



HAL
open science

Changing settlement patterns and subsistence strategies in Northeast China: Results of the Yueliang regional survey

Pauline Sebillaud, James Williams, Xiaoxi Liu, Lixin Wang

► **To cite this version:**

Pauline Sebillaud, James Williams, Xiaoxi Liu, Lixin Wang. Changing settlement patterns and subsistence strategies in Northeast China: Results of the Yueliang regional survey. *Archaeological Research in Asia*, 2021, 25, pp.1-19. 10.1016/j.ara.2020.100250 . hal-03086087

HAL Id: hal-03086087

<https://hal.science/hal-03086087v1>

Submitted on 15 Dec 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial 4.0 International License

Changing Settlement Patterns and Subsistence Strategies in Northeast China: Results of the Yueliang Regional Survey

Pauline Sebillaud, James Williams, Liu Xiaoxi, Wang Lixin

Pauline Sebillaud

French National Center for Scientific Research (CNRS), East Asian Civilizations Research Center (CRCAO, UMR 8155), 52 rue du Cardinal Lemoine, 75005, Paris, France.

Corresponding author: pauline.sebillaud@college-de-france.fr.

Secondary affiliation: Jilin University, School of Archaeology, 2699 Qianjin Avenue, 130012, Changchun, PRC.

James Williams

Renmin University of China, Department of Archaeology and Museum Studies, 59 Zhongguancun Avenue, Haiding, 100872, Beijing, PRC.

jamesw1220@gmail.com

Liu Xiaoxi (刘晓溪)

Heilongjiang University, Faculty of History, Culture and Tourism, Archaeology Department, 74 Xuefu Street, 150080, Harbin, PRC.

114859571@qq.com

Wang Lixin (王立新)

Jilin University, Research Centre for Chinese Frontier Archaeology, 2699 Qianjin Avenue, 130012, Changchun, PRC.

wanglixinjl@qq.com

Funding

This work was supported by the Social Science Foundation of the Chinese Government [grant number 15ZDB055].

Changing Settlement Patterns and Subsistence Strategies in Northeast China: Results of the Yueliang Regional Survey

Abstract

Between 2012 and 2016, a systematic regional survey was conducted around the Xinhuang and Yueliang Lakes in northwest Jilin, Northeast China. This paper investigates the results of that fieldwork. We are especially interested in the degree to which the settlements are integrated with one another. The spatial analysis of the results shed new light on the local trajectory of settlement patterns and subsistence strategies from pre-Neolithic to the historical era, and provides data about the current and ancient environment and socio-economic changes in this region and how they differ from other nearby regions.

Keywords

Settlement pattern, systematic regional survey, Northeast China, subsistence strategies

1. Introduction

How environmental and social conditions impact settlement patterning is not a focus of most Chinese archaeology, because of its orientation towards historiography (Falkenhausen 1993), and often, “regional approaches in China are focused on identifying cultures and defining their geographical extent rather than to study settlement patterns” (Shelach 2002: 50). In contrast, far outside the core regions of historical China, several systematic regional surveys have been carried out in Northeast China, focusing on the emergence and development of complex societies from an anthropological perspective. So, what could a new survey add to the knowledge of settlement patterns in this region? Northeast China is often conceived as one large unit, but it is in fact as vast as two or three European countries (about 350,000 km²). The previous surveys all focused on the southern part of the Northeast Chinese Plain, on the region located west of the Liao River, known as “Liaoxi”, which includes western Liaoning province, and the southeastern part of Inner Mongolia. So far, no well-designed systematic survey has been carried out in Jilin and Heilongjiang provinces, as well as in the eastern part of the Liaoning province (the “Liaodong” region). Outside of the well documented Central Plains, where historical considerations sometimes restrain archaeological research questions, Northeast China, with its unwelcoming climate and diverse landscapes, provides interesting contexts to look at the solutions created by past human groups to survive and grow. The diversity of landscapes in this region creates the ideal setting for comparison within a large region as well as beyond.

From 2012 to 2016, the Houtaomuga archaeological project team carried out four seasons of a systematic regional survey on 284 km² around the Yueliang Lakes, in northwestern Jilin Province. Based on this data, we better understand the settlement patterning in this region and the changing social organization over time; we are also able to make comparisons to the existing surveys to better understand the macroregion.

