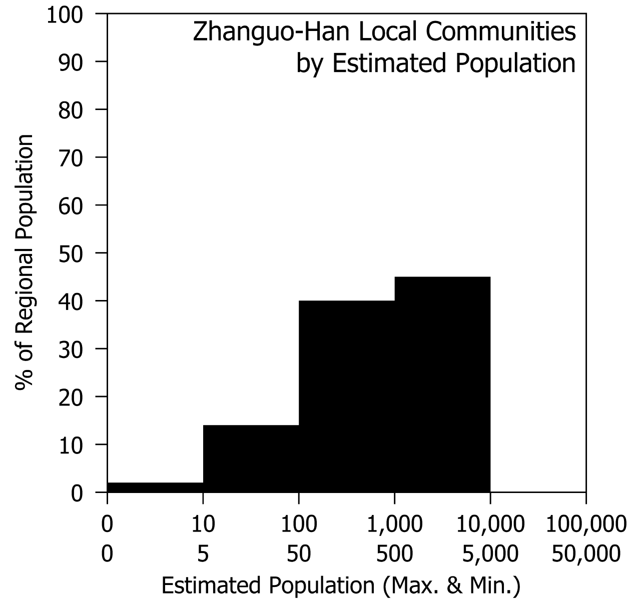


Figure 5.54. Histogram of Zhanguo-Han local communities by percent of regional population in each population range.

this growth in the number of communities even as population declined substantially is that Zhanguo-Han local communities are considerably smaller. The largest has only an estimated 1,500–3,000 inhabitants, and the number with over 500–1,000 inhabitants is probably fewer than 10 (Fig. 5.53). Fully half the local communities delineated probably consist of only one or two families, and around 20% of the population lives in local communities that probably number fewer than 100 inhabitants (Fig. 5.54). Clearly the pattern of town dwelling that so characterized Lower and Upper Xiajiadian times has reversed itself, and small villages and hamlets, along with one- or two-family homesteads, have again become common. At 1,500–3,000 inhabitants, the largest settlement is probably more like a large village than a small town. There is a greater scattering of families across the landscape than ever before, with substantial numbers of people living, not really in "local communities" at all but rather in homesteads on the land where their food production activities were carried out.

Multiple supra-local communities also characterize the Zhanguo-Han distribution (Figs. 5.55 and 5.56). Two of these districts have estimated populations of 3,000–6,000, but most are quite small, with some clearly containing fewer than 1,000 inhabitants. The overall rank-size pattern for the survey area is strongly and significantly convex (A = .137, Fig. 5.57). This suggestion that the region was not integrated into a single centralized political or economic unit is consistent with the widely scattered distribution of supra-local communities. In no previous period have the supra-local communities been so clearly separated by buffer zones—not even during Lower Xiajiadian when extensive fortifications suggested substantial hostilities. The internal organization of these districts, however, is again strongly centralized, with an average A value for the four Zhanguo-Han districts composed of six or more separate local communities of −.962 (Fig. 5.58). The larger political context in which the Chifeng region existed in Zhanguo-Han times, of course, was the emergence across northern China of much larger-scale political entities in competition with each other. Perhaps surprisingly, the basic organizational principles of supra-local communities or districts in the Chifeng survey area are not so different from those of earlier periods. The scale of the Chifeng polities, however, was much smaller than it had been earlier—in both spatial and demographic terms.

The climatic conditions confronted by Zhanguo-Han inhabitants of the Chifeng survey area were broadly similar to those of Upper Xiajiadian times (Chapter 3.2). Temperature and precipitation continued to fluctuate, at least occasionally creating slightly drier conditions than before. With substantially lower population levels in the survey zone, any pressure on resources would have decreased.

Systematic analysis of the distribution of Zhanguo-Han settlement with respect to environmental variables (Chapter 4.4) confirms that the unusual aspects of patterning that appeared in Upper Xiajiadian times largely disappeared, producing a distribution of occupation not unlike that of Lower Xiajiadian times. Around 60% of the population lives in the uplands within 500 m of the edge of the valley floor, and nearly another 10% lives in the valley floor. South and southeast facing slopes are especially popular. Most occupation is on land now classified as of agricultural use, with land that appears as grassland on the modern land-use maps having a lower proportion of the region's Zhanguo-Han population than expected.

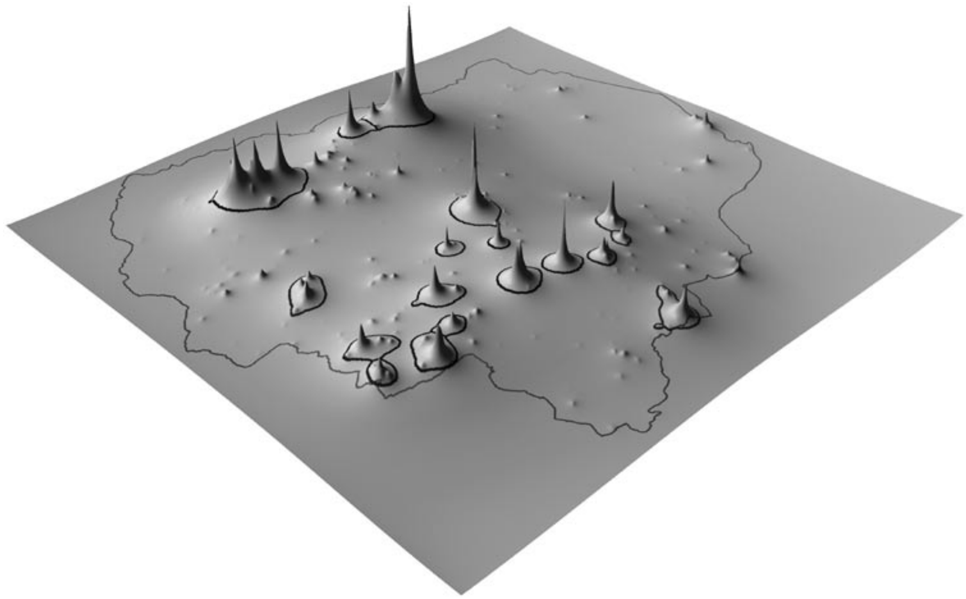


Figure 5.55. Smoothed density surface for Zhanguo-Han occupation. (Available online in color, see Appendix B.)

