

# Prehistoric settlements and environment of West Liaohe River Valley

Maoli Han\*

\* College of Urban and Environmental Sciences, Peking University, Haidian District, Beijing 100871  
E-mail: maolih@urban.pku.edu.cn

## Abstract

Investigations show that the settlements of the Xinglongwa and Zhaobaogou Cultures (a. 8–6ka BP), the subsistence types of which were mainly gathering, fishing and hunting, were located within the timberland zone largely concentrated at altitudes between 400–600m above the sea level suitable for these economic activities, while the zones higher and lower than these altitudes only occasionally played this role. In the Hongshan through Upper Xiajiadian Cultures (a. 6–3ka BP), the weather became cold and dry, primitive agriculture increased its importance in the means of subsistence and the population grew gradually, all of which caused the settlements to be expanded from timberland to lower steppes. Every change in the subsistence pattern was embodied in the relationship between the settlement and the environment, and the breakthrough in the settlement location choices by expanding living space from forest margin was just a result of promotion by agricultural production. The gathering, fishing and hunting economy of the Xinglongwa and Zhaobaogou periods made the settlement occupation shorter than that in the Hongshan period and later times when agriculture had held the leading position in economy. Both the duration of settlement occupation and the alteration of settlement culture prove that the man-land relationship in the prehistoric West Liaohe River Valley was kept in a relative equilibrium.

**Keywords:** Human settlements—China—archaeology; man-land relationship—prehistory

## General introduction on the issue

Locations of settlement sites were the results of interaction between human adaptation and the environment. Therefore, settlement study not only illuminates the trajectory of social evolution, it also generates environmental information.

The geographic region of West Liaohe River Valley is bracketed between 41°–45° N and 118°–124° E. It is an expansive drainage system comprising the mainstream of West Liaohe River, and its tributaries of Xar Moron, Laoha and Jiaolai Rivers. The region situates within the ecological fragile zone of North China. Synchronized

with the global warm-cold oscillation of Holocene, a number of prehistoric cultures emerged in succession in West Liaohe River Valley. They included Xinglongwa, Zhaobaogou, Hongshan, Fuhe, Xiaoheyuan, Lower Xiajiadian and Upper Xiajiadian Cultures. The patterns of settlement locations of these cultures showed considerable variation stemmed from their difference in adaptive strategies. Decision on where to build a settlement would have weighed the available adaptive strategies and the local environmental resources. The latter were effected by the global climatic oscillation. The goals of this paper are to extrapolate the environmental information from settlement location pattern and human adaptation, to reveal the environmental factors in the choices of settlement locations, and to discern the man-land relationship in the West Liaohe River Valley during prehistoric times.

## The environmental selections of settlement locations among the various archaeological cultures of West Liaohe River Valley

The terrain of West Liaohe River Valley features hills, valleys and plains. Landscape and altitude are the most important factors regulating the distribution of water, plant and animal resources, which are the necessary conditions for human adaptation and thus crucial to the decisions of settlement locations among human groups. This study is based on the landscape information of prehistoric sites documented in the *Atlas of Chinese Cultural Relics* (Inner Mongolian Fascicle). It delineates the relationship between settlement location and physiognomy. It generates topographic maps by using DEM, and further analyzes the data with GIS. In the following, we use Aoji Township of Aohan Banner, Inner Mongolia as an example to discern the effects of altitude in the decision-making of settlement location among the various archaeological cultures distributed in the West Liaohe River Valley. Table 1 suggests that the prehistoric sites of Aoji distribute mainly in lands situate between altitudes of 400m and 600m. Table 2 summarizes the local landscape of archaeological sites and calculates their percentages. It is evident that for the five millennia of prehistory spanning from Xinglongwa Culture to Upper Xiajiadian Culture, people in Aohan tended to select slopes and hillsides in immediate vicinities of rivers to build their settlements.

To summarize the above investigations, slopes and hillsides in altitude between 400–600m were the priorities of settlement location in West Liaohe River Valley during the prehistoric era. Mountain summits and valleys situate beyond the above altitude range were only used for settlements in certain cultural phases.

