Sustaining Ritual:
Provisioning a Hongshan Pilgrimage Center at Niuheliang

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This research is focused on the Hongshan period society of the greater Niuheliang area in the Hongshan core zone. To investigate the social and economic focuses of different local communities within this area, fieldwork was carried out at Shangchaoyanggou, a Hongshan local community in an alluvial river valley 5 km away from the famous Niuheliang ceremonial structures. During the fieldwork, 41 artifact clusters, which represent 40 Hongshan household units and one potential ceremonial platform, were delineated by intensive survey. Surface collections were made to collect remains on the ground surface and shallowly buried within the areas of these artifact clusters, and all field remains were later analyzed in the lab.

Based on analyses of data collected in the fieldwork, it is suggested that Shangchaoyanggou household units were generally more involved in food production compared to other Hongshan local communities, such as near the Niuheliang ceremonial structures and in the Upper Daling Valley. The degree of participation in ritual activities, on the other hand, was much lower at Shangchaoyanggou than any other Hongshan local communities in comparison. Corresponding to the general character of the Shangchaoyanggou local community is its internal differentiation of productive activities, featuring a group of spatially clustered household units with a stronger focus on food production and related activities than others within the same local community. In addition, these food production-focused household units also played active roles in social activities within Shangchaoyanggou.

These findings support the existing hypothesis on different roles played by Hongshan local communities within the greater Niuheliang area. Shangchaoyanggou, as one of the food providers within the region, helped feed ritual-focused residents near the Niuheliang ceremonial structures. Coexisting with the regional differentiation are socio-economic differences within Shangchaoyanggou, which provides favorable conditions for food surplus production. This research suggests that the regional pattern within the greater Niuheliang area, with the existence of modest productive and ritual differentiation between local communities, and the internal structures of local communities, support this regional pattern.

Table of Contents

List of Tables

List of Figures

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1.0 Introduction

1.1 Economic Strategies of Early Ritual-based Complex Societies

Ritual has long been recognized by archaeologists as one of the most important sources of power that shape early complex societies in different parts of the world (Earle 1997, p.8-10). Enormous ceremonial structures, elegant ritual-related artifacts, and vast food consumption during the ritual ceremonies have been found in various ritual-based early complex societies with different environmental settings and cultural traditions. While on many occasions it is hard for archaeologists to understand the ideologies behind those ritual activities directly, the remains related to ritual practices do provide clues for understanding how the ritual activities are conducted, and how these activities help enhance various types of social differentiation. Efforts have been made on such topics as how did certain groups of people manipulate the ritual activities in order to expand their privilege to broader scopes of the societies (Rick 2004; Potter 2000). Some discussions focus on the differences between theological dogmas and how such differences would change the ritual manipulators' agenda (Moore 2005, p. 220; Sayre 2010, p. 81-82).

On the other hand, ritual activities can be costly in terms of the number of resources and effort devoted to practice them. As Spielmann (2002) argues: "Ritual does not simply regulate work; it demands work." It is costly not only because large amounts of extra resources are needed to build the ceremonial structures, make the artifacts or produce food surpluses, but also because ritual activity would occupy the time and energy that could be used for other social or economic practices (Pauketat et al. 2002). It is especially the case when the full-time ritual

specialists and craftsmen related to ritual activities emerged. Thus, ritual, in its nature, requires resources produced from economic activities to maintain and even enhance itself. Although this statement doesn't imply the ritual practice would enforce productive intensification automatically, ritual can be a motivation to executing such agenda, as has been confirmed by many ethnographic and archaeological cases (e.g. Lemonnier 1996; Twiss 2008). Thus, exploring the potential approaches through which the ritual activities may stimulate general changes in economic strategies and the retroaction of these changes back to the ritual activities are critical topics for understanding how different aspects of social differentiation emerge in ritual-based early complex societies, and hence call for investigations on the economic strategies of these societies.

So far studies have been made to interpret the economic strategies of ritual-based early complex societies, with special attention to the production of resources used for ritual and communal activities. Interpretive models on this topic, such as the "ritual mode of production" suggested by Spielmann (2002), usually focus on the demands generated by the ritual and communal activities such as feasting. These demands call for large amounts of socially valuable goods and unusual food and hence provide a motivation to enhance the production of surplus, which is not for coping with the future risk, but for completing the ritual practice. For another, the communal activities can be regarded as arenas for the competition on productions. By intensifying the production of the product mentioned above, individual agents can collect more resources that could be used in the competition to enhance their ritual status or social prestige. Through such paths, the ritual activities would conduct an influence on economic production in the long run and stimulate the emergence of economic differentiation of ritual-based early complex societies (Clark and Blake 1994; Potter 2000; Junker et al. 1994). In general, this type

of model focuses on the demands of holding ritual or communal activities, regards competitive productions as an important path to enhance productive differentiation, and is widely applied among the studies focus on the economic development of ritual-based early complex societies.

While the models mentioned above can explain the development of economic strategies in many ritual-based complex societies, they don't take other demands into account, such as the daily subsistence demands of the ritual-specialist group who devote more energy to ritual-related activities than food production. It is argued here that although both the subsistence demands of ritual specialists and the food demands for feasts aim to require food resources from the less ritual-specialized group, their features are quite different from each other. Compared to the feast demand, the subsistence demand seems to be more rigid and persistent, which calls for more reliable, instant resources in order to make it easier to transport a large number of utilitarian resources to meet the needs of ritual specialists. In the long run, the subsistence demand may also evoke productive specialization, especially in food production. Thus, it is argued here that different natures of demands would tend to form different economic strategies that encourage productive differentiation, and this difference is worth to be investigated in depth. It is suggested that Hongshan societies in Middle Neolithic northeastern China provide ideal cases for the investigation of the influences of daily subsistence demands on the economic strategies of ritual-based early complex societies.

1.2 First Early Complex Societies in Northeastern China

Between 4500 and 3000 BC, following the earlier establishment of the first settlements (Zhongguo 1997), a number of small regionally integrated polities emerged in northeastern

China (Chifeng 2011; Peterson and Lu 2013; Peterson et al. 2010, 2014a; Zhang et al. 2013). These Middle Neolithic societies, whose remains were labeled the "Hongshan Culture", were among the earliest complex societies in East Asia. Evidence on millet cultivation, such as abundant remains of domesticated millet as well as potential agricultural lithic tools, indicated a relatively high degree of food production. In addition, remains of domesticated animals, especially pigs, were widely recovered in Hongshan sites, while hunting and gathering still played important role in the Hongshan subsistence economy, as backed by wild faunal remains, such as deer bones and shell artifacts recovered in various Hongshan sites (Guo and Zhang 1984; Liu et al. 2004; Wang et al. 2017; Ma et al. 2016; Teng 2017). Dozens or possibly even hundreds of separate small polities occurred in an area more than 600km across, substantially separated from the Central Plain, where archaeological research on early complex societies has focused because of the later very large-scale Bronze Age states centered there (Figure 1). Hongshan societies have come to be considered complex only within the last few decades as fairly large-scale ceremonial structures and elaborate burials with carved jades have become well documented (Liaoning 2012; Guo and Zhang 1984; Fang and Liu 1984). These elaborate remains are more abundant and larger in scale in what has been referred to as the "Hongshan core zone" (Peterson et al. 2010; Drennan, Lu and Peterson 2017) than they are in more peripheral parts of the Hongshan territory, which refers to all the known geographic distribution of Hongshan remains (Figure 2). Among different types of ceremonial architecture, ceremonial platforms are probably the commonest and most important ones. They are usually circular or rectangular in shape, 15 to 20m across, and around 1m high. In most cases, the platforms are formed of earth, with retaining walls of cut stone. Often large painted ceramic cylinders (*tongxingqi*) are placed around the platforms' perimeters. Multiple stone slab tombs are often dug into platform bodies,

with a central principal tomb sometimes extending well down into the sterile soil below the platform construction. The dead are usually accompanied with non-utilitarian items of carved jade and/or shell, which are usually taken to be of symbolic or ritual importance (Liaoning 2012; Guo and Zhang 1984; Fang and Liu 1984, 2005). Similar structures but without burials are often referred to as "altars." Platforms also occur outside the "core zone" but in smaller numbers and with less elaboration. In addition to the carved jade artifacts found in tombs, clay human figurines found in altars, and ceramic cylinders are generally believed to have religious or ideological meanings (Liaoning 2012; Guo and Zhang 1984. Figure 3, 4). These remains, then, are generally agreed to demarcate places used for ceremonial purposes (Nelson 1996, 1997; Suo and Li 2011).

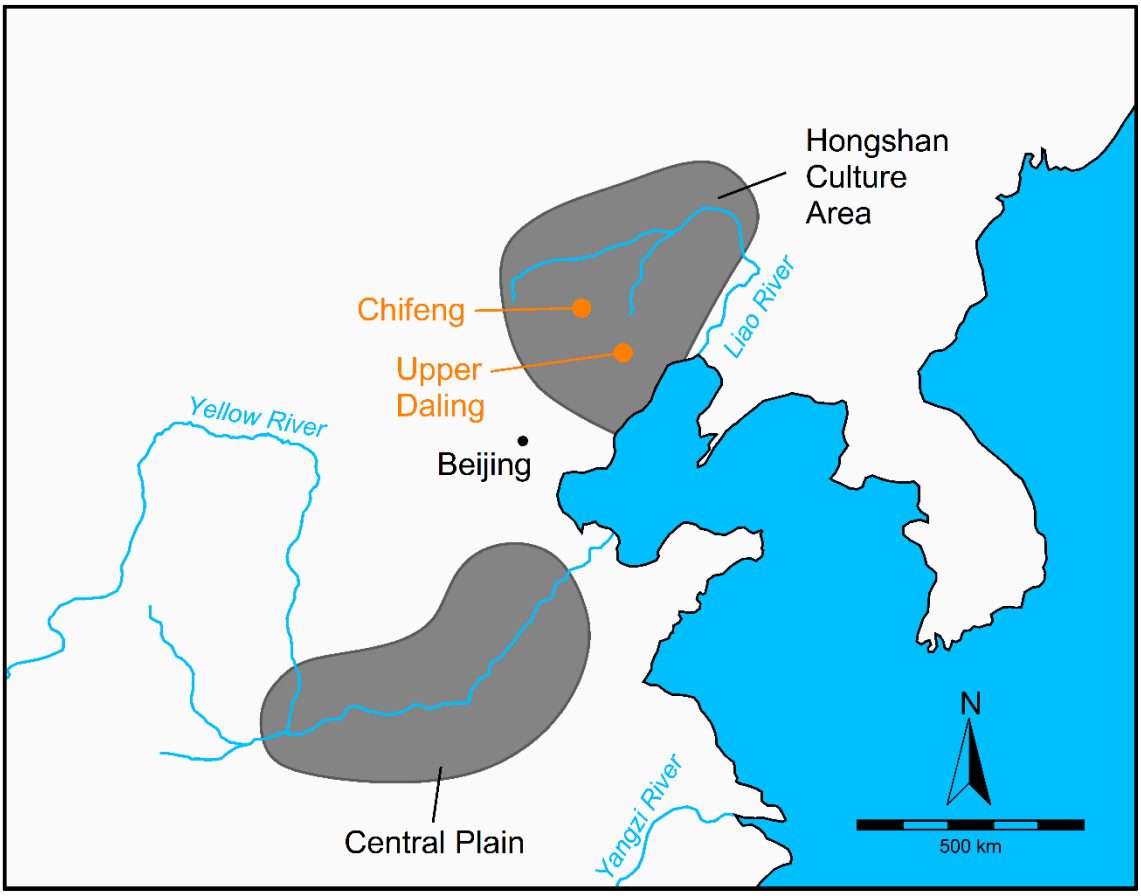

Figure 1 The location of the Hongshan culture area in China (redrawn from Drennan et al. 2014 pp.51)

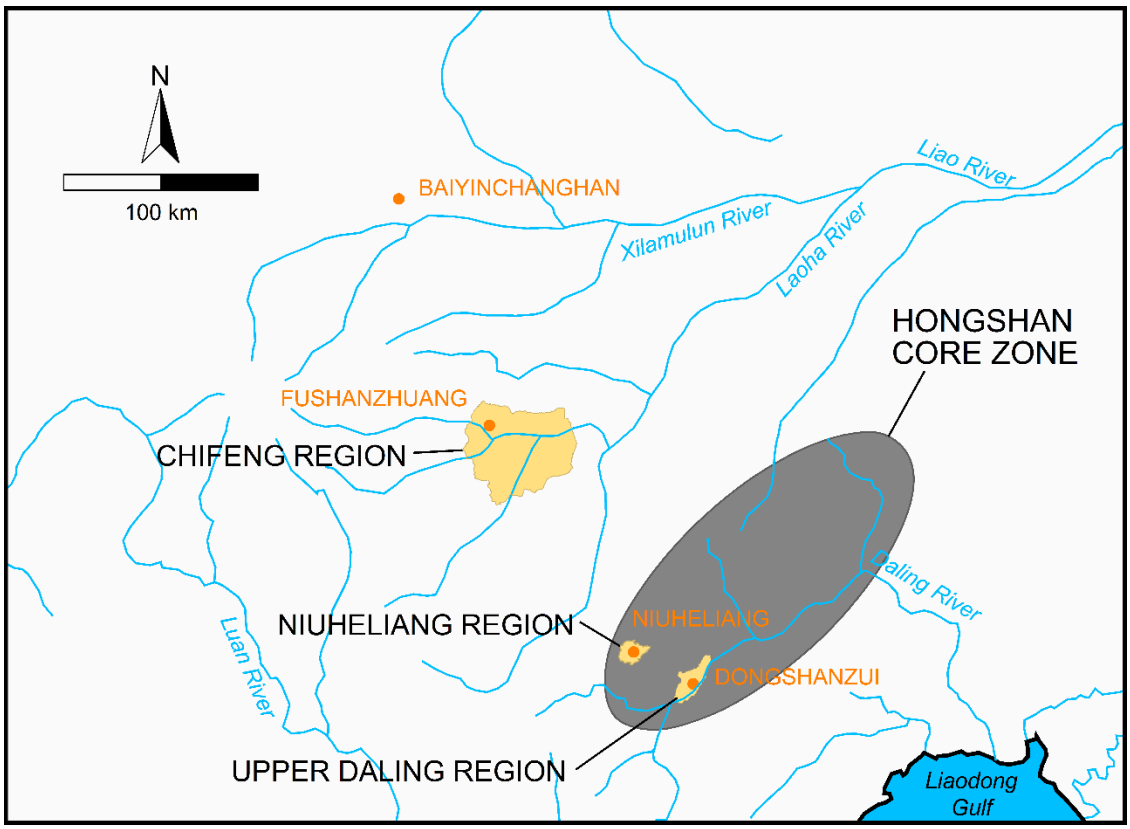

Figure 2 The locations of the Hongshan core zone and previous field projects (redrawn from Drennan et al. 2017 pp.52)

Figure 3 An overview on the Niuheliang Locality 2, a Hongshan period ritual compound (after Liaoning 2012 Figure 40)

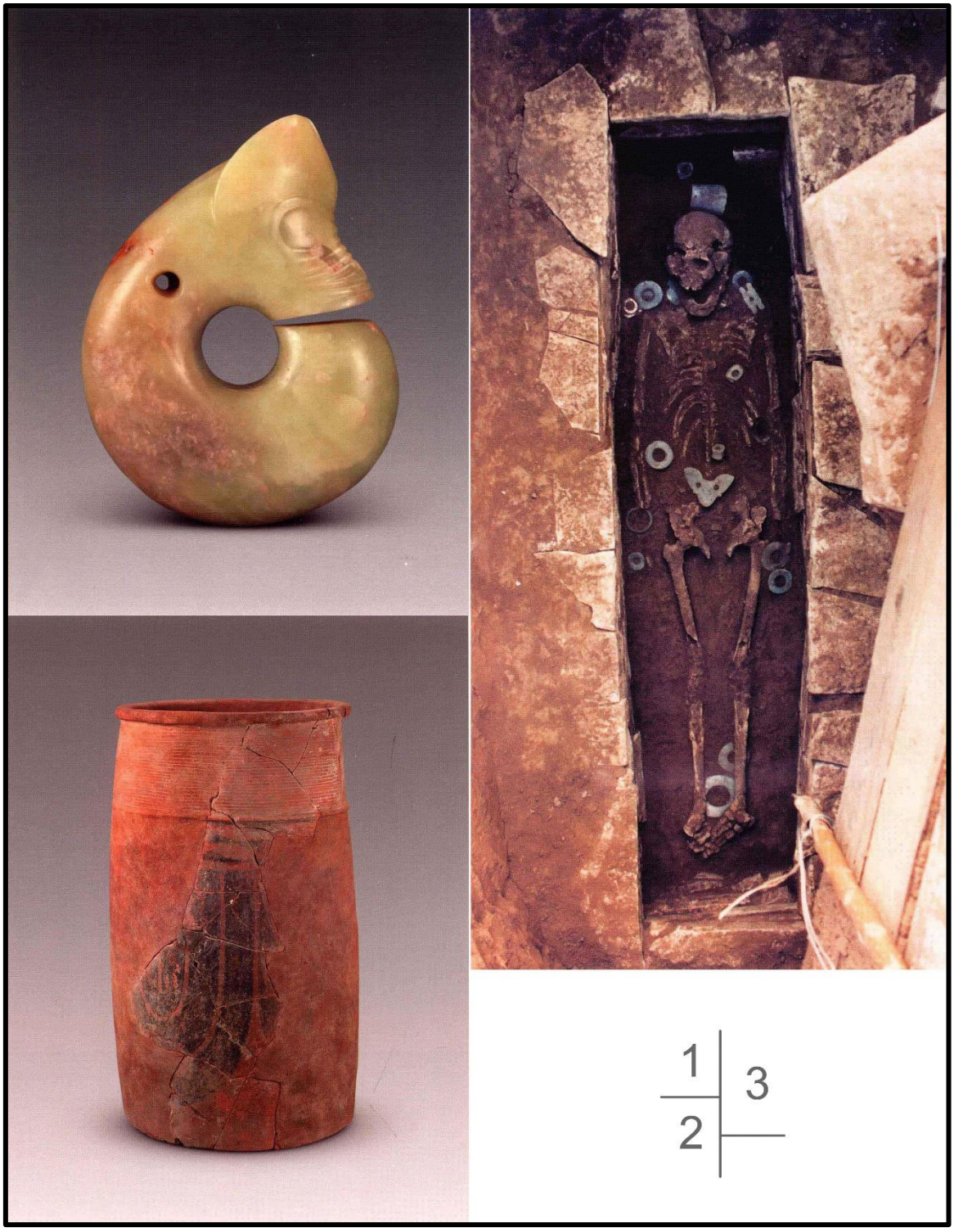

Figure 4 Examples of classic Hongshan remains 1. Jade dragon-shaped artifact (Yuzhulong); 2. Ceramic bottomless cylinder (Tongxingqi); 3 Hongshan burial on a ceremonial platform (after Liaoning 2012 Figure 69, 81 and 160)

The regional sociopolitical organization during the Hongshan period has been documented by several regional settlement studies. Within the Hongshan core zone, 200km^2 have been surveyed in the Upper Daling river valley (Peterson et al. 2014a), and some 50km^2 including all the numbered ceremonial localities have been surveyed in the Niuheliang area (Drennan, Lu and Peterson 2017). Farther out toward the margins of the Hongshan territory, 1,234km^2 have been surveyed at Chifeng (Chifeng 2011). Data collected in these surveys provide insight into regional demographic patterns from the Neolithic period to the Iron Age. Compared to the earlier Xinglongwa and Zhaobaogou periods, the number of local communities and the average number of residents increased dramatically in all three regions during Hongshan times. Spatial clustering in all three zones reveals that some Hongshan local communities merged into the earliest supra-local communities or regional polities observed in northeastern China. While the existence of these regional-scale sociopolitical entities is clearly shown in settlement distributions, their spatial and demographic scale is quite limited. In the Upper Daling valley, none of the four Hongshan supra-local communities occupied an area larger than 100km^2 or had a population greater than 1,000 people. In the Chifeng region, the polities were even smaller than those of the Upper Daling valley in terms of both area and population. Thus, although some scholars have suggested the existence of a single well-integrated polity covering the entire Hongshan culture area of some 250,000km^2 (Nelson 1996; Xu, Zhao and Xie 2015), the data from systematic settlement research suggest that regional integration only happened on a small scale and did not provide a base for larger polities.

On the other hand, the small scale of Hongshan polities does not mean that their formation processes are simple or easy to understand. Assessment of the possible forces at work in this early sociopolitical integration has focused at the household and local community scale,

beginning with work at the Fushanzhuang local community in Chifeng of the Hongshan periphery (Peterson 2006) and continuing with research in residential zones at Sanjia, Erbuchi and Dongshanzui in the Upper Daling region of the Hongshan core zone (Drennan et al. 2017). This research has centered on the recovery by intensive surface collections of household artifact assemblages and analysis of the similarities and differences between them to determine the degree and nature of any ritual, productive, prestige, and wealth differentiation present in these communities. A modest degree of prestige differentiation has been detected, but no wealth differentiation. There was some productive differentiation in all four communities—enough to indicate that households were not all self-sufficient but related through minor amounts of economic interdependence. The study of ceramic distributional patterns indicates that the exchange of goods produced by some but not all households transcends the boundaries of the small regional polities but probably does not extend more than a few kilometers from production locations. The strongest inter-household differentiation in evidence is in the realm of ritual activities, a finding consistent with the notion that ceremonial activities were important in Hongshan life and played a substantial role in regional-scale political integration. Ritual differentiation and, correlated with it, prestige differentiation was stronger in the Hongshan core zone communities than at Fushanzhuang in the Hongshan periphery zone (Drennan et al. 2017).

1.3 The Myth of Niuheliang: Capital of Empire or Pilgrimage Center?

The Niuheliang area, located in the southwestern part of the Hongshan core zone, is unique for its concentration of especially numerous, elaborate, and unusual ceremonial structures at more than 20 locations within an area of some 50km^2, which formed the largest known

Hongshan ceremonial compound. Although most of the structures around Niuheliang are similar in form to their counterparts in other areas, they are especially large and well-constructed. Several unique ceremonial structures have been found only in the Niuheliang area, including a semi-subterranean "goddess temple" (Locality 1) with a life-size female human figure made of clay and painted designs on its wattle and daub walls (Figure 5, 6, 7). An especially tall, conical mound made of earth and stone is at Locality 13. Special stone-lined pits with buried vessels were also recovered at Localities 1 and 5. These observations have suggested to virtually everyone who has written about the subject that Niuheliang played a special and important role in ritual activities for people across the entire Hongshan territory (Liaoning 2012). Just what this role consisted of, however, has been debated.

Niuheliang has been described as a vacant ceremonial center, a collection of ceremonial facilities with little or no associated occupation (Barnes and Guo 1996; An 1987; Liu 2010). A recent systematic settlement survey of about 50km^2 including the Niuheliang ceremonial localities, however, clearly demonstrates a substantial resident population during the Hongshan period (Drennan, Lu and Peterson 2017; Liaoning and Zhongguo 2015). The total population, estimated at between 350 and 700 people, is in the same general range as that seen for single Hongshan regional polities in other survey zones. This was clearly not a vacant ceremonial center.

Figure 5 An overview on Niuheliang Locality 1 ("The Goddess Temple") (after Liaoning 2012 Figure 7)

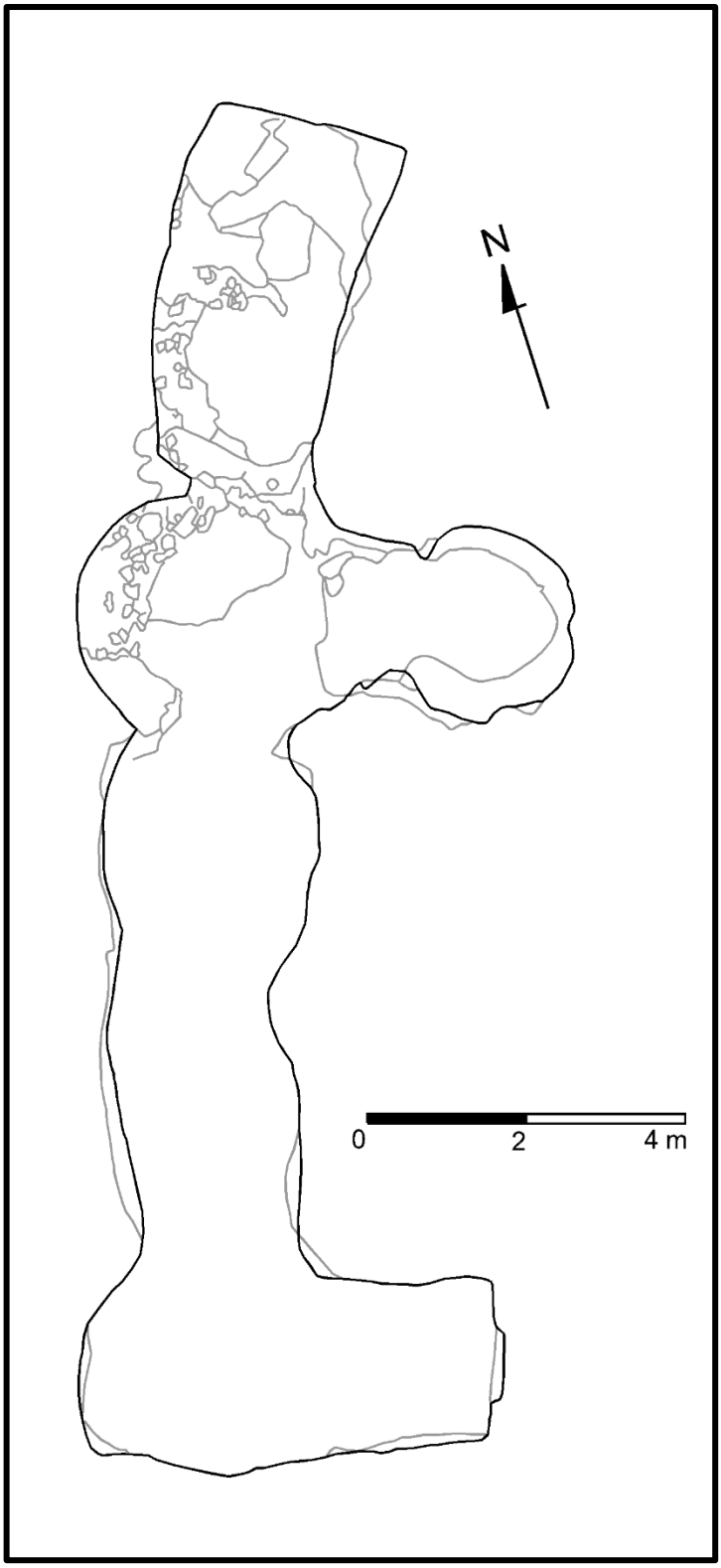

Figure 6 The outlines of Structure 1 of Niuheliang Locality 1 after excavation (redrawn from Liaoning 2012 Figure 19)

Figure 7 The facial part of the female statue ("the statues of the goddess") recovered in the Niuheliang Locality 1 (after Liaoning 2012 Figure 10)

Other visions of Niuheliang's macro-regional role have been more grandiose. It has been seen as a multi-functional macro-regional political capital with impressive and unique ceremonial architecture, especially the “goddess temple” at Locality 1 and the conical mound at Locality 13. It is suggested that in addition to being a ceremonial center, Niuheliang was also the political-administrative capital of an "ancient state" covering a very extensive territory (Xu, Zhao and Xie 2015). Drennan, Lu and Peterson (2017), however, come to a different conclusion. They argue that the "goddess temple" had a very restricted entrance as well as extremely limited indoor space. This observation, together with the large clay human figure within the structure, suggests ritual activities for small numbers of people. Although some residential occupation was nearby, this building was not suitable for political or administrative functions. The conical mound of Locality 13, on the other hand, while unique, does share some characteristics with the usual Hongshan platforms, such as stone-faced surfaces and the use of *tongxingqi* cylinders. In contrast to what one would expect if this structure were a center of political-administrative activities, it is specially set off from the residential population of the region. Thus, while the Niuheliang area was not a vacant ceremonial center, neither was it a major population concentration standing out as strongly different in terms of demographic scale or political-administrative function from a multitude of small regional polities.

