Foothills and Intermountain Basins: Does China's Fertile Arc have „Hilly Flanks“?

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Abstract : In 2009, Liu and colleagues considered the parallels in topographic context between early farming sites in Southwest Asia and those in North China associated with millet cultivations. This paper extends the geography of this conceptual framework by moving south of the Qinling Mountains-Huai River divide, incorporating sites in South China that associated with the beginnings of rice exploitations. We highlight the continuous mountain chains running from the Greater Khingan range in the northeast to the Nanling Mountains in the south that give form to China's Fertile Arc. Key sites in the northern part of the Arc are situated along China's "Hilly flanks" while southern sites are located in a diverse array of landforms including piedmont plains and intermountain basins. A parallel could be drawn in the context of early land choice 'ecological opportunism' between the Fertile Crescent and China's Fertile Arc.

Key words: Hilly Flanks, China's Fertile Arc (CFA), Southwest Asian Fertile Crescent (SWAFC), Ecological Opportunism, Millet, Rice

1. Introduction

In the context of Old World agriculture, the foothill chains along the various river catchments across Eurasia have repeatedly proven key to the locations of early farming sites (Fig. 1). These sites demonstrate a conceptual connection between the "Hilly Flanks" of the Southwest Asian Fertile Crescent (SWAFC), the Inner Asian Mountain Corridor, and north China's Foothill Arc (cf. Braidwood and Braidwood, 1953; Liu *et al.*, 2009; Frachetti, 2012). Early settlements in each of those regions appear along elevated locations at the edge of river catchments, sometimes at a considerable distance from the valley bottom below.

Intellectual implementation of this concept can be traced to V. Gordon Childe (1936) and his suggestion of seasonal water-use enabling human settlement. In the 1960s, pioneering studies brought to light the role of geology, hydrology and ecology in constraining early farmers. Braidwood and colleagues (1953, 1969) emphasized the role of the “Hilly Flanks” of the Fertile Crescent along the Taurus-Zagros Arc (TZA), in the context of the natural abundance of wild ancestral plants that later became domesticates. Shortly after, Claudio Vita-Finzi (1969a) outlined the importance of fluvial geology and the subsequent down-cutting of alluvial fans, particularly along the Jordan Valley. Vita-Finzi (1969b) suggested that early communities probably took advantage of their local environments in what he calls “ecological opportunism”. In the decades that followed, Andrew Sherratt (1980, 1997, 2007) focused on the context of the diversity of early agriculture, particularly in the Levant and Anatolia. He noted a recurrence of early sites located at “spatially limited but highly productive environments” along the hilly flanks of the TZA and the Levantine Corridor.

There are two crucial components to this settlement system. One is a water source that is dependable and can be controlled by small family units, despite it requiring effort and ingenuity. The second component is that in those foothill locations - at least in Southwest Asia - cereals would not grow naturally and would have to be re-sown every season; this process would create ecological/anthropogenic circumstances in which domesticated cereal varieties would rapidly predominate (Sherratt, 2007).

Beyond the Fertile Crescent, various authors have highlighted that early farming sites in other parts of Eurasia have also been concentrated around similar landscapes. The earliest village sites in southeast Iran and Baluchistan, for example, are similarly located on alluvial fans (Prickett, 1986; Petrie and Thomas, 2012). In central Asia, Michael Frachetti (2012) highlighted the role of the Inner Asian Mountain Corridor in the early spread of crops and pastoralism, and in north China, Liu and colleagues (2009) has noted a similar pattern of recurrent landscapes along the foothills elevated above the bottom of river valleys in the Yellow River (*Huang He*) valley. In this paper, we aim to extend the

scope of the 2009 article to the south, looking at both sides of the Qinling Mountains-Huai River Line. In light of the flood of new information that has transformed our knowledge of the subject in the last decade, we ask if there are “Hilly Flanks” to China’s Fertile Arc (CFA), where early communities may have taken advantage of their local environments in a kind of “ecological opportunism” in foraging and farming various plant foods. Before drawing the comparison between the two “Fertile Crescents”, we will start with early farming sites in China.