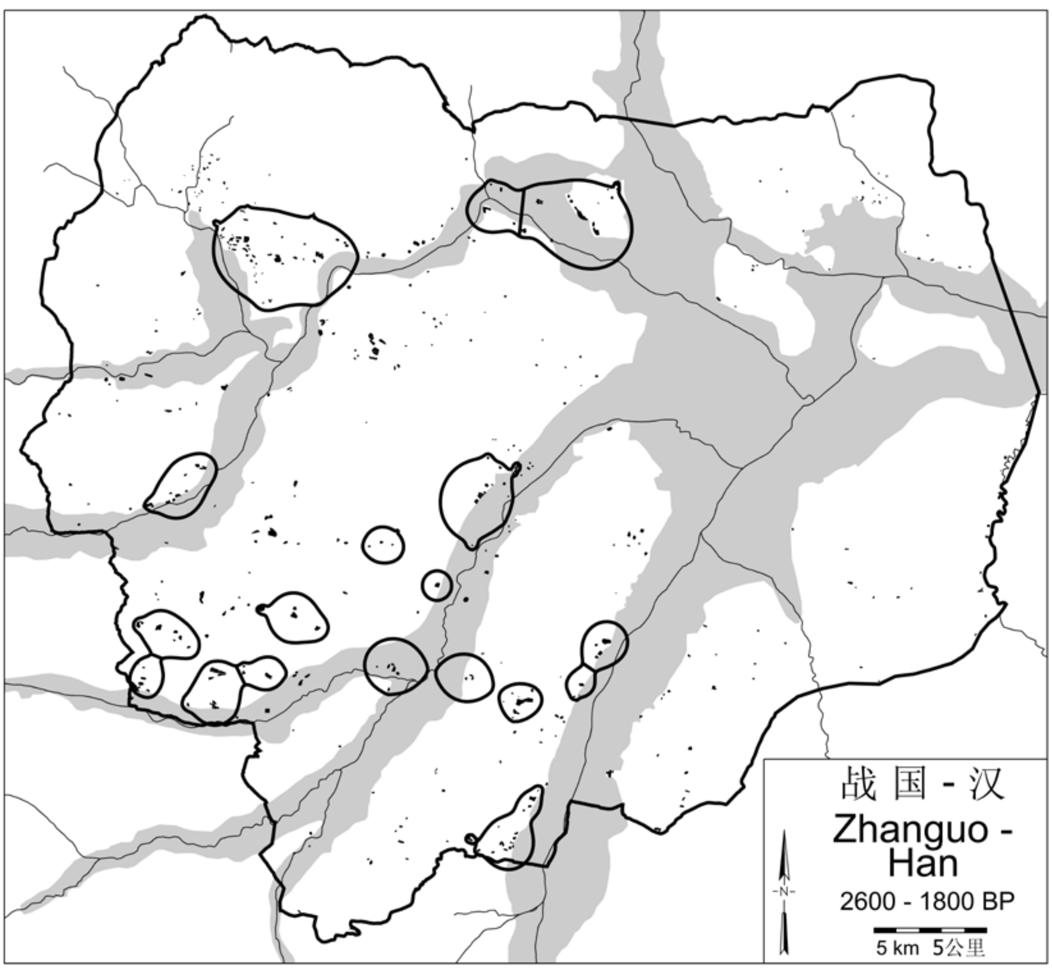


Figure 5.56. Delineation of Zhanguo-Han supra-local communities or districts based on the smoothed density surface (Fig. 5.55). (Available online in color, see Appendix B.)

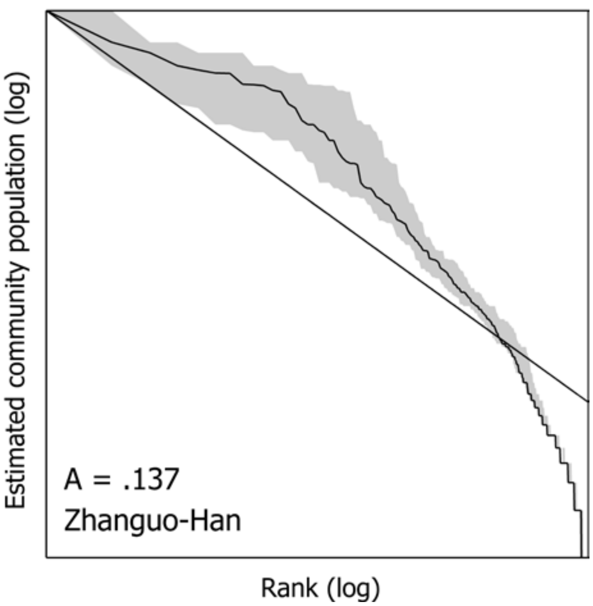


Figure 5.57. Rank-size graph for Zhanguo-Han local communities (error range for 90% confidence).