**Table 1** The percentage of Aoji settlements by altitude (%).

Cultural Phase	Altitude	400–500m	500–600m	600–700m	700–800m
	Xinglongwa		22.2	66.6	11.1
Zhaobaogou		25.0	50.0	25.0	
Hongshan		54.9	31.3	13.7	
Xiaoheyuan		75.0	25.0		
Lower Xiajiadian		23.0	51.1	20.2	3.3
Upper Xiajiadian		27.2	45.5	27.3	

**Table 2** Topographic types of Aohan settlements and their percentages.

Cultural Periods	Topographic												
	Slopes (Mountain slopes, low slopes, ridges, etc.)		Mountain summits		Tablelands		Riverine tablelands		Low-lands		Sandy land		Sum
	amount	%	amount	%	amount	%	amount	%	amount	%	amount	%	
Xinglongwa	48	81.3	2	3.4	9	15.3							59
Zhaobaogou	42	84.0	1	2.0	7	14.0							50
Hongshan	319	72.7	14	3.2	104	23.7	1	1.2			1	0.2	439
Xiaoheyuan	22	88.0			3	12.0							25
Lower Xiajiadian	893	43.2	625	30.2	523	25.2	27	0.3	2	3.3			2068
Upper Xiajiadian	53	86.8			6	9.8							61

### Choices of settlement location and environment

The necessary and sufficient conditions for the survival of prehistoric human groups included water, food supply and security. Fulfillment of these conditions was the primary concern in the decision-making of settlement location. Hillsides situated at altitudes between 400–600m provided easy access to water and food. They became the favorable environments for settlements sites. Unraveling the choices of settlement locations would lead to better understanding of the man-land relationship during prehistoric West Liaohe River Valley.

#### 1. Environmental analysis of choices of settlement locations in Xinglongwa and Zhaobaogou Cultures

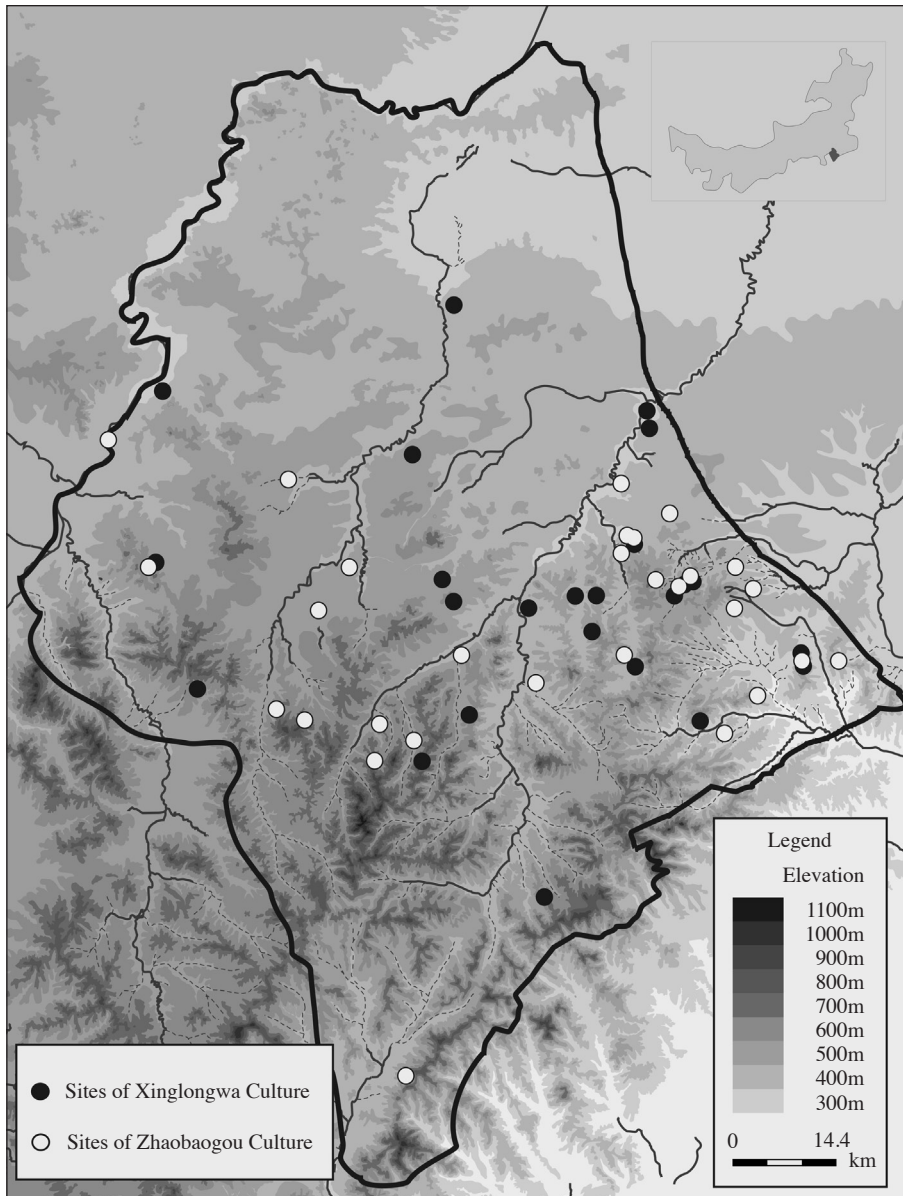
Xinglongwa and Zhaobaogou Cultures are dated to 8–6.5ka BP and 6ka BP, respectively. Their material remains show that these people subsisted mostly on a foraging strategy comprised of collecting, fishing and hunting (Liu 2001). This contention is independently confirmed by a paleo-diet study on Xinglongwa Site.