2. Foothills and the Diverse Origins of Farming in China

Various authors have drawn attention to the location of early sites in north China that are closer to the mountains than the valley bottom (Ho, 1969; Li and Lu, 1981; Tong, 1984; Liu *et al.*, 2009). In the same year that Braidwood and colleagues (1969) published the hypothesis of the “Hilly Flanks” of the Fertile Crescent, Ho wrote:

“The beginnings of Chinese agriculture had nothing directly to do with the great flood plain of the lower Yellow River; that irrigation did not begin in China until Chinese agriculture was four millennia old; and that the earliest Chinese agricultural crops are botanically quite different from those cropping systems based on a common core of wheat and barley.” (1969: 2)

Our knowledge of the subject has been transformed dramatically since 1969. One of the causes behind this intellectual development is the application of flotation and various other archaeological sciences in Chinese archaeology (e.g. Zhao, 2005, 2011; Jones and Liu, 2009). These studies have revealed diverse origins and an early spread of farming within the context of contrasting geographical and ecological extremes in China. China’s vast landmass ranges from tropical in the south, sub-arctic in the north, and alpine in the west. Seventy percent of this landmass is composed of mountains, plateaus and hills, and in a substantial part of the country - particularly the continental interior - the availability of water is critical. Early Holocene sites are largely concentrated in the areas to the east

of this mountain and plateau system (Fig. 2). This is likely because of the enhanced summer monsoon during the Holocene, which brings water from the Pacific Ocean onto much of southern and eastern China and has a powerful ameliorative effect on the intrinsic aridity of the continental interior. Recent essays have helpfully placed subsistence transitions within the context of this geological and ecological mosaic, particularly in the north (e.g. Dong *et al.*, 2012; Wagner *et al.*, 2013; Zhuang and Kidder, 2014; Zhuang, 2015). Likewise, on a global scale, scholars have drawn our attention to the climatic context of north China and southwest Asia and the possible interaction between them (e.g. Jones *et al.*, 2011; Bar-Yosef, 2011).

3. To the East of the Plateau, North of the Qinling Mountains—Huai River Line

3.1 The beginning of farming in the north

Recent archaeobotanical and archaeogenetic research makes it clear that the two East Asian millets - broomcorn (*Panicum miliaceum*) and foxtail millet (*Setaria italica*) - originated in North China (Lu *et al.*, 2009; Zhao, 2011; Hunt *et al.*, 2011; Yang *et al.*, 2012; Liu *et al.*, 2013). Stable isotope studies have documented that they were used as staple calorie sources in this region from about 8000 years ago (Barton *et al.*, 2009; Liu *et al.*, 2012; Liu *et al.*, 2015b), and they continued to be staple grains throughout historical periods (Bray, 1984). It remains the case that our knowledge, however, about how the domesticated forms of these two species evolved from their wild ancestors is still limited (Liu *et al.*, 2015a). Indeed, the wild progenitor for broomcorn millet remains unknown.

A few micro-botanical and macro-botanical reports allude to the origin of millet use in the early Holocene between 12,000 and 8000 years ago. These come from a range of sites in Hebei and Beijing including Nanzhuangtou, Donghulin and Cishan (Fig. 2). In the case of foxtail millet, processing of *Setaria italica* and/or *S. viridis* at the site of Donghulin (about 9500 years ago) and Nanzhuangtou (about 11,500 years ago) has been

inferred from starch grain studies (Yang *et al.*, 2012). Charred grains of foxtail millet were also recovered from Donghulin, but there is no direct radiocarbon date associated with the sample (Zhao pers. comm.). In the case of broomcorn, the earliest published claims relate to phytoliths of *Panicum miliaceum* from Cishan (Lu *et al.*, 2009). AMS radiocarbon dates on associated pit sediments range between 8500 and 7500 cal. BC. While Cishan is the only attempt to associate AMS dates with botanical remains, further discussions have questioned these results (Zhao, 2011).