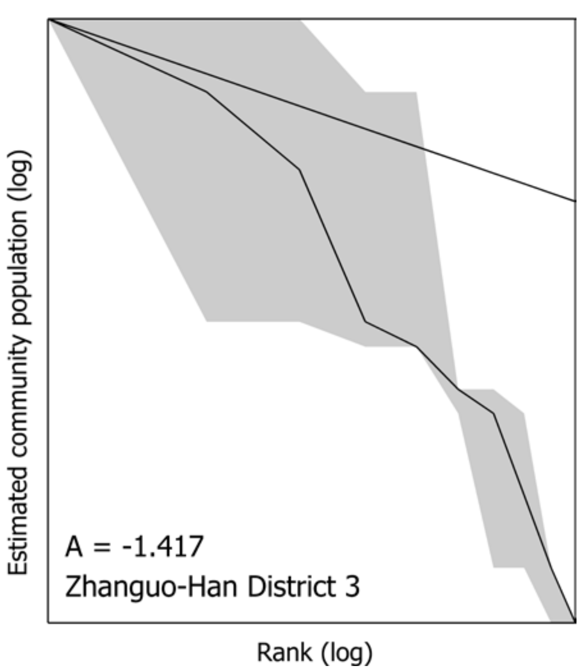


Figure 5.58. Rank-size graph for local communities in a typical Zhanguo-Han district (error range for 90% confidence).

The small scale of Chifeng's supra-local communities in Zhanguo-Han times may well have been a consequence of its position as a frontier region on the borders of the Yan and then the Qin-Han polities. Remains of the Zhanguo and Qin-Han "great wall" have been located west of the Chifeng survey area (Guojia 2003, Vol. 1:59), and this may indicate that the southern polities considered this a marginal border region. The decline in population in the survey area could reflect some drawing off of Chifeng's population toward more vigorously developing communities south of the line of the great wall. A large Zhanguo-Han-period city, known today as Heicheng is located near the Chifeng survey area in Ningcheng Banner just south of the line of the great wall. The settlement started out as a relatively small fortress of the Yan state during the Zhanguo period and developed into a large city during the Qin or Western Han period. At its peak, during the Han period, Heicheng's rammed-earth walls enclosed an area 1800 by 800 m (Zhongguo 2002:78–81), making it much larger and more elaborate than any settlement in the Chifeng survey area. Although no direct evidence for the identification of Heicheng with any specific historically known Han city has been found, its impressive walls, elaborate buildings within the walls, and artifact assemblage suggest that it was the seat of the Han prefecture and of the local government (Ping and Jiang 1982:164) for a region including the Chifeng survey area. The overall distribution of occupation in the survey area, as well as the scale and organization of local and supra-local communities, is consistent with an agrarian population sustaining itself and possibly providing some foodstuffs in tribute to the larger political and administrative centers outside the survey area such as Heicheng.

Liao (200–1300 CE)

The total population of the survey area is estimated at 30,000–60,000, representing a doubling of the Zhanguo-Han population, so regional density was 25–50 persons per km^2. While the available documents of the Liao Dynasty do not provide specific population numbers for the Chifeng survey area, estimates based on those documents suggest that the entire Liao Zhongjingdao region, of which Chifeng was part, had some 1,210,000 inhabitants (Wang 2007:112). Zhongjingdao encompasses much of what is now western Liaoning province, northeastern Hebei province, and a large territory around Chifeng south of the Xilamulun River. The estimated population for the Chifeng survey area amounts to around 2–4% of this historic estimate of Zhongjingdao's population, which seems plausible. Wang's (2007:112) estimated population density for the entire Zhongjingdao region of 11.4 persons per km^2 is lower than our estimate, but given the variability that likely existed across Zhongjingdao and the fact that it includes much territory of lower productivity than the Chifeng survey area this does not seem a major discrepancy.

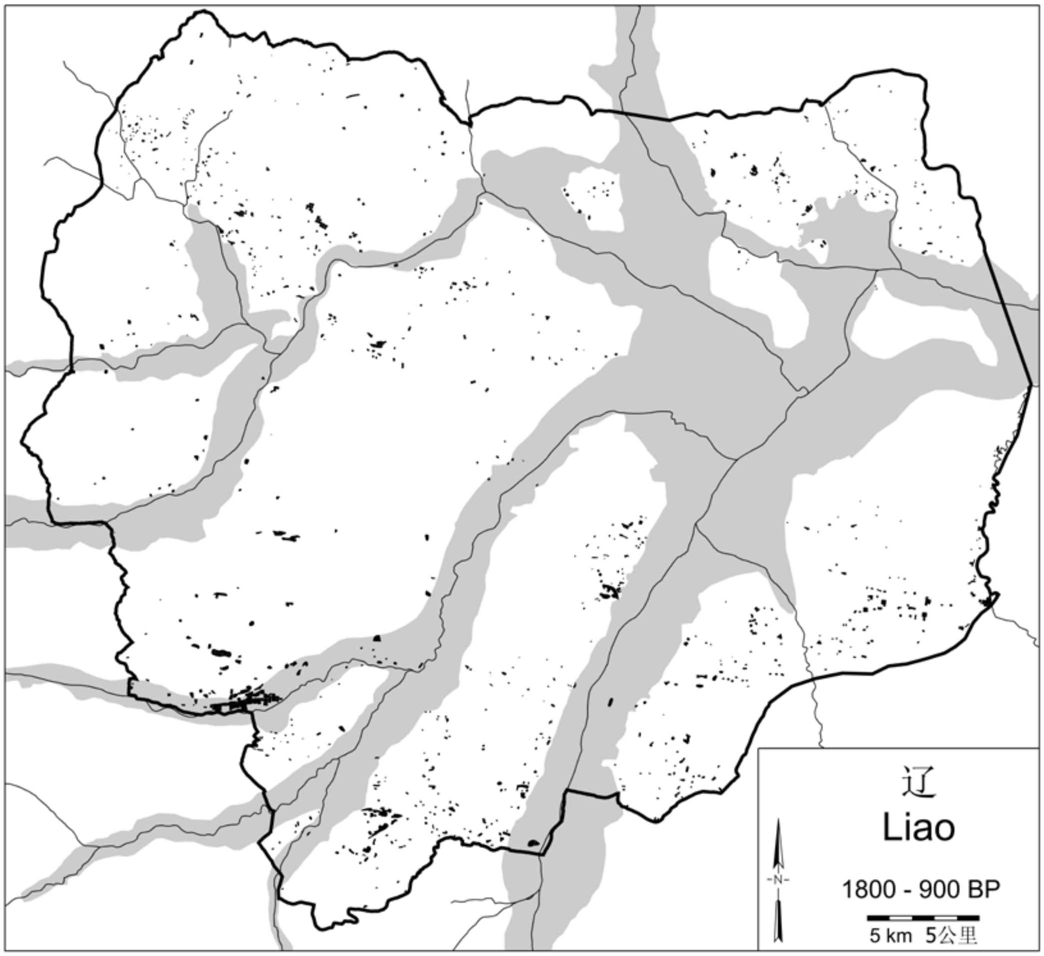


Figure 5.59. Distribution of Liao period ceramics in the Chifeng survey area. (Available online in color, see Appendix B.)