This research is aimed to investigate the growth and development of human communities within Yueliang region. The project also aims to elucidate how those social changes intersect with the unique trajectory of subsistence strategies found at Yueliang. Finally, we aim to place Yueliang into broad comparison with other similar projects within the region and beyond.

2. Environment

In northwestern Jilin, the Song-Nen Plain is formed by the alluvial deposits of the Songhua and Nenjiang Rivers. The Yueliang survey area is located in the downstream of the Tao'er River, where this tributary merges into the Nenjiang River (Fig.1). The area as a whole is very flat (less than 2% slope, between 114 and 156 m on over 560 km²). Poor water flow created numerous lakes and marshes. Based on topography and vegetation, the area can be divided into two types: north-south orientated terraces on the edge of the lake and low ancient river beds. Due to the effects of man-made erosion and arid climate in modern times, saline-alkali areas with sparse vegetation replaced these marshes (Liu et al. 2016).

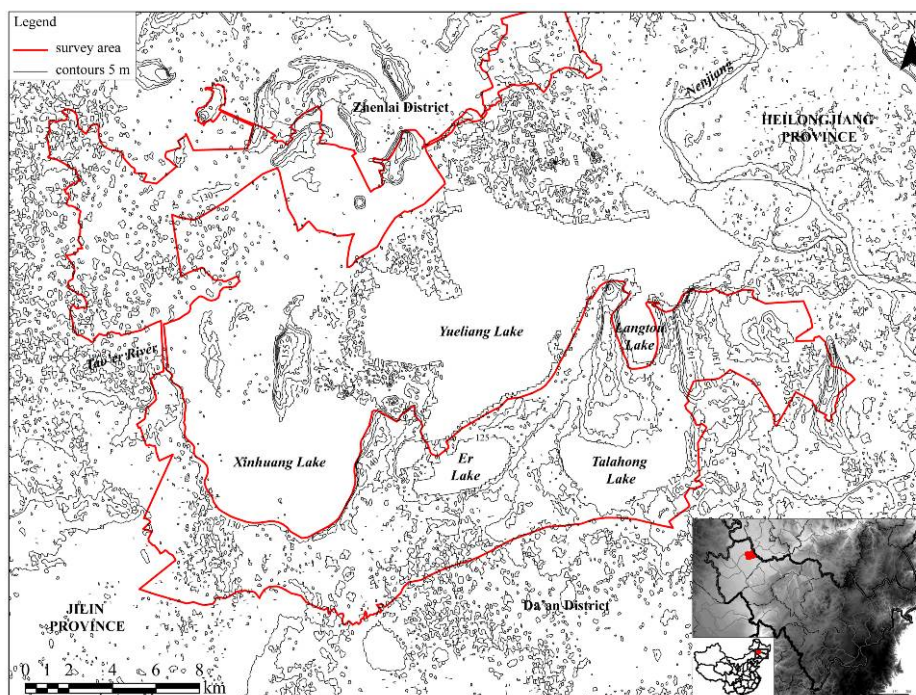


Figure 1. Topography of the Yueliang survey area

The region has been greatly affected by dams and agricultural water use in recent decades. Therefore, the precise hydrological conditions during the survey differ from the ancient ones. Despite this, we are confident that it does not impact the results of the survey. For example, the submerged zones were not accessible to survey, but because these were former river beds and flood plains, they were probably not suitable for ancient occupation. Additionally, we attempt to take into consideration the impact of these changes. For example, as we mentioned above, the marshy environments of the past have been transformed into plains with sparse vegetation. Finally, all of the intensive agricultural activity that has transformed the landscape is beneficial to the survey, as it offers good observation conditions and brings artifacts to the surface through plowing.

The main soil type in the survey area is phaenozems, followed by chernozems. There are also some patches of arenosols, gleysols and solonetz (FAO 2006; Nachtergaele and al. 2012). These are all fine unconsolidated sandy deposits, transported by water and wind and highly subject to erosion. These soil types suggest relatively stable and productive soils since the Holocene. The sources of the lithic raw materials have yet to be identified. Some authors suggest that the raw materials are evidence of long-distance exchanges (Doelman et al. 2014; Liu 2019).