Macrofossil evidence shows millets becoming abundant during the period between 8000 and 6000 years ago. The number of sites where charred broomcorn and foxtail millet grains are reported has increased significantly during the last five years (Zhao, 2011; Crawford *et al.*, 2013; Jin *et al.*, 2014; Wu *et al.*, 2014; Zhao, 2014). Nevertheless, people did not live by millet alone. Over the course of the Neolithic, additional domesticates came to contribute to the human diet and livelihood, including pigs (*Sus scrofa* spp.), soybeans (*Glycine max*), and hemp (*Cannabis sativa*). Key sites in this period include: Xinglonggou in Inner Mongolia; Xinle in Liaoning; Yuezhuang, Xihe and Zhangmatun in Shandong; Peiligang, Shawoli, Tanghu, Egou and Wuloxipo in Henan; and Dadiwan in Gansu; and probably Cishan in Hebei (*see* Table 1; Fig. 2).

3.2 Along the mountain chain foothills

A striking feature of the geographical distribution of early millet sites is their concentration along the marginal mountains of the loess plateau and Inner Mongolian plateau. To the east of these plateaus lie North China's two major alluvial plains, the Huabei plain (the north China plain) and the Dongbei Plain (the northeast plain). A chain of mountains, broadly running northeast to southwest, extends over some 2500 km along the boundary between the plateaus and the floodplains (Fig. 2). Most millet sites listed above, such as Xinglonggou (Fig. 3a), as well as settlements along and in the Taihang and Funiu Mountains, such as the Peiligang cultural sites, are situated on foothills close to the mountain chain (Fig. 3b). Beyond this mountain chain, other early millet sites

likewise share the same spatial relationship with mountains, for example Dadiwan's position relative to the Liupan mountains and Yuezhuang and Xihe to the Taiyi mountains (Fig. 3c).

Many of these sites share typological memberships with a few archaeological cultures, including Xinglongwa, Peiligang, Houli and Laoguantai. Sites belonging to those cultures are mostly clustered in the piedmont zones that transition from hilly areas to vast alluvial plains. This situation could be understood in the context of development of the Holocene hydrological system. For example, Xia and colleagues (2000) demonstrated that variation of the riverine system and Quaternary loess accumulation are key to understanding the settlement choice of Xinglongwa cultural sites as well as sites belonging to later episodes. Peiligang cultural sites (i.e. Peiligang, Shawoli, Tanghu, Egou and Wuloxipo) are located around the foothills of Song Mountains (Fig. 3b). Those alluvial fans developed no later than the early Holocene (Xu *et al.*, 2013). Situated in the lower reaches of the Yellow River, Houli cultural sites are located around the piedmont foothills of the Taiyi Mountains (Fig. 3c). A micromorphological study of Yuezhuang provided us with a detailed account of the location in the context of site formation processes in relation to the Yellow River's alluvial history (Zhuang *et al.*, 2013). The reconstructed sequence consists of frequent alternations of short-period surface stabilities and succeeding alluviation, with human occupations corresponding to those short-term surface stabilities.

4. South of the Qinling Mountains—Huai River Line

Moving south of the Qinling Mountains—Huai River line a different context for early Neolithic settlement is present. Our area of concern here consists of the Huai River basin and the middle and lower reaches of the Yangtze River. Broadly speaking the Qinling Mountains - Huai River line serves as an important geographical divide of demarcation between North and South China. As a result of the hydrothermal condition, the southern part is more productive than the North, with higher temperatures and a substantial

increase in rainfall (Zhao *et al.*, 1995). The landforms of this region are mainly hills with lower elevations relative to the north, as well as alluvial or lacustrine plains. Today, rivers, lakes, and other kinds of water bodies contribute to a dense water reticulation system, which facilitates an abundance of aquatic resources such as water chestnuts (*Trapa natans*), fox nuts (*Euryale ferox*), many kinds of fishes, and wild rice (*Oryza rufipogon*) (Zhao *et al.*, 1995; Guo *et al.*, 2014; Liu *et al.*, 2015a).