The settlement study in Chifeng and Upper Daling has suggested that the inter-household ritual differentiation seen within local communities provided the principal regional-scale centripetal force that drew people together and integrated small regional polities. This conclusion is based on two observations. First, the emergence of ceremonial architecture was contemporaneous with the earliest evidence for the demographic centralization that creates supra-local communities. And second, one or more ceremonial platforms, with or without tombs,

are known to occupy central locations in many of these small regional polities (Chifeng 2011; Peterson et al. 2014a). Thus, ritual activities that took place on or around platform structures seem vital for the Hongshan regional population centralization process.

The consistent nature and patterning of ceremonial structures across Hongshan territory, the consistency with which inter-household ritual differentiation, the correlation between ritual differentiation and prestige differentiation, and the consistent proximity of more prestigious households to ceremonial structures, then, indicate a consistently important place for ritual and ceremony in Hongshan political life and centralization at a regional scale. Even though Niuheliang seems not to have been a vacant ceremonial center, the unique concentration of especially large, elaborate, and unusual ceremonial structures there does suggest that it could have played an important religious and ceremonial role at a macro-regional scale, perhaps forming a central focus in the interaction between and among small regional polities that existed in the Hongshan territory. Drennan, Lu and Peterson (2017) have suggested that Niuheliang might have functioned as a pilgrimage center visited periodically by elites and/or common folk from regional polities throughout the Hongshan territory. Such a role could perhaps have begun with a landscape imbued with spiritual significance that was through the years reinforced and amplified by the construction of a series of special ceremonial structures. Traveling to visit such a place might have been a pivotal life event for pilgrims and could also have been especially important for elites in enhancing their social, ritual, and political positions back in their own polities.

The existing evidence, including religious practice shared by people living in a large area and the unique architecture and relatively small regional population in the Niuheliang area, favors the hypothesis that Niuheliang functioned as a pilgrimage center. Additional kinds of

evidence could help to confirm (or deny) this hypothesis. Drennan, Lu and Peterson (2017) argue that if the Niuheliang area is a sacred place that attracts pilgrims, the local people who live in close proximity to the ceremonial structures might be especially intensively involved in the ritual activities visitors came to participate in. This involvement could become a specialization strong enough to cause these people to diminish their participation in subsistence activities—a development that would certainly be encouraged by the relatively unfavorable local environment of Niuheliang for farming. If so, they (as well as visitors who would need to be fed during their stays) would likely come to rely at least in part on food produced by residents of nearby local communities with better access to more productive agricultural resources.

1.4 Hypothesis and Questions on Hongshan Social Differentiation

Unlike most other known Hongshan occupations, the Niuheliang ceremonial compound and residential zones in relatively close proximity to them are located among relatively steep slopes and on generally thin and stony soils. It is quite evident that neither agricultural productivity nor rich wild food resources would draw either ceremonial construction or residential occupation to these locations. On either side of the range of hills in which Niuheliang is situated, however, is a large flat, fertile, well-watered alluvial bottom-land - one to the west where Lingyuan city is now located and one to the east where Jianping city is now located. While not within a few hundred meters of Niuheliang's ceremonial compound like the residential zones described above, the margins of these fertile plains are readily accessible only a few kilometers away. It is here that local communities might have come especially to emphasize subsistence production to supplement whatever food was produced in the hills nearer the

ceremonial structures and thus to help sustain the several hundred people that comprised the Niuheliang resident population, as well as pilgrims engaging in the ritual activities they came to participate in. Hongshan subsistence clearly included both cultivated millet and domesticated pigs as well as a variety of wild resources, and the mix probably varied from one Hongshan village to another. The practical strategy for augmenting the food supply available to those associated with the Niuheliang ceremonial compound would have been to cultivate more millet and raise more pigs in the highly productive agricultural zones lying only a few kilometers away from the concentration of ceremonial structures. This might sound like agricultural "intensification" but the scale of the enterprise (supplementing the food supply of a population numbering less than 1,000) would have been far smaller than other instances to which the term "intensification" is customarily applied. To sum up, the scenario of Niuheliang and adjacent area is more likely to be a number of local communities located in fertile plains mentioned above, by producing a small amount of food surplus for each, to provide enough food to support the sustenance of several hundred ritual specialists live next to the Niuheliang ceremonial compound.

To the extent that this notion of the economic arrangements that sustained Niuheliang as a pilgrimage center is accurate, we should see evidence of greater involvement in ritual activities and less participation in food production in households near the ceremonial compound in the hills. There should be more artifacts connected with religious rituals and possibly with the production of these artifacts. Correspondingly, we would see evidence of a higher degree of participation in agricultural activities in households located on or adjacent to the good farmland a few kilometers away. It might even be the case that households in these latter communities focused even more heavily on farming than did households in the previously studied (more "normal") Hongshan villages in Upper Daling and Chifeng areas. This would happen if they had

to some degree become subsistence specialists playing an important role in provisioning ritual specialists and pilgrims at Niuheliang ceremonial compound. It is even possible that this subsistence specialization might have become intensive enough to result in a lessening of craft production in these households (also as compared to the more "normal" Hongshan households studies in Chifeng and Upper Daling). Since food is a mass good and costly to transport for long distances in large amounts, it makes sense for households who may have provided food to the ceremonial district of Niuheliang to be concentrated relatively close by.

Hence, this research will seek to answer the following four questions:

1. Compared to the residents living near the Niuheliang ceremonial architectures, did the residents of communities a few kilometers away in proximity to much better farmland concentrate more heavily on food production?

2. Compared to the residents of the Chifeng and Upper Daling regions, did the residents of communities accessible to good farmland a few kilometers away from Niuheliang, concentrate more heavily on food production?

3. Compared to the residents living near the Niuheliang ceremonial architectures, were the residents of communities accessible to good farmland a few kilometers away from Niuheliang less involved in ritual activities?

4. Did the residents of communities accessible to good farmland a few kilometers away from Niuheliang concentrate more or less equally on food production, or was there productive differentiation between these households involving non-subsistence crafts as has been discerned to a modest degree in Upper Daling and Chifeng communities?

It is argued here that the answers to these questions will not only test the hypothesis listed above but also help reveal the more detailed economic strategy of the societies in Niuheliang and

adjacent areas. Furthermore, with a more comprehensive understanding of Hongshan economic strategy, a comparison could be made between Hongshan societies and other ritual-based early complex societies in terms of differences between their economic strategies. If the pilgrim hypothesis is accepted, we would expect differences to be detached in several aspects between the agricultural strategies of farming communities near Niuheliang and more "normal" Hongshan farming communities farther away, whose farming patterns would be geared to meeting their own subsistence needs. Near the pilgrimage center, however, communities located in the most productive farming zones might feel extra demand for food production to satisfy the needs of both ritual specialists at the pilgrimage center and pilgrims who had come to visit. The result could be a modification of the local economy, along the general lines of the "ritual mode of production" but in the subsistence arena.

In the context of East Asian archaeology, primitive complex societies have been widely found in other regions during the middle Neolithic period. Previous studies have heavily focused on the well-known Yellow River basin, not only because of the detailed records of numerous local communities but also for the fact that this region later became the home of the first well-developed complex societies and even the states. Complex societies of northeast China, on the other hand, had very different trajectories of social development in the later periods, based on currently available records. A better understanding of the socio-economic strategy of the Hongshan core zone would help delineate the critical factors that formed such a difference.

2.0 Recovering the Remains of Shangchaoyanggou Hongshan Households

2.1 Selection of Field Methodology and Research Objectives

Since the research questions listed above call for data on the intra-community level, a study of household artifact assemblages from a Hongshan local community would provide an ideal dataset for answering them. To collect data of the desired kind, "intensive surface collection" is an appropriate and efficient field methodology. In contrast to excavation and survey, the intensive collection is designed to delineate the activity areas of different households and recover remains on and buried slightly beneath the ground surface within that activity area at high resolution. Data gained from previous excavation and surveys suggest that Hongshan households were sparsely distributed within local communities, with an average of 20m between adjacent households. This household distribution pattern makes delineation of the activity areas of households possible with only the information on the spatial distribution of surface artifacts. The first application of intensive surface collection in Hongshan territory was carried out by Peterson (2006) on the household remains of the Fushanzhuang local community in the western peripheral area of the Hongshan territory. Since then, the methodology of the intensive surface collection has been applied in three local communities of Hongshan households in the Upper Daling valley located within the core zone, and its results have been confirmed by stratigraphic testing and magnetometer survey to match the remains buried underground (Drennan et al. 2017; Peterson et al. 2014a, 2014b, 2017). These field projects have confirmed the utility of intensive surface collection as a methodology to recover data on household assemblages, especially those of the Hongshan period.

Based on the field projects mentioned above, the intensive surface collection has three advantages for recovering data on Hongshan household assemblages. First, although the topographical and vegetational conditions are varied in different parts of the Hongshan territory, the intensive surface collection has been proved to be a robust methodology that works well under varied conditions, and the data it generates from different conditions are highly comparable with each other. Second, in some instances, Hongshan residential sites are shallow and deflated, and the only remains there to be recovered are at or near the surface. Even in these instances, the horizontal movement of material has been so slight that individual household units are reliably detectable as surface artifact concentrations. In sites like these, the intensive surface collection is the only effective method to recover data. Third, even in areas where other field methodologies, such as excavation, can be applied, the intensive surface collection shows its higher efficiency in collecting large samples of artifacts associated with single households or sets of two or three very closely spaced households. This means a larger sample both of artifacts and of households can be collected by applying intensive surface collection than by using other methodologies with the same amount of research resources, and this helps provide answers for the research questions with more confidence. Considering these advantages, intensive surface collection, with several modifications to the operational process, was selected as the field methodology of this study, and the details of the methodology will be discussed in later sections of this chapter.

With field methodology in mind, the next question is to identify the specific archaeological contexts in which the data can be collected. It is clear that to conduct the comparisons required by the research questions, data are needed on household artifact assemblages from the Hongshan periphery, the Hongshan core zone, the Niuheliang pilgrimage

center, and settlements in the productive agricultural zones only a few kilometers away from the pilgrimage center, and those in the Hongshan core zone but are kilometers away from Niuheliang ceremonial center, are needed. As mentioned above, the data for the Chifeng and Upper Daling local communities have already provided information on the periphery and core zone, respectively; the nature and extent of productive, ritual, prestige, and wealth differentiation have been evaluated; the results have been published (Drennan et al. 2017); and the full household datasets have been made available online (Peterson et al. 2017). The material for this vital part of the comparison is thus already available. Fieldwork to collect household artifact assemblages in residential zones directly adjacent to the major Niuheliang ceremonial structures has been conducted for two seasons in 2017 and 2018 by Peterson, Lu and Drennan, and preliminary information is available for comparison. Thus, data from communities that are a few kilometers away from Niuheliang ceremonial center and in agriculturally productive settings are the main concerns of this field project.

Based on research questions, the target archaeological site should fulfill two major requirements: first, it should have a location that is not too far from the Niuheliang pilgrimage center, so as to enable frequent interaction between the residents of the target site and those of the pilgrimage center. Second, this site should be within or near an area that provides good conditions for food production. In addition, it should have abundant household remains in order to generate large enough samples both of households and of artifacts from each household, and surface visibility should be good. Identifying a good site for this research calls for detailed information about the regional environment and settlement pattern. Fortunately, the regional environmental data are available, and with the data from the previous systematic regional survey in the Niuheliang area, we can easily draw a general settlement pattern for the Hongshan period.

Data recovered from the Niuheliang area's systematic regional survey show that the ceremonial structures are located primarily on hilltops and slopes in a mountainous zone. In contrast, residential settlements are located in various landscapes (Drennan, Lu and Peterson 2017). Such a distribution implies not all the Hongshan settlements in the Niuheliang area have good agricultural potential. Thus, in order to select a site for intensive surface collection, an investigation on the environmental setting of the Niuheliang area is necessary for revealing the agricultural potentials for different parts of this area.

2.2 Environmental Settings of Greater Niuheliang Area and Shangchaoyanggou Local Community

Located in the southwestern part of the present Liaoning province, the greater Niuheliang area, which includes all the Niuheliang localities and an adjacent area of about 120 km^2, is commonly regarded as a part of northeastern China. However, this area is also very close to some other major geographical units which have different environmental characters, such as Northern China and the Inner Mongolian Plateau (Figure 8). With such a transitional location, the greater Niuheliang area has an environment with mixed characters, which further influences its subsistence economy, demographic pattern, and communicational pattern. All these features finally helped shape the process of social development in situ.

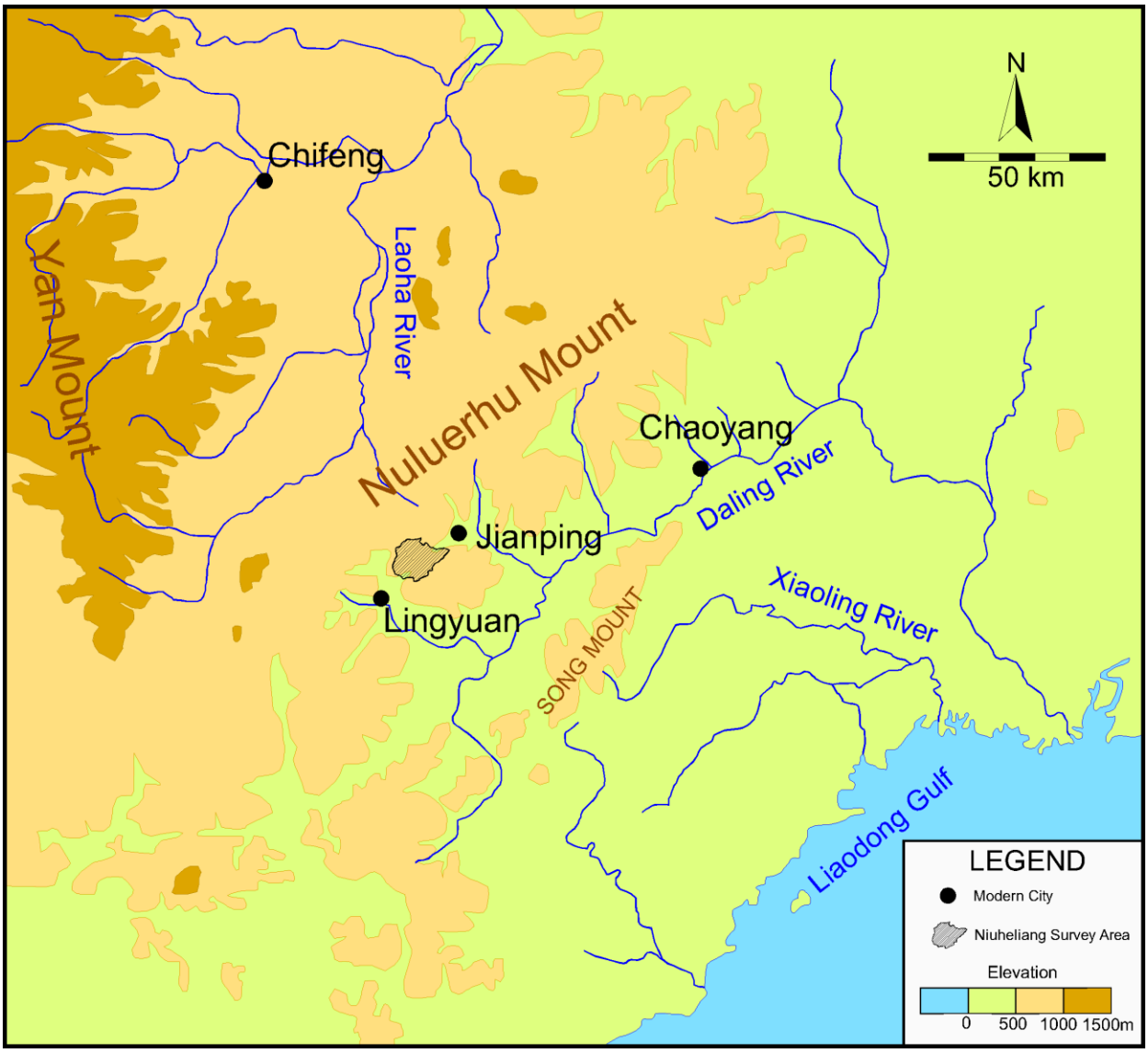

Figure 8 The location and environment of the Niuheliang area

Topographically, the greater Niuheliang area is a part of the southern extension of the Nuluerhu Mountains in the northwest and faces the lower Song Mountains and the coastal plain that is next to Bohai Bay. Nuluerhu Mountains in the north block the cold air from the Mongolian Plateau leading to a relatively mild local climate compared to the adjacent eastern Inner Mongolian region (Chaoyang 1996). The mountains also provide headstreams for several branches of the Daling River, which flow southwards through the greater Niuheliang area. These branches cut into the generally hilly area and help form band-shaped river valleys, which along

with mountainous and hilly terrain, dominate the landscape of the greater Niuheliang area (Mo et al. 2002). Like other regions in the eastern part of China, the climate of the greater Niuheliang area today is determined by the duration and strength of the East Asian monsoon that originates in the western Pacific Ocean. The monsoon usually brings warm and humid air to the greater Niuheliang area during the summer, which provides precious sunlight and precipitation for the subsistence economy. However, since this area is close to the Mongolian Plateau, the influence of the Mongolian anticyclone makes the local climate fluctuate occasionally. Thanks to these two shaping forces, farmers in the greater Niuheliang area today generally enjoy a regular climate that is favorable for agriculture, but at the same time have to face occasional uncertainty.

The paleoenvironment of the Hongshan territory during the Hongshan period has long been an important topic in Chinese archaeology for its importance for understanding the environmental foundation of the Hongshan societies. In general, most paleoenvironmental studies agree that after the last glacial period, China, along with most other regions of the world, experienced a significantly warmer period, which is usually referred to as the "Holocene Megathermal". Even though different sources of evidence have slightly different opinions on the extract durations of the Holocene Megathermal, generally the data from ice cores, sea level, and pollen analysis suggest a time range for a warmer period from about 10,000 B.P. to about 3,000 B.P. for the eastern part of China (He et al. 2003; Shi et al. 1992; Winkler and Wang 1993). During the Hongshan period, the climate was substantially warmer and more humid than at present across the whole Hongshan territory, including the greater Niuheliang area.

While the general paleoclimate pattern is clear, different sources of data contradict each other on climate fluctuation on a finer time scale. Many observations have suggested a period of relatively cooler and drier climate in the middle of the Holocene Megathermal. While most

researchers agree this period started roughly between 6,000 and 5,000 B.P., there is no agreement on a more accurate date (He et al. 2003; Jin and Liu 2001; Mo et al. 2002; Teng 2010). The current time range of 1,000 years is obviously too approximate to help clarify the environmental setting for some critical developments of Hongshan societies, especially the practice of food production of the residents of the greater Niuheliang area within the duration of the Niuheliang ceremonial center. Despite the debate on detailed paleoenvironmental data, Mo et al. (2002), based on pollen within and near the Niuheliang pilgrimage center, suggest that even during the cooler and drier period, the climate during the late Hongshan period was still warmer and wetter than at present. The current information on the paleoenvironment, although quite rough, is still able to help us access the potential of prehistoric food production, when combined with observation of modern agricultural practices in the greater Niuheliang area.

Generally, the modern potential of cultivation for various types of land in the greater Niuheliang area is determined by two main environmental factors: soil and water availability. The mountainous and hilly areas of high elevation within the greater Niuheliang area consist of rock formations, with only thin layers of soil or even no soil, making the higher parts of the mountainous and hilly areas uncultivable. In contrast, lands in valleys formed by the rivers and on the lower gentle slopes of the rolling hills have soils that are thick enough and of good quality for cultivation. As for precipitation, the climate of the greater Niuheliang area is semi-arid, with annual precipitation of 450-560mm (Chaoyang 1996), which is enough for the cultivation of crops that are commonly cultivated in northern China based on experimental data. The seasonal distribution of precipitation is unbalanced, with most precipitation during the summer from early May to late August. This pattern was favorable for prehistoric agricultural production, just as it is today since it provided enough water for plants during the summer, which is critical for their

growth. However, due to the unstable local climate pattern, the annual fluctuation of precipitation is large. This fluctuation contributes to different threats in different years that all affect the output of local cultivation. For example, in a year with less precipitation, drought may occur from late August to middle September, which is the critical growth period right before the harvest, and put crops, especially those on the hills in danger. On the other hand, in the year with more precipitation, summer storms may lead to floods, sometimes severe enough to destroy crops on the valley floor. Drennan, Peterson and Berrey (2020) have argued that a similar environmental fluctuation pattern was the case during the Hongshan period.

Today, the most important form of subsistence economy in the greater Niuheliang area is the cultivation of various crops, such as maize (*Zea mays*), foxtail millet (*Setaria italica*), and broomcorn (*Sorghum bicolor*). Cultivation is focused on the river valleys and gentle slopes of hills since these areas have generally better soils. For supplemental cultivation, some hill tops and steep slopes are occupied by apricot orchards, and semi-mobile animal husbandry focused on cattle and goat grazing is also practiced in the mountainous areas during the summer. Although cultivation is the most important subsistence activity in the modern greater Niuheliang area, modern farmers have to face agricultural risks occasionally because of the unstable environmental factors, which to the annual fluctuation of agricultural output. In addition, based on the information from local farmers, numerous local small rivers and streams have been cut off and attached wetlands have been drained during the past three decades, largely due to water overuse by modern humans. This has caused a shortage of backup agricultural water supply in the dry years and hence added more uncertainty to the productivity of modern local cultivation.

The modern information mentioned above provides a foundation for suggesting the Hongshan period agricultural pattern of the greater Niuheliang area. During the Hongshan

period, the overall climate pattern was generally like the present in the greater Niuheliang area, but with higher temperature and precipitation; annual fluctuation would have affected the climate as it does today. Rivers, streams, and wetlands that have disappeared today would have existed then. The wetter and warmer climate during the Hongshan Period might decrease the chance and severity of droughts on one hand but increase the chance and severity of floods on the other. In general, although climate change has happened in the last several thousand years, it didn't fundamentally change the conditions of food production in the Niuheliang area, or the risks the producers faced (Winkler and Wang 1993). An optimal strategy for Hongshan period cultivation would have to cope with the risks to ensure relatively stable agricultural outputs in different years. Based on the environmental setting of the greater Niuheliang area, a Hongshan local community in a location with easy access to both the gentle slopes of hills and the river valley would be ideal for cultivation. A cultivation pattern focused on both types of land would effectively control losses from both environmental threats to production. In dry years, the land in the river valley gets a good water supply from the river while the crops on the hill slopes suffer. In wet years, the land on the gentle slopes, due to their relatively high elevation, would be much less likely to be affected by flooding compared to the land in the valley. By living at the border between these two zones and cultivating both, the residents of such local communities would be able to manage both types of risks enjoy the reliable agricultural output, and be reliable food suppliers for the ritual specialists as well (Drennan, Peterson and Berrey 2020). In the greater Niuheliang area, the Shangchaoyanggou site has a location that matches the previous description well.

The Shangchaoyanggou site, named after the nearby village, was first discovered and recorded during the continuation in 2017 of the 2014 Niuheliang survey (Liaoning and

Zhongguo 2015; Drennan et al. 2017). The regional survey reported a site area of 37.6 hectares, which makes it a large local community within the greater Niuheliang area. The Shangchaoyanggou local community is on a gentle slope of a hill extending from the Nuluerhu Mountains and faces the valley of a tributary of the Daling River. The Shangchaoyanggou local community is only a few hundred meters away from the arable lands of the valley floor, which makes daily cultivation activities possible for its residents, and this location also avoids the wetlands near the river and risks of flooding. At the same time, the Shangchaoyanggou site is only about 5km away from the heart of the Niuheliang pilgrimage center, which enables frequent visits by the residents to the Niuheliang ceremonial compound. All these observations suggest the Hongshan local community represented by the Shangchaoyanggou site fulfills the requirements of the locations of a target community for the field project (Figure 9).

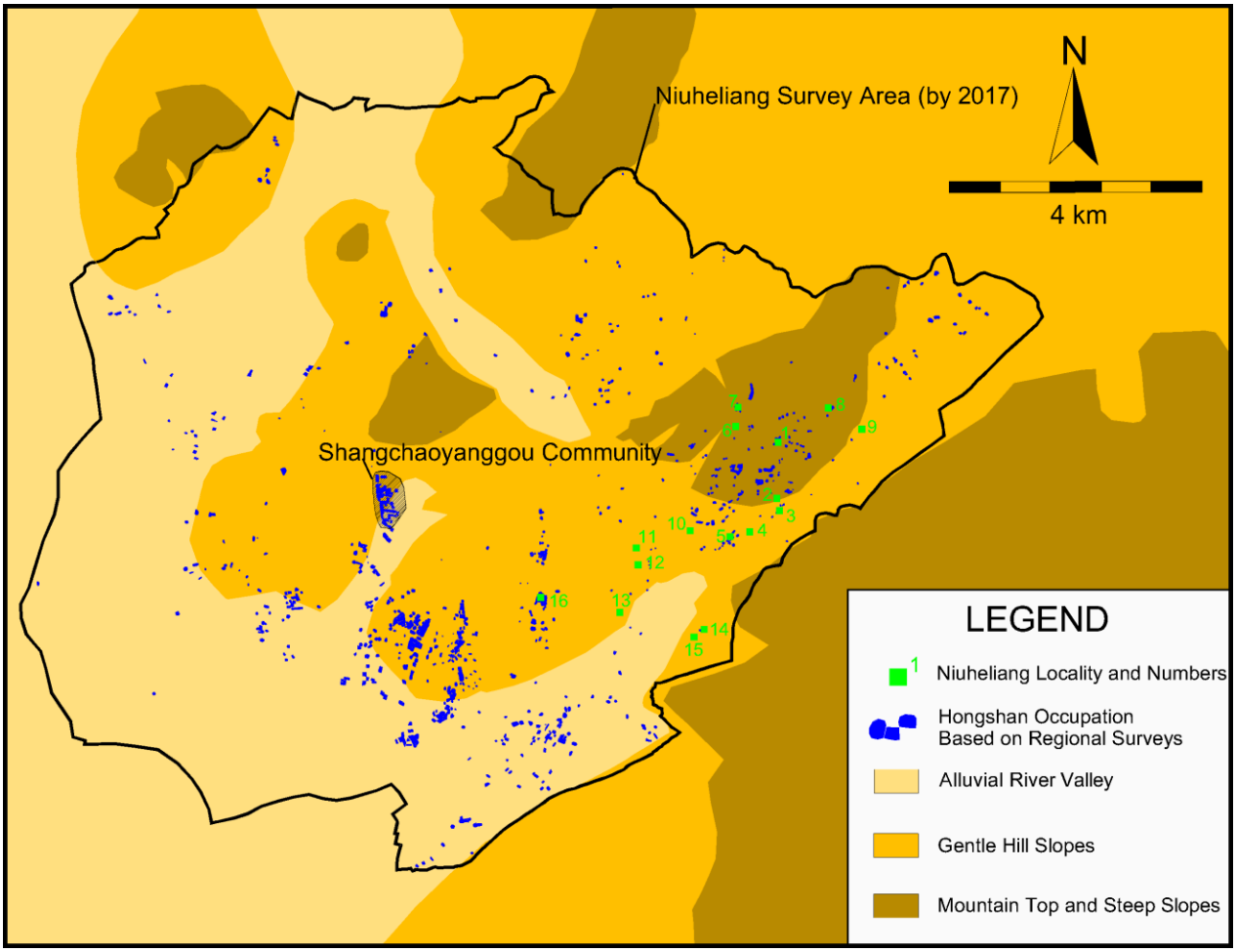

Figure 9 Shangchaoyanggou local community within the Niuheliang Area

In order to check the household-level remains of the Shangchaoyanggou local community, a visit to it during a pilot study was made. The result of the visit suggested the household remains of the Shangchaoyanggou local community followed a clustered distribution pattern, with most clusters having areas between 200 to 600m^2, which is roughly the total activity area of one to three Hongshan households. In addition, the remains of most clusters were abundant enough for collecting a sample of household units large enough to confidently see patterns of differing activity emphasis between them, and clusters were far enough from each other to make the delineation of activity areas of households possible. Based on both the regional survey data and observation during the visit, most of the sherds recovered from the site could be

dated to the Hongshan period, which suggests that most premodern human activities within this site happened during the Hongshan period. Most of the other archaeological remains were dated as of Zhanguo-Han and later periods, during which iron tools had taken the place of lithic tools. All the lithics recovered at Shangchaoyanggou could thus be taken to pertain to the Hongshan period. In sum, while there are many Hongshan local communities that could potentially be food providers for the Niuheliang ritual specialists, the Shangchaoyanggou site is an ideal one conceptually and practically for this study. Therefore, this field project set its goal to recover data from the Shangchaoyanggou site in order to carry out comparative studies and answer the research questions.