The subsistence practice suggested by paleo-diet study on human remains and micro-wear study on lithics (Wang

2006) is consistent to the faunal and floral assemblages yielded from archaeological excavations. The floral assemblage of Xinglongwa Site in Aohan Banner included walnut catalpa, a tree species most adaptive in environment of 15–30° C mean annual temperature (Kong 1985). Albeit today Aohan Banner situates in the zone of temperate semi-arid steppes, in 8–6.5ka BP its vegetation was dominated by mixed forest of coniferous and broad-leaved species. Corresponding to this mixed forest environment was the recoveries of faunal remains of deer, roe deer and pig from the same site. Deer and roe deer are animals active in the edge of mixed forest. Their presence indicates that Xinglongwa Site was located in an environmental interface of forest and steppes rich in faunal and floral resources. This type of environment naturally became the first choice for settlement location of foraging groups due to the simple reason of easy access to food sources.

#### 2. Hongshan Culture and primitive agriculture

Radiocarbon dating indicates that Hongshan Culture spanned in 6–5ka BP. Using site size and potsherd density, the Chifeng Sino-US Team developed a population index based on surface reconnaissance results of the area. The population index of Xinglongwa Culture was 0.16, that of



**Figure 1** The distribution of Xinglongwa and Zhaobaogou settlement sites in Aohan Banner, Inner Mongolia.

Zhaobaogou Culture was 1.06, and finally that of Hongshan Culture was 2.78 (Drennan et al. 2003). In addition to substantial population increase during the Hongshan phase, the artifact, faunal and floral assemblages suggest that primitive agriculture had emerged and played an increasingly important role in human adaptation.

The sixth millennium BP of Hongshan Culture was a period of Holocene Megathermal and “severe climatic fluctuation,” during which North China experienced significant temperature reduction (Kong 1992). The coverage of coniferous forest increased in the expense of broad-leaved deciduous forest. Although the climatic fluctuation did not change the overall climatic characteristics of Megathermal, it effected the distribution of faunal and floral species on which foraging groups depended. To cope

with this environmental stress, Hongshan people started the transition from foraging to food production. It is argued that primitive agriculture emerged under this kind of stress condition.