4.1 Beginning of farming in the south

For decades scholars have assumed that rice farming originated in the Yangtze basin. There has long been an archaeological and genetic case made for separate origins of domesticated *indica* rice in India, although it now appears that distinct early cultivation practices in India were enhanced by hybridization with introduced domesticated rice forms from East Asia around 4000 years ago (Fuller, 2011). Recent improvements in archaeobotanical recovery indicates that rice domestication was a slow process lasting for a few millennia. In the case of the Lower Yangtze River valley, the complete suite of domestication traits is only visible after the Hemudu cultural phase, around 7000 - 6000 years ago (Fuller *et al.*, 2009).

The earliest evidence of rice exploitation was reported from a number of cave sites in the middle Yangtze, including Xianrendong and Diaotonghuan. According to Gross and Zhao (2014), these records are dated to about 10,000 years ago. A recent dating program has pushed the date of the lower layer of Xianrendong to 20,000 years ago (Wu *et al.*, 2012). Evidence shows that between 20,000 and 15,000 years ago, Pleistocene communities in the middle Yangtze developed ceramics as a device associated with a novel strategy for food-processing (Boaretto *et al.*, 2009; Wu *et al.*, 2012). While it is unclear how significantly it contributed to the diet, rice might be exploited and played some role in the subsistence of those cave sites (Gross and Zhao 2014).

The situation in the middle Yangtze may represent a parallel situation to the Lower

Yangtze and Huai River valleys. Reports on Shangshan in Zhejiang and Jiahu in Henan show charred rice remains together with many other types of plant food in the context of emergent sedentary villages. The early phases of these two sites are dated to between 11,000 - 9000 years ago at Shangshan and 9000 - 8000 years ago at Jiahu (HPICRA, 1999; ZPICRA and PM, 2007; Wu *et al.*, 2014).

After 8000 years ago, a few more sedentary sites report rice remains. These are Pengtoushan and Bashidang in Hunan, and Kuahuqiao, Xiaohuangshan and Tianluoshan in Zhejiang. Recent studies indicate that rice domestication was underway during this period (Gross and Zhao, 2014). Rice evolved domestication traits that are recognized as adaptations to cultivation and harvesting, including the loss of wild seed dispersal mechanisms and increasing grain size, and by inference, other traits such as closed panicles, increased seed number, erect growth habit, and increased annuality. It is clear that rice cultivation emerged in the context of broad spectrum foraging focused on the collection of tree nuts, especially acorns of various oak species, and wetland nuts including water chestnuts and foxnuts. Alongside gathering and storing these nuts, increasingly sedentary societies began to manage the shallow freshwater wetland margins for the production and planting of perennial wild rice. Freshwater fish were also heavily exploited in these environments. In the next section, we will discuss the locations of those sites in the context of food resource availability (Liu *et al.*, 2015a).

4.2 Middle and lower Yangtze and Huai Rivers

Archaeological studies reveal that Paleolithic hunter-gatherers in the south mainly occupied the intermountain valleys and hilly areas with hunting and gathering as the main subsistence strategy (Guo *et al.*, 2014). Later, at the onset of the Paleolithic - Neolithic transition, archaeological sites are found towards lower elevations and are mainly distributed in the intermountain basins or piedmont plains south of the Yangtze River. Key sites are clustered, broadly, in the middle and lower Yangtze and Huai River. We will consider the circumstances in the three regions in this section.