2.3 Delineating Hongshan Period Household Units

The Shangchaoyanggou field project was carried out from July to October 2018. By the beginning of the field project, a small portion of the southern part of the site had been destroyed by previous mining activities and thus was excluded from the fieldwork, amounting to about 1% of the total site area. The remaining portion of the Shangchaoyanggou site was used for three main purposes: about 48% of the land was a part of a state-owned preserved forest and grassland, while another 42% was a part of apricot orchard owned by the residents of the Shangchaoyanggou village. The vegetation of both types of land is managed by people and includes only trees and short grass, which provide very good visibility for ground survey even during the summer. The remaining 10% of the land is a maize field, which is located on the marginal part of the site. It has quite low visibility during the growing season of maize, and data

from the previous survey indicate a low density of remains, so this portion of the site was not the main focus of this field project.

The earlier regional survey had delineated 48 regional survey collection units within the Shangchaoyanggou site (Figure 10). The areas covered by these collection units were regarded as the potential area for the intensive surface collection, while they were too large to be fully investigated with given time and resources. Given this situation, it was necessary to make an educated guess on the total number of households within all the collection units, and then calculate the minimum number of households that were needed to provide a dataset with a certain level of confidence and appropriate for comparative studies with other intensive surface collection datasets. To complete this task, the area-density index was used to estimate the intensity of human activities. To calculate the area-density index, the density of total sherds (sherds/m^2) was multiplied by the number of Hongshan sherds as a proportion of the total. The result is divided by the number of centuries in the period (Drennan et al. 2003). The overall area-density index of the Shangchaoyanggou is 1.91. Based on the established approach to calculating population with the area-density index, the population of the Shangchaoyanggou local community during the Hongshan period was estimated at 95 to 191 (Chifeng 2011, p.57-79). If an index of 4 persons per household was applied, then the number of households at the Shangchaoyanggou site would be 24 to 48. This field research, then, set a target of collecting artifact samples from about 20 household units, which, in most cases, would be more than 50% of the calculated household number. Such a sampling rate was consistent with the intensity of household sampling at Fushanzhuang and the Upper Daling local communities where delineation of various kinds of differentiation in artifact assemblages had been successful and with which Shangchaoyanggou would be compared (Peterson et al. 2014b). The median sherd density of all

the 48 collection units in the Shangchaoyanggou site is 0.1 sherds/m^2, and 15 units had a density higher than the median. In addition, 19 collection units have sherd densities that are exactly equal to the median. Considering 0.1 sherds/m^2 is a relatively high density that field crews have a good chance to discover household remains, they were also included as target collection units. Hence, a total of 34 collection units were marked as primary survey areas. Based on the same logic applied above, they were expected to represent 20 to 40 households, which was enough for this field project. These 36 collection units are also located in different parts of the site area, which avoids any spatial sampling bias for neglecting some parts of the site. Thus, these 36 high-density collection units, roughly covering 7.7 ha, were the primary places for intensive surface collection.

To begin the intensive surface collection a group of field crews, usually of 3 to 5 persons, walked back and forth across an area at 5m intervals to look for any artifacts on the ground surface (Peterson et al. 2014b). When an artifact was observed by any crew member, it would remain in its original location, and a bright-colored pin flag would be placed to mark it. This would help show the distribution of ground artifacts with more details and make it more convenient for a later stage of surface collection. (Figure 11)

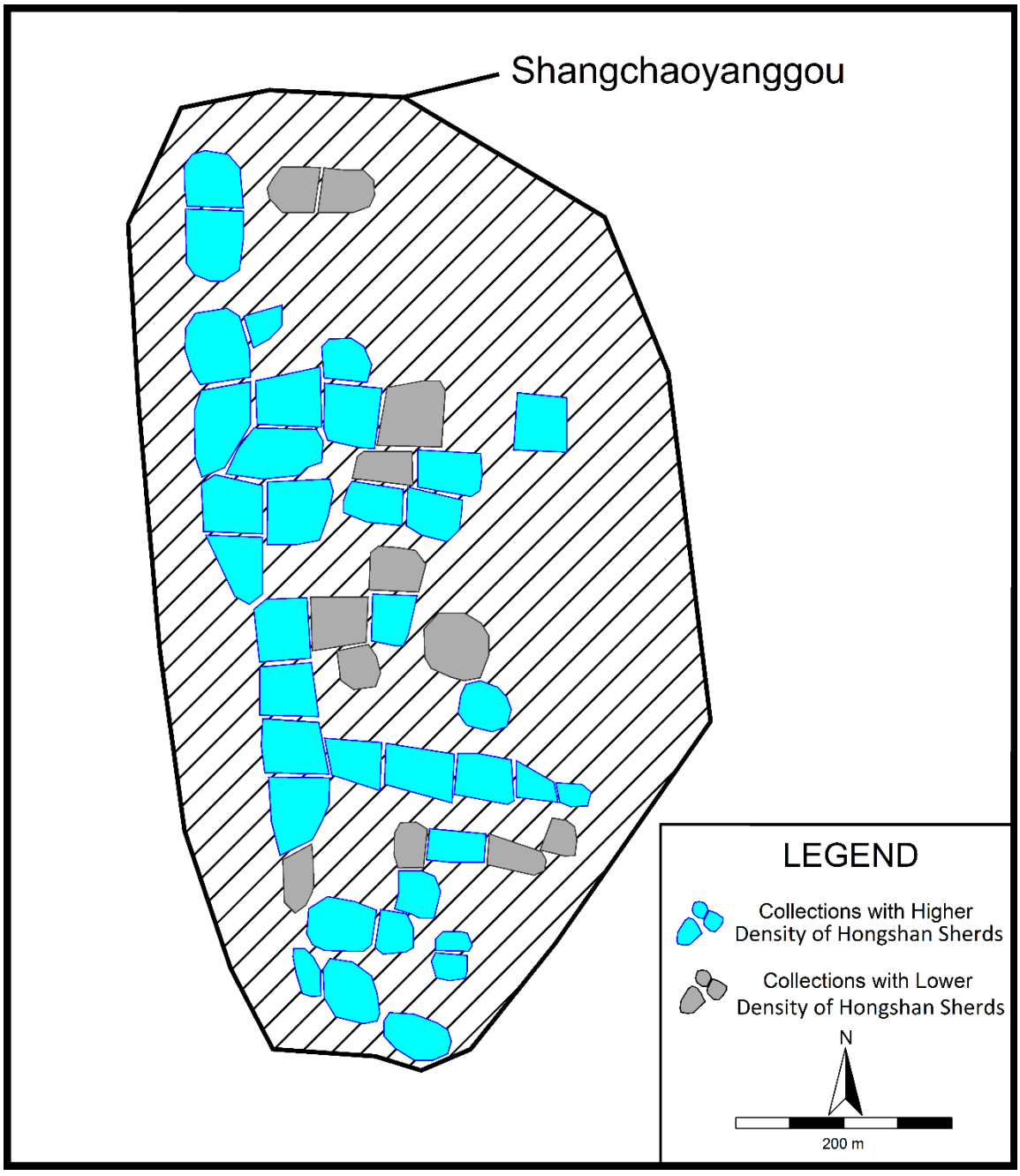

Figure 10 Collection units from the regional survey that comprise the local community of Shangchaoyanggou

Figure 11 Pin-flagging artifacts in the field during Shangchaoyanggou field project

After a considerable area of land, usually around 4000m^2, had been flagged in this way, the field crews would pause, stand back from the surveyed area and observe the distribution of pin flags to see whether artifact concentrations were observable. Any area with artifact density that was significantly higher than adjacent areas would be considered an artifact concentration, and the field crews then walked through and checked the concentration again in order to delineate its boundary. A decision was then made about whether to collect the concentration intensively.

The first factor considered was the possibility of secondary movement of household remains due to natural or artificial processes after the end of the Hongshan period. Generally, the

greater Niuheliang area has experienced a long time period with intensive modern human activities, but there is no evidence of large-scale modification of the land within the area of the Shangchaoyanggou site, except the mined area on the southeastern corner, which had been excluded from the field project. Some human activities, such as digging tree pits to plant the orchard, have even increased the visibility of surface remains and made the delineation of clusters clearer. Human activities were thus not the main concern for household delineation. Natural processes, however, are more common, such as flood water running down the hill slopes after rapid storms during the summer. Even, such floods would not move remains far enough to affect the general distribution of clusters, and the remains that were moved, such as the artifacts found at the foot of the hill slopes, were not big enough to be recognized as a cluster. Thus, in general, secondary movement was not a critical concern when delineating the artifact clusters in the Shangchaoyanggou site.

The second and most important factor is the size of the artifact concentration. Previous research indicates that Hongshan houses were typically rectangular semi-subterranean structures with areas ranging from 20-30m^2. Artifact concentrations indicating the area of household activities would of course be larger than the house structure itself, and previous intensive surface collection projects have found artifact concentrations to be some 20-25m across (Neimenggu 2004; Peterson et al. 2014b, 2017). At Shangchaoyanggou a slightly smaller area, ranging from 15 to 20m across, was usual since the surface artifacts tended to be more tightly clustered. Based on this standard, any artifact concentration with an area much less than 200m^2 was defined as an artifact cluster. At the same time, although most clusters had activity areas all in this range, one cluster (J076-1) covered 733m^2. An area this large could be the joint activity area of two or even three closely spaced households. Although this field project aimed to delineate the activity areas

of Shangchaoyanggou households as accurately as possible, it was not possible to subdivide this large cluster on the basis of lower density zones. The term “household unit” rather than “household” was used so as not to imply one-to-one connections between artifact clusters and Hongshan households. Once a cluster had been, a number was assigned to it based on the regional survey collection unit the cluster was located in (for example, the first cluster delineated within the regional survey collection unit J075 would be called J075-1).

2.4 Recovering Remains of Shangchaoyanggou Household Units

With the boundaries of all Shangchaoyanggou artifact clusters delineated, the remains of each cluster were collected in order to generate artifact samples that were large enough to represent the activities of each Shangchaoyanggou household unit. Previous research had found a huge variation in the numbers of recovered artifacts between different clusters. For example, in all 50 artifact clusters delineated in the Upper Daling area, the field crew recovered more than 200 lithics in 5 clusters, while in another 12 clusters fewer than 50 lithics were collected from each (Peterson et al. 2017). In household-scale collections at Fushanzhuang and the Upper Daling area, the entire surface of each artifact cluster was collected. This often produced far larger artifact samples than were needed to characterize household unit assemblages with high statistical confidence. In a more recent intensive collection near Niuheliang, an incremental approach has been followed in which intensive collections are made in different parts of an artifact cluster until an artifact sample of established target size is obtained. This approach was used at Shangchaoyanggou as well.

The target sample size was calculated based on error ranges for estimating the proportions of different artifact types in the assemblage. With the data from the Upper Daling intensive surface collection as references, the sherds were about 7.9 times more numerous than lithics in an average Hongshan household artifact assemblage. Since lithics are especially important to the detection of productive differentiation, the size of the sample of lithics is the key index of the intensive collection. In Upper Daling local communities, farming tools and tools related to craft production occurred as a small proportion of all lithics—5% or less. Hence, a satisfying sample would help investigate relatively small proportional differences in artifact proportions between different household datasets with a relatively high level of confidence. The minimum size of the artifact sample was determined with the following formula:

$$n = \left(\frac{t*\sqrt{(1-p)p}}{ER}\right)^2,$$

with a proportion (p) value of about 0.07, which implies the worst situation for a certain type of lithic tools, an error range (ER) of 0.04 and t value of 1.282 (for an 80% confidence level with >120 degrees of freedom). This result is n=66.87 (Drennan 2010:139-142). In such a target sample of 67 lithics for each household unit, a tool type representing 5% of the assemblage can be estimated with an error range of about ±4 % at the 80% confidence level. While not all analyses will take the form of estimating proportions, this is a sample size in which random noise will be low enough to detect the kinds of differences in artifact assemblages that must be detected in order to answer the research questions. Based on previous research, a sample of 67 lithics corresponds to a sample of 529 sherds for the same household unit, which will provide a much higher level of confidence for ceramics.

Previous intensive surface collection projects have been based on 5-m grid squares covering the entire area to cover all the areas of each artifact cluster (Peterson et al. 2017). At

Shangchaoyanggou, collection areas sampled household units by collecting one circular area after another until the target sample size had been attained, following procedures devised in the household-scale collections carried out earlier in 2018 in the Niuheliang pilgrimage center. The distribution of these circles within the clusters and their radii were determined arbitrarily, while their specific locations were determined in a more random way. Circles were more flexible, and avoid obstructions. They were also more efficient because they could focus on the highest density areas while retaining a certain degree of randomness. Delineating a circle for collection is also more convenient than establishing a grid of squares.

Based on the early stage of fieldwork, circles with radii between 2.0m and 4.0m were most appropriate since they were not too small work with nor so big that they included patches with low artifact density that took a long time to collect and yielded few artifacts. The number of circles needed to attain the target sample size was estimated, and their general distribution was determined so as to spread coverage across the household unit area. In each rough location for a circle, a crew member would throw a small rock with eyes closed to simulate a random event, and a wooden stake was driven into the ground where the item fell to mark the center of the collection circle. Eight to ten large nails were driven into the ground at the designated radius distance from the center, and a string was tied from nail to nail to form a circle, which is the boundary of the collection circle. A four-digit number starting from 4001, was assigned to the circle and written on the stake, and basic information (the ID number, the radius, and the name of the corresponding household unit) was recorded. Typically, three circles were set for each new cluster, leaving potential areas for additional circles in case the artifact samples from the initial three circles were not large enough.

Within each collection circle field crews first collected all artifacts on the ground surface. All the pin flags, along with the artifacts they marked, were collected, then the whole area within the circle was raked to remove small rocks and fallen. The rock and leaf piles were examined in order to avoid overlooking artifacts, and so was the exposed soil surface within the circle after raking. Specifically, four categories of artifacts were collected: all the sherds (including porcelain sherds) of various periods, pieces of daub, and lithics were collected and put separately into three different collection bags for each collection circle. Other items, such as bones and metal that were possibly pre-modern, were also collected, classified as miscellaneous artifacts, and put into the fourth bag. Modern items, such as plastics and stainless-steel items were discarded.

After all the artifacts on the surface had been collected, the upper layer of soil, to a depth of about 5 cm, was shoveled and screened in order to recover shallowly buried artifacts. The soil was passed through screens with 6 mm wire mesh, and all the items that didn't pass the mesh were examined, with artifacts of the four categories recovered and stored separately (Figure 12). Once the upper layer of soil was screened, the four categories of recovered artifacts were combined with their counterparts collected on the ground surface and brought back to the workstation for cleaning and preliminary indoor analysis.

Figure 12 Screening dirt in a collection circle at Shangchaoyanggou

All circles were collected following the same procedure described above. After the collection of one circle, the field crew would continue with a new circle in the same cluster, unless the target sample size had been reached, or no area within the cluster was promising enough for collecting more artifacts by shoveling and screening the soil. When no more circles were to be collected, and all remaining pin flags and artifacts within the household unit were collected. These artifacts would be classified in the same way as those collected within the circles, and given a different four-digit ID number (sharing the same series with the collection circle IDs) and marked in the record as "general collection" so that they would not be confused with artifacts from collection circles.

By the end of the field project, most areas of all the 36 regional survey collection units with high artifact density, roughly 6ha, had been pin-flagged and 41 artifact clusters (household units) had been delineated within the area of the Shangchaoyanggou site. In the collection phase, 108 circles were collected with a total area of 2549m^2. In general, this sample size (in terms of household units) is much larger than the target sample size discussed above and hence is satisfying in terms of characterizing Shangchaoyanggou households with a high level of confidence.

2.5 Mapping Shangchaoyanggou Household Units

The approach discussed above was successful in recovering the tangible remains from Shangchaoyanggou household units. At the same time, intangible data, such as the locations of Shangchaoyanggou household units are equally essential for discussing the relationships between them. Household unit outlines and locations were recorded on a sketch map, which was drawn during the intensive survey and circle collection phases. Specifically, the base maps that covered the entire area of the Shangchaoyanggou site were designed and printed before the beginning of the field project. Sketch maps were drawn on a base map prepared in advance and including the boundary of the site, the outlines of collection units from the previous regional survey, and the lines of dirt roads that went through the site. This information, along with a 10m-grid that covered the site, was designed to help the field crew locate the field features and draw their outlines quickly with a certain degree of accuracy.

With satellite images georeferenced in Universal Transverse Mercator (UTM) coordinates with high resolution as references, the field crews could draw the outlines of

archaeological features on the base maps and turned them into draft maps in the field conveniently. Before starting the intensive survey, the leader of the crew read the maps and planned the area to be surveyed, and marked the area that had been surveyed, as well as the area which could not be surveyed. The outline of an artifact cluster would be drawn once its area was delineated, and its ID number would be written on the map. Later when collection circles were established, their rough locations and sizes would be drawn on the maps as well in order to keep their relative locations recorded. Hence, the spatial data on an artifact cluster and the corresponding collection circles were available for the field crews soon after the collection had finished, which was beneficial for tracking the progress of the project and adjusting the plan for further work.

The sketch maps were good for understanding the general distribution of Hongshan household units within the Shangchaoyanggou site. Collection circles were also located more precisely using differential GPS to record the coordinates of their centers in the Xi'an-80 geographic coordinate system. It was not necessary to map the outlines of artifact clusters with such precision, and it would have been quite time-consuming to map them by differential. Thus, the outlines drawn on the draft map were the sources for the final digital map, since their level of accuracy is sufficient for the purpose of later analysis.

Since the sketch maps were drawn in UTM coordinates based on the WGS-84 geodetic datum according to which the satellite imagery was georeferenced, and the UTM coordinates recorded by the differential GPS equipment were based on the Xi'an-80 geodetic datum, one system had to be translated to the other for integration into a single map (Fig. 13). The Xi'an-80 datum is usually only used in China, and its particulars are kept as secrets. In order to integrate the two sets of coordinates, the locations of fixed points visible in the satellite imagery were

mapped with the differential GPS and all the GPS coordinates were moved and rotated so as to bring the positions of the visible points to their correct locations in the satellite imagery. The area mapped was small enough that other kinds of differences between the two systems were very small.

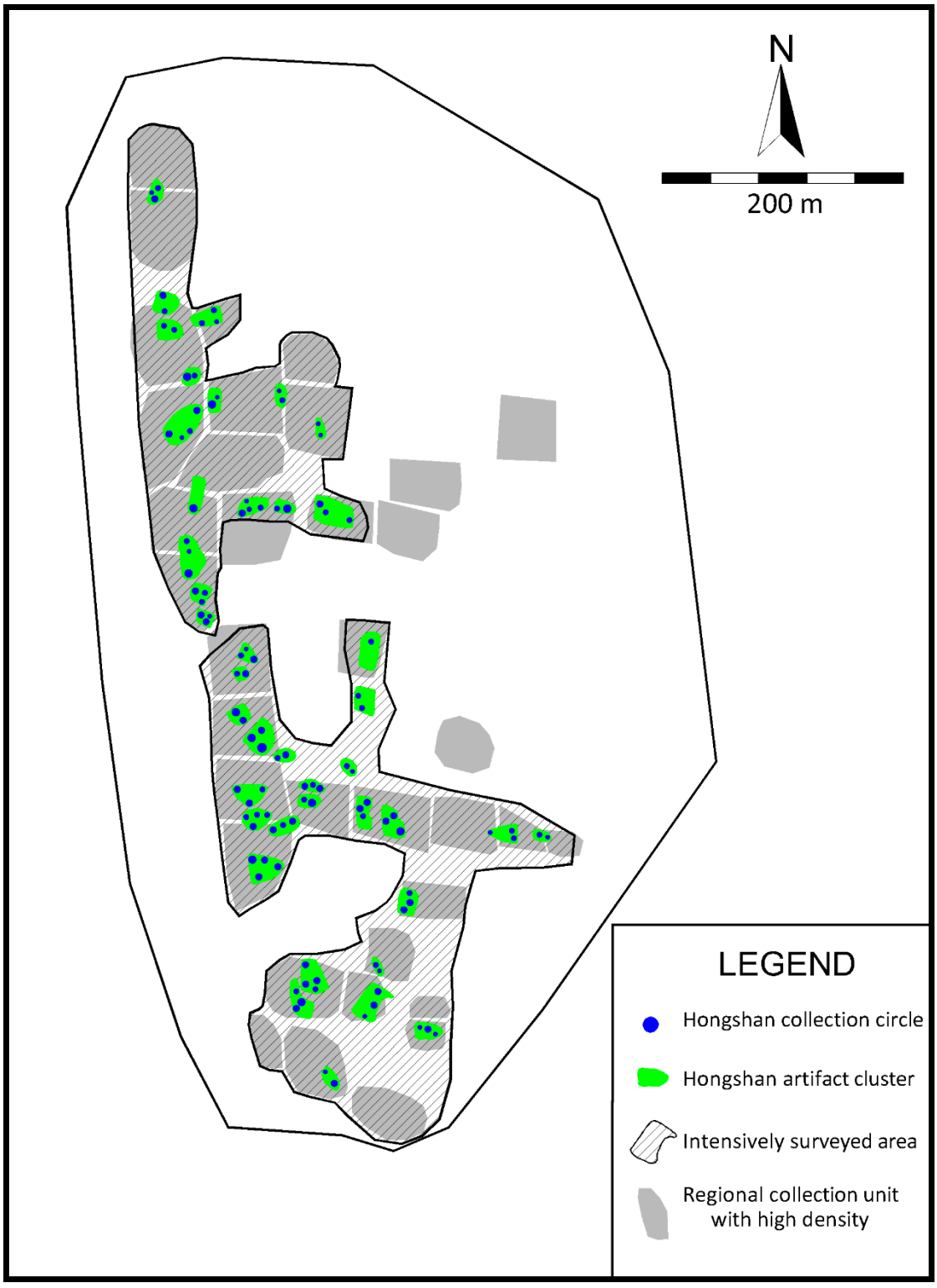

Figure 13 The collection circles and artifact clusters at Shangchaoyanggou

3.0 Reconstructing Social and Economic Activities of Shangchaoyanggou Households

After being cleaned, the four categories of artifacts (ceramics, lithics, daub, and miscellaneous artifacts) were analyzed separately in the lab. The two main parts of the analysis separate Hongshan artifacts from those of other periods and record data that are useful for reconstructing socio-economic activities of Hongshan household units within the Shangchaoyanggou local community. The analytical approach generally followed that developed through previous research in Fushanzhuang, Upper Daling, and Niuheliang. This framework had proven its utility in those three projects and applying the same framework for Shangchaoyanggou analyses would generate data that are fully comparable to data from those three projects. All the primary analyses were conducted in the Niuheliang Work Station of the Liaoning Institute of Archaeology and Cultural Relics from September to October 2018.

3.1 Relative Dating and Analysis of Ceramics

The Shangchaoyanggou ceramic category included not only the remains of ceramic vessels, but also other artifacts made from different types of clays and fired intentionally under high temperatures, such as ceramic roof tiles, porcelain, and ceramic tools. Due to the different nature of ceramic and lithic artifacts, the analysis of Shangchaoyanggou ceramics was very different from lithic analysis.

The first phase of the ceramic analysis was chronological assessment. The regional survey revealed that the vast majority of the sherds at the Shangchaoyanggou local community

pertained to the Hongshan period, but those of all periods were classified and counted, according to the criteria discussed by Zhu and Guo (Chifeng 2011: 9-16). Designed specifically for the systematic regional survey, this system focused on delineating major chronological periods based on colors, hardness, surface finish, paste, temper, thickness, and other characteristics of ceramics that could be observed on the vast majority of sherds of any size. This approach did not seek maximal chronological resolution, but simply the ability to classify almost every sherd to one of the major periods. Further modifications to this scheme were made in later projects (Peterson et al. 2014a: 13-21; Peterson et al. 2017). Specifically, this system divided the long chronology into eight periods, Xinglongwa, Zhaobaogou, Hongshan, Xiaoheyan, Lower Xiajiadian, Upper Xiajiadian, Zhanguo-Han, and Liao. Sherds that date after the end of the sequence relevant to the research questions in these studies were characterized as Recent or Modern. The vast majority of the sherds were fragments of ceramic vessels. For the Zhanguo-Han and Liao periods, sherds of fired clay roof tiles were also recovered, and these were counted separately from sherds of ceramic vessels. No ceramic tools were recovered at Shangchaoyanggou, but a few ceramic artifacts other than vessel fragments were classified as “miscellaneous”. Table 1 contains the overall counts and proportions by period (combining Xinglongwa and Zhaobaogou into Early Neolithic) of ceramics of all sherds recovered in the intensive collections at Shangchaoyanggou, 90.9% of which are of the Hongshan period, reconfirming the regional survey assessment that Hongshan ceramic remains were the most abundant ones at Shangchaoyanggou. It thus continues to be safe to assume that all lithic tools were Hongshan, since from Zhanguo-Han time onward iron had almost entirely replaced lithic tools, and only 0.004% of the pre-Zhanguo-Han sherds at Shangchaoyanggou were not Hongshan.

Table 1 Counts and proportions of ceramics of different periods in the Shangchaoyanggou site

Period	Count	Proportion
Early Neolithic	15	0.077%
Hongshan	**17642**	**90.910%**
Xiaoheyan	0	0.000%
Lower Xiajiadian	60	0.309%
Upper Xiajiadian	4	0.021%
Zhanguo-Han (Vessels)	254	1.309%
Zhanguo-Han (Roof Tiles)	0	0.000%
Liao (Vessels)	1124	5.792%
Liao (Roof Tiles)	27	0.139%
Recent	112	0.577%
Modern	167	0.861%
Indeterminate	1	0.005%
Total	**19406**	**100.000%**

After the initial separation of sherds by period, the Hongshan ceramics were subjected to further analysis. Hongshan ceramics were divided into two major functional categories: utilitarian vessels in daily use mostly for storing, preparing, and serving food, and bottomless cylinders (*tongxingqi*) used for ritual-related activities. The analysis of ceramics aimed to understand two aspects of the activities of each Shangchaoyanggou household unit: the use of ceramic vessels for daily dining and feasting and involvement in ritual activities indicated by ceramics with ritual uses.

For each collection unit, ceramic sherds were investigated for five characteristics: decoration, surface treatment, paste, vessel form, and ware. Decoration and surface treatment was helpful in characterizing the labor input for producing the ceramic vessels used in each household, with the underlying assumption that better-decorated ceramics required more labor to produce. The vessel form was helpful in evaluating the relative importance of different activities (daily dining, feasting, ritual activities, etc.) for each household unit. By contrast, the paste was a more mixed characteristic, related both to production (affected by the quality and procurement of clay) and use. For example, less labor input for refining the clay or making cooking vessels

(which require a more coarse temper) could both lead to a higher proportion of coarse-paste sherds.

Accordingly, 28 numeric variables were designed to describe five characteristics of the sherds from each collection. Table 2 contains the list of 28 variables, grouped according to the five characteristics. Each sherd must fall into one and only one of the variables in the groups consisting of paste, vessel form, and ware, while in the decoration group, one sherd can be counted for multiple variables, and for the surface treatment variables, one sherd can be counted in multiple variables or none at all. Since the number of Hongshan ceramic sherds recovered at Shangchaoyanggou is huge, this analysis of characteristics was a question of counting the number of sherds present in each collection circle (or general collection) for each of the 28 variables.

All the ceramics were stored separately grouped by collection units after analysis was complete.

Table 2 List of characteristics variables used for Shangchaoyanggou Hongshan ceramic analysis

Group	Variable
Decoration	Incised horizontal Z
	Incised vertal Z
	Incised other motif
	Painted
	Applique band
	Fingernail impressed
	Undecorated
Surface Treatment	Slip
	Burnished
	Mat impressed
Paste	Coarse
	Fine
Vessel Form	Guan
	Bo
	Hu
	Weng
	Xiekouqi
	Pen
	Bei
	Tongxingqi
	Other Form
	Indeterminate
Ware	Orange
	Brown
	Gray
	Black
	Yellow-brown
	Other

3.2 Analysis of Lithics

All the lithics recovered at Shangchaoyanggou were analyzed as Hongshan period artifacts, with one exception. On very rare occasions a lithic artifact that is obviously not of the

Hongshan period. For example, a few lithic artifacts have traces of mechanical polishing, which is so advanced technique that can not be used during the Hongshan period. Such artifacts were placed with “miscellaneous” artifacts instead of “lithics”. As in the ceramic analyses, the basic lithic analysis units were collection units, which include collection circles and general collection. The process of analysis generally follows the one developed for Fushanzhuang intensive surface collection (Peterson 2006) as modified for later Upper Daling and Nuheliang collections (Peterson et al. 2014a, 2014b; Drennan et al. 2017).