By comparison with earlier periods, Liao population levels are somewhat below Lower Xiajiadian times, and about half those of Upper Xiajiadian. Distribution is broad across the survey area, and the west is not as strongly favored as it had been in most previous periods (Fig. 5.59). Of particular note, the southern and especially southeastern part of the survey area, which had never before been much occupied, now is occupied. Occupation is broadly scattered through the uplands, with less tendency to concentrate on valley floor edges than in previous periods. Once again the distribution of occupation is the opposite of what we would expect if it were strongly conditioned by deposition of sediments in the valley floors. If that were the case, Liao is the period for which valley margin locations would be most detectable; in contrast to this expectation, it is much earlier when substantial zones of occupation are noted along valley margins.

Interaction is still fairly strongly structured by local communities (Figs. 5.60 and 5.61). Most of these now consist of one or a few contiguous collection units, often representing quite small populations, and these small local communities are fairly densely distributed on the landscape in some parts of the survey area. In a few parts of the survey area there are awkward combinations of collections stretching across 1 km or so which may be more a consequence of high densities of homesteads than genuine larger local communities. Choosing a higher cutoff contour on the unsmoothed surface, however, would miss substantial numbers of combinations in other areas that seem reasonable. Altogether, 673 local communities are delineated in this analysis—the largest number of local communities for any period by a substantial margin. Nearly half these local communities are actually homesteads of probably only one or two families (Fig. 5.62), and others are quite small, continuing the pattern of living in very small communities or individual homesteads that reappeared in Zhanguo-Han times. A sharp contrast to Zhanguo-Han times, however, is the appearance of the largest single settlement recorded in the survey area for ancient times—the historically known town of Songshanzhou, estimated on the basis of its archaeological remains at 15,000–30,000 residents. About half the total population of the survey area lived in this one town (Fig. 5.63). Town dwelling was thus intensely present in Liao times, and there is a sharp distinction in terms of lo-

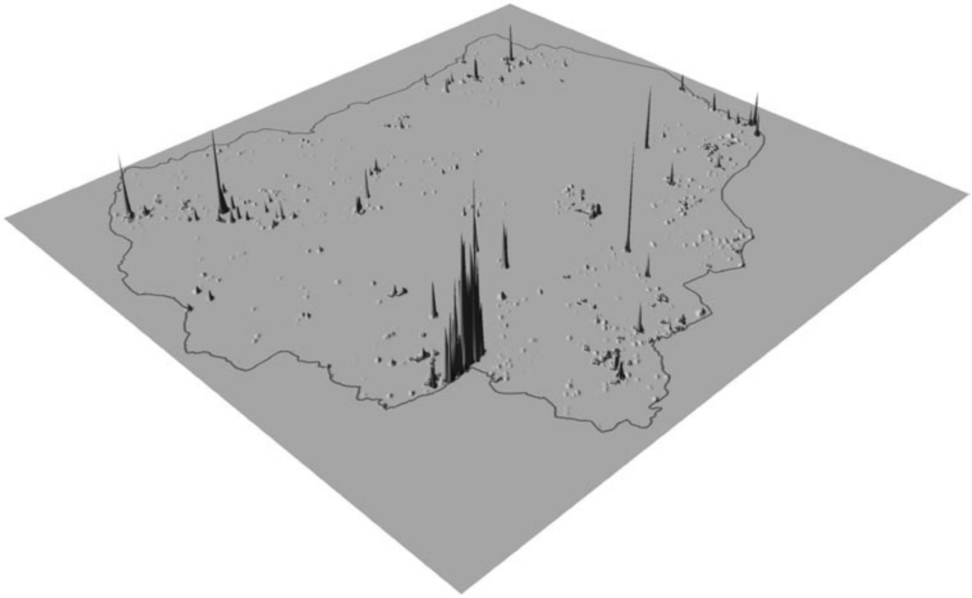


Figure 5.60. Unsmoothed density surface for Liao occupation. (Available online in color, see Appendix B.)