4.2.1 The middle Yangtze

In the catchments of the middle Yangtze, we highlight two topographic categories where key sites are found: (1) those found in the intermountain basins; and (2) those found in the foothill plain. The first category includes cave sites, such as Yuchanyan, Xianrendong, and Diaotonghuan (*see* Table 1; Fig. 2, Fig. 3d). Food resources were probably acquired from nearby hills and the flat open lands around the caves.

The second topographic category includes sites such as Pengtoushan, Bashidang, and Chengbeixi (Fig. 3e). The first two sites share the same typological membership to the Pengtoushan culture, and both are in the Liyang plain. The Liyang plain is situated in the transition zone between the Wuling Mountains and Dongting Lake. The central and eastern sectors of this region consist mainly of alluvial plains with an elevation of 30-50 masl, while other parts are primarily uplands and mountains with relatively higher elevations. The Li River and its tributaries constitute dense and complex water networks within the plain. There are more than a dozen Pengtoushan cultural sites in Liyang region (Guo *et al.*, 2014). Many Pengtoushan cultural sites share similar geographical settings on hillocks surrounded by open and flat plain areas (Guo, 2010). A recent geoarchaeological study showed that the complex history of the Liyang plain combines the Pleistocene loessic deposits and the Holocene formed fluvial landscape (Guo *et al.*, 2014). A tributary of the Cen River would have surrounded the Pengtoushan site and provided ample water supply. Additionally, the site's location on the slightly upland hillock would have prevented flooding.

4.2.2 The lower Yangtze

Settlement patterns for sites in the lower reaches of the Yangtze River similarly conform to those in the Liyang plain. Shangshan, for example, is located in the center of the Puyang River Basin in Zhejiang Province (Fig. 3f). Surrounded by low mountains, the

Puyang River Basin is mainly controlled by the NE - SW tectonic belt and formed as a result of river erosion and accumulation. Shangshan is situated on a high second terrace of the Puyang River, with an altitude of 50 masl (Mao *et al.*, 2008). The Wugong River, a tributary of the Puyang, flows to the east of the site in a north to south direction. Xiaohuangshan in the Xinsheng Basin is also situated in similar geographic settings as Shangshan (Fig. 3f).

Dated later than Shangshan, Kuahuqiao shows a slightly different geographical configuration (Fig. 3f). Kuahuqiao lies at the boundary between the upland region to the south and west and the flat coastal plain around Hangzhou Bay to the east and north (Innes *et al.*, 2009). This site is situated in a shallow depression between two lines of small hills, with an altitude around 4 masl. Numerous studies have shown that the sea level rose rapidly on the eastern coast in the early Holocene and that the present Hangzhou bay area, including the Kuahuqiao site, was inundated (Chen and Stanley, 1998; Zong, 2004; Innes *et al.*, 2009).

4.2.3 The Huai River Valley

The Huai River valley is bordered to the northwest by the Funiu Mountains and to the southwest by the Tongbai Mountains. The elevation of the plain is relatively low, with areas of seasonal inundation, low-lying lands, and small water bodies including lakes and swamps. The site of Jiahu lies on the alluvial and lacustrine plain in the upper reaches of the Huai River, just east of the Funiu Mountains. It has an altitude of 67.5 masl and is located on a natural river levee about one meter higher than the surrounding plain surface (HPICRA, 1999). A very diverse subsistence base of both terrestrial and aquatic resources indicates that people at Jiahu obtained food from the ecologically abundant areas around the site. Farther east, the Shunshanji site is located in the alluvial plain of the middle reaches of the Huai River, and is not far from small low hills, such as Chonggang Mountain. The elevation of the site is about 26-30 masl and the Suishui River—an ancient tributary of the Huai River—was not far from the site (IANM and

SCM, 2014).