Lithic artifacts were first separated into "tools" and “debitage”. Tools are lithic artifacts that were retouched after primary reduction (mainly flaking) or required tremendous preparation before reduction (e.g. microblades and cores of different types). All lithic artifacts possessing neither of these characteristics are categorized as debitage. These definitions were used in earlier analyses of Hongshan intensive surface collections (Peterson 2006; Drennan et al. 2017), and while other definitions of these categories are sometimes used, this one provided ideal criteria for picking out the lithics which required more labor input during the production process and could become tools with meaningful functions.

After the separation of tools and debitage, the two were analyzed separately. Tools were further categorized into different tool types with an emphasis on function. Since the lithic assemblages of Shangchaoyanggou household units, like those from other Hongshan local communities, combined the techniques of flaking, pecking, and grinding in complicated ways, several different typological systems were used for Shangchaoyanggou lithic tools identification. For flaked tools without grinding or pecking, the typological system focused on morphological characteristics for ground and pecked tools, types were based mainly on functions (Peterson

2006: 94-96; Chifeng 2011: 57-80; Peterson et al. 2014b). Table 3 lists all the tool types used in Shangchaoyanggou lithic analysis.

Table 3 Shangchaoyanggou lithic tool types and variables investigated

Tool Types	Quality of Material	Manufacture Type	No. of Functional Edges	Functional Edge Angles	Completeness
Abrader	√	√			√
Awl/Drill	√	√			√
Axe/Adze	√	√			√
Blade	√	√	√	√	√
Retouched Blade	√	√	√	√	√
Retouched Flake	√	√	√	√	√
Hammerstone	√	√			√
Knife	√	√			√
Unifacial Scraper	√	√	√	√	√
Bifacial Scraper	√	√	√	√	√
Chopper	√	√			√
Blade Core	√	√			√
Uni-directional Flake Core	√	√			√
Multi-directional Flake Core	√	√			√
Proj Point	√	√			√
Blank	√	√			√
Roller/Quern	√	√			√
Ornament	√	√			√
Indeterminate	√	√			√

Two features of this tool type system are worth emphasizing. First, establishing the functions of lithic tools involves subjective judgment. The traditional approach to lithic functions in China focuses more on morphological characteristics and analogies with the historical or ethnographic literature, with extremely speculative results (e.g. Mu and Song 1981; Wang 1998). In the past decade, the fashion has shifted, with many studies of use ware and of residues on lithic tools (e.g. Liu et al. 2010; Liu et al. 2014a; Chen et al. 2014). These and other experimental studies provide evidence to help narrow down the possibilities for functions of Neolithic tools

found in different parts of China, especially those widely believed to be connected to food production (e.g. Cui et al. 2017; He et al. 2018; Yang, Chen and Wang 2018; Xu 2019) so that other types of analyses could be done on this foundation. Still, it is difficult to connect some lithic tools to specific human activities, partly because current lithic analyses were not sufficient to support such connections, and partly because some tools were originally designed for multiple purposes. Considering this situation, for Shangchaoyanggou lithic analysis each tool type was only linked to one or several general functions ("chopping", "scraping", etc.).

The second feature of the tool type system is that every tool is placed into at least one tool type. Artifacts with clear marks of retouch but not identifiable to any existing type were called "undetermined". At the same time, a lithic tool can be assigned to more than one tool type. There are three possible reasons for this. First, some tools were designed to be multifunctional. For example, a flake may have more than one functional edge, with one used for cutting and another for scraping. Such a tool would be classified as both "retouched flake" and "scraper". Second, tools might be retouched or even remodeled to add new functions during their process of use. If a tool previously used as a scraper was remodeled as an awl, then its tool type would be "scraper" and "awl/drill". Last, since the tool typology takes both morphological features and functions into account, a tool might match both a type that describes both morphological characteristics and one related to function. For example, an awl made from part of a micro-blade will be both "awl/drill" and "blade".

After assigning every tool to appropriate tool types, the further analysis described their key characteristics. This step aimed at generating detailed data on each lithic tool based on the previously established approach (Peterson 2006, Appendix B; Peterson et al. 2014b; Peterson et

al. 2017; Drennan et al. 2017). Specifically, as described by Peterson et al. 2017, the following features of lithic tools were the focuses of analysis:

1. The quality of raw material
2. The method of manufacture
3. The tool type
4. The current condition (complete or broken)
5. (For the tools that have functional edges) the number of functional edges
6. (For the tools with one or more functional edges) the angles of each edge

Generally, these features are related to the whole lives of lithic tools, which include raw material acquisition, production, use, and discard. Specifically, the material quality was recorded to measure the ability to acquire lithic materials of higher quality for producing certain tools (such as flints and cherts with fine granularity for blades, or sandstone with uniform texture for querns and rollers). Only "good" and "bad" were recorded for the material of each lithic tool. The method of manufacture refers to the main techniques applied in the production of the tool (flaking, grinding, and pecking). Some tools, such as modified polished stone axes, had been both flaked and ground during their production, and hence have two options checked. The current condition of the records whether the tool is complete or broken, and which part of the tool is remaining. Finally, the number of functional edges and the angle of each edge were recorded, which is informative for understanding how the tools were used (scraping, cutting, etc.).

The variables related to the aspects mentioned above for each tool type are also listed in Table 3. After analysis, each lithic tool was assigned a unique tool ID, and one or more photos

were taken to record general and particular characteristics and for potential review in the future. Each lithic tool was stored separately in an individual bag.

The analysis of lithic debitage contained three parts: typological analysis, metric analysis, and mass analysis. This approach was established analysis of artifacts from the intensive collection at Fushanzhuang (Peterson 2006, p 114) and used since then (Peterson et al. 2014b; Peterson et al. 2017; Drennan et al. 2017). It focused on identifying the stage of production of each piece of the debitage so that the degree of involvement in different stages of lithic production could be determined for each household unit. The initial units of analysis were collection units, later aggregated into household units.

The total number of debitage fragments was counted for each collection unit. Then count of debitage of good or poor quality raw material was recorded for each collection unit. Then Sullivan and Rozen's (1985) approach was used to divide the debitage into four types, based on three dimensions of variability: single interior surface, point of applied force, and margins:

1. complete flakes (discernible single interior surface, point of applied force, intact margins)
2. broken flakes (discernible single interior surface, point of applied force, no intact margins)
3. flake fragments (discernible single interior surface, no point of applied force,)
4. pieces of shatter (no discernible single interior surface)

While Sullivan and Rozen's typological framework is influential, their original distinction between core reduction and tool reduction assemblages was not entirely sustained by subsequent experiments. For example, Sullivan and Rozen expected core production to produce more complete flakes than broken flakes or flake fragments, and tool production to produce more

flake fragments than complete flakes. Later experimental studies suggested, however, that the production of small bifacial tools usually produces a much higher proportion of complete flakes and flake fragments, the same or slightly lower proportion of broken flakes, and a lower proportion of shatter than core reduction and bifacial tool blank production do (e.g. Baumler and Downum 1989; Mauldin and Amick 1989; Prentiss and Romanski; Prentiss 1998).

Hence, a modified version of Sullivan and Rozen's typology was used, which applied their original framework, with some changes suggested by the later experimental studies. Even so, typological analysis on debitage by itself cannot provide sufficient evidence, so metric analysis and mass analysis were added to the typology.

Metric analysis was performed on every complete flake and broken flake in order to evaluate whether it was removed during core production or tool production (Bradbury and Carr 1999). The length of the platform, the width of the platform, the thickness of the bulb, and the thickness of the midpoint of the flake were measured for each complete and broken flake. Then these data were used to calculate the indexes of core production and tool production. If the core production index is higher, then the flake is taken to be a result of core production; if the tool production index is higher, then the flake is taken to be a result of tool production (Bradbury and Carr 1999). Finally, the counts of flakes most likely removed during core production and tool production were recorded for each collection unit. Generally, household units focus on the early stage of lithic reduction were taken to be those with more flakes removed from cores, while those focused on late-stage production were those with should claim more flakes removed from tools.

The mass analysis collected data on the sizes and shapes of debitage fragments by applying size-sorting. Mass analysis handles large samples and produces consistent and

relatively objective results (Ahler 1989; Shott 1994). All the debitage pieces recovered in each collection unit were put through a set of three screens with gauges of 1 inch, 0.5 inches, and 0.25 inch and divided into four groups, based on how many screens the fragments fell through (none, one, two, or three). The total weight of all fragments of debitage in each size group was measured with an electronic scale and recorded. Finally, the total count of fragments of debitage with cortex and without cortex was recorded as well for each size group. Debitage that is large and with cortex is more likely to be the by-product of the early stage of lithic reduction.

The data collected in all the lithic analyses mentioned above provided multiple lines of evidence to evaluate the role each household unit played in the process of lithic production. For example, a household unit with a large hammerstone and many large complete flakes with poor material quality and cortex was involved primarily in the early stage of lithic production. In contrast, a household unit with preforms and a large number of small flake fragments and pieces of shatter from good materials was a household that focused on the late stage of lithic production.

3.3 Analysis of Daub and Miscellaneous Artifacts

The other two categories of remains, daub, and miscellaneous artifacts, comprise all the rest of the artifacts recovered at Shangchaoyanggou besides ceramics and lithics. These were not part of the subsequent quantitative analysis but were used anecdotally based on the approach used for the Upper Daling intensive surface collections (Peterson et al. 2017).

Daub consists of broken hardened clay fragments of wattle and daub structures, usually the dwelling structures or the hearths within them. The fragments were baked hard by the sun or hardened even more by accidental fires that occasionally destroyed the houses. Daub fragments

are evidence for the presence of structures (Peterson et al. 2017). Since Zhanguo-Han and later structures were built of fired bricks they did not leave daub fragments, and activities of pre-Zhanguo-Han periods almost entirely dated to Hongshan times, the daub recovered at Shangchaoyanggou must be from structures of the Hongshan period, following a logic similar to that used for lithics.

Unlike other artifact categories, the daub is extremely fragile because it was never as hardened as ceramics. Fragments broke up very differently, and they could break at a touch, making counts of daub very erratic indicators of quantity. Hence, the daub in each collection unit was weighted with an electronic scale and the weight was used as the main indicator of quantity. Daub fragment with flat surfaces and stick or other impressions were noted especially carefully. Daub recovered from the walls of dwelling structures in previous Hongshan excavations usually had sticks or grasses as tempers, which would leave impressions after burning. The walls of the dwelling structures were also smoothed, which would leave a flat surface on the daub (Liaoning 2012, p 17; Neimenggu 2004, p 44). Hence, these two characters served as more concrete evidence of the presence of dwelling units and suggested that the daub has remained in its original location since the pieces of daub moved by natural forces might lose these characteristics. After all the analyses, the pieces of daub of the same collection unit were put in the same bag and stored according to the collection unit ID.

Daub was found in 98 out of 149 collection units. Among the units with daub, 24 have pieces of daub with flat surfaces and 53 have daubed with an impression. This is concrete evidence of the presence of Hongshan structures in the Shangchaoyanggou local community and confirms that the distinct collection units match the original locations of these structures.

Compared to daub, the category of miscellaneous artifacts was more heterogeneous in terms of materials and nature. Considering that this category aimed to include all the other potential artifacts besides those in the previous three categories, the miscellaneous artifacts were grouped according to their materials. In light of the data from previous fieldwork (Peterson 2006, p 118-119; Neimenggu 2004), five material-based subcategories were designed for all miscellaneous artifacts, namely ceramic, stone, bone, shell, and metal. Again, all the miscellaneous artifacts in the same collection unit were recorded together, with the ID of the collection unit, counts of each sub-category, and a brief description of the artifacts.

Only 12 collection units yielded miscellaneous artifacts. Most of these artifacts were ceramic kiln wasters and animal bones. The former was the sherds of ceramics that broke during the firing process, which made them helpful indicators of ceramic production. No metal or shell artifacts were earlier than about 10 years before our fieldwork.

3.4 Organization and Storage of Primary Data

The Microsoft Access database structure that had been successfully used in previous intensive surface collections (Peterson 2012; Peterson et al, 2017) was used for the Shangchaoyanggou data management as well. The database contains seven tables; three were designed for ceramics, pieces of daub, and miscellaneous artifacts. For lithics, there were two tables, one for tools and one for debitage to manage related data. Another table was for the metric attribute data on lithic debitage. The last table stored all the information pertaining to the collection units from the fieldwork except their location information. In addition to the tables,

seven more visual forms were also designed for convenient input of data. Finally, data were exported as .xls or .csv files to import to other programs for various statistical analyses.

4.0 Analyzing Interactions between Shangchaoyanggou Households

4.1 Statistical Analysis on Key Indexes of Shangchaoyanggou Households

For the Shangchaoyanggou household units, the primary questions to be answered were "Were there socioeconomic differences between Shangchaoyanggou households?" and "How strong and significant were these differences if they existed?"

To evaluate the potential differences between Shangchaoyanggou household units in activities of food production and ritual involvement, three proportions were focused on in each household unit: the proportions of food production tools, the proportions of food processing tools, and the proportion of ritual-related ceramic sherds. Previous Hongshan field projects have recovered abundant faunal remains associated with ceremonial architecture indicating the use of faunal resources in these ceremonial activities (Guo and Zhang 1984; Liaoning 2012). Hongshan local communities like Shangchaoyanggou might have provided faunal food resources in addition to plant food resources to ritual specialists near the Niuheliang ceremonial facilities. Faunal remains dated to the Hongshan period, however, were not found in the fieldwork at Shangchaoyanggou. Lithic tools potentially used for hunting and meat processing are mostly multifunctional and less persuasive as evidence for meat production. Hence, for the Shangchaoyanggou analysis, the primary focus is the production and processing of plant food resources.

The proportion of food production tools in a household unit is the total number of axes/adzes, hoes, and knives divided by the total number of identifiable lithic tools in that household unit. The proportion of food preparation tools in a household unit is the number of

rollers/querns divided by the total number of lithic artifacts in that household unit. The tools counted as food production tools and food processing tools do not exhaust all types of lithic tools that could be used for food production/processing. Other types of tools that could be used in food production/processing activities, however, are multi-functional tools, which makes them less persuasive indicators of food production/processing activities. The proportion of ritual-related ceramic sherds in a household unit was the number of *tongxingqi* sherds divided by the total number of Hongshan sherds from identifiable vessel forms in that household.

Bullet graphs of the three proportions are presented in Figures 14, 15, and 16. The household units are organized according to their spatial locations running from north at the left to south at the right.

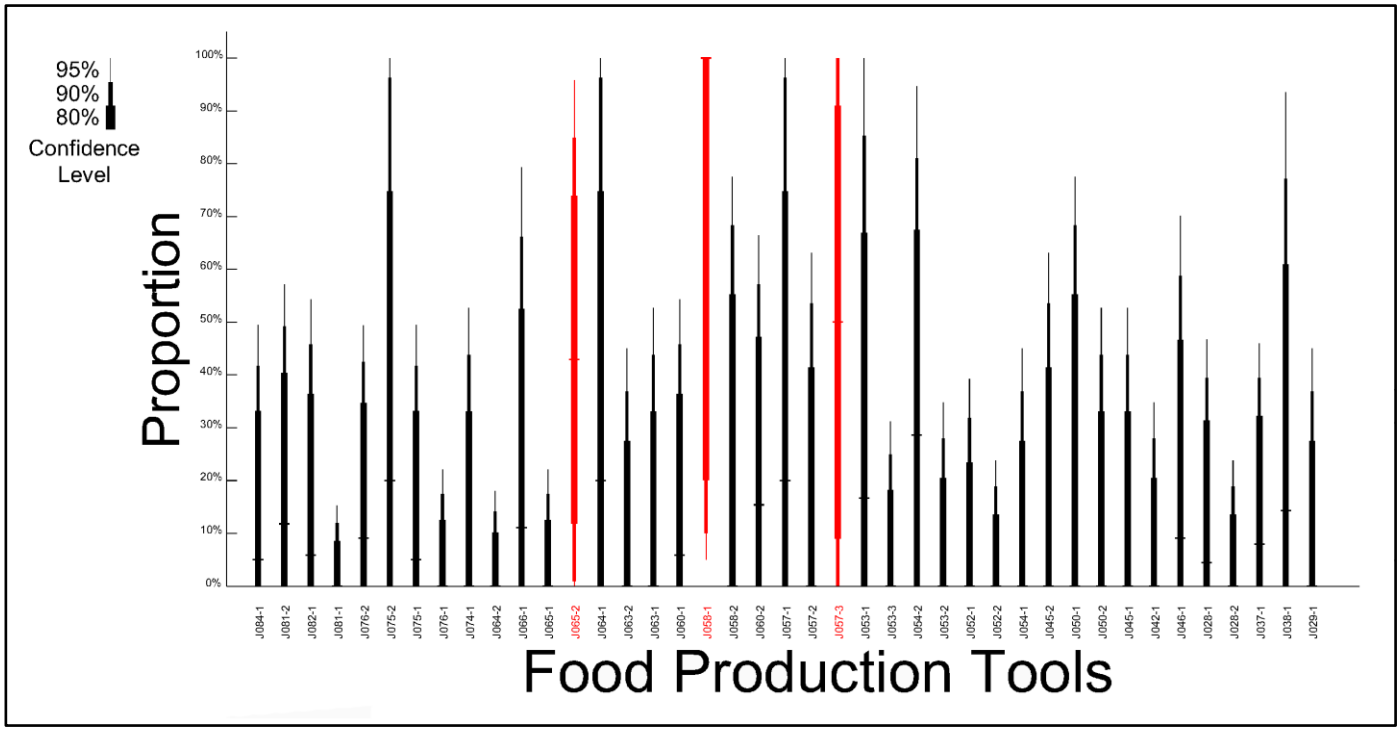

Figure 14 Bullet graphs of food production tools in Shangchaoyanggou household units

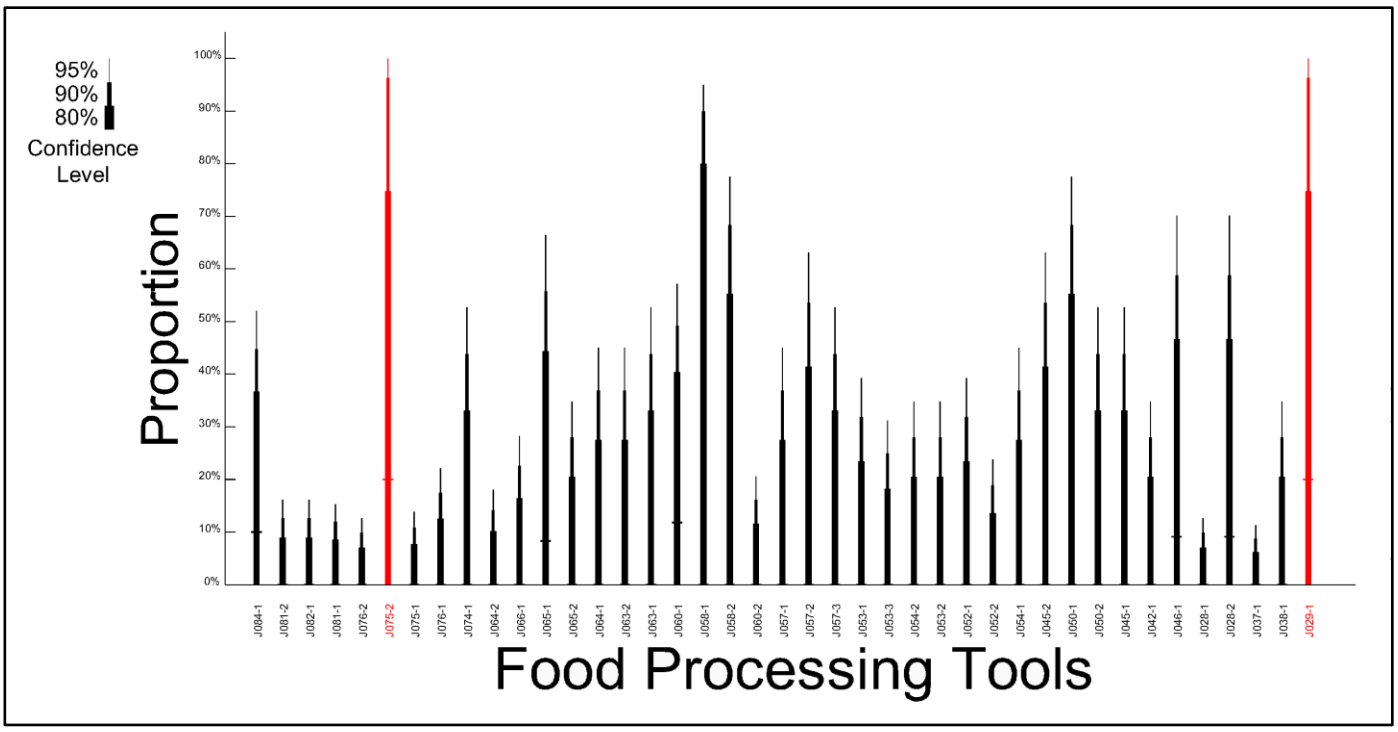

Figure 15 Bullet graphs of food processing tools in Shangchaoyanggou household units

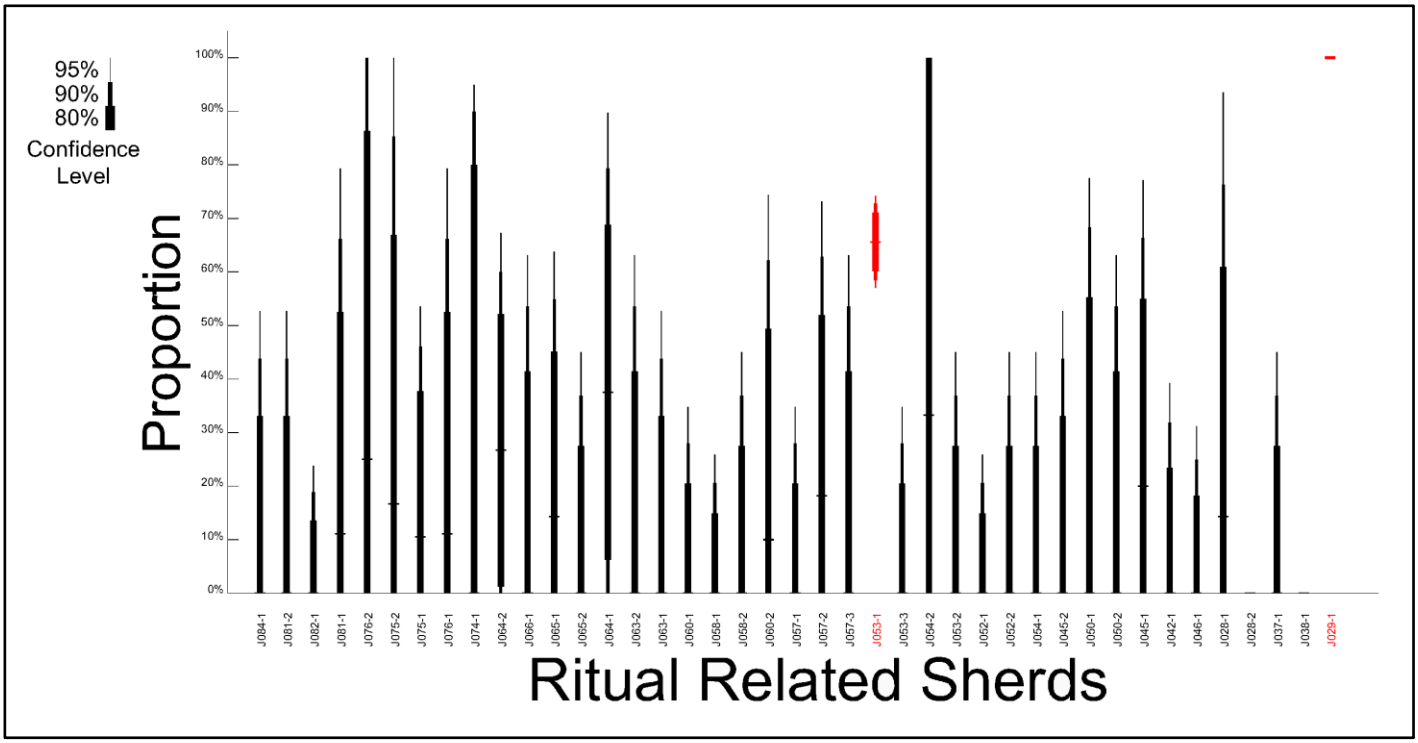

Figure 16 Bullet graphs of ritual-related sherds in Shangchaoyanggou household units

There were strong differences between three household units with proportions of food production tools over 40% (the red units in Figure 14) and the rest with proportions less than 30%. The three households with proportions greater than 40% are far above the mean proportion of food production tools (9.8%) for all Shangchaoyanggou household units. The proportions of the top three household units are higher than the 80% error range upper limit for most of the rest of the household units but are lower than the 90% and 95% upper limits of these error ranges. While small sample sizes prevent statistical confidence levels as high as one might like, these results make it fairly unlikely that the differences between the top three and the rest of the household units are just the results of the vagaries of sampling. Thus, several Shangchaoyanggou household units were more dedicated to food production activities than the other household units were.

Two Shangchaoyanggou household units had proportions of food-processing tools that were nearly 10% higher than all the rest of the household units and far more than 10% higher than many units (the red units in Figure 15). However, the highest two proportions were lower than most of the 80% confidence level error range upper limits for the other Shangchaoyanggou household units. The differences then, although strong, were uncomfortably likely to be the result of the vagaries of sampling. The absolute numbers of identified food processing tools were quite small, with only 9 items found in 7 Shangchaoyanggou household units. This, combined with the relatively small samples of identified lithic tools for many household units, led to extremely large error ranges. Hence no persuasive evidence was found to indicate that any household unit in the Shangchaoyanggou local community was dramatically more dedicated than the others to food processing. This is consistent with the general expectation that food processing was a widespread economic activity, with each household processing food for its members.

It is important to note that food production tools and food processing tools, because of their nature, are relatively rare in all Neolithic artifact assemblages in northeastern China. In this context, Shanchaoyanggou household units have relatively high proportions of these two types of tools compared to their Hongshan counterparts in other local communities. This is especially the case for the household units with the highest proportions of food production or food processing tools. Broader comparative studies will pursue this observation further in the next chapter.

The differences between the household units with the highest proportions of ritual-related sherds and the rest of the household units were also large. Two household units (J029-1 and J053-1) had proportions of ritual-related ceramic sherds higher than 60%, and the rest of household units were lower than 40% and often much lower (Figure 16). These differences were fairly unlikely to be the results of the vagaries of sampling as the top two values were higher than most of the 80% confidence level error range upper limits of the rest of household units. Although these differences were very strong and fairly significant statistically, the archaeological contexts need to be considered before drawing conclusions. J053-1 had a high proportion of ritual-related ceramic sherds and very narrow error ranges for all confidence levels, so it is very strongly and significantly different from the rest of the Shangchaoyanggou household units. The *tongxingqi* sherds found in J053-1 were generally very large, and some of the sherds belonged to the same vessel. Perhaps the remains of J053-1 were buried in a shallow pit or an uninterrupted deposition of ceramics, especially *tongxingqi*, which was a very different taphonomic context than the other household units. A more persuasive interpretation is that the location of J053-1 was formerly a ceremonial platform, and although surface traces of a small platform were absent, some of the most common vessels related to the platform, *tongxingqi,* were buried and preserved in situ as the remains of J053-1. This taphonomic account makes better sense because of the field

observation of a large number of big *tongxingqi* sherds that sometimes fit together. This is much more likely to be the taphonomic results of *tongxingqi* being left in place and slowly breaking apart as has been observed in other Hongshan ceremonial platforms. This is less likely to be the case for ceramic vessels broken in daily use, swept up and thrown on a garbage heap, and left in that state on the surface before being covered. If J053-1 represents the location of a ceremonial platform, then the Shangchaoyanggou local community seems to be a "normal" Hongshan community with its own ceremonial structure, in contrast to communities located closer to the Niuheliang ceremonial facilities, which usually had no such structure. J029-1 on the other hand had only one sherd with a recognizable vessel type, which happened to be a *tongxingqi* sherd, quite likely by pure random chance. It is impossible to calculate the error range with this sample size of 1, and such a small sample size made its 100% proportion highly likely to be fortuitous and not convincing at all.