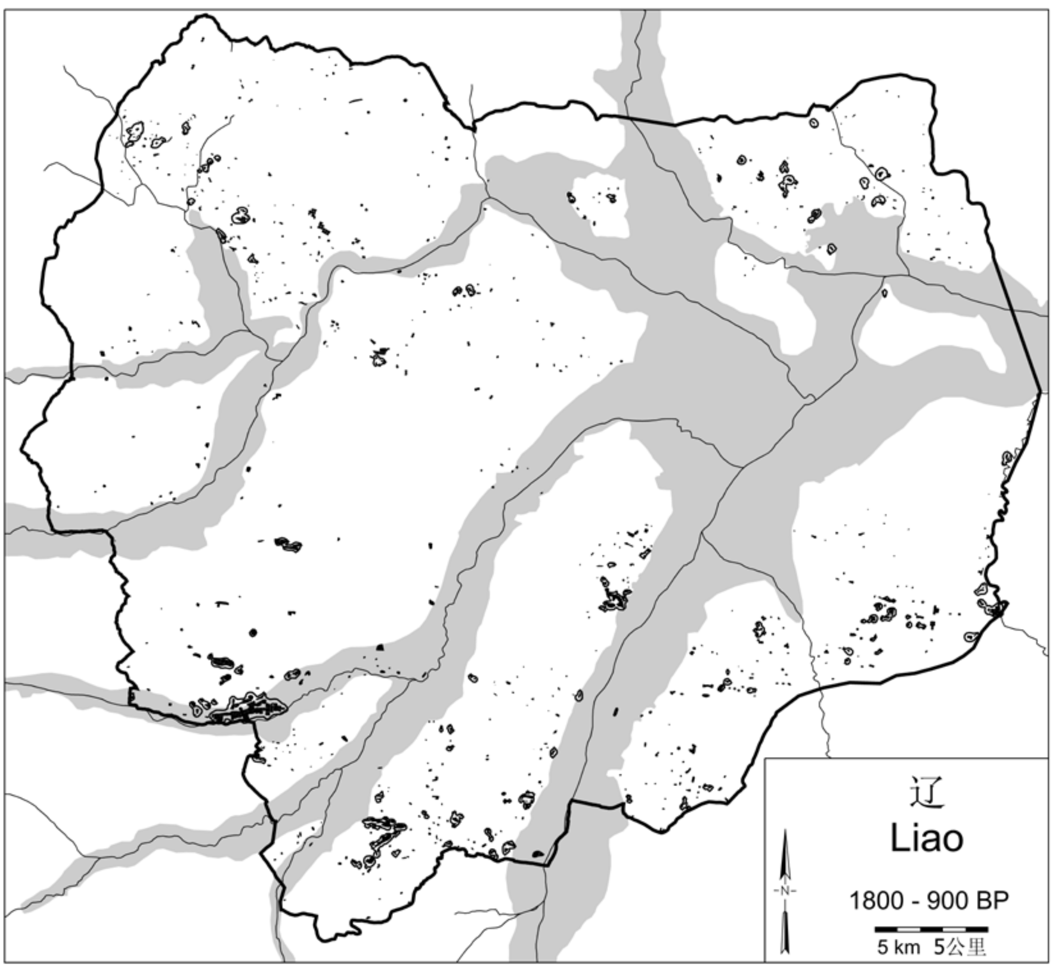


Figure 5.61. Delineation of Liao local communities by cutoff contour from the unsmoothed density surface (Fig. 5.60). (Available online in color, see Appendix B.)

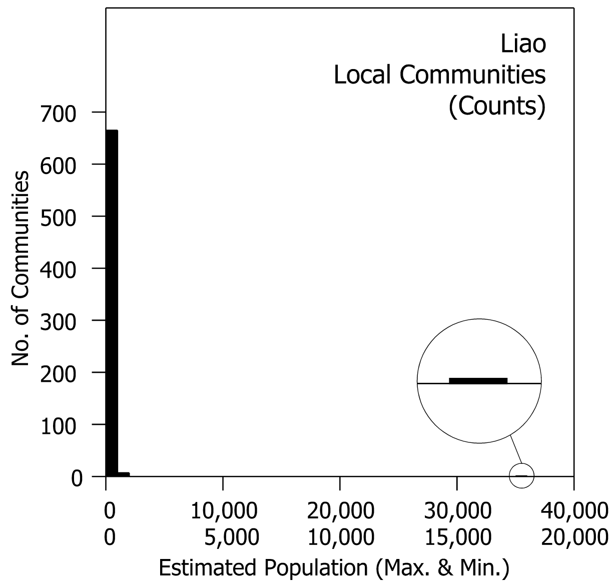


Figure 5.62. Histogram of Liao local communities by number of communities in each population range.

cal community life between the town-dwellers and the residents of the rural hinterland. This rural population lived in homesteads, hamlets, and villages, of which only a handful reached populations of 1,000 inhabitants or a bit more.

Songshanzhou is clearly the overwhelming demographic heavyweight in the region (Fig. 5.64). It appears to dominate the entire survey area and perhaps a considerable territory beyond it as well. For the first time, the entire Chifeng survey area seems politically and economically integrated into a single large supra-local entity ($A = -.536$, Fig. 5.65), and this evidently happened in the context of the region's incorporation into the yet larger Liao political domain.

Overall climatic conditions in Liao times approximate those of Zhanguo-Han (Chapter 3.2). A number of periods of notably warmer or notably cooler conditions lasting a few decades each are well documented. Precipitation also fluctuated, although the details are not as well documented. The amplitude of these fluctuations in Liao times was greater than those seen before, so they would have represented sharper and more sudden challenges to established systems of subsistence production than earlier inhabitants had faced.

Systematic analysis of the distribution of Liao settlement with respect to environmental variables (Chapter 4.4) confirms that the distribution of Liao occupation differs from all previous periods in several respects. First and foremost, a substantially higher proportion of the population lived in the flat valley floor than we would expect, given the proportion of the survey area taken up by the valley floor. This is largely a consequence of the fact that the large town of Songshanzhou is located in the flat valley floor. When this town is removed from the analysis, the proportion of population in the flat valley floor is less than would be expected in the abstract, and at a level similar to that observed through much of the sequence. The ability to locate such a town on the alluvial floor of the valley adjacent to a river must, in part at least, derive from technology. Fired bricks are common remains from Liao times, and would have made the construction of moisture-resistant dwellings easier. Floods may have been more under control than before by means of dike construction. And

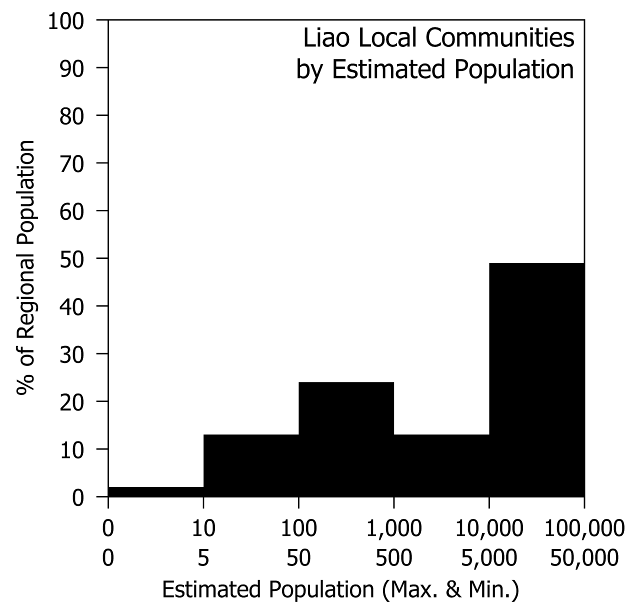


Figure 5.63. Histogram of Liao local communities by percent of regional population in each population range.