Hongshan Culture was a turning point in the prehistory of West Liaohe River Valley that a new environmental preference of settlement locations emerged. Compared to that of Xinglongwa and Zhaobaogou Cultures, the settlement density of Hongshan Culture increased, and its distribution expanded to the previously unused steppes. The co-existence of material remains attributable to agricultural and foraging activities from Hongshan sites suggests that during the early Hongshan phase, its settlements distributed in forest edges, which was similar to that of Xinglongwa and Zhaobaogou Cultures. However, Hongshan people gradually expanded their settlements into the previously unoccupied steppes during the middle and late phases (Figure 2).

### 3. Environmental choices of settlement locations of Lower Xiajiadian Culture

The number of settlement sites of Lower Xiajiadian greatly increased from the previous cultural phase. According to the *Atlas of Chinese Cultural Relics* (Inner Mongolian Fascicle), 154

pure Hongshan settlement sites were found in Aohan Banner; wherein the number of pure Lower Xiajiadian settlement sites increased more than nine folds to 1321. In addition to forest edges, Lower Xiajiadian settlements were also found on mountain tops and riverbank terraces. Hillside settlements comprised of 70.2% of the Hongshan settlement assemblage; they decreased to 43.2% during the Lower Xiajiadian phase. At the same time, the percentage of mountain top settlements greatly increased during the Lower Xiajiadian phase. Mountain top settlements comprised a meager 3.2% of the Hongshan site assemblage. They soared to 30.2% during the Lower Xiajiadian phase.

The fourth millennium BP of Lower Xiajiadian Culture was a period of dramatic climatic oscillation of lower

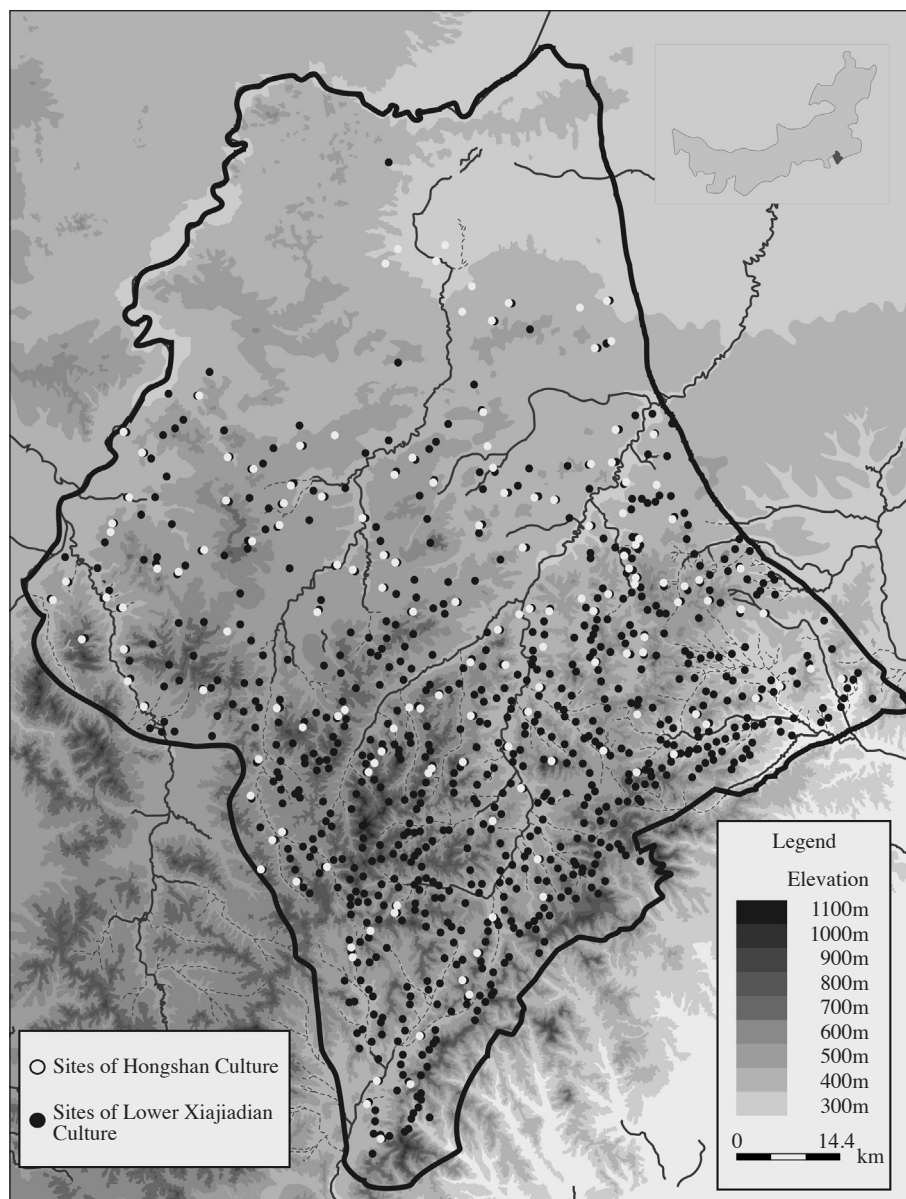
mean annual temperature and increased aridity. Under this cold and dry spell, species indispensable to human subsistence generally decreased in number (Wu 1992). In response to the environmental stress, the importance of food production increased in the expense of foraging. People became decreasingly reliance on natural food supply from foraging economy and increasingly reliance on food production from agriculture. Through the development of arable land, human groups greatly expanded their occupation space. This was exactly the reason for the expansion of the distribution of Lower Xiajiadian sites.