These two household units, then, were not likely to be especially active participants in ritual activity. Besides these two cases, two household units, J054-2, and J064-1, also have proportions of *tongxingqi* that are much higher than the rest of the units. These two household units, however, both had extremely large error ranges for *tongxingqi* proportions due to the small sample size of recognizable ceramic sherds and are hence not persuasive as active ritual activity participants either. Thus, there is no evidence that any Shangchaoyanggou household participated in ritual activities on a much higher level than the others.

A few Shangchaoyanggou household units thus have emphasized food production more than the others, having proportions far above the overall mean. Shangchaoyanggou, like other "normal" Hongshan local communities, had a small ceremonial platform, but the evidence of household ritual activities shows less internal differentiation than other studied Hongshan local

communities. There was no evidence to support the existence of a meaningful difference between the Shangchaoyanggou household units in terms of food processing activities based on available data. In addition, no household unit had especially high values for proportions of both food production tools and ritual-related ceramic sherds, which implied that none of the households was especially dedicated to both food production and ritual activities.

4.2 Evaluating Socio-economic Activities within Shangchaoyanggou Local Community

Having examined the Shangchaoyanggou household units with respect to three artifact proportions of specific interest broader analysis of socio-economic activities of Shangchaoyanggou household units was pursued. Multidimensional scaling had been successful in previous research and in an experimental comparative study conducted by the author (Drennan et al. 2017). As a case-based approach, multi-dimensional scaling was extremely useful for revealing the similarities and dissimilarities between the household units. This approach was hence applied as the main multivariate analysis for Shangchaoyanggou household units.

Two multi-dimensional scaling analyses were carried out separately for lithic and ceramic data for the Shangchaoyanggou household units. To ensure the results were comparable between different Hongshan household datasets, the 19 variables designed for lithic analysis and the 4 variables for ceramic analysis were exactly the same as in Drennan et al, (2017; Table 4, 5). As discussed above, the J053-1 was likely a platform but not a household unit, and its extremely high proportions of decorated and slipped sherds obscured the potential patterns of other Shangchaoyanggou household units. It was thus decided to remove J053-1 from the ceramic multidimensional scaling analysis, making the number of cases included in this analysis 40.

Since all the data used for these two multi-dimensional scaling analyses were numeric, Euclidean distances on standardized variables between each pair of household units were the best measure of similarity and hence were used for the multidimensional scaling analyses.

Choosing the most appropriate number of dimensions to illustrate the data structure is important in multi-dimensional scaling. While higher dimensions would decrease the loss of original information in the final data structure, this would also increase the complexity of the data representation, making it too complicated to interpret. A common rule of thumb is that a stress value of 0.15 or less often facilitates meaningful interpretations. It is usually only feasible to interpret 2 or 3-dimensional configurations. The stress value of the Shangchaoyanggou multi-dimensional scaling analysis of ceramics was 0.195, which is slightly higher than 0.15. Since a two-dimensional configuration is much simpler to work with than a three-dimensional configuration, this stress value slightly higher than the rule of thumb was accepted.

Table 4 Variables used in multidimensional scaling analysis on ceramic

Name of Variables	Expressions of Variables
Prop. of Decorated Sherds	Number of Hongshan sherds with incisized "Z" motifs, other incising, printed disigns, applique bands, or finger nail impressions/ total Hongshan sherds
Prop. of Fine Paste Sherds	Number of Hongshan fine paste sherds/total Hongshan sherds
Prop. of Slipped Sherds	Number of Hongshan clay slipped sherds/total Hongshan fine paste sherds. Corase paste Hongshan sherds are not slipped
Prop. of Serving Sherds	Number of Hongshan serving vessel (*bo* and *pen*) sherds /total Hongshan identifiable vessel (*guan*, *bo*, *hu*, *pen* and *tongxingqi*) sherds
Prop. of *Tongxingqi* Sherds	Number of *tongxingqi* sherds/total Hongshan shreds from identifiable vessel forms

In the multidimensional scaling of lithics, the stress value for two dimensions was 0.245, which is much higher than 0.15, so the three-dimensional configuration, with a final stress value of 0.182, was used. Although the three-dimensional configuration was more complicated to

interpret than the two-dimensional one, it revealed additional patterning. Accordingly, one scatter plot was drawn to illustrate the two-dimensional configuration for the analysis of ceramics, and three scatter plots were drawn, one for each pair of the three dimensions in the lithic configuration.

Table 5 Variables used in multidimensional scaling analysis on lithic data

Name of Variables	Expressions of Variables
Proportion of Good Raw Materials	Number of lithic tools of high quality raw materials/total lithic tools. (Good raw materials include siliceous cherts and diorites in contrast to mudlithics, sandlithic, and quartzite)
Proportion of Ground Stone Tools/Artifacts	Number of Ground stone tools/total flaked and Ground Stone tools
Proportion of Abraders	Number of grooved abraders (for making Ground stone tools)/total lithic tools
Proportion of Awls and Drills	Number of flaked awls and drills/total lithic tools
Proportion of Axes and Adzes	Number of Ground stone axes and adzes/total lithic tools
Proportion of Blades	Number of retouched and unretouched blades/total lithic tools
Proportion of Retouched Flakes	Number of retouched flakes/total lithic tools
Proportion of Hammer Stones	Number of hammer stones/total lithic tools
Proportion of Knives	Number of ground knives/total lithic tools
Proportion of Unifacial Scrapers	Number of flaked unifacial scrapers/total lithic tools
Proportion of Bifacial Scrapers	Number of flaked bifacial scrapers/total lithic tools
Proportion of Chopping Tools	Number of flaked chopping tools/total lithic tools
Proportion of Cores	Number of flake and blade cores/total lithic tools
Proportion of Projectile Points	Number of flaked projectile points/total lithic tools
Proportion of Tool Blanks and Preforms	Number of unfinished tools (blanks or preforms)/total lithic tools
Proportion of Rollers and Querns	Number of rollers and querns/total lithic tools
Proportion of Acute Edge Angles	Number of flaked scrapers, blades, and retouched flakes with acute edge angles (25–44°)/total lithic tools
Proportion of Obtuse Edge Angles	Number of flaked scrapers, blades, and retouched flakes with obtuse edge angles (45–65°)/total lithic tools
Proportion of Complete Unretouched Flakes	Number of complete unretouched flakes/total debitage (complete and broken flakes, flake fragments, and shatter)
Proportion of Broken Unretouched Flakes	Number of broken unretouched flakes/total debitage (complete and broken flakes, flake fragments, and shatter)
Proportion of Unretouched Flake Fragments	Number of unretouched flake fragments/total debitage (complete and broken flakes, flake fragments, and shatter)
Average Debitage Weight	Total weight of debitage in grams/total count of debitage (complete and broken flakes, flake fragments, and shatter)

4.2.1 The Multi-dimensional Scaling Analysis of Shangchaoyanggou Ceramic Data

In the two-dimensional multi-dimensional scaling configuration of Shangchaoyanggou ceramic data (Figure 17) most of the household units cluster in the upper part of the plot, forming a big group, with a smaller sample of units separated towards the bottom. Among these outliers, J084-1, J058-1, J065-2, and J042-1 are clearly separated from the big group towards the lower right, for their high proportions of serving vessels. J082-1 separates in the same direction but to a lesser degree. Household unit J053-3, with a high proportion of decorated and slipped sherds, is an extreme outlier toward the lower left part of the figure and is far away from the big group and other outliers. J057-3 and J074-1 also separated in the same direction but more modestly. Another two household units, J053-2, and J063-2 are intermediate outliers in the lower center of the plot, with relatively high proportions of both serving vessel sherds and decorated/slipped sherds, but not as high as the household units mentioned previously.

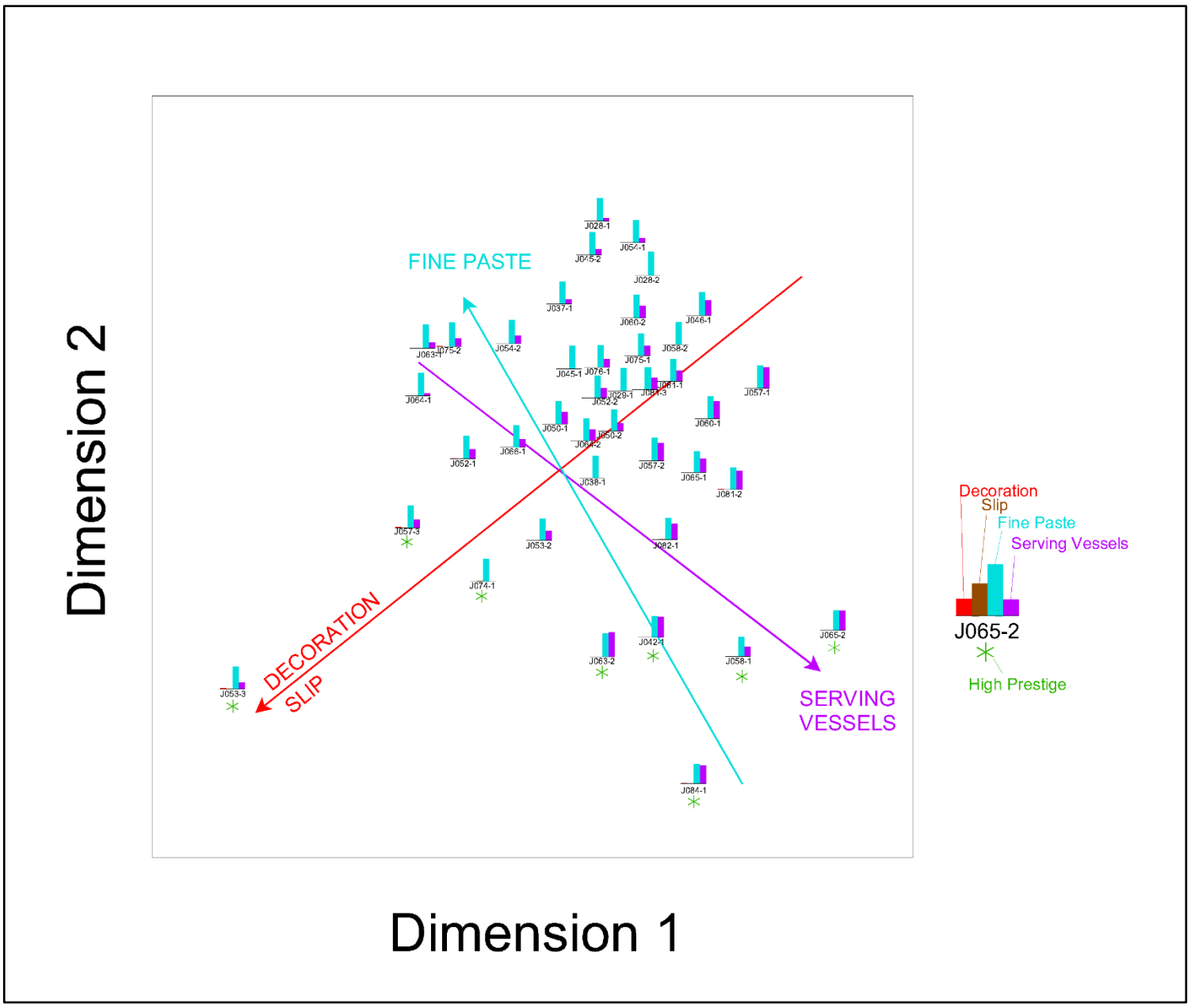

Figure 17 Multi-dimensional scaling of Shangchaoyanggou ceramic data

The overall patterns in the multi-dimensional scaling of Shangchaoyanggou ceramic data are somewhat similar to those of the Sanjia, Dongshanzui, and Erbuchi households in the Upper Daling region (Drennan et al. 2017, Figure 5). Like the Upper Daling household units, most Shangchaoyanggou household units were relatively clustered, with a limited number of household units consuming ceramics of relatively but not extremely higher quality than the

majority. The only exception in Shangchaoyanggou is J053-3, the closest household unit to the potential platform J053-1, which had proportions of decorated and slipped ceramic sherds far higher than other units which makes it more extreme than other Shangchaoyanggou outliers, and roughly similar in this regard to the most extreme Upper Daling outliers. The relatively large sample size (605 Hongshan sherds) means that the data for J053-3 are probably quite free of random noise.

As in the Upper Daling analysis, the Shangchaoyanggou ceramic scaling showed complex patterns. As among the Upper Daling household units, the outliers in the Shangchaoyanggou local communities could utilize ceramics in various ways, which are not exclusive to each other. The only major contrast is that in the Upper Daling an axis of increasing s parallels that for serving vessel proportions, while at Shangchaoyanggou high proportions of fine paste sherds correspond to low proportions of serving vessel sherds. Since the serving vessels of Shangchaoyanggou household units were generally of coarse paste, this could explain this major difference.

Drennan et al. (2017) have discussed the social meanings of the four variables applied in this multidimensional scaling and suggested that some Upper Daling households consumed ceramic of higher quality as a display of social prestige rather than as a consequence of greater wealth. Several Shangchaoyanggou household units seem interpretable in the same way. Like Upper Daling household units, the differences between Shangchaoyanggou household units in respect to ceramics were on a modest scale, which, combined with the fact that the extra labor cost of finer ceramics is minimal, suggesting that these differences did not display much in the way of wealth differences.

To sum up, the multi-dimensional scaling analysis of ceramics in the Shangchaoyanggou local community provided evidence about different kinds of differentiation. While some household units, by utilizing ceramics of higher quality, displayed a higher level of prestige compared to other units, such differences in ceramics do not indicate the existence of strong wealth differentiation. Also, compared to the most significant outliers of Fushanzhuang and Upper Daling, the household units of Shangchaoyanggou were less set off from "ordinary" household units in terms of the pursuit of social prestige, and this may due to Shangchaoyanggou's proximity to and special relationship with the Niuheliang pilgrimage center. The joint multidimensional scaling analysis in the next chapter will pursue this issue more comprehensively.

4.2.2 The Multi-dimensional Scaling Analysis of Shangchaoyanggou Lithic Assemblages

Since the Shangchaoyanggou lithic analysis involves many more variables, the patterns revealed in the configurations are more complicated and require more dimensions for an understandable presentation (Figures 18-20). Nonetheless, some features stand out clearly. In each figure, there is a main cluster in the center. Some minor clusters are located around the main one in all three figures, but with fewer household units included in each. No household unit was pulled far away from the majority of household units in Figure 18, while J063-2 lies very far from the other household units in both Figures 19 and 20. J058-1 is another household unit far away from the majority in Figure 20.

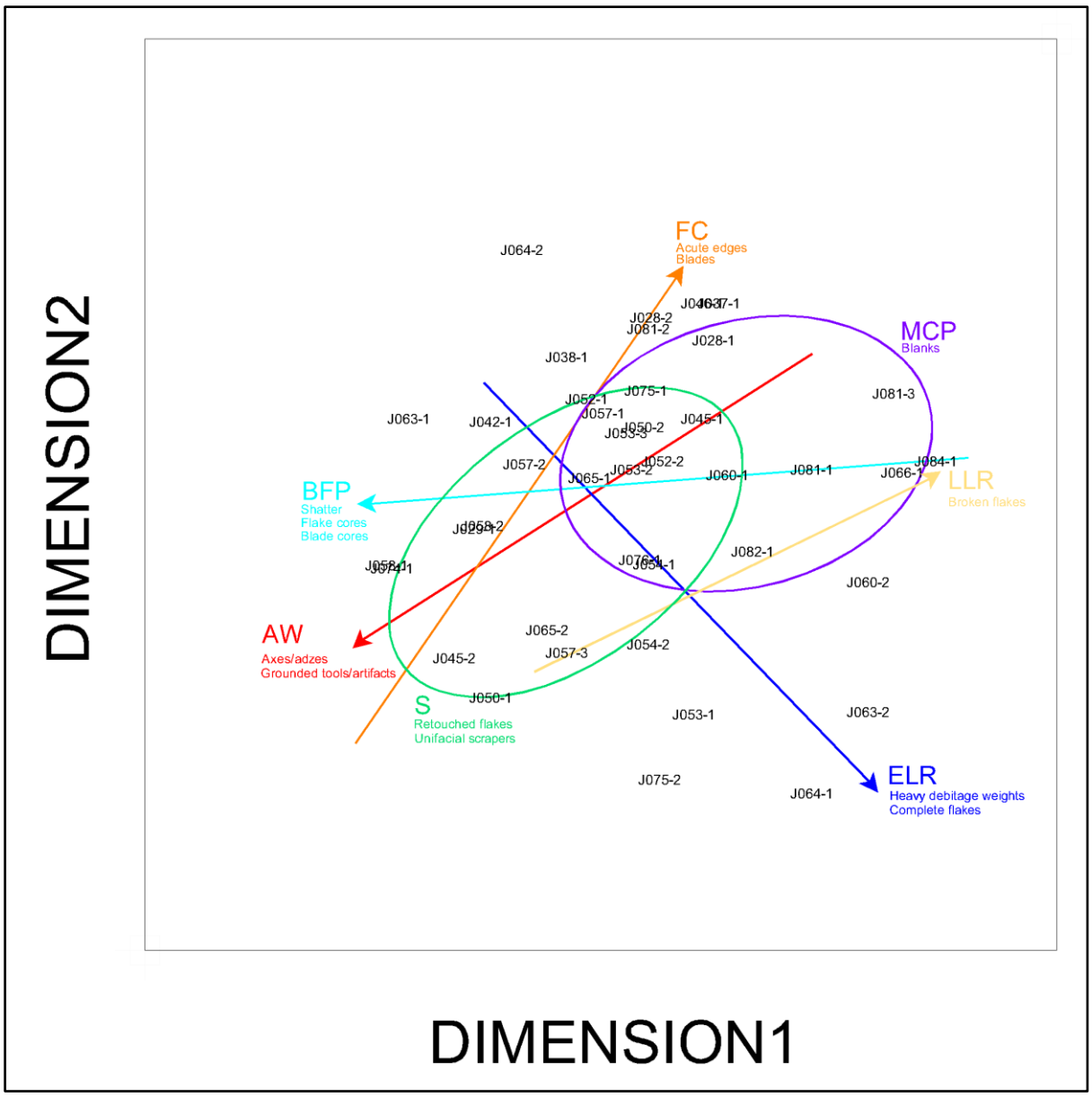

Figure 18 Multi-dimensional scaling of Shangchaoyanggou lithic data (dimension 1-2)

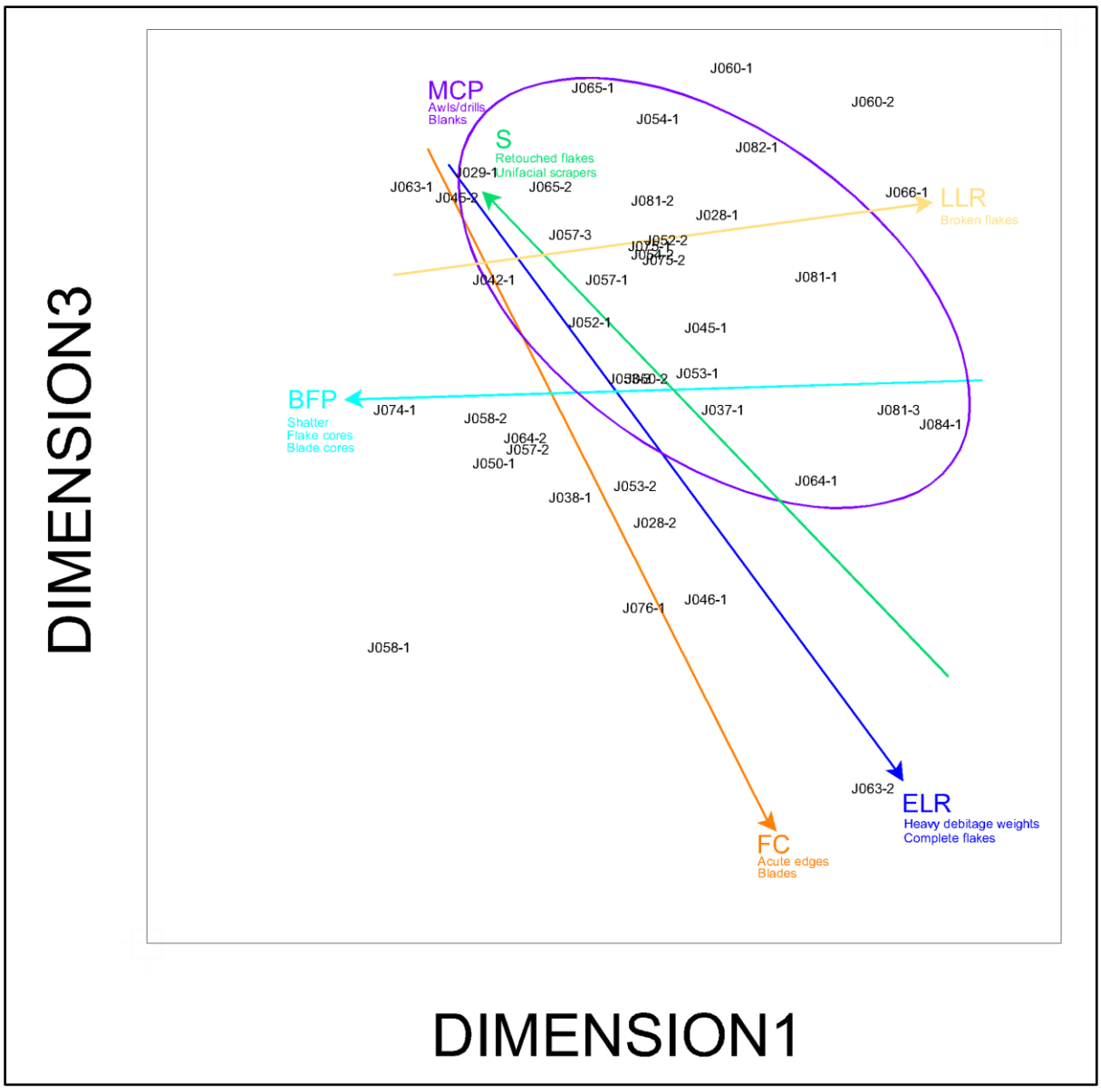

Figure 19 Multi-dimensional scaling of Shangchaoyanggou lithic data (dimension 1-3)

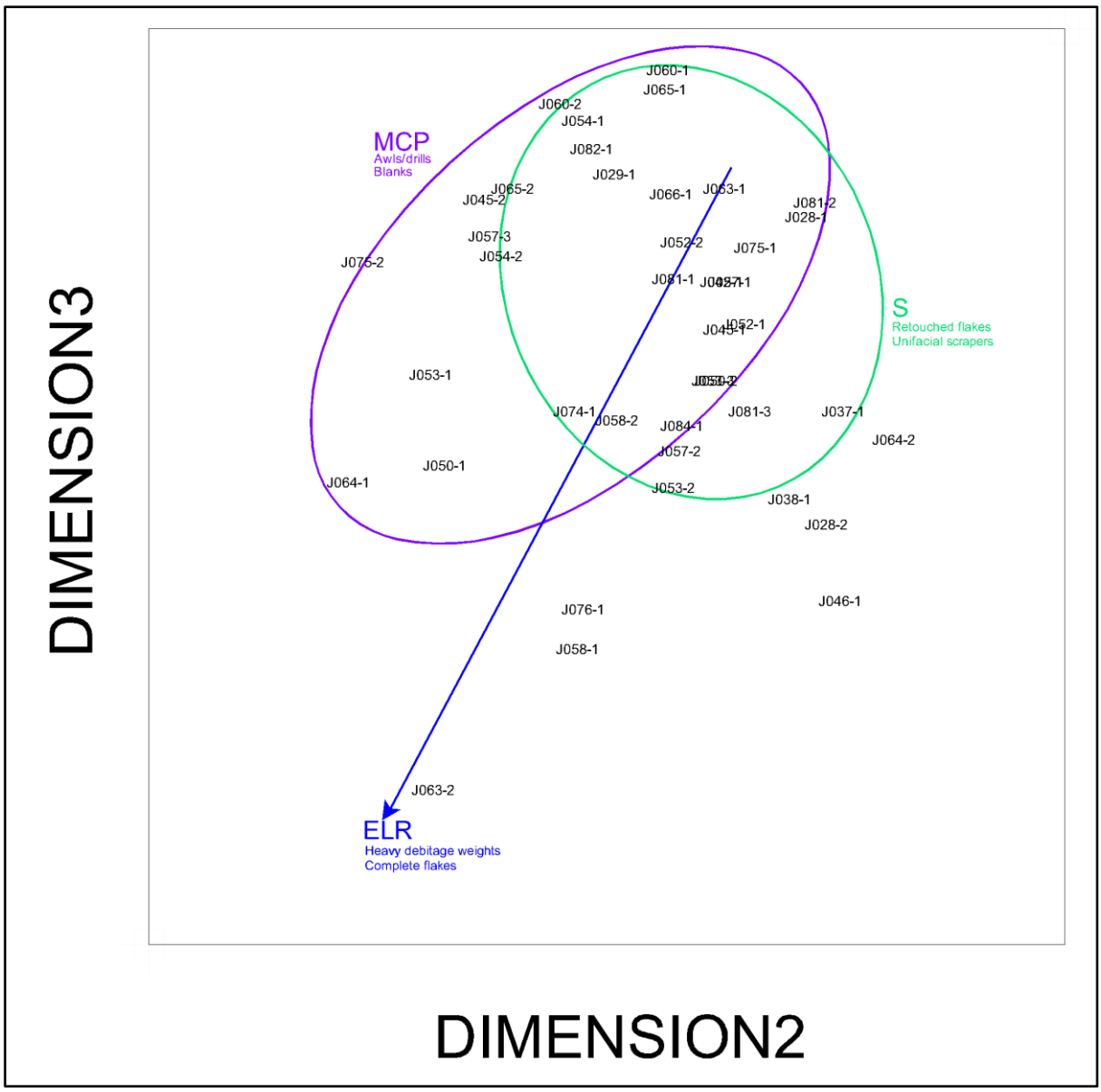

Figure 20 Multi-dimensional scaling of Shangchaoyanggou lithic data (dimension 2-3)

In order to further investigate the various economic activities different Shangchaoyanggou household units participated in, we will look at "tool sets" as was done in previous analyses on the Upper Daling and Fushanzhuang analyses (Drennan et al., 2017) For the Shangchaoyanggou analysis, seven tool sets were delineated, as presented in Table 6. In addition, functional groups of household units with more artifacts belonging to certain tool sets were identified. In Figure 18, the household units toward the left and lower left had high values

for two variables: the proportion of axes/adzes and the proportion of ground stone tools/artifacts. Specifically, many ground stone tools recovered at Shangchaoyanggou, as in other middle Neolithic sites of northern China, are used for field clearance, which was usually a preparation for later cultivation. Hence, these artifacts were placed in the tool set for agriculture/woodworking. Another three artifact proportions had increasing values from right to left in Figure 18, including blade cores, flake cores, and pieces of shatter. Since these three tool types are closely related to both flake reduction and blade reduction, they formed another tool set blade and flake production. The third tool set, which included retouched flakes and unifacial scrapers, is the scraping tool set.

Table 6 List of tool sets delineated based on Shangchaoyanggou lithic multi-dimensional scaling analysis

Name of Tool Sets	Abrevation	Variables with High Values
Agriculture/Woodworking	AW	Proportion of axes/adzes
		Proportion of grounded stone tools
Blade and Flake Production	BFP	Proportion of shatter
		Proportion of flake cores
		Proportion of blade cores
Scraping	S	Proportion of retouched flakes
		Proportion of unifacial scrapers
Early Lithic Reduction	ELR	Average debitage weight
		Proportion of complete flakes
		Proportion of lithic tools of low quality materal
		Proportion of choppers
Fine Cutting	FC	Proportion of blades
		Proportion of acute edges
Misc. Craft Production	MCP	Proportion of blanks
		Proportion of awls
Late Lithic Reduction	LLR	Proportion of broken flakes

On the lower right in Figure 18, an isolated group of household units had high values for the average weight of lithic debitage and the proportion of complete flakes. At the same time, these household units also have relatively low proportions of debitage of good materials and high proportions of choppers. This was clear evidence that these household units focused on the early

stage of lithic reduction, especially for the production of the large tools used for agriculture and related activities. Thus debitage of poor quality material and choppers were included in the early lithic reduction tool set. High proportions of acute edge angles and of blades have high values in the right-center of Figure 18. These two tool types comprise the fine cutting tool set. These activities are usually related to precise or delicate tasks, like food preparation, generic domestic tasks. The miscellaneous craft production tool set included blanks and awls, and the households with high proportions of the two types, especially of blanks, were clustered in the upper right part of Figure 18. The late lithic reduction tool set included only broken flakes, and its proportions increase from the lower left to the upper center in Figure 18.