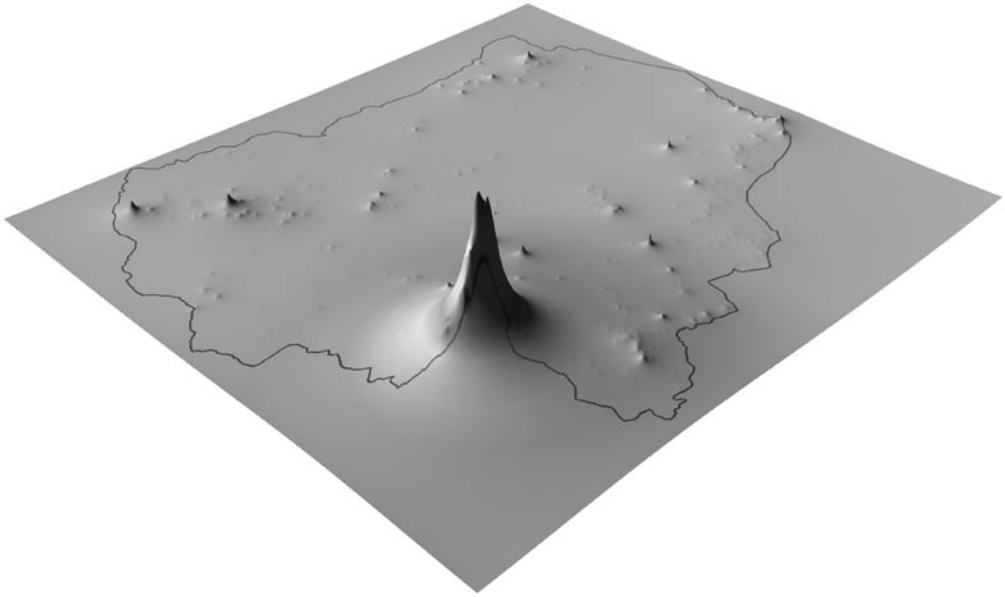


Figure 5.64. Smoothed density surface for Liao occupation. (Available online in color, see Appendix B.)

Songshanzhou was fairly far upstream on a relatively minor river. Facilitating transport of goods by animal-drawn carts using roads across the level valley floor may have been a major factor in the valley floor location. Food production in the region was apparently carried out by a rural population more broadly dispersed through the uplands than ever before, and foodstuffs to sustain the population of Songshanzhou would have needed to be moved from longer distances away than would have been necessary in earlier times. Historical documents make clear that Zhongjingdao was the most densely populated region and a key economic area for the Liao Dynasty (Wang 2007:85, 112). While no reliable information on the taxation system of the Liao Dynasty has survived in the historical texts, a large proportion of the Liao population resided in cities (Wang 2007:60–94), and these urban populations would have had to depend on surpluses generated by rural farming communities and transported to the cities. The settlement distribution suggests the possibility of more intensive craft specialization in Songshanzhou than in earlier communities, and some of the town's products as well as of the region's agricultural production may well have been shipped off to help sustain the larger Liao empire, whose central capital (Zhongjing) was some 50 km to the southeast. Although the Liao empire has often been given the image of a "nomadic" polity, its economy clearly depended heavily on food production in the agricultural areas it controlled. Chifeng must have been one of those regions, and both the population increase and the settlement distribution observed are easily interpreted as responses to this larger political context.

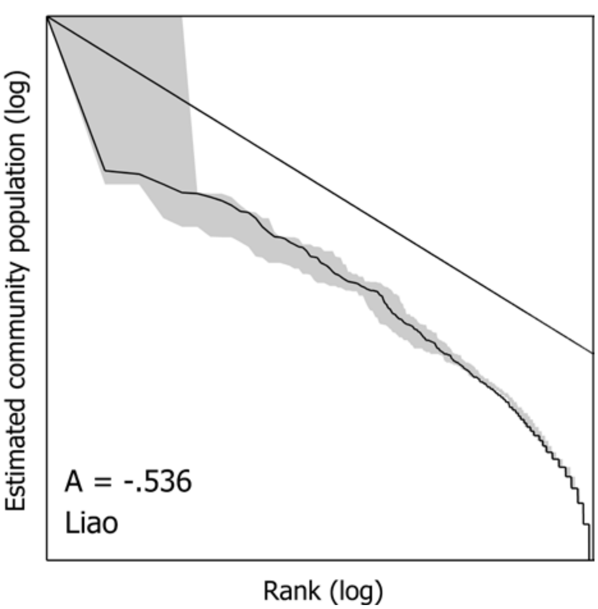


Figure 5.65. Rank-size graph for Liao local communities (error range for 90% confidence).