5. Discussion

China's earliest Neolithic sites are predominately concentrated to the east of a long and almost continuous chain of mountains, which serves as an environmental divide between semi-arid areas to more humid ones. It runs from the Greater Khingan (Daxing'an) range in the northeast through to the Yan, Taihang and Funiu Mountains in modern day Hebei and Henan provinces. The divide is less clearly defined further south, but the chain extends to the Wu and Wuling Mountains. The Nanling Mountains further divide these areas into those where cultivation of rice and/or millet is present to the north, and those to the south and southwest whose subsistence is characterized by enduring hunting and foraging strategies (Prendergast, 2009; Zhang and Hung, 2010, 2012) or perhaps a type of tropical horticulture (Zhao, 2011). These mountain ranges to the north and south give form to the China's Fertile Arc (CFA).

Various authors have drawn attention to the location of the early northern sites on the foothills, rather than at the valley bottoms (e.g. Ho, 1969; Liu *et al.*, 2009). This change in archaeological perception parallels similar changes to understanding the origins of agriculture in Southwest Asia. In both regions, the focus was once great river valleys: the Nile, Tigris and Euphrates rivers in the West and the Yellow and Yangtze rivers in the East. Following subsequent archaeological investigations in Southwest Asia, the emphasis moved from the valleys themselves to the —hillyflanks” above them. It is worth noting, however, that while Braidwood's —hly flanks” theory referred specifically to the Taurus-Zagros Arc within the Southwest Asian Fertile Crescent (*see* Fig. 1), this geographic constriction was by the author's own admission —rathertoo restrictive” (Braidwood, 1972: 312). More recently, Melinda Zeder has described the conditions of initial domestication in this area within —river valley catchments with easy access to multiple eco-zones” (2015: 8). In the context of the diverse origins of agriculture and varied utilizations of local environments in north and south China, we will revisit the

perception of a “hilly flanks” in the CFA.

5.1 “Hilly flanks” in the “China’s Fertile Arc (CFA)”

In north China Neolithic human settlement patterns conform to a distribution within the CFA that reflects a locally specific and opportunistic sedentary subsistence strategy (Liu *et al.*, 2009). Most of the early millet sites are concentrated on the foothills of the mountain chains, particularly along the Taihang and Yan mountains, on the edges of the loess and Inner Mongolian plateaus (Fig. 2). As is elaborated by Liu *et al.* (2009), early settlements on these foothills afforded Neolithic people unique opportunities to take advantage of their local environments. Because of site positions on slopes, where seasonal rainwater was captured in freely draining plots, as well as the enhanced summer monsoon, humans were capable of opportunistically practicing dry land, rain-fed cultivation, exemplifying the “ecological opportunism” that Vita-Finza (1969a) described for the Jordan Valley.

Sites described previously in this paper such as Xinglonggou, Peiligang culture sites, and Houli culture sites all adhere to this model. Even early millet sites to the west of the mountain chain barrier, such as Dadiwan in modern day Gansu, which at first glance appear to be outliers, conform to the general pattern of opportunistic foothill settlement. Dadiwan, for example, sits at the edge of a loess hill at a position about 10m above the water table of the Qingshui River. It is probable that the community at Dadiwan extensively utilized the loess slope behind the settlement. It is also worthy a note that the early phase of the Dadiwan occupation belongs to the widespread Laoguantai culture. Many Laoguantai sites are located along the northern foothills of the Qinling Mountains overlooking the Wei River or its tributaries. This east - west branch perhaps defines the western border of the CFA. In addition, Dadiwan’s location outside of the Arc illuminates that the pattern under discussion is not merely a product of geography, but one of similar ecologically mitigated opportunistic choices made by early communities.

Turning from north China to the south, key early sites continue to be generally constrained to the margins of the CFA. Despite a decrease in average elevation in this region relative to the North, the physical geography of the southern CFA is no less varied. A diverse array of landforms and water bodies are found across the landscape, creating a mosaic of aquatic and terrestrial microenvironments. As was the case for north China, we see a concentration of sites within transitional zones, which take advantage of ecological settings of both the river valleys and the low mountains. Sites are located either at the piedmont or foothill plains near the mountain bottoms—as is the case for Kuahuqiao, Jiahu, and the Pengtoushan culture sites—or on other intermediate intermountain basins above the river valleys, like Shangshan and Xiaohuangshan.