Some of the functional groups shown in Figure 18 are also seen in Figures 19 and 20 as well. For example, the scraping and blade and flake production tool sets show the same relationship in Figure 19 as in Figure 18. In addition, some new correlations between tool sets are also observed in Figures 19 and 20. For example, early lithic reduction and fine cutting relate strongly to each other in Figure 19, and there was a relatively large overlap between the clusters with high proportions of the miscellaneous craft production and scraping tool sets. Compared to those observed in Figure 18, however, these correlations were weaker and hence less informative about patterns.

Stepping back from the specific tool sets and the relations between them, it becomes clear that three groups of tool sets tend to co-occur in the plots. In Figure 18 for example, three groups of tool sets have proportions that increase toward three different edges of the plot. Blade and flake production together with agriculture/woodworking have their highest proportions toward the left and lower left, while the proportions of late lithic reduction increase toward the upper right, where high proportions of miscellaneous craft production are concentrated. In addition,

early lithic reduction proportions increase toward the lower right corner and hence form the third group of tool sets independent of the first two. Compared with these tool sets, the fine cutting tool set has somewhat contradictory relations with other tool sets in different plots. While in Figure 18, its proportions increase toward the upper right, which is generally consistent with late lithic reduction and miscellaneous craft production, this axis represents decreasing proportions of the agriculture/woodworking tool set. The fine cutting tool set pattern in Figure 18 is heavily dependent on edge angles, since the household units with high proportions of the fine cutting tool set usually have high proportions of acute edge angles, while the household units focused on agriculture/woodworking have extremely low proportions of acute edge since most agricultural and woodworking tools have obtuse edge angles. Hence, the close correlation between fine cutting and early lithic reduction in Figure 19 seems more persuasive, and the fine cutting tool set should also be in the third group of tool sets. Different from all others, the scraping tool set has a broader distribution of high values in the middle of the plot and overlaps with other tool sets. This is not surprising, though, since scraping is a very common type of activity practiced by many households.

These three groups of tool sets form concentrations of household units that form a triangle in plots, which indicates three corresponding groups of households in the Shangchaoyanggou local community that focused on activities related to each of the three groups of tool sets. The triangular pattern also indicates these three groups of households are generally exclusive to each other, which means households that focus on one group of tool sets were less likely to focus on any of the other two.

Generally, the multi-dimensional scaling analysis of Shangchaoyanggou lithic data confirmed the existence of a group of household units that focused on the activities related to

food production. Furthermore, it indicates these household units are also deeply involved in some other activities, such as blade and flake productions. In addition, two other groups of household units with different economic focuses have also been delineated, which suggests the economic activities of different Shangchaoyanggou household units tend to be divergent. Whether this divergence could be seen as "productive specialization", however, should be answered in a comparative perspective, and will be discussed in Section 5.1. The next section will investigate how Shangchaoyanggou household units with different economic and social focuses are distributed, in order to know more about the relationship between them.

4.3 Evaluating the Spatial Pattern of Shangchaoyanggou Household Units

The Shangchaoyanggou spatial analysis aimed to reveal the spatial distribution of socio-economic activities among Shangchaoyanggou household units, as well as spatial relations between household units. Stem-and-leaf plots were drawn for each ceramic and lithic variable used in the multidimensional scaling analysis. In addition, the stem-and-leaf plot of proportions of *tongxingqi* sherds was also investigated as an indicator of ritual activities in the Shangchaoyanggou local community. In each stem-and-leaf plot, a threshold line was drawn to delineate the household units with high values from the others. For some variables, there were household units with secondary high values, which were significantly lower than the highest ones but higher than the majority. In this case, another threshold line would be drawn to delineate the second-highest group from both the highest group and the main group. Although it was impossible to avoid somewhat subjective decisions during the process of drawing threshold lines, especially when there was no strong difference between the highest and the main groups,

in most stem-and-leaf plots clear clues indicated a cutting point, and the results of previous practices in the Upper Daling and Fushanzhuang analyses were examined as references to make sure the results were relatively objective and comparable to the results of other Hongshan datasets. The resulting maps appear in Figure 21. In the figure, the household units with the highest values of certain lithic tool sets were marked with a large colored circle, while a small circle stood for a second highest value. Histograms were used to present values of four ceramic variables for all household units, and green asterisks stood for the household units with high prestige. Finally, grey circles were used to mark the household units with high *tongxingqi* proportions.

Different tool sets had different distributional patterns. Some tool sets had quite uneven spatial distributions. Four tool sets (agriculture/woodworking, early lithic reduction, blade and flake production, and miscellaneous craft production) all formed clear clusters in which the household units with high proportions gathered. In contrast to these four, the fine cutting tool set was not clustered but generally occurred in higher proportions from the northern to the southern end of the local community. Thus some household units located close to each other focused on the same kinds of productive activities. Such a pattern has also been observed at Fushanzhuang and Upper Daling, although the specific tool sets that were involved are somewhat different (Drennan et al., 2017). The tool sets of late lithic reduction and scraping, in contrast, were more scattered, which suggests that these economic activities were practiced by the household units in different parts of the site on relatively similar levels.

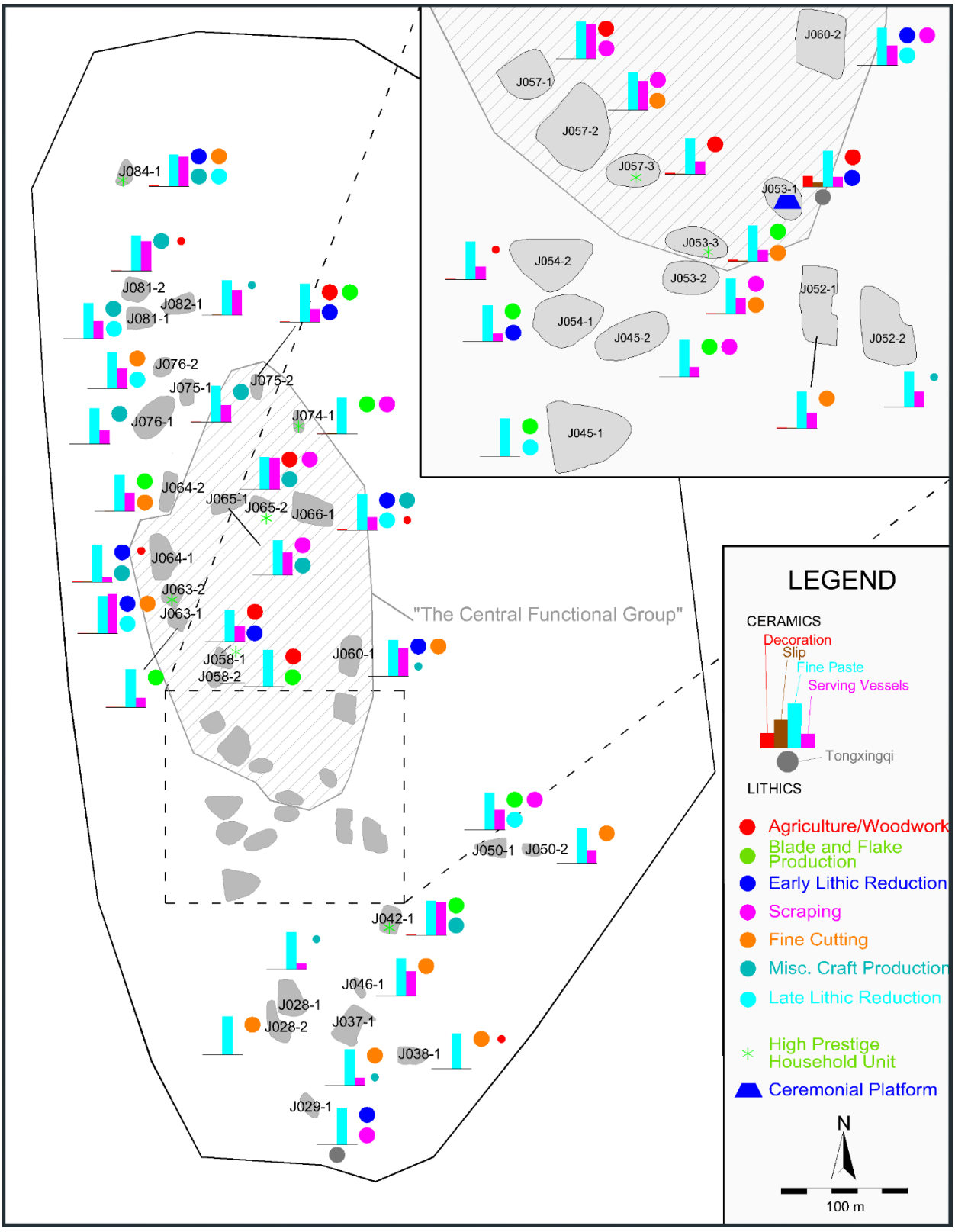

Figure 21 Distributional map of the artifact assemblages of Shangchaoyanggou household units

Varied distributional patterns also appear for the ceramic variables. Although only four household units had unusually high proportions of decorated/slipped sherds, three of them were located in the central part of the community, while the proportions of fine-paste ceramic sherds and serving vessel sherds were more evenly distributed patterns, with high proportions scattered in different parts of the community. A similar pattern could be seen in the proportion of *tongxingqi* sherds. As discussed above, however, the two household units with the highest proportions, respectively, were a ceremonial platform and a sample with only one sherd. Besides these two household units, the others had a relatively scattered distribution within the Shangchaoyanggou local community, with no clear hotspot.

The spatial relationships between clusters of different tool sets and ceramic variables were very interesting. The most important finding was that the clusters of agriculture/woodworking and early lithic reduction showed considerable overlap in the central part of the local community suggesting a relationship between the productive activities related to these two tool sets. In addition, these two clusters also partly overlapped with the miscellaneous craft production cluster, and all four household units with high proportions of decorated/slipped sherds were within or near the combined area of the two clusters. Based on these observations, 16 household units and the platform in the central part of the Shangchaoyanggou local community were designated a “central functional group”. This label is not intended to suggest that there is any evidence indicating any Shangchaoyanggou household unit was highly specialized in or controlled any social or productive activity, such as food production.

It is nonetheless reasonable to imagine that the central functional group was more intensively involved in an array of productive activities, such as food production, the early stage of lithic tool production possibly for making heavy-duty agriculture/woodworking tools, and

fancy ceramic consumption. Some household units in this group were also involved in miscellaneous craft production.

While it is not entirely clear why the household units with relatively high proportions of these lithic tool sets tended to cluster together, evidence from lithic tool production could help generate a plausible hypothesis. Potential agricultural tools were mainly ground stone knives and axes/adzes, and the production of these tools required shaping by removing large complete flakes in the early stage, and all ground stone tools began as flaked preforms whose flake scars were later erased through abrasion. This approach saves a lot of time and labor compared to removing the same mass of materials through grinding alone. Sometimes pecking the material and drilling holes on the tool bodies are also needed for producing these tools. Some variables related to the tool sets mentioned above, such as the proportion of complete flakes, the average debitage weight, and potentially the proportion of blanks and the proportion of awls, were connected to these needs. Since some household units of the central functional group have higher proportions of these tools, it is likely that they participated in the production of agricultural tools to an even higher degree.

Further analysis of the 16 household units of the central functional group suggested only five of these household units had high proportions of both agriculture/woodworking and early lithic reduction tool sets. In addition, four household units (J057-1, J057-3, J058-2, J065-2) had high proportions of just the agriculture/woodworking tool set, and three units (J060-1, J060-2, J063-2), of the early lithic reduction tool set. Only two household units had high proportions of all three tool sets when miscellaneous craft production was also taken into consideration, and there was one household unit (J065-1) focused only on this tool set. Thus only a few of the household units had actively participated in all the activities that the central functional group, in

general, focused on. Compared to it, more household units focused on only one or two types of activities. This all suggests a pattern in which a large proportion of household units in the central functional formed part of a chain of agricultural tool production and consumption. Then, it was reasonable to expect a degree of interdependence between these household units in order to fulfill the goals of both producers and consumers. Among known Hongshan communities, this function group is unique; such a thing was not present in either Upper Daling or Fushanzhuang. The central functional group featuring activities related to food production suggests a more central role for food production in the Shangchaoyanggou local community, which is consistent with the hypothesis of Shangchaoyanggou's regional role as a food provider.

The importance of the Shangchaoyanggou central functional group is not limited to productive activities, since it was also deeply involved in some essential social activities. Located in the central part of the community, the household units within the central functional group were more likely to maintain close connections with different Shangchaoyanggou household units than those in the other parts of the community. In addition, this group includes six out of eight Shangchaoyanggou household units with high prestige. The evidence on ritual activities, however, is ambiguous. As mentioned above, based on the analysis of *tongxingqi* proportions, there was no evidence suggesting a significant ritual difference between Shangchaoyanggou household units. At the same time, it can be seen that many household units within the central functional group were close to the potential ceremonial platform (J053-1), which implies connections between these household units and the ritual activities that occurred at the platform. Even so, the food production group did not monopolize the area adjacent to the platform; some other household units with different economic focuses were also located around it. Despite this somewhat confusing evidence, the generally lower *tongxingqi* proportions and

their even distribution across the household units, household ritual activities did not play an especially important role in daily life and social differentiation in the Shangchaoyanggou local community.

Besides the central functional group discussed above, there were several other clusters located in different parts of the community. Among them, a cluster with a focus on miscellaneous craft production was in the northern sector, with a degree of overlap with the central functional group. Considering the activities related to this tool set all concern the later phase of tool production, especially of agriculture/woodworking/field clearance tools, the households focused on this tool set might play a supportive role in providing tools for the food providers. Located in the southern part of the community, the clusters that focus on blade and flake production cluster and fine cutting show that some degree of differentiations existed in regard to other economic activities, although compared to the functional group, these clusters were more isolated from each other.

The central functional group was clearly at the center of economic and social affairs as its household units played key roles in all the productive activities related to food production, and they also enjoyed the advantages of living in the center of the community with relatively higher social prestige. Although the situation with ritual activities is rather unclear, most of the household units were close to the only ceremonial platform, which might also indicate their closer connections to ritual activities, or to the ritual specialists who lived near the main ceremonial facilities of the Niuheliang pilgrimage center.

What kind of overall picture can be drawn from these observations? It is reasonable to suppose that in a community that focuses on food production, activities related to food production would occupy a central position, with many other social and economic activities

organized around them. In this situation, the household units who were able to organize food production and even maintain relationships with those outside the local community who may have been provided with some of the food produced would gain extra social prestige. In the Shangchaoyanggou local community, household units in the central functional group were the most involved in activities related to food production, and their higher social prestige could have been the outcome of this social organizational pattern. This pattern contrasts with those observed in the Fushanzhuang and Upper Daling communities, possibly because the residents of those communities did not focus on producing food to provision people outside the local community. It is also clear that evidence related to ritual activities was not as prominent in the Shangchaoyanggou local community as in the Upper Daling and Fushanzhuang communities. It may be that Shangchaoyanggou residents were simply less involved in ritual activities, or they participated in ritual activities elsewhere. A direct comparison between Shangchaoyanggou and other Hongshan communities will be made in the next chapter in order to fully discuss all these differences.

5.0 Understanding Socioeconomic Differences between Hongshan Local Communities

This chapter compares activity patterns in the Shangchaoyanggou local community with its counterparts in the form of other Hongshan communities for which similar data have been collected, including the Fushanzhuang, Upper Daling, and Niuheliang.

5.1 Primary Statistics: General Characters of Socioeconomic Activities among Hongshan Local Communities

The first part of the comparative analysis provides answers to the first three research questions in Chapter 1 regarding Shangchaoyanggou and other Hongshan communities. Bullet graphs were drawn for each local community for the three key proportions used in the analyses reported in Chapter 4: the proportion of food production tools, the proportion of food processing tools, and the proportion of ritual-related sherds.

As discussed above, three intensive surface collection projects have been done: in the Dongshanzui, Erbuchi, and Sanjia local communities of the Upper Daling Valley, at the Fushanzhuang local community in the Chifeng area, and in households near the ceremonial structures in the Niuheliang pilgrimage center. Data for Fushanzhuang and Upper Daling projects are published (Peterson 2012; Peterson et al. 2017), and while the analysis for the households at Niuheliang is still incomplete and detailed data have not been published, preliminary data were made available for this study by Drennan, Peterson, and Lu. Like the Shangchaoyanggou dataset, the data for the other communities were collected and organized by

household units, with household units yielding varied numbers of artifacts. Considering this data organization, it was necessary to treat each of the datasets as a cluster sample, in which each household was a sampling unit that provided a statistical cluster of artifacts (Drennan 2010, p 243-247).

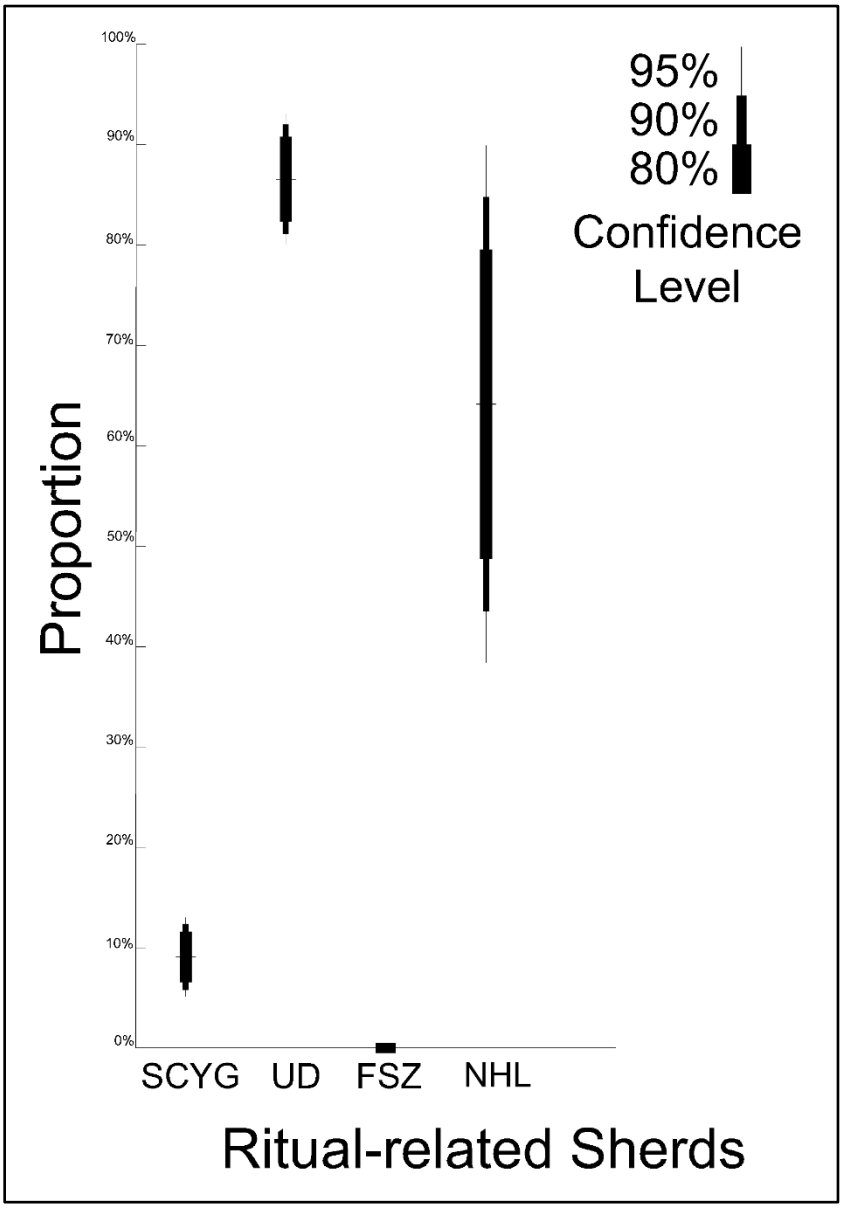

Figure 22 Bullet graphs of ritual-related sherds from Hongshan local communities

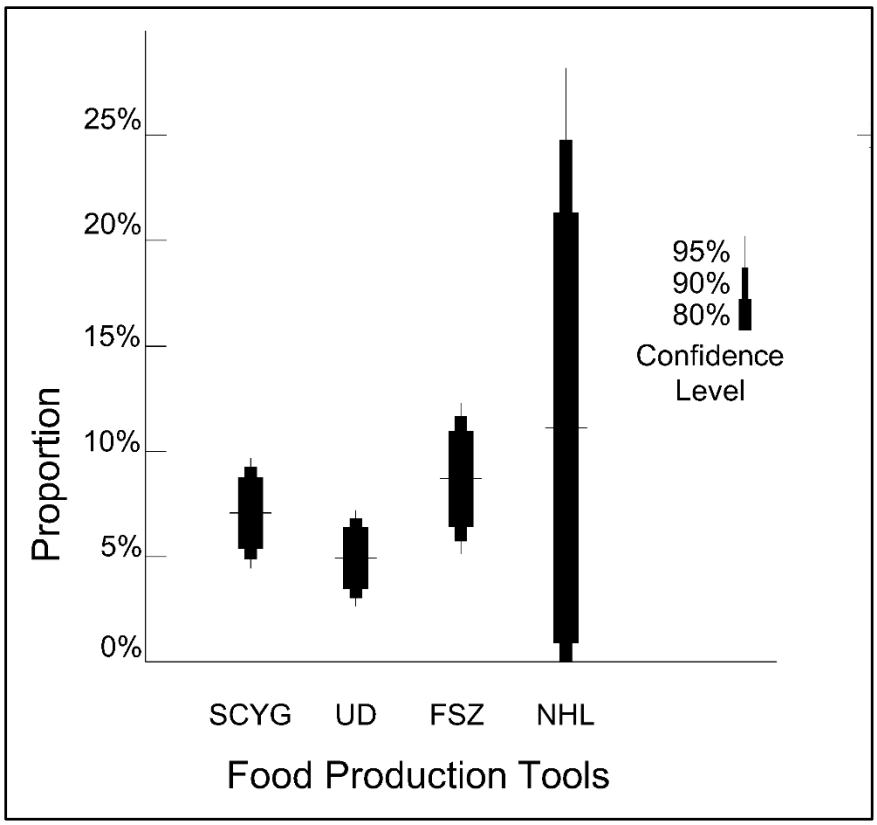

Figure 23 Bullet graphs of food production tools from Hongshan local communities

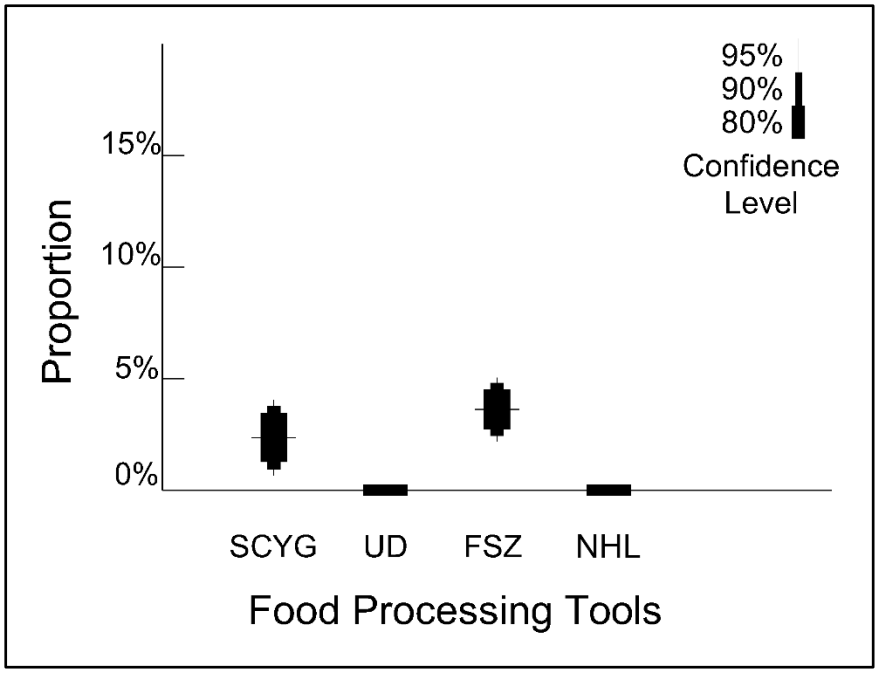

Figure 24 Bullet graphs of food processing tools from Hongshan local communities

The proportions of ritual-related ceramic sherds showed extremely strong and significant differences between two groups of local communities: Upper Daling (86.8%) and Niuheliang (64.3%) household units have proportions much higher than Shangchaoyanggou counterparts (9.1%). Only 4 *tongxingqi* sherds were recovered (from two households) in the Fushanzhuang local community using systematic intensive surface collection methods, and the total number of sherds is 15,355 (Christian Peterson, personal communication, October 27, 2020). This is clearly by far the lowest proportion of *tongxingqi* sherds of all the Hongshan local communities. The bullet graphs in Figure 22 clearly show a very strong and significant difference between Fushanzhuang and Shangchaoyanggou, on the one hand, and Upper Daling and Niuheliang, on the other, with regard to proportions of *tongxingqi* sherds. This finding is consistent with the hypothesis that Hongshan residents at Shangchaoyanggou were less involved in ritual activities than those from both Niuheliang and Upper Daling. At the same time, the proportion of ritual-related sherds in Upper Daling local communities was significantly higher than that of Niuheliang at greater than 90% confidence as well, which seems inconsistent with the notion that households within the Niuheliang pilgrimage center should have a proportion of ritual-related sherds no lower than any other Hongshan local communities. This difference between Niuheliang and Upper Daling household units could be explained by the relative locations of household units in local communities. The Niuheliang household units, while within the pilgrimage center, were generally not very close to any structure that had *tongxingqi*, while at least some Upper Daling household units are quite close to platforms right within the local communities. Since *tongxingqi* are generally widely spread across Hongshan local communities but were much more concentrated in ceremonial platforms than households, it is reasonable to expect that some of the *tongxingqi* sherds collected within Upper Daling household units were

actually from nearby platforms, which led to an exaggerated proportion of tongxingqi sherds in Upper Daling household units.

As for the proportions of food production tools, it might be surprising to see Niuheliang, which was expected to have the lowest involvement in the subsistence economy, with the highest proportion (11.1%). However, along with this relatively high proportion of food production tools are huge error ranges on all confidence levels. This results from the fact that only nine lithic tools were collected in Niuheliang and one of them is related to food production. This apparently high proportion is thus statistically unreliable. For the other three datasets, the proportions of food production tools in Fushanzhuang (8.7%) and Shangchaoyanggou (7.1%) datasets are much higher than that of the Upper Daling (4.9%). This difference can also be stated at a confidence level greater than 95%. The proportions of food production tools at Shangchaoyanggou and Fushanzhuang are roughly on the same level and are much higher than that of Upper Daling.

Food processing tools were recovered only in Shangchaoyanggou and Fushanzhuang household units, which lead to very significant differences between their values and those of the other two datasets. At the same time, the proportion of food processing tools of Fushanzhuang (4.5%) is only slightly higher than that of the Shangchaoyanggou (2.4%) local community, and the difference is associated with only about 80% confidence. Shangchaoyanggou and Fushanzhuang household units thus seem more involved in food processing activities than those of Upper Daling and Nushenmiao, while at the same time, Shangchaoyanggou household units are relatively less involved in food processing activities than their Fushanzhuang counterparts.

Considering all the results above, the primary statistical analysis suggests Shangchaoyanggou and Fushanzhuang local communities had similar patterns that focus more on food production and food processing activities than Upper Daling and Niuheliang households.

They were less involved in ritual activities if only ritual-related artifacts, such as *tongxingqi* sherds, are considered. When ceremonial structures are considered, however, the Fushanzhuang local community has more conspicuous evidence of ritual activities than the Shangchaoyanggou one. Shangchaoyanggou has only one ceremonial platform, which is far less than Fushanzhuang local community, where four platforms were recorded. This is a strong signal that residents in Fushanzhuang local community were more involved in the ritual activities than those in the Shangchaoyanggou local community. Hence, it seems that residents of Shangchaoyanggou maintained a lower degree of ritual participation than any of the other Hongshan local communities that have been intensively collected. Upper Daling and Niuheliang local communities, on the contrary, had a different pattern that focuses more on the ritual and related activities.

To sum up, the comparison of Hongshan local communities ended up with the results that matched the expected pattern.