#### 4. Settlements and environment in Upper Xiajiadian Culture

Upper Xiajiadian Culture was dated to 3ka BP. Although the material remains suggest that the Upper Xiajiadian people lived a sedentary life and practiced agriculture, animal husbandry had fully developed. Therefore, the subsistence base of Upper Xiajiadian Culture could be classified as mixed economy of agriculture and animal husbandry, which was different from that of Lower Xiajiadian Culture.

Animal husbandry enhanced the food source of human group; nevertheless, its effect on environmental choice of settlement location was limited. Animal husbandry in Upper Xiajiadian was not independent of agriculture; instead, it developed in lock-step with agriculture. In other words, animal husbandry and agriculture were simultaneously practiced in the same communities or in the same households. Under this kind of mixed economy, animal husbandry was dependent on the sedentary agricultural life. A grazing zone was formed with a year-long settlement in the center. Analogous to modern communities of mixed economy, we speculate that the settlement was ringed by a zone of farmlands, which was in turn ringed by a zone of grazing fields.

The above analysis of environmental choices of settlement locations in prehistoric West Liaohe River Valley illuminates the human efforts in balancing subsistence needs and environmental constrains. Although past people



**Figure 2** The distribution of Hongshan and Lower Xiajiadian settlement sites in Aohan Banner.

might not have clear environmental perception, they knew exactly what were available in the environment and where the resources distributed. The decision of where to build a settlement, therefore, was a pursuit to find the point of highest density of food resources. Regardless of the food procurement technologies, which might include collecting, fishing, hunting and farming, selecting the optimal location for settlement was the first step toward ensuring satisfactory return for the subsistence effort. In prehistoric era, choices of settlement locations became an issue in the decision-making of human group when sedentary life emerged in Xinglongwa and Zhaobaogou phases. People of these cultures tended to build their settlements on forest edges that faced the expansive grassland. This kind of environment was not only where civilization emerged,

it was also the optimal settlement locations for foraging economy. The development of settlement pattern from Hongshan to Upper Xiajiadian Cultures was affected by the cold and dry climatic oscillation, the increasing dependence on agriculture, and population growth. Settlement locations expanded from forest edge to other environmental zones. In the universal pursuit of food resources, these cultures had different approaches, such as collecting, fishing, agriculture and animal husbandry. Agriculture emerged and became the main staple source of Hongshan people; while a mixed economy of agriculture and animal husbandry was pursued by the Upper Xiajiadian people. We can track the change in food procurement strategy from the dynamic relationship of settlement location and environment. A foraging economy was completely dependent on the natural environment; wherein, the addition of farming to the subsistence economy reduced human dependency on nature. The emergence of agriculture made possible an expansion of settlement sites from forest edge to other environmental spheres.