A wealth of new information from either side of the Qinling Mountains - Huai River divide has demonstrated that studying these two regions retrospectively - i.e., in terms of the two staple crops that would become the basis for two types of agriculture in the proceeding millennia - falls into a teleological trap. Close examination of the geography of settlement locations and its relationship to subsistence make it clear that early Neolithic sites on either side present a unified pattern of *land choice* rather than *food choice*. Regardless of the specific resources exploited or what side of the divide they belong to, early Neolithic sites within the fertile arc are characteristically similar in their strategic positions on the landscape and their broad subsistence base. Their locations in various kinds of transitional zones (foothills, piedmont plains, intermountain basins) would have given residents access to a number of diverse microhabitats from which to extract resources, facilitating year-round settlement. Access to and control of dependable water appears to have been a concern in both regions as well, and very likely played a significant role in early plant cultivation and management.

Selection of these transitional zones for year-round, sedentary occupation can be explained in contrast to the alluvial valleys. In the context of the Mississippi River Valley, Kidder and colleagues (2008) explain that rapid Early to Middle Holocene sea level rise coupled with aggradation caused by sedimentation and avulsion would have made

alluvial valleys unsuitable for permanent settlement. While floodplain resources were likely quite rich and diverse, they would have been unstable, with patchy spatial and temporal distribution across the landscape, preventing continuous occupation. As was the case for the Mississippi Valley, it is probable that groups used short-term logistical strategies to exploit floodplain resources in the Chinese Neolithic, with permanent settlements located in areas with more predictable and sustained access to resources.

5.2 Parallelism in the Old World: Western and Eastern Fertile Crescents

Despite obvious differences in chronology, environment and seasonal availability of local resource composition, the earliest sedentary sites in China resemble those in the Near East in two particular ways. The first of these was detailed above for China and concerns the strategic locations of these early villages. In the case of the Levant, permanent, sedentary Natufian (~14,500 - 11,500 years ago) settlements are generally located in highland areas that granted access to a diversity of topographically differentiated microenvironments (Bar-Yosef and Belfer-Cohen, 1992; Henry, 1988). A parallel pattern is observed for the roughly contemporary Round House Horizon (~12,000 - 10,000 years ago) in the TZA. The earliest village sites in this region are located along the slopes of the higher mountain ranges, providing easy access to “a large number of vertically stratified microenvironments” (Peasall, 2000: 493). Epipaleolithic Hallan Çemi (~11,700 years ago) in Southeastern Turkey for example, demonstrates nearly identical patterns to a number of sites in the CFA discussed here. It is located on the southern slopes of the foothills of the Sason Dağları—an extension of the eastern Taurus Mountains—and sits 640 masl and on the edge of a river terrace overlooking a tributary of the Batman River (Peasall, 2000). Subsistence consequently reflects this site location strategy. As in China, subsistence was diverse and included a reliance on nuts (such as *Quercus* and *Pistacia*), several species of pulses, and a wide variety of locally specific plant and animal resources, to which cereals contributed in varying degrees (McCorriston and Hole, 1991; Peasall, 2000). The Chinese as well as the Near Eastern scenarios, thus provide ample evidence that early strategies of sedentism were based on local access to a

diverse array of resources—whereby diversity *was* reliability.

This leads to the second major way that the CFA and the SWAFC converge, which concerns trajectory. Intervening on the question of the origins of agricultural economies in either region goes well beyond the scope of this paper; however, it is impossible to ignore the subsequent similarities in pattern seen in these two fertile arcs, and they do warrant some discussion. As Sherratt pointed out, the crucial shift for “neolithization” was the shift in settlements from upland to lowland (1980). Whatever the impetus, this transition, from self-sufficient locations at the confluence of multiple ecozones to the more productive, but hierarchically dependent and labor-intensive valley bottoms, necessarily requires an elaboration of social contracts (Rosenberg, 1990).