5.2 Comparing Degrees of Internal Socio-economic Differentiation of Hongshan Local Communities

The central question this section asks is "Generally speaking, which Hongshan local community had the largest prestige or productive differentiation?" A simple and direct index of differentiation between household units, the median Euclidean distance per variable, based on Euclidean distances between each pair of the households, has been useful in previous analyses of Hongshan household datasets with a large number of variables (Drennan et al. 2017). Since the same variables for lithic and ceramic data were used for the Shangchaoyanggou analysis as for

Upper Daling and Fushanzhuang, the datasets are comparable in this way. Standardized Euclidean distances were calculated between each pair of Shangchaoyanggou households in a conceptual 19-dimensional space for lithic data and a 4-dimensional one for ceramics. The median and upper and lower limits for a 95% confidence level error range were divided by the number of either lithic or ceramic variables to produce the final median distance and an error range at 95% confidence for lithics and for ceramics.

The median Euclidean distance per variable was 0.526 (0.534 to 0.576 at 95% confidence) for the Shangchaoyanggou household ceramic assemblages. For Upper Daling this value was 0.627 (0.606 to 0.646 at 95% confidence) and for Fushanzhuang it was 0.509 (0.452 to 0.599 at 95% confidence) (Drennan et al. 2017). It was clear that the Shangchaoyanggou median falls between the Upper Daling and Fushanzhuang ones and is much closer to Fushanzhuang than Upper Daling. The difference between Upper Daling and Shangchaoyanggou medians was the stronger difference as well as very significant considering the Shangchaoyanggou median falls well outside the Upper Daling 95% confidence error range. In contrast, the difference between Shangchaoyanggou and Fushanzhuang medians was weaker and of little significance, since the 95% upper limit of the latter was much higher than the median of the former. In general, the degree of prestige differentiation between Shangchaoyanggou households was roughly on the same level as at Fushanzhuang, and prestige differentiation at both was much lower than between Upper Daling households.

As for lithic assemblages, the median of Euclidian distance per variable for Shangchaoyanggou household units was 0.211 (0.211 to 0.220 at 95% confidence), while the value for Upper Daling was 0.299 (0.291 to 0.305 at 95% confidence) and for Fushanzhuang was 0.287 (0.273 to 0.305 at 95% confidence). The median of the Shangchaoyanggou dataset was

lower than both Upper Daling and Fushanzhuang medians, and well below the 95% confidence level error ranges for both. These statistically significant results indicate less productive differentiation for Shangchaoyanggou household units, although the difference was not terribly strong. The lower median Euclidian distance per lithic variable at Shangchaoyanggou local community, combined with the observation from the last section that Shangchaoyanggou had a higher proportion of food-related tools compared to some other Hongshan local communities, suggests that household units at Shangchaoyanggou were more homogeneous with respect to productive activities and more focused on food production.

It is also worth noting that the median Euclidian distance per variable for Shangchaoyanggou ceramics is much higher than for lithics, which was also the case for the Upper Daling and Fushanzhuang datasets. Fitting well with previously published conclusions (Drennan et al. 2017), this result suggests that, as in the other two datasets, prestige differentiation was stronger than productive differentiation at Shangchaoyanggou, which is a widespread situation among Hongshan local communities.

5.3 Comparing Socio-economic Activities of Hongshan Local Communities Comprehensively

This section compares household datasets from different Hongshan local communities with multi-dimensional scaling analyses combining household assemblages from all the communities. As in the analyses of Shangchaoyanggou household units, the median Euclidean distance between each pair of household units was calculated as a simple and direct index of the degree of social differentiation within each local community. Two multi-dimensional scaling

analyses that included all the available Hongshan household datasets were conducted for ceramic and lithic data respectively.

5.3.1 Multi-dimensional Scaling Analysis of Hongshan Ceramic Assemblages

In the analysis of ceramic data for all households, the final stress value for the 2-dimensional configuration (0.227) was high enough to suggest that the 3-dimensional configuration, with a final stress value of 0.159, was optimal solution. The plots of all pairs of dimensions are presented in Figures 25, 26, 27.

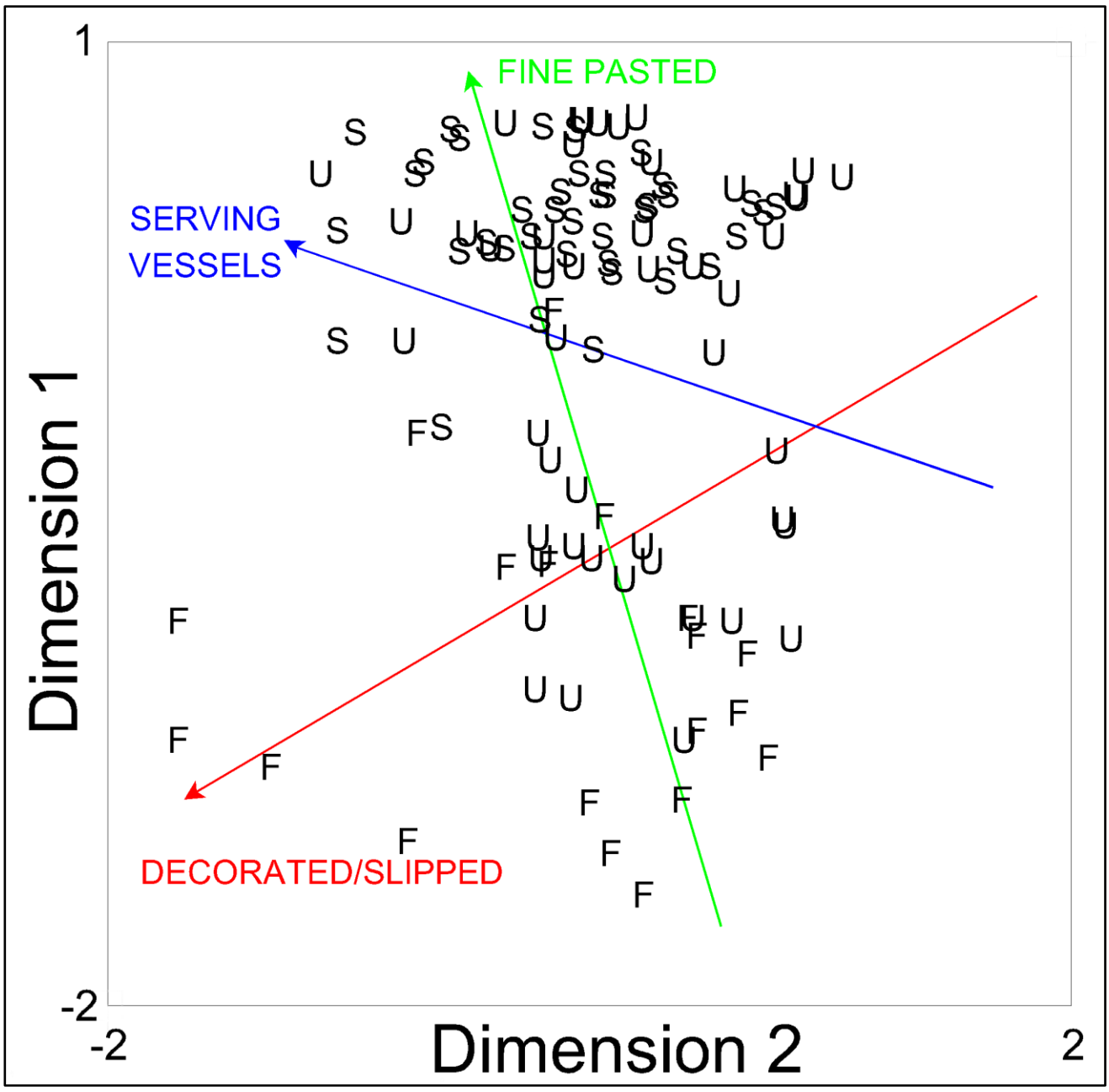

Figure 25 Multi-dimensional scaling of Hongshan ceramic data (dimension 1-2)

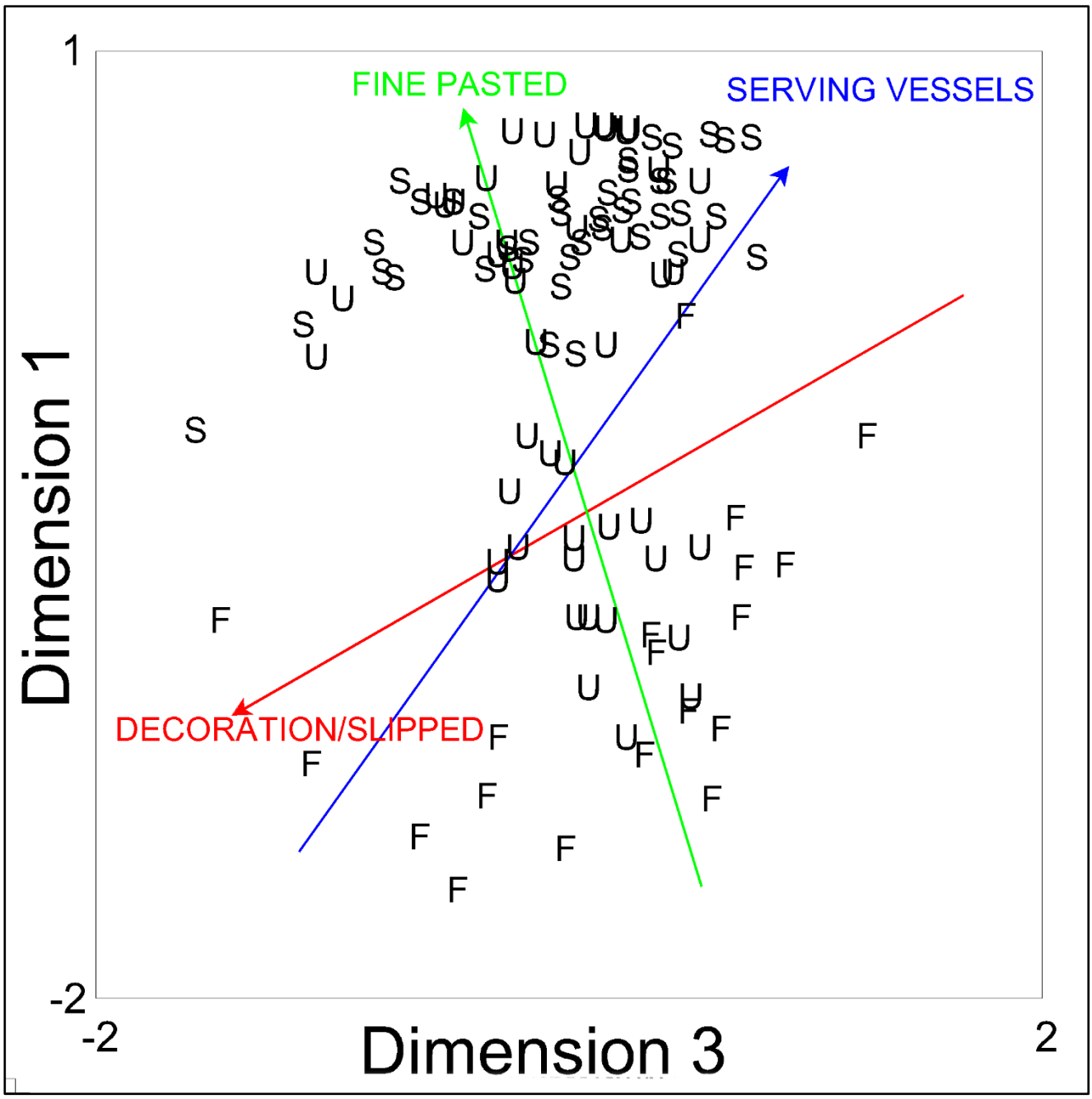

Figure 26 Multi-dimensional scaling of Hongshan ceramic data (dimension 1-3)

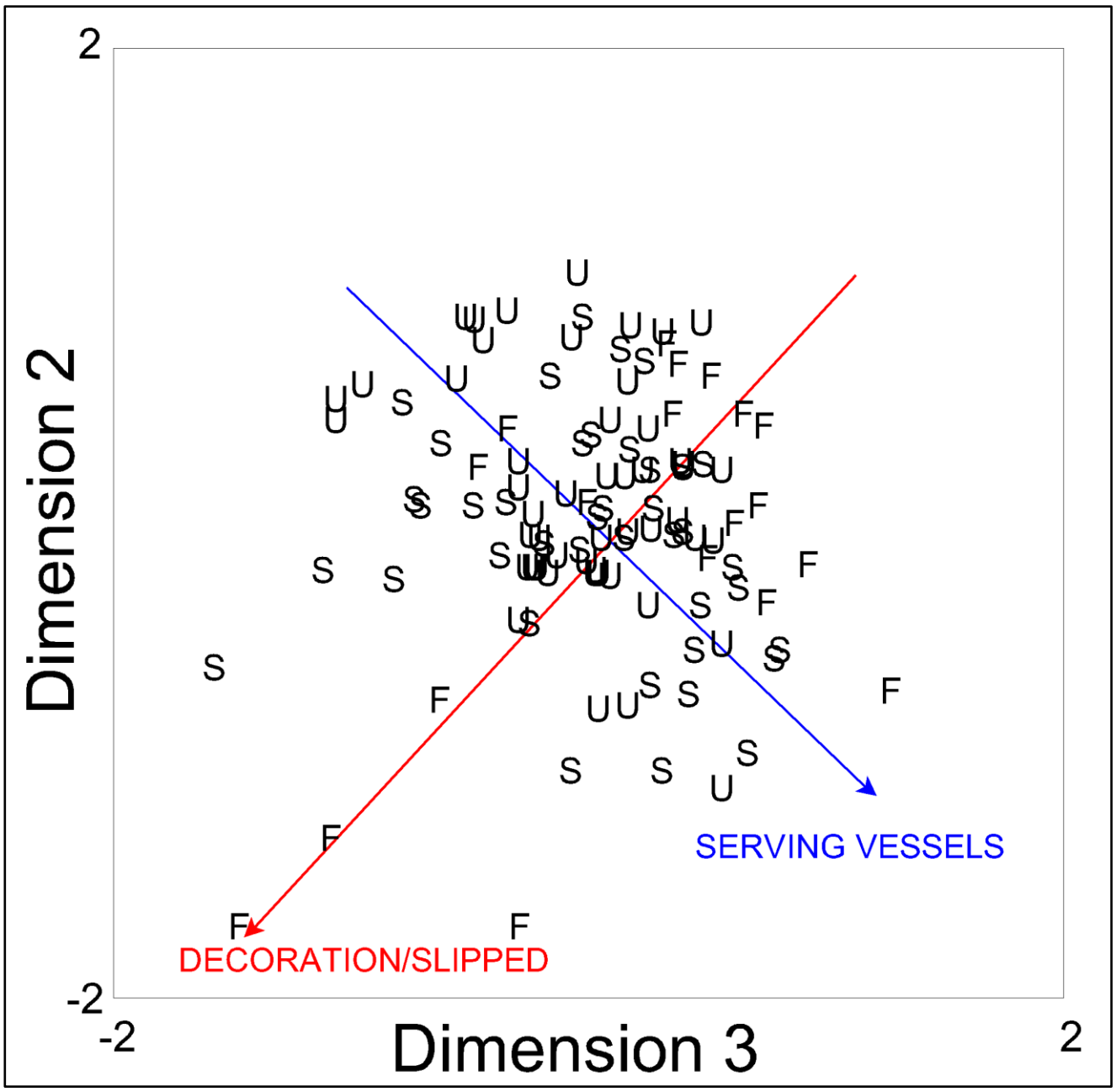

Figure 27 Multi-dimensional scaling of Hongshan ceramic data (dimension 2-3)

Generally, the configuration shows a distributional pattern in which household units from different local communities are intermingled. Figures 25 and 26 show a large cluster in the upper part of the plot, and another in the lower part. In both figures, the upper cluster includes the majority of the Shangchaoyanggou household units mixed with Upper Daling household units, and the lower cluster includes most of the Fushanzhuang household units also mixed with Upper

Daling ones. This pattern shows up in both plots because it is primarily a reflection of coordinates on Dimension 1. Two outliers, both from Fushanzhuang, are separated from the majority in all three plots, and three less severe outliers represent one household unit from Shangchaoyanggou and two from Fushanzhuang.

The general trends for different variables are the same as in the Shangchaoyanggou ceramic analysis. In all three plots, the highest values for proportions of decorated and slipped/burnished sherds were in the lower left corner, where the Fushanzhuang outliers were located. Most of the household units with a high proportion of decorated and slipped/burnished sherds were at Fushanzhuang, except for J053-3.

In Figures 25 and 26 the proportion of fine-paste sherds had higher values in the upper cluster. Most Shangchaoyanggou and some Upper Daling household units had more fine-paste sherds. In addition, although household units in the lower cluster had lower proportions of fine-paste sherds, Upper Daling household units in these clusters have values that are generally higher than those of Fushanzhuang ones. Shangchaoyanggou household units thus had the highest proportions of fine-paste sherds, with Upper Daling household unit proportions lower, and the Fushanzhuang household unit the lowest.

The final ceramic variable, the proportion of serving vessel sherds, shows different trends in different plots. In Figure 25, the highest proportions of serving vessel sherds occur in the upper left part; in Figure 26, in the upper right part. In Figure 27, the highest values are in the lower right part. No matter where the higher values are located, though, the trend in the proportion of serving vessel sherds was very different from fine-paste, slipped/burnished, and decorated sherd proportions, so this variable was not correlated to the other ceramic variables. The household assemblages with high proportions of serving vessel sherds were mingled

together from all three local communities. However, more Upper Daling household units had low proportions of serving vessels than the Shangchaoyanggou and Fushanzhuang ones. The median of serving vessel proportion for Upper Daling households (0.011) was lower than Shangchaoyanggou (0.400) and Fushanzhuang (0.286).

In sum, several Fushanzhuang household units had the highest values for the proportion of decorated and slipped/burnished sherds, while some Shangchaoyanggou and Fushanzhuang household units had a higher proportion of fine-pasted sherds. All three local communities had several household units with high proportions of serving vessels. Generally, the Shangchaoyanggou and Upper Daling household units were more similar in terms of sherd proportions.

The Shangchaoyanggou household units were fairly homogeneous since most of them lay in the upper cluster. The majority of Fushanzhuang household units were located in the lower cluster, although several of these lay far from the rest of the household units. In contrast to Shangchaoyanggou and Fushanzhuang, Upper Daling household units were divided between the two major clusters, with relatively equal numbers in each (30 in the upper cluster and 20 in the lower). Thus, although there was no Upper Daling outlier, the general internal differences between Upper Daling household units were larger than at the other two local communities. Generally, this observation on internal differentiation matches the conclusion from the median Euclidean distance per ceramic variable and suggests that the degrees of internal differentiation of the Shangchaoyanggou and Fushanzhuang household units are similar to each other and lower than that of Upper Daling household units.

This analysis adds to our knowledge of the similarities and differences between Hongshan local communities. Drennan et al. (2017) have suggested that prestige differentiation

in Hongshan local communities is clear but modest. When the Shangchaoyanggou local community is placed in this larger picture using multi-dimensional scaling, its degree of internal prestige differentiation seems very low compared with the Fushanzhuang and Upper Daling local communities. With respect to the specific social and ritual activities, the data indicate Shangchaoyanggou households generally had a very high proportion of fine-paste sherds and some also had high proportions of serving vessels. This observation, combined with the low proportion of *tongxingqi* sherds, indicates that, aside from productive activities, Shangchaoyanggou households focused more strongly on secular affairs such as social gathering and feasting, rather than ritual. In contrast, the proportion of decorated/slipped sherds is very low compared to other Hongshan local communities, and Shangchaoyanggou household units with relatively higher proportions of decorated/slipped sherds all have quite high proportions of serving vessel sherds as well, which suggests a connection between hosting social activities and gathering prestige. It is also argued that prestige may even be more crucial for Shangchaoyanggou household units in a general situation of scarcity and this encouraged some households to work hard for it, as has been observed for the households in the central functional group.

5.3.2 Multi-dimensional Scaling Analysis on Hongshan Lithic Assemblages

The multi-dimensional scaling analysis on lithic data including Shangchaoyanggou, Upper Daling, and Fushanzhuang household units together followed the same process as the lithic analysis of the Shangchaoyanggou dataset. Several of the variables used in the Shangchaoyanggou and Upper Daling analyses were not recorded in the earlier Fushanzhuang analysis (proportion of good quality raw materials, proportion of chopping tools, proportion of

blade cores, proportion of flake cores, proportion of acute edge angles, and proportion of obtuse edge angles). These variables were treated as "missing data" for Fushanzhuang in the analysis. The final stress for the three-dimensional solution was 0.179, and the resulting scatter plots are presented in Figures 28, 29, 30.

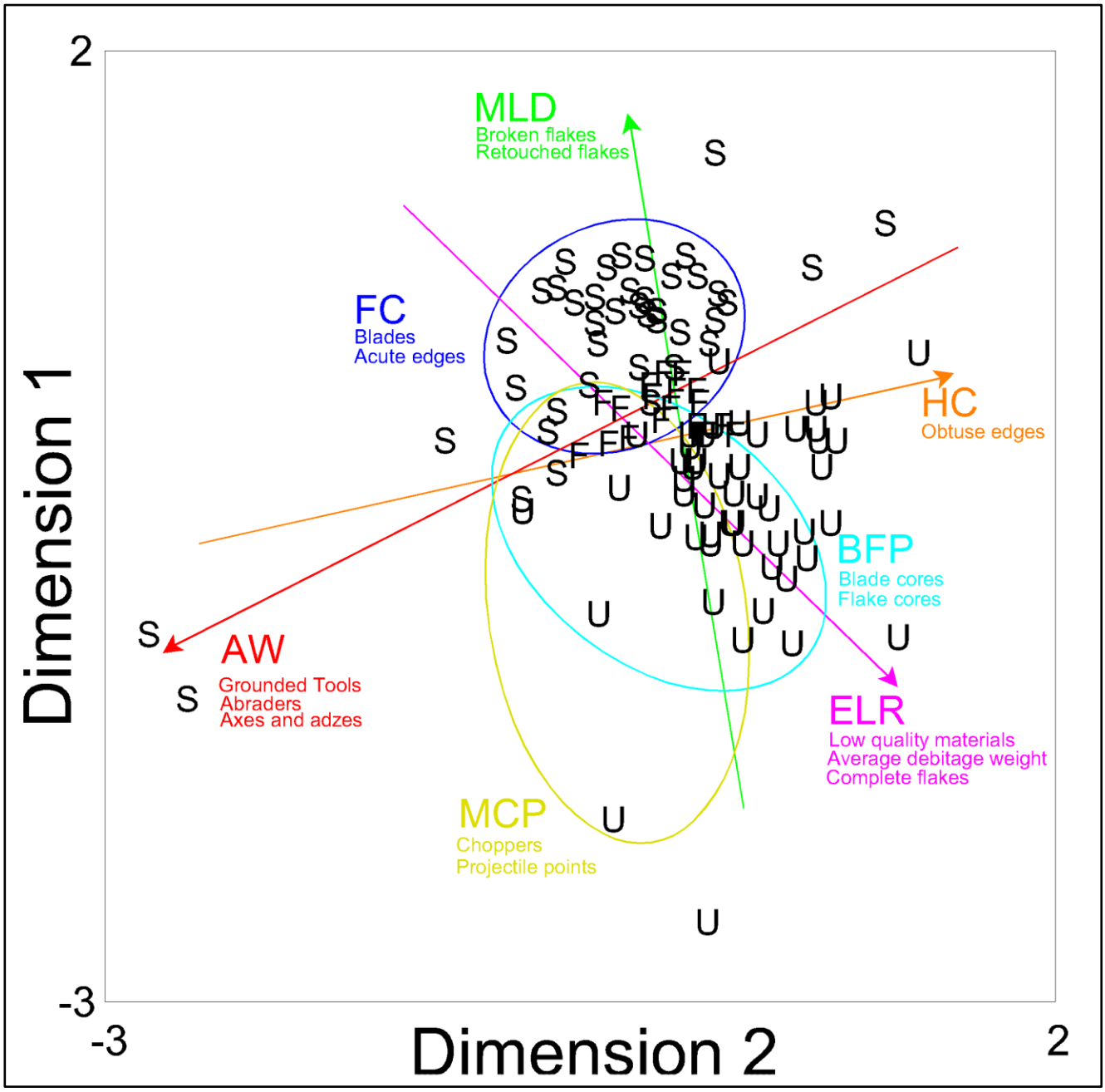

Figure 28 Multi-dimensional scaling of Hongshan lithic data (dimension 1-2)

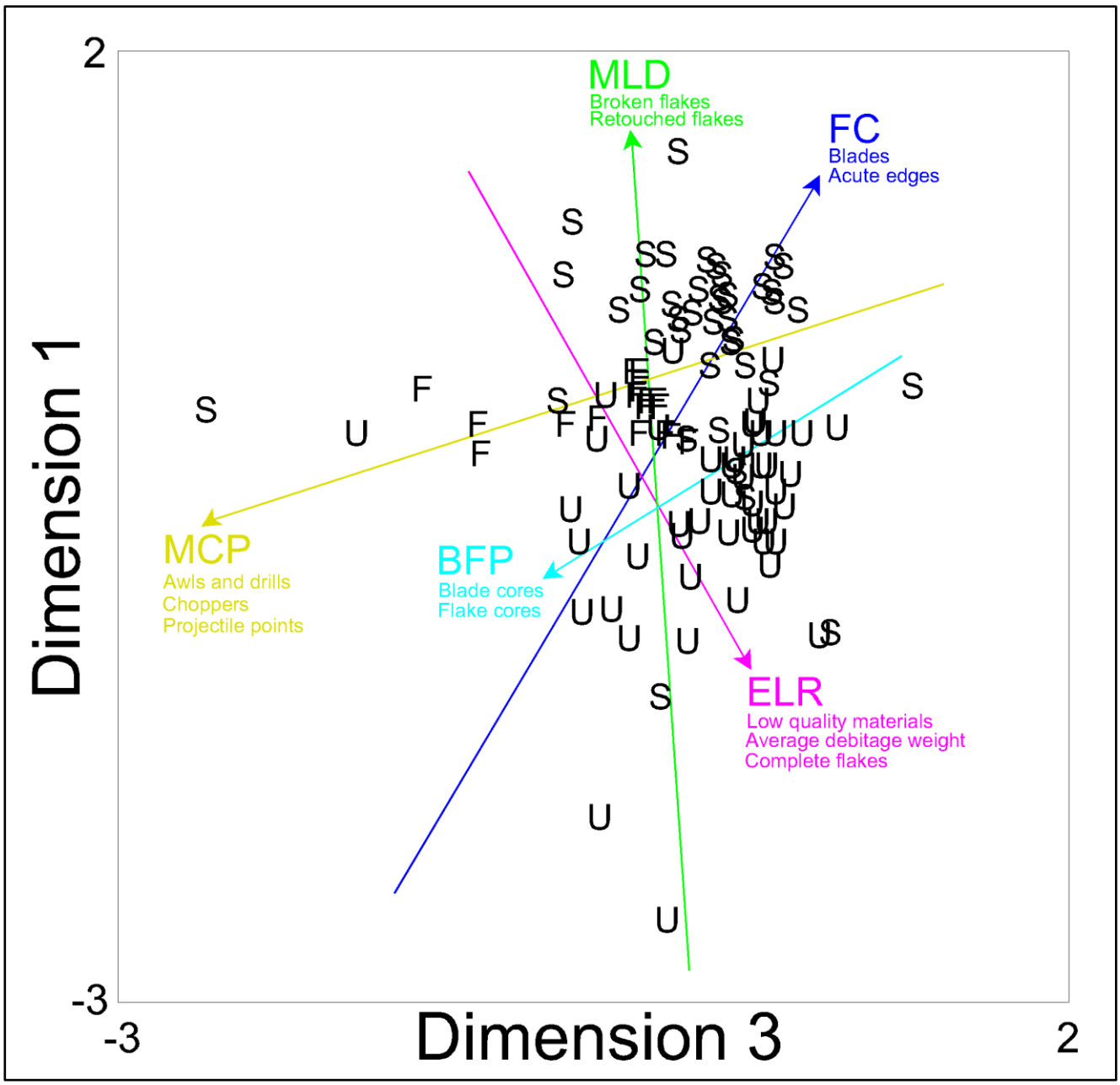

Figure 29 Multi-dimensional scaling of Hongshan lithic data (dimension 1-3)