Conclusion

Regional-scale settlement study in the Chifeng region has contributed to the documentation of a complex sequence of social change through some 7,500 years in an area of 1,234 km^2 in the *beifang*. Despite Chifeng's lower potential for agricultural production than the vast and fertile Central Plain, initial sedentary farming communities were established in both regions in a similar time frame. Early Neolithic regional population densities were clearly extremely low in Chifeng, and much of the population lived in very small local communities. The wide distribution of the Xinglongwa and Zhaobaogou ceramic styles provides unequivocal evidence that these people participated in networks of communication with their neighbors that eventually covered large distances, but there is no indication in settlement distribution of the true integration of societies or polities at a supra-local scale. Such supra-local polities or districts first appeared in Hongshan times, when stratigraphic excavation provides complementary evidence of substantial social inequalities, some degree of craft specialization, and the construction of public/ceremonial architecture. Population had grown substantially, but regional demographic density was still far below the carrying capacity of the region under virtually any imaginable subsistence regime. Some villages, often with recognizable traces of ceremonial structures, became central in supra-local communities that probably comprised small chiefly polities. While populations across an area much larger than the Chifeng survey zone were clearly still in contact with each other, there is no evidence in the Chifeng settlement distribution of political integration on any larger scale than these districts a few kilometers across with populations numbering in the low hundreds.

Lower Xiajiadian regional community organization seems a natural outgrowth of this pattern of small, separate polities and infilling of the landscape, with the possibility of a Xiaoheyan interruption of uncertain nature and magnitude. In terms of spatial extent, Lower Xiajiadian polities were not much larger than Hongshan ones, but their populations numbered a few thousands instead of the few hundreds characteristic of Hongshan districts. Conflict between them is strongly evidenced in fortifications of sometimes massive proportions. Regional population levels were for the first time high enough that thoughts of pressure on subsistence resources can be seriously entertained (although the settlement analysis presented here does not pretend to show that this was in fact the case).

Population continued to grow in Upper Xiajiadian times, and several local communities were now large enough that labeling them "towns" seems appropriate. The supra-local districts headed by these towns perpetuate earlier patterns, but with consolidation producing fewer but more populous units. Bronze metallurgy was well developed. There is still, however, no indication of the political integration of the entire survey zone. Evidence of fortifications wanes, suggesting an abatement of the conflict that had characterized Lower Xiajiadian times, and there is no indication in the settlement evidence of the generalized shift toward a mobile pastoral way of life that has sometimes been attributed to Upper Xiajiadian times. The populations of the Chifeng region clearly did not abandon settled reliance on grain cultivation and animal husbandry for specialized mobile herding.

As the Iron Age began, the political and economic impact of much larger scale social formations centered elsewhere began to be strongly felt. The populations represented by earlier archaeological cultures had been politically fragmented into many units of quite small size. In Zhanguo-Han and Liao times, this was no longer the case. For the first time, single political entities were much larger than the 1,234 km^2 of the Chifeng survey zone. Population was presumably drawn off to emerging centers in other regions during Zhanguo-Han times, then at least partially returned when a Liao provincial town was established in the Chifeng survey area.

The Late Neolithic and Bronze Age sequence in the Chifeng survey area, though, reflects the independent development of a productive and stable subsistence regime centered on cultivating millet and other crops and tending livestock, especially pigs. This subsistence system sustained substantial regional population growth through time. Small supra-local communities possibly integrated largely through ritual and ceremony emerged in the Late Neolithic, and were followed, as the Neolithic transitioned into the Bronze Age, by hierarchically organized polities that were demographically much larger, but spatially still quite small. While artifacts show stylistic and other indications of contact between the *beifang* and the Central Plain, there is no indication that the political entities that were emerging in the Central Plain during these times had any sharp impact on the course of demographic, social, political, or economic change in the Chifeng survey zone. The situation is thus ripe for comparative analysis that seeks to find understanding of the dynamics of early complex societies in the patterns of similarities and differences between the two trajectories. The collaborators in the Chifeng Project hope that this volume contributes to the establishment of a basis for such comparisons by providing a broad regional-scale demographic, social, and political context in which what was already known from stratigraphic excavation can take on additional meaning.

Appendix A

Glossary of Chinese Characters

Anhui 安徽
Anxinzhuang 安新庄
Aohanqi 敖汉旗
Baiyinchanghan 白音长汗
Balinyouqi 巴林右旗
Balinzuoqi 巴林左旗
Bang River 蚌河
Banlashan 半拉山
Banzhijian River 半支箭河
Baomiying 苞米营
beifang 北方
Beipiao 北票
Bohai Gulf 渤海湾
Chahai 查海
chaotu 潮土
Chaoyang 朝阳
Chengzishan 城子山
Chifeng 赤峰
Dadianzi 大甸子
Dajing 大井
Dalihu 达里湖
Daliudaogou 大六道沟
Danangou 大南沟
Dashanqian 大山前
Daxing'anling 大兴安岭
ding 鼎
dongkui 冬葵
Dongshanzui 东山嘴
Dongzhai 东寨
dou 豆
duiwen堆纹
Erdaoliang 二道梁
Erlitou 二里头
Fanzhangzi 范仗子
Fengxia 丰下
Fuhegoumen 富河沟门
Fushanzhuang 福山庄
Fuxin 阜新
Gansu 甘肃
Guandongche 关东车
Gushantun 孤山屯
Halihaitu 哈力海吐
Han 汉
Hebei 河北
Hedong 河东
Heicheng 黑城
Hongshan 红山
Hongshanhou 红山后
Hougang 后冈
huangmiantu 黄绵土
Huangshan 黄山
Huinan 辉南
Hutougou 胡头沟
Jiangsu 江苏
Jiangzhai 姜寨
Jianhu 建湖
Jianping 建平
jiaochawen 交叉纹
jihewen 几何纹
Jilin 吉林
Jin 金代
Jinchuan 金川
Jinggouzi 井沟子
Jingoutun 金钩屯
Jinguishan 金龟山
Jinxi 锦西
Jitan 祭坛
Kalaqinqi 喀喇沁旗
Kangjiatun 康家屯
Kazuo 喀左
Keerqin 科尔沁
Keshiketengqi 克什克腾旗
Kulunqi 库伦旗
Lamadongshan 喇嘛洞山
lanwen 篮纹
Laoha River 老哈河
Laohushan 老虎山
li 鬲
Liao 辽代
Liaoning 辽宁
Liaoxi 辽西
ligaitu 栗钙土
lihetu 栗褐土
Lingyuan 凌源
Linxi 林西
Longchangzhen Daba 隆昌镇大坝
Longshan 龙山
Longtoushan 龙头山
Luanping 滦平
Lüshi Chunqiu 吕氏春秋
Majiagouyingzi 马家沟营子
Mengzhuang 孟庄