### The prehistoric man-land relationship in West Liaohe River Valley

The relationship between humans and land is one of the focuses of this paper. We are going to discern the man-land relationship through analyses of occupation span and environmental capacity.

#### 1. Occupation span and environmental capacity

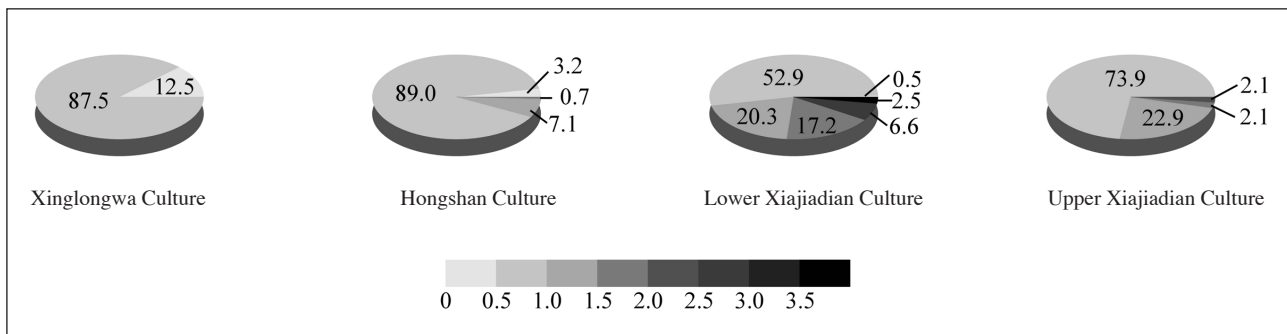
We use the thickness of cultural deposition to determine the time spans of settlement occupations. Thickness of cultural deposition is not a precise measure of occupation span; it cannot be used to compare individual sites. However, if we focus on comparing the average thickness of the settlements of different cultural phases within a given region, the results have certain significance. Formation of occupation deposition was a process of daily accumulation of domestic refuses punctuated by the ruins of occasional collapse of structures. Because every cultural deposition comprised of these gradual and sudden events, the thicker a deposition was, the longer the occupation would be.

We continue here to use Aohan Banner for illustration. To simplify the problem, we choose to analyze the single

component sites only. In general, there was an increase in occupation spans through cultural phases of the region. Although the majority of occupation spans of the settlement sites of the four cultural phases under study fell in between 60 and 120 years, sites occupied for less than 60 years comprised of 12.5% of the total Xinglongwa sites, that of Hongshan Culture comprised of 3.2%, that of Lower Xiajiadian Culture comprised of 0.5%, and finally no Upper Xiajiadian site was occupied for less than 60 years. On the contrary, no Xinglongwa site was occupied for more than 120 years, but these long occupations comprised of 7.8%, 46.6%, and 27.1% of the site assemblages of Hongshan, Lower Xijiadian and Upper Xiajiadian Cultures, respectively (Figure 3).

Settlements are places where people reside and their locations are the results of environmental choices. Environmental capacity provides human beings the conditions for living. When population density maintains balance with environmental resources, that is to say, the environmental capacity has not been exhausted; people tend to stay in one place. On the contrary, when population density reaching and exceeding the carrying capacity of environment, people tend to migrate and relocate.

Migration was one of the ways to relief the pressure on environment by past human groups. It was also an indication that the carrying capacity of environment had reached. Foraging was the main adaptive strategy of Xinglongwa and Zhaobaogou Cultures, whose settlement relocation was frequent. On the contrary, agriculture was the main adaptive strategy of Hongshan and Lower Xiajiadian Cultures, whose settlement relocation was less frequent. Livestock became one of the important components of food production during Upper Xiajiadian Culture; but it was a practice of animal husbandry dependent on sedentary agricultural life. Therefore, settlements of Upper Xiajiadian were relatively stable. Obviously, foraging and farming needed different environmental conditions and capacities. Foraging economy depended on natural faunal and floral resources. The frequent relocation of Xinglongwa and Zhaobaogou Cultures suggests the insufficiency and slow recovery of natural animal and plant resources in West Liaohe River Valley, even though the population of the time was low. Hongshan Culture witnessed the emergence of primitive agriculture. In spite of population increase,