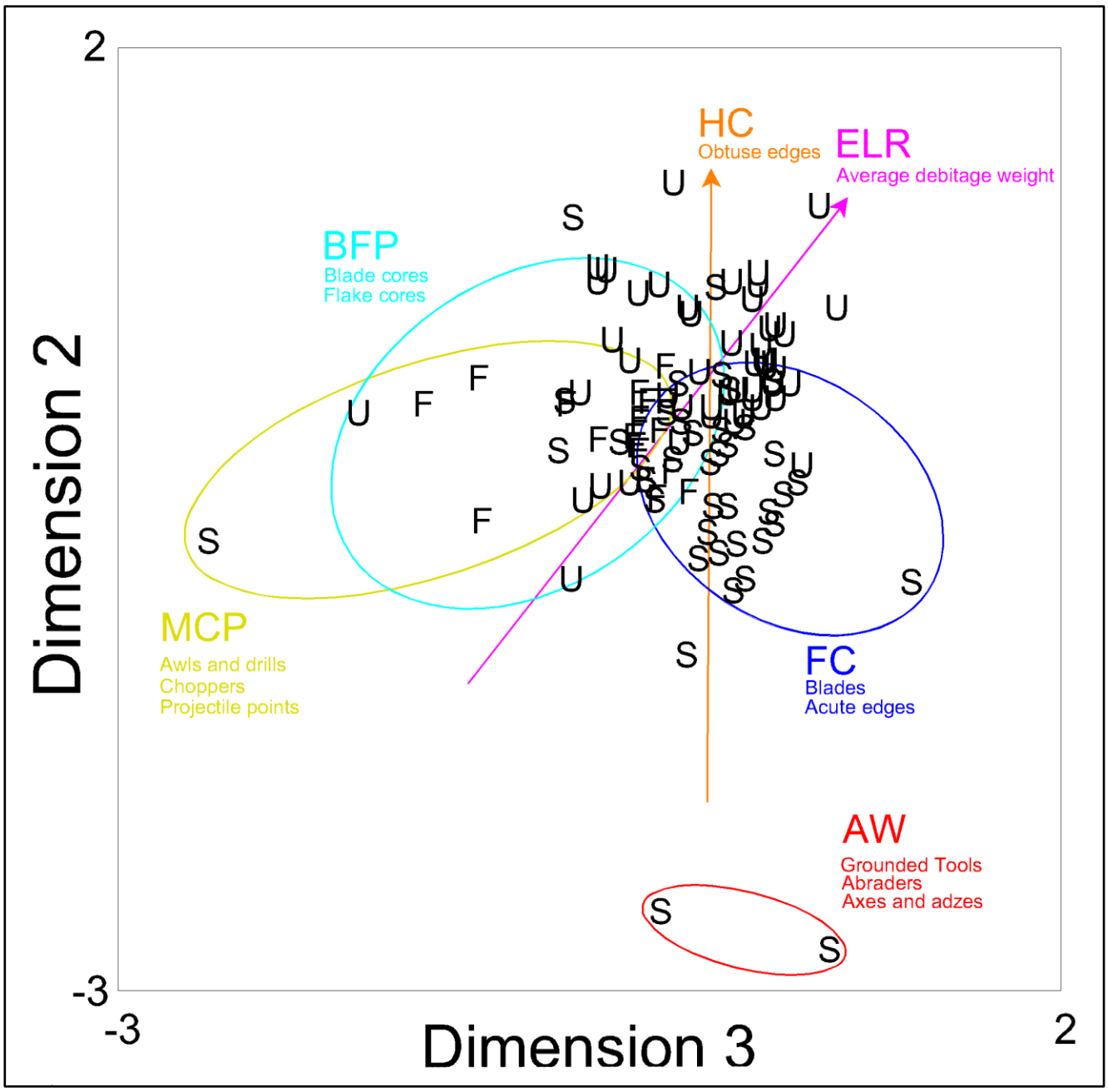

Figure 30 Multi-dimensional scaling of Hongshan lithic data (dimension 2-3)

All three figures (but especially Figure 28) show homogeneity for Shangchaoyanggou and Upper Daling household unit lithic assemblages. The characteristics of these two sets of lithic assemblages, however, are very different from each other, showing up as two tight clusters quite separate from each other. The Fushanzhuang lithic assemblages, on the other hand, were

dispersed through the "buffer zone" between the two clusters. This distribution implies quite different focuses in the productive activities of Shangchaoyanggou and Upper Daling household units, while those of Fushanzhuang were less specialized, with miscellaneous craft production as a potential exception. Some outliers are found in each of the three figures, mostly pertaining to the Upper Daling and Shangchaoyanggou local communities. Among them, two Shangchaoyanggou household units were extremely separated toward the lower left in Figure 28 and the bottom in Figure 30. However, these two household units had only one and two identifiable lithic tools respectively, which makes their outlier character not very meaningful. The same issue arises with the other two seemingly extreme outliers located in the lower center of Figures 29 and 30. These two Upper Daling household units had samples consisting of only 2 and 3 objects, respectively.

Seven tool sets were identified in the multidimensional scaling configuration following the same processes as before. The names and constituents of the tool sets were only partly the same as the Shangchaoyanggou lithic tool sets in Table 4. All the names of tool sets and the variables they relate to are listed in Table 7.

Different tool sets were most common in different local communities. In Figure 28, for example, several tool sets (agriculture/woodworking, fine cutting, and mixed light-duty) are more common in Shangchaoyanggou household units. Specifically, many Shangchaoyanggou household units in the upper central part of the plot as well as several moderate outliers nearby tended to focus on activities in which fine cutting and mixed light-duty tools were used. Several of the other tool sets (early lithic reduction and heavy cutting) showed high proportions mostly in Upper Daling household units. The trends of the proportions of these two tool sets are not consistent parallel, with the proportion of heavy-duty tools increasing toward some moderate

outliers in the center-right, while the proportions of early lithic reduction increase toward moderate outliers in the lower right. Miscellaneous craft production tools, and flake, and blades production are more common in Upper Daling household units. Only the miscellaneous craft production tool set is slightly more common in Fushanzhuang household units than in those of the other local communities. Generally, Figures 29 and 30 revealed similar patterns although in somewhat different ways. These patterns are consistent with the idea that generally Shangchaoyanggou residents are more focused on food production than other Hongshan local communities were. They also support the observation of Chapter 4 that in the Shangchaoyanggou local community, food production was entwined with other activities, and helped form the "central functional group", which is a very different pattern than in the Upper Daling communities.

To sum up, the results of the more inclusive multi-dimensional scaling analysis of lithic assemblages provided evidence of differences between Shangchaoyanggou and Upper Daling households in terms of the productive activities they participated in.

Table 7 List of tool sets delineated in the intersite multi-dimensional scaling analysis on lithic data

Name of Tool Sets	Abrevation	Variables with High Values
Agriculture/Woodworking	AW	Proportion of axes/adzes
		Proportion of abraders
		Proportion of grounded stone tools
Blade and Flake Production	BFP	Proportion of flake cores
		Proportion of blade cores
Early Lithic Reduction	ELR	Average debitage weight
		Proportion of complete flakes
		Proportion of lithic tools of low quality materal
Fine Cutting	FC	Proportion of blades
		Proportion of acute edges
Misc. Craft Production	MCP	Proportion of choppers
		Proportion of projectile points
		Proportion of awls
Heavy Cutting	HC	Proportion of obtuse edges
Mixed Light Duty	MLD	Proportion of broken flakes
		Proportion of retouched flakes

5.4 Evaluating Household-level Spatial Patterns of Hongshan Local Communities

The spatial distribution of Shangchaoyanggou household units is discussed in Section 4.3, and those of Upper Daling and Fushanzhuang household units had been discussed in Drennan et al. (2017).

The Upper Daling and Fushanzhuang household units were distributed around platforms. The Shangchaoyanggou household units generally followed a similar pattern, since the potential ceremonial platform, J053-1 was located in the central part of the community with the highest density of household units. In addition, a close spatial association was observed in Upper Daling and Fushanzhuang between prestige and ceremonial activities, since household units with indicators of higher prestige were especially close to ceremonial platforms (Drennan et al. 2017). The same was true of the Shangchaoyanggou local community, with two of the three household units with indicators of higher prestige located within 100m of the potential platform of J053-1; they were the closest household units to it. At the same time, a few household units with no indicators of higher prestige were also close to the potential platform at Shangchaoyanggou, as in the Fushanzhuang local community.

The spatial analysis of Shangchaoyanggou household units discussed in the last chapter revealed spatial clusters of household units that had high proportions of the same tool kits. In the Fushanzhuang community the agriculture/woodworking tool set was represented “in a goodly number of households, widely scattered through the village” (Drennan et al. 2017). The distributional map for the Upper Daling local communities (Peterson et al. 2017, Distributional Map) suggested fewer household units had high proportions of the agriculture/woodworking tool set than at Fushanzhuang, and there was no indication that they clustered together. By comparison, the Shangchaoyanggou household units have several features. First, the number of

Shangchaoyanggou household units with high proportions of the agriculture/woodworking tool set is much greater than in the Upper Daling local communities, and at roughly the same level as at Fushanzhuang, which suggests that more household units at Shangchaoyanggou and Fushanzhuang were more deeply involved in food production than in the Upper Daling local communities. Second, in contrast to Fushanzhuang, where more household units had moderate proportions of agriculture/woodworking tools than high proportions, in the Shangchaoyanggou local community far more household units had high proportions than moderate proportions. This implies that agricultural production was more centralized at Shangchaoyanggou than at Fushanzhuang. Most important, the distribution of household units with high proportions of agriculture/woodworking tools in the Fushanzhuang local community was more scattered than at Shangchaoyanggou.

As established in Chapter 4, food production played a central role in the socio-economic activities of the Shangchaoyanggou local community. This pattern was not the case for the Upper Daling and Fushanzhuang local communities, even though the latter has a similar emphasis on agriculture/woodworking activities. Drennan et al. (2017) see the scattered distribution of household units with high proportions of agriculture/woodworking tool as expected since this tool set represents a fundamental activity expected in most households. The more intensive focus on food production at Shangchaoyanggou sets this community apart from other Hongshan local communities. This observation is consistent with the idea that the Shangchaoyanggou local community was a regional food provider since this pattern would enable households to work together with other related household units to produce food surplus more efficiently.

Playing such a regional role also seems to have changed the internal social structure of the Shangchaoyanggou local community in fundamental ways. With a strong concentration on

producing more food, the households who took advantage of their connection to this productive activity earned themselves influential roles within the community and formed the "central functional group". This group also gained advantages in social activities, as spatial analysis suggested most of the household units with high prestige were among the central functional group. This food production-driven social development is quite different from what has been observed in other Hongshan local communities with a strong focus on ritual affairs, and it shows that even in the same region and during the same period, different communities, with different regional roles and focuses, could be very different in terms of their social organizations.

Analysis of the Upper Daling artifact assemblages revealed a connection between productive activities and social prestige in the Sanjia household units of the Upper Daling local community. Drennan et al. (2017) note that "The evidence would be consistent with the idea that higher prestige facilitated access to varied lithic raw materials used in the production of a diversity of tools, especially agricultural tools, and blades." A similar connection was also observed at Fushanzhuang. At Shangchaoyanggou, Sanjia, and Fushanzhuang, then, household units connected with productive activities may have enhanced their prestige in this way. At the same time, the types of productive activities connected to prestige were different in these different local communities. While food production and related activities were linked to social prestige at Shangchaoyanggou, there were a series of diverse activities were linked to prestige among Sanjia and Fushanzhuang household units. There was no clear concentration of high *tongxingqi* proportions within the Shangchaoyanggou local community besides the one potential platform, and the mean level of *tongxingqi* proportions was much lower than for Upper Daling household units, suggesting greater ritual differentiation more closely connected to prestige at

Upper Daling. In contrast to Upper Daling where ritual and prestige differentiation were related, at Shangchaoyanggou prestige differentiation was closely related to food production.

Since the residents of the Shangchaoyanggou local community were heavily focused on food production in order to support the ritual specialists in the Niuheliang pilgrimage center they would likely focus less on other productive activities and receive goods or services back from the ritual specialists in exchange for their subsistence support. Since the Niuheliang pilgrimage center is the largest known cluster of ceremonial architecture in the entire Hongshan territory, Niuheliang ritual specialists could easily provide ritual services to Shangchaoyanggou residents most likely in the Niuheliang pilgrimage center itself, as the distance between Shangchaoyanggou and the Niuheliang ceremonial structures is very short. This could also account for the fact that fewer *tongxingqi* sherds were recovered within the Shangchaoyanggou local community implying fewer ritual activities in situ. In such a situation, household units in the central functional group at Shangchaoyanggou would find it difficult to manipulate ritual activities as a part of their own agenda, leaving them to fall back on food production for this purpose.

The pattern observed in the greater Niuheliang area with food producers in the Shangchaoyanggou local community and ritual specialists in the Niuheliang pilgrimage center is very different from that in the Upper Daling area, where the three local communities being studied, especially Dongshanzui, placed considerable emphasis on ritual activities, indicated by their relatively high proportions of *tongxingqi* sherds and a larger number of ceremonial structures. Upper Daling elites would thus have had a very different foundation than Shangchaoyanggou ones.

To sum up, the household units in all the Hongshan local communities were distributed around ceremonial structures. Within all local communities, prestige differentiation was fundamental to overall social organization. At least some connections between productive activities and prestige differentiation were also observed in different Hongshan local communities, although the particular productive activities involved varied from one local community to another. While ritual activities were fundamental to prestige differentiation in the Upper Daling, such activities were less observable in the Shangchaoyanggou local community, making economic cooperation in food production fundamental prestige differentiation.

6.0 Conclusion

6.1 Sustaining Ritual: The Regional Role of the Shangchaoyanggou Local Community

The intensive surface collection of the Shangchaoyanggou local community and subsequent analyses have confirmed Shangchaoyanggou as a Hongshan period local community located in the fertile gentile slope that faces the river valley within the greater Niuheliang area. The location of the Shangchaoyanggou local community gave residents easy access to both hilly terrain and alluvial river valley facilitating the "upland-lowland strategy" discussed by Drennan, Peterson and Berrey (2020) to buffer the risk brought by unstable annual precipitation. Intensive surface collection suggested a total of 40 household units as well as one potential ceremonial platform, and an estimated population of 160 with the assumption of 4 persons per household unit, which agrees with the estimate made from the regional survey data. This population falls into the usual range of population for Hongshan local communities and suggests Shangchaoyanggou is a typical Hongshan local community in terms of its size.

The analyses conducted for this dissertation research helped evaluate the pilgrimage center hypothesis about regional socio-economic activities and provided clear answers to the four research questions listed in Chapter 1. Both bullet graphs and multidimensional scaling analysis of Hongshan local communities confirmed Shangchaoyanggou as a local community with one of the strongest focuses on food production. Compared to Fushanzhuang, another Hongshan local community with a strong focus on food production, the lithic tools related to food production in Shangchaoyanggou were more concentrated in several key household units that were spatially close to each other, which indicates some household units putting more effort into the production

of food. Considering the fact that lithic tools related to food production were very rare within the Niuheliang ceremonial center, it is highly likely that as a neighboring community, Shangchaoyanggou produced surplus food to support the subsistence needs of residents near the Niuheliang ceremonial structures who were less involved in the subsistence economy.

In contrast to their high degree of food production involvement, the residents of Shangchaoyanggou were less involved in ritual activities within the local community. After excluding the potential ceremonial platform of J053-1, the Shangchaoyanggou household units had an average proportion of ritual-related *tongxingqi* sherds much lower than in the Upper Daling local communities or within the Niuheliang pilgrimage center, and this difference is significant at an extremely high confidence level. In addition, the number of ceremonial structures identified at Shangchaoyanggou is lower than other Hongshan local communities, such as Fushanzhuang and Dongshanzui. These observations suggest that Shangchaoyanggou household units were not as involved in local ritual activities as those of other Hongshan local communities. All the results generally matched the pilgrimage center hypothesis, that the residents at Shangchaoyanggou local were more focused on food production in order to support the residents near the Niuheliang ceremonial structures.

Corresponding to the regional role of the Shangchaoyanggou local community is its unusual internal social organization. In some Hongshan local communities that were also especially involved in food production such as Fushanzhuang, food production was conducted in a quite dispersed way by many households in different parts of the community. In contrast, the spatial analysis of Shangchaoyanggou household units suggested activities most related to food production were highly clustered, with some household units located close to each other more involved than the rest. Such a productive pattern indicates a particularly strong focus on

agricultural production in order to produce more food surplus, which is consistent with the regional role of the Shangchaoyanggou local community as a food provider. This economic focus on food production stimulated the development of other related activities, making Shangchaoyanggou a more tightly integrated community in an economic sense than many other Hongshan communities, such as Fushanzhuang. In addition, Shangchaoyanggou household units most focused on food production also used more decorated ceramics, which can be regarded as efforts to gain social prestige. The coexistence of food production and the high social prestige of the same group of Shangchaoyanggou household units suggests that their social advantages were the result of their management of economic production. In contrast, while ritual has been recognized as one of the main factors in Hongshan social organization and strong ritual differentiation has been observed in many Hongshan local communities, the Shangchaoyanggou local community was not as involved in these activities, as suggested by its much lower proportion of *tongxingqi* sherds. The lower proportion of *tongxingqi* sherds might just indicate a lower degree of ritual participation by Shangchaoyanggou residents, but it seems more likely that frequent interactions between Shangchaoyanggou and local communities near the Niuheliang ceremonial structures involved ritual specialists providing ritual services within the pilgrimage center for Shangchaoyanggou residents, especially those who managed food production. And this special tie between the two groups of residents might have been the mechanism to stimulate food production at Shangchaoyanggou.

This research helped delineate a scenario for how environmental conditions and relationships with other communities helped shape the regional role and internal organization of a local community. As for Shangchaoyanggou, its regional role as food provider was a result of both favorable agricultural conditions and the external needs of residents of the pilgrimage center

for food. The internal productive pattern of Shangchaoyanggou focusing on producing food surplus enabled its residents to fulfill this external demand, and also the internal pursuit of prestige. These features, while different from those of other Hongshan local communities, enabled Shangchaoyanggou to be perfectly integrated into the regional settlement system, and help sustain it.

Many previous studies of Hongshan period societies of northeastern China started with the assumption that different local communities belonged to the same "Hongshan culture" and would thus be homogeneous with regard to socio-economic strategies, with some central or more important settlements having some "extra" features that were more precious. Much research has focused on finding common features in the remains from some "classic" archaeological sites and assumed these features would automatically characterize the other sites in the same region and time period (e.g. Suo and Li 2011; Chen 2008). This study, on the other hand, suggests that contemporaneous settlements only a few kilometers away from each other could have different regional roles, economic concentrations, and social focuses. These differences are not the results of random noises that should be filtered out. Rather, they are linked to the key features of the environmental setting and the social development trajectory and are hence of critical importance for understanding not only how the prehistoric residents adapted to the environment, but also how they interacted with each other and then were integrated into the process of social complexity. Future field projects could benefit from recognizing the potential heterogeneous natures of contemporaneous human organizations in the same region, and fully collecting data on the environments and broader demographic patterns in order to understand the internal activities of certain communities more comprehensively and more systematically.

6.2 The Broader Indication of Economic and Social activities in the Greater Niuheliang Area

This study has revealed the internal social structure and regional role of the Shangchaoyanggou Hongshan local community and provided a case study approaching how ritual activities stimulated the development of other aspects of social differentiation. This approach to Hongshan societies could be more fully developed by placing it in the broader picture of comparative study with early complex societies in different parts of the world.

The relationship between ritual activities and economic production, especially food production has long been discussed. One of the classic models on this topic is the "ritual mode of production" as described by Spielmann (2002). This model focuses on the influence of ceremonial feasting and the need for socially valued goods on the organization of production and suggests that in many small-scale societies, these activities created demands that led to economic intensification. In this model, the food consumed in feasts was not just left over from the normal subsistence economy but produced through intensification that enabled surplus food production. The motivation for doing this is usually to win the competition of feasting and gain more prestige. Several archaeological cases provide examples of this mode, such as Chaco Canyon in the North American Southwest and Newgrange in Ireland (Earle 2001; Mount 1994).

The relationships observed in the greater Niuheliang area, while also indicating the influence of ritual activities on intensive economic production, suggested a very dynamic approach. As discussed in the previous chapters, the primary demand for producing food surplus in the Shangchaoyanggou local community was not to use as capital in the feasting game in order to gain prestige but to feed the residents in another community so that they could focus on ritual-related activities. As food producers, residents of the Shangchaoyanggou local community were

not major players in ritual affairs, but rather gained prestige from their role in food production and expanded this advantage into a slightly higher standard of daily life as indicated by the better-decorated ceramics they used. Finally, the enhancement of food production led to the emergence of another group of elites who managed economic activities in the greater Niuheliang area beside the ritual specialists who lived closest to the ceremonial structures.

This mosaic distributional pattern of communities is at the heart of the uniqueness of the greater Niuheliang area. In many other cases, elites gained power in one aspect of the social life, and then consolidated their power by expanding it to more aspects. In the greater Niuheliang area, however, different local communities had different focuses in their social lives. These differences in emphasis led to very different internal social structures of the two local communities, as well as two groups of active household units with big socio-economic impact, ritual specialists within the Niuheliang pilgrimage center, and leading food producers in the Shangchaoyanggou local community existed at the same time. As discussed in Chapter 5, the low proportion of ritual-related artifacts of Shangchaoyanggou, with little internal variation and the extremely small number of food production-related tools near the Niuheliang ceremonial structures indicated the power of both groups of households was limited to the field they focused on, with no signs of expansion as seen in other cases. In addition, since the two local communities had internal social structures that were very different from each other, the interaction between the two communities was more likely to be limited to exchanges that were reciprocal to both. While ritual activities generally played an important role in the whole Hongshan territory, they seem to be not as important in the Shangchaoyanggou local community. Given this fact, it would be rather difficult for the elites of ritual activities within the Niuheliang

pilgrimage center to employ their ritual power in order to influence or even control Shangchaoyanggou within a more integrated regional system.

In one earlier comprehensive study, Drennan and Peterson (2006) compared the trajectory of Hongshan chiefdom development in Chifeng, where the Fushanzhuang local community was located, to counterparts in the Valley of Oaxaca in Mexico and the Alto Magdalena in Colombia. They observed that in Chifeng there was "separation between symbolic and economic hierarchies" compared to other early complex societies such as Oaxaca. This feature of Hongshan societies in Chifeng led to limited abilities in the consolidation and supralocal projection of power. The observations made for the greater Niuheliang area confirmed that such a separation not only existed within a local community but also existed on a broader scale between different local communities within the same area. In such a situation, it is not surprising that some means of consolidating or projecting power on the supralocal scale were even less feasible for the elites, especially the ritual elites of the greater Niuheliang area.

The unique social organization of Hongshan societies possibly influenced the trajectory of social development of the following periods. As one of the most well known early complex societies, Yangshao societies in the Yellow River basin had a developmental trajectory that is broadly similar to that of Oaxaca, with nucleated local communities suggesting a higher degree of interdependence between household units, and indications of elites trying to acquire multiple sources of power. The archaeological record shows that the subsequent late Neolithic period societies that emerged in the Yellow River basin eventually led to the first state-level societies in the region. Such a trajectory suggests that elites like those of Oaxaca and Yangshao societies, with concrete foundations of power, gained the opportunity to project their power and carry out social integration on a much larger scale.

The scenario of social development in northeastern China after the Hongshan period is still somewhat blurred, in part because of the very scarce archaeological remains of the "Xiaoheyan Culture" right after the Hongshan period. In any case, there has been no evidence suggesting the existence of more complex societies in the Xiaoheyan period than in the Hongshan period, which has led to a characterization of "the decline of Hongshan culture" (e.g. Liu and Feng 2012a; Guo et al. 2018). While it is unlikely that Hongshan complex societies simply collapsed in the following period, one would not expect early complex societies in northeast China to develop further and become more complex with larger supralocal communities and a much higher degree of social differentiation, as has been observed in the Yellow River basin during the late Neolithic period. Efforts have been made to interpret this gap or period of little growth in northeastern China, and many factors, such as environmental deterioration and changes in the subsistence economy, have been taken into consideration (e.g. Li 2017; Liu et al. 2017). Here we would suggest that the fragmented power scenario without a unified elite group is very likely to be an insurmountable barrier and blocked Hongshan societies from a broader scale of integration. The evaluation of this hypothesis, however, requires a more comprehensive understanding of the interaction between local communities in both the Hongshan core and peripheral zone.

6.3 Unanswered Questions

This study has provided answers for the research questions it posed and opened a window to observe the household and local community interaction within certain environmental settings that made a ritually focused complex society happen. From this base, future studies can improve

our understanding of Hongshan society and the general process of social complexity and answer some key questions related to this topic.

The first question is about the nature of the interaction between Hongshan local communities, such as between the Niuheliang pilgrimage center and Shangchaoyanggou: while it is clear that Shangchaoyanggou was potentially one of the food suppliers for the residents in the Niuheliang pilgrimage center fact that the ritual specialists in Niuheliang could not have compelled the Shangchaoyanggou local community to provide them with food, such exchange must have provided some benefits to the residents of Shangchaoyanggou. Hence the question arises: what did the residents of Shangchaoyanggou get from the inter-community exchange?

While there is no obvious answer for this question, some of the observations that have been discussed above may indicate candidates. The multidimensional scaling conducted on ceramic assemblages of the three Hongshan local communities has shown that Shangchaoyanggou household units have relatively low proportions of painted/decorated ceramic sherds compared to other local communities. Such a result is reasonable; if the primary focus of Shangchaoyanggou household units was food production, then less effort would be put into the production of fancy ceramics. At the same time, several household units of the central functional group, who played the central role in food production, had the highest proportions of painted and decorated sherds within the Shangchaoyanggou local community. This pattern would make one wonder if the fancy ceramics they consumed were provided by the residents of the Niuheliang pilgrimage center as the rewards for the food they provided. If this is true, then the fancy ceramics would be a signal of social prestige and would stimulate the further enhancement of food production.

Another possibility could be, as discussed above, that ritual specialists of the Niuheliang pilgrimage center provided ritual services as compensation for the food they received. Since in Shangchaoyanggou the proportion of *tongxingqi* sherds is relatively low and only one ceremonial platform has been identified, it is reasonable to expect that Shangchaoyanggou residents, especially those who managed food production, may have participated in the ritual activities conducted in the Niuheliang pilgrimage center. In this case, the close connection between economic managers in Shangchaoyanggou and ritual specialists in Niuheliang might help the former establish special social advantages. While these hypotheses may or may not be true, a more comprehensive understanding of the community-level interaction between Hongshan local communities would provide evidence to evaluate the hypothetical explanation about productive differentiation mentioned in the previous section.

Second, since the Shangchaoyanggou was recognized as the first known "food provider" community in the Hongshan territory, it would be interesting to know if such a pattern existed more generally in the Hongshan territory. Given the uniqueness of the Niuheliang pilgrimage center, it could either be the only or just one of several local communities that mainly focused on ritual activities and didn't practice food production much. In this case, specialized food suppliers such as Shangchaoyanggou might be sparks of economic development that never quite caught fire.

An alternative possibility, however, could be that such a pattern was existed widely all over the region, but was overshadowed by attention to impressive ceremonial structures and neglected by previous studies. The third possibility, because some important local communities outside the Hongshan core zone, such as Fushanzhuang, also focus strongly on food production but only for their own residents, is that the kind of interdependence reconstructed for

Shangchaoyanggou only existed widely in the Hongshan core zone. If so, then the difference between the Hongshan core zone and the peripheral zone would not be limited to counts and size of ceremonial structures but expand to strategies of production and exchange that support those ceremonial structures and their keepers.

Finally, it is important to investigate the factors that help create the unique community level social differentiation and power structure of the greater Niuheliang area. Among the factors that might influence the trajectory of social development in the greater Niuheliang area, the environmental setting seems to be the most attractive one. This is not to argue that there is a pre-determined causal relationship between environment and trajectory of development within an area, commonly labeled as environmental determinism. Instead, what has been observed in the greater Niuheliang area is its unique environmental setting, with a mosaic of various types of land providing different opportunities for food production on a relatively fine scale. Such a setting provided possibilities for residents in local communities such as Shangchaoyanggou and the Niuheliang pilgrimage center to focus on different aspects of their social lives and develop inter-community interaction to acquire goods that were essential for them. It is thus suggested that environmental settings that were diverse on a fine scale (one to several km) are one of the important factors in the formation of inter-community productive differentiation. This hypothesis can be tested and modified by introducing case studies from other areas with environmental settings similar to that of the greater Niuheliang area.

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