6. Conclusion

In 2009 Liu, Hunt and Jones drew the comparison between the ecological contexts of early sedentism in North China and the Southwest Asian Fertile Crescent. In this paper we have expanded this convergence in conceptual frameworks to incorporate southern sites associated with the beginnings of rice cultivation. We highlight the mountain chain that gives form to China’s Fertile Arc. While key sites in the northern sectors of the Arc are situated along the “fly flanks”, the southern sites appear in a diverse array of landforms, ranging from intermountain basins to piedmont plains. What northern and southern sites have in common is their location in ecological transitional zones above the river valleys. Early communities appear to have taken advantage of a broad spectrum of resources available in these locations, as well as the added benefit of flood avoidance from major river courses. This pattern echoes the “ecologically opportunistic” strategy seen in SWAFC.

Given the dynamic of Holocene sedimentation and avulsion, the landscape of the “fly flanks” was by no means simple, and subsistence was likely as complex as the geomorphology. It is possible that early communities with different short-term logistical

and mobility strategies may have sought seasonally available resources within the resource-rich alluvial valleys and that sedentary sites in these transitional zones are only one part of a more complex subsistence strategy. Given the deeply buried nature of sites, especially in the Yellow River Valley, future studies to understand the ecological context of the valleys themselves will be necessary to test this hypothesis. Additionally, our analysis contextualizes these sites in regards to their relationship to local *macromorphology*. Analysis at a *micromorphological* scale, examining the immediately local allocation of resources at each of these sites may reveal additional conditions guiding human choices to settle, which awaits further inspection.

Similarly, social conditions and contexts also played important roles in settlement decisions. One characteristic of the transitional zones where these early sites are located is a dependable water source that can be controlled by small family units. While water in the valley bottoms could indeed be plentiful in certain seasons, its use as a dependable source for agriculture requires an elaborate social contract and, by implication, a hierarchy enforcing and maintaining the collective contract. This social elaboration can be seen in the archaeologically identified trajectories of the subsequent millennia both in the East and West. As they do for the origins of plant domestication, the precursors of this social change are alluded to in these early sedentary sites.

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Captions

Figure 1: Map of Eurasia Highlighting Mountain Chains significant to Old World Origins of Agriculture (SWAFC/CFA).

Figure 2: Key sites in the China's Fertile Arc.

1. Shizitan, 2. Cishan, 3. Tanghu, 4. Peiligang/Shawoli, 5. Egou, 6. Wuluoxipo, 7. Dadiwan, 8. Yuezhuang, 9. Zhangmatun, 10. Xihe, 11. Nanzhuangtou, 12. Donghulin, 13. Zhuannian, 14. Shangzhai, 15. Xinle, 16. Xinglonggou, 17. Baiyinchanghan, 18. Xianrendong/Diaotonghuan, 19. Yuchanyan, 20. Pengtoushan, 21. Bashidang, 22. Chengbeixi, 23. Baligang, 24. Jiahu, 25. Shunshanji, 26. Shangshan, 27. Xiaohuangshan, 28. Kuahuqiao.

Figure 3: Topographic maps of the locations of key sites and site clusters in the Early Holocene CFA. a. Xinglonggou; b. Peiligang Culture sites: Peiligang, Shawoli, Tanghu, Egou and Wuluoxipo; c. Houli Culture sites: Yuezhuang, Zhangmatun, Xihe and Houli; d. Xianrendong and Diaotonghuan; e. Pengtoushan, Bashidang and Chengbeixi in Middle Yangtze; f. Shangshan, Xiaohuangshan and Kuahuqiao in Lower Yangtze.

Table 1: Summary of archaeobotanical information and topographic context of early Holocene sites in the CFA.