**Figure 3** The thicknesses of cultural depositions of the settlement sites in Aohan Banner.

Hongshan settlements had longer occupation spans and higher stability than that of Xinglongwa and Zhaobaogou Cultures. Agriculture altered the man-land relationship. It was not a practice of simple exploitation on the naturally available resources. It involved the modification of environment to enhance the propagation of specific species under human control. Through the production of food, people could multiply the number of their own kind in a sedentary setting. Because of that, Hongshan settlements were able to maintain stability and settlement relocation was infrequent. In addition, the occupation spans of Hongshan, Lower Xiajiadian and Upper Xiajiadian settlements were relatively long. It was an indication that agriculture was practiced within the carrying capacity of the West Liaohe environment. There was no need for the people to acquire sufficient space for survival through migration.

## 2. Settlement movement and environmental disturbance

West Liaohe River Valley is a region of fragile environment. Constant human activities would have seriously disturbed the environment, which might result deprivation of food resources leading to disruption of settlement occupation. The studies on continuation of settlement use and movement provide information about environmental disturbance.

The archaeology of Aohan Banner yielded an assemblage of 60 Xinglongwa settlement sites. Among them, only one site had been occupied throughout all the successive cultural phases from Xinglongwa to Upper Xiajiadian. Emergence of year-long settlements was dependent on reliable food supply. Regardless of the food procurement strategy, discontinuation of occupation was the consequence of disruption of food supply. In this cause and effect relationship, settlements and environment were closely linked. Following human disturbance to the environment, coupled with global climatic oscillation, local environment deteriorated to the degree that human demand for food could not be adequately met. The option for the human group was to terminate the occupation, pursued new locality of rich food resources, and relocated the settlement to environment that had not been disturbed.

Migration is one of the ways how humans confront the challenge of environmental deterioration. The prehistory of Aohan Banner shows that many of the settlements went through cycle of occupation, abandonment and reoccupation. People left the settlement during a cultural phase, and after a lapse of many years people returned in a cultural phase of later times. This is an indication of the process of environmental deterioration and recovery. The richness of food resource was closely connected to the balance of ecosystem. Stability of ecosystem was determined by its recovering ability. Only one of the many prehistoric settlement sites of Aohan Banner had been continuously occupied in all the cultural phases. 49 settlement sites were abandoned after the Xinglongwa phase, fallowed, and reoccupied at later phases; whilst 10 sites were never reoccupied. The prehistoric settlement sites of West Liaohe River Valley were seldom occupied continuously throughout the

prehistoric era; yet examples of cultural rupture were also rare. This observation indicates that human disturbance to the environment did not completely destroy the environment. Intensification of human food procurement might have caused environmental deterioration. Upon the retreat of humans, the environment could start the process of recovery. Given time, it might again become a favorable option in human settlement location.

Investigations in occupation span and settlement movement allow us to argue that man-land relationship of prehistoric West Liaohe River Valley maintained a relative equilibrium. The foraging economy of Xinglongwa and Zhaobaogou or the agricultural economy of Hongshan and the successive cultural phases had never exhausted the carrying capacity of the entire region.

## The conclusion

To sum, prehistoric settlements were the results of interaction between humans and environment. The above discussions showed that this process was a long and complicated one. The primary force of the process was the environment coupled with human adaptive strategy. People of West Liaohe River Valley started their sedentary life on forest edges. From the Hongshan phase to the Upper Xiajiadian phase, climatic oscillation encouraged the emergence and intensification of agriculture. Human settlements began to extend beyond forest edges and diffused into the steppes. Settlement occupation was by no means continuous. Changes in environment and human subsistence strategy would prompt settlement movement. On the surface, settlement movement was driven by human pursuit of food, but the underlying force was the carrying capacity of environment. Environmental capacity was viewed as the ability of environment to sustain the people living in it. Environmental constraints exacted on collecting, fishing, hunting, and agriculture were rated from high to low. One of the manifestations of changing man-land relationship was the occupation span of settlement. The occupation span of settlement gradually increased from Xinglongwa Culture to Upper Xiajiadian Culture was viewed as the results of this man-land dynamics. To conclude the discussion, we emphasize that there was no disharmony in the man-land relationship in West Liaohe prehistory in terms of population density and the changing adaptive strategy in reaction to environmental change.