Ming 明代
Nantaidi 南台地
Nantaizi 南台子
Nasitai 那斯台
Ningcheng 宁城
Niuheliang 牛河梁
Nuluerhu Mountains 努鲁儿虎山
Pingdingshan 平顶山
Pinggu 平谷
Qianan 迁安
Qianxi 迁西
Qiguoshan 七锅山
Qilaotu Mountains 七老图山
Qin 秦
Qing 清代
Qinghai 青海
qiu 楸
Reshuitang 热水塘
Rizhao 日照
Sanzuodian 三座店
Shaanxi 陕西
Shaguotun 沙锅屯
Shandong 山东
Shang 商
Shangdian 上店
Shangjifangyingzi 上机房营子
Shangzhai 上宅
Shaolang River 少郎河
shengwen 绳纹
Shenshi 审时
Shipengshan 石棚山
Shiyangshihushan 石羊石虎山
Shuiquan 水泉
Shuiquangou 水泉沟
Shuishouyingzi 水手营子
Sidaozhangfang 四道杖房
Sifendi 四分地
Songliao 松辽
Songshanqu 松山区
Songshanzhou 松山州
Songshushan 松树山
Sui 隋代
Tabuaobao 塔布敖包
Taipusiqi 太仆寺旗
Tang 唐代
Tengwen Gong 滕文公
Tianguan Jiyi 天官疾医
Wangxianggou 王祥沟
Wei-Jin 魏晋
Wengniuteqi 翁牛特旗
Wudanzhen 乌丹镇
Wudaowan 五道湾
Wulanaodudianzi 乌兰敖都甸子
Xia 夏
Xiajiadian 夏家店
Xiaoheishigou 小黑石沟
Xiaoheyan 小河沿
Xiaoshan 小山
Xiaoshandegou 小善德沟
Xibo River 锡伯河
Xidao 西道
Xilamulun River 西拉木伦河
Xiliao River 西辽河
Xincheng 新城
Xindian 新店
Xinglonggou 兴隆沟
Xinglongwa 兴隆洼
Xinjiang 新疆
Xinjing 新井
Xishuiquan 西水泉
Xitai 西台
Xizhai 西寨
yan 甗
Yan 燕
Yan Mountains 燕山
Yangchangzi River 羊肠子河
Yangshao 仰韶
Yaowangmiao 药王庙
Yingjin River 英金河
Yiwulü Mountains 医巫闾山
Youbeiping 右北平
Yuan 元代
yuli 郁李
Zhao Qi 赵岐
Zhaobaogou 赵宝沟
Zhanguo 战国
Zheng Xuan 郑玄
zhiziwen 之字纹
Zhizhushan 蜘蛛山
Zhongjingdao 中京道
zhongshiji nuanqi 中世纪暖期
Zhou 周
Zhoujiadi 周家地
Zhouli 周礼
zongrangxingtu 棕壤性土

Appendix B

Electronic Access to Color Illustrations and the Full Dataset

Detailed data from the research reported on in this volume are available in digital form online in the Comparative Archaeology Database provided by the Center for Comparative Archaeology at the University of Pittsburgh. The objective of the online database is to provide detailed primary data in a form directly amenable to further analysis by computer, and thereby complement printed volumes such as this one in serving the fundamental function of an archaeological report—making available the full datasets upon which conclusions are based so that interested scholars can explore them further. It is hoped that this will facilitate comparative analysis firmly grounded in archaeological data. Since digital media, standard formats, and means of access all evolve, and since the Comparative Archaeology Database will attempt to keep pace with this evolution, it is impossible to provide permanently valid full descriptions here of the contents of the database and of means to access them. As of this writing, the detailed datasets on which this study is based are directly accessible to Internet users via the following URL:

http://www.cadb.pitt.edu/

The files containing the data can be downloaded via the tools provided in web browsers such as Firefox, Opera, Safari, and Internet Explorer. An alternative means of contacting the Comparative Archaeology Database is by e-mail:

cadb@pitt.edu

Current information about the datasets and access to them (as well as about other contents of the Comparative Archaeology Database) can be obtained via the Internet or e-mail as described above.

Stratigraphic Data Available

Complete details of each of the stratigraphic tests excavated by the Chifeng Project are available for browsing. These data include stratigraphic profiles, photographs, and the specific context that corresponds to each individual excavation unit.

Quantitative and Spatial Data Available

The complete dataset for the Chifeng settlement study is available in a variety of formats. Since these may change through time, they are not described in detail here. The objective, however, is to provide formats that are most accessible for import to the widest possible array of application software for further examination and analysis. The settlement data are provided in full detail, collection unit by collection unit for the entire survey zone. There are both quantified data on materials recovered from each collection unit and the exact location of each collection unit. Both settlement data (period by period) and environmental information are provided in the form of map layers for import to GIS software. Quantities of all materials recovered from each excavation unit (see Stratigraphic Data, above) are also provided.

Color Images Available

Many of the photographs, maps, and other graphics that appear in black and white as illustrations in this volume are also available as color images in the Comparative Archaeology Database. This includes settlement and environmental maps, which are available both in data formats for analysis (see Quantitative and Spatial Data, above) and in color image formats for browsing.

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Dizhi Xuebao 地质学报
Dongfang Kaogu 东方考古
Dongya Guwu 东亚古物
Haiyang Dizhi yu Disiji Dizhi 海洋地质与第四纪地质
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