## References

- Drennan, Robert D. et al. 2003. *Approaches to regional demographic reconstruction*. In the Chifeng International Collaborative Archeological Research Project [ed]. 内蒙古东部 (赤峰) 区域考古调查阶段性报告 (Regional archeology in eastern Inner Mongolia: a methodological exploration). Beijing: Kexue Chubanshe. pp. 152–65 and 178.
- Kong, Zhaochen 孔昭震 et al. 1985. 内蒙古敖汉旗兴隆洼遗址植物的初步报告 (A preliminary report on the flora

- of the Xinglongwa Site in Aohan Banner, Inner Mongolia). *Kaogu* 考古 (Archaeology) 10: 873–4.
- Kong, Zhaochen 孔昭宸 et al. 1992. 中国北方全新世大暖期植物群的古气候波动 (Paleoclimatic fluctuations reflected in flora of Holocene Megathermal in the northern part of China). In Shi, Yafeng 施雅风 [ed]. 中国全新世大暖期气候与环境 (The climates and environments of Holocene Megathermal in China). Beijing: Haiyang Chubanshe. pp. 48–65.
- Liu, Guoxiang 刘国祥. 2001. 兴隆洼文化聚落形态初探 (A preliminary probing into the settlement pattern of Xing Long Wa Culture). *Kaogu yu Wenwu* 考古与文物 (Archaeology and cultural relics) 6: 58–67.
- Qiu, Shanwen 裘善文 et al. 1992. 东北西部沙地古土壤与全新世环境 (Palesols of sandy lands and environments in the western plain of Northeast China during Holocene). In Shi, Yafeng 施雅风 [ed]. 中国全新世大暖期气候与环境 (The climates and environments of Holocene Megathermal in China). Beijing: Haiyang Chubanshe. pp. 153–60.
- Shi, Yafeng 施雅风 et al. 1992. 中国全新世大暖期气候与环境的基本特征 (Basic features of climatis[sic] and environments during Holocene Megathermal in China). In Shi, Yafeng 施雅风 [ed]. 中国全新世大暖期气候与环境 (The climates and environments of Holocene Megathermal in China). Beijing: Haiyang Chubanshe. pp. 1–18.
- Wang, Xiaoqing 王小庆. 2006. 兴隆洼与赵宝沟遗址出土细石叶的微痕研究 — 兼论兴隆洼文化和赵宝沟文化的生业形态 (The micro-wear analyses on the micro-blades unearthed from Xinglongwa and Zhaobaogou Sites – also on the subsistence types of Xinglongwa and Zhaobaogou Cultures). In School of Cultural Heritage, Northwest University [ed]. *Xibu Kaogu* 西部考古 (Western China Archaeology), vol. 1. Xi'an: Sanqin Chubanshe. pp. 59–76.
- Wu, Jihua 武吉华 and Zheng Xinsheng 郑新生. 1992. 中国北方农牧交错带 (赤峰市沙区) 8000 年来土壤和植被演变初探 (Preliminary study on the changes of soils and vegetation in the semi-agricultural and semi-pastoral zone in the northern China since 8000 years ago). In Zhou, Tingru 周廷儒 [ed]. 中国北方农牧交错带全新世环境演变及预测 (Changes and predication of environments of the semi-agricultural and semi-pastoral zone in the North China in Holocene). Beijing: Dizhi Chubanshe. pp. 55–70.

### Postscript

The original paper written by Han Maoli 韩茂莉 was published in *Kaogu Xuebao* 考古学报 (*Acta Archaeologica Sinica*) 2010. 1: 1–20 with seven illustrations and five tables. The present version is translated into English by Lee Yun Kuen 李润权.