3. Method

“Survey is not simply a poor substitute for archaeological excavation, or meant only to discover sites for us to excavate. In fact, it is uniquely able to address some research questions that excavation alone will never answer” (Banning 2002: 1). The Yueliang project was aimed to shed light on the distribution and evolution of settlement patterns in the area.

The field methods used in this project are only a slight variation on the successful collection strategies used by several surveys throughout China and Mongolia and thus can provide data sets that are directly comparable (Chifeng 2003; Drennan et al. 2004; Teng 2009; Drennan et al. 2014; Peterson et al. 2014; Williams 2014; Williams 2017a; Williams 2017b). Images from Google Earth were stitched together used to produce A4 sized field walking maps with sufficient resolution to record site location.

The survey work was mainly carried out in cornfields in April, just before plowing, when visibility was excellent. During survey, the team was divided into 3-4 persons groups covering the landscape at 50 m spacing. Where more than two sherds were found within 20 steps, a 50x50 m collection unit was implemented, and a collecting strategy chosen. Where the sherds were not too abundant (less than roughly 0.5 sherds per m²), they were thoroughly collected (general collection). Where the sherds were very abundant (hundreds or thousands of sherds within a 50x50 m unit), a dog-leash sample was made by collecting all sherds inside 10 m² circles, it could take between 1 and 5 circles to reach 30 sherds. Thirty sherds is an appropriate sample to distinguish the proportions of different periods found in the collection unit (this is referred to as a systematic collection). This method of general and systematic collection has been used by several other surveys in the region (Chifeng 2003; Drennan et al. 2004; Teng 2009; Drennan et al. 2014; Peterson et al. 2014; Williams 2014; Williams 2017a; Williams 2017b). Each collection was marked on a satellite image and on the OvitalMap geopositioning application. The information was entered into a FileMaker database (number of the unit, coordinates, collection type, landscape characteristics, etc.).

The sherds, bagged by collection units, were all counted, dated, and recorded. Most of the collected materials were body sherds; the best preserved pottery rims, bases and decorated sherds, stone tools and metal objects were then isolated and recorded to be individually photographed later on. The quantitative and qualitative information was entered into the database. The definition of the pottery fabric attributed to each period was further confirmed and refined using petrographic analysis on thin sections of type sherds of each period.

The recording on satellite maps was redrawn using AutoCAD. The sherds quantity for each period was processed through an Excel table, and all the information was imported into ArcGIS, using CGIAR DEM or satellite imaging as a base map. The distribution and density of sherds for each period was calculated and mapped. Flooding simulations were used to assess the highest possible water level during each period.

The concept of “site” in the following study is conceived as “a high-density cluster of cultural remains, does not necessarily correspond with a discrete ancient or prehistoric settlement or other locus of activity” (Banning 2002: 18). In other words, a “site” is an area with dense materials, limited in space, and also limited in time, where the remains belong to one or several determinable periods (Dabbas et al. 2006: 22). The survey methodology uses collection units, when several units are connected or very close, we consider this a “site”. Although we do understand that the etic “site” designation is somewhat arbitrary (Dunnell and Dancey 1983), we find the concept of site useful for the clarity of discussion and analyses. Statistical analysis on the sites’ area (rank-size) has been carried out for each period. Comparison between the rank-

size curves is used to identify changes in settlement dynamics (Drennan and Peterson 2004). Rank-size analysis has been used on various human geography and archaeological samples; in the present paper, we use it as an indication of the level of integration of the settlements' systems (Johnson 1980).

4. Results: Trajectory

The survey area is 560 km², in which water covers 276 km², the actual surveyed area is 284 km². A total of 4266 collection units were made (3492 general collections and 774 systematic collections). The total surface of the collections is about 10,665 m² (1.0665 ha, 3.75% of the surveyed area), and 152,245 pottery sherds were collected. A total of 73 sites were identified, including 61 newly discovered sites (Fig. 2, Table 1 and 2).

The understanding of the archaeological cultural sequence in the area is based on previous excavations and well-documented typologies; the collected materials are divided into nine periods. Prior to the Bronze Age, we use the archaeological culture names and a simple sequence in this study. Since there is considerable debate about the defining features of the Neolithic and the existence of a Mesolithic period, we attempt to avoid the term "Neolithic" as a chronological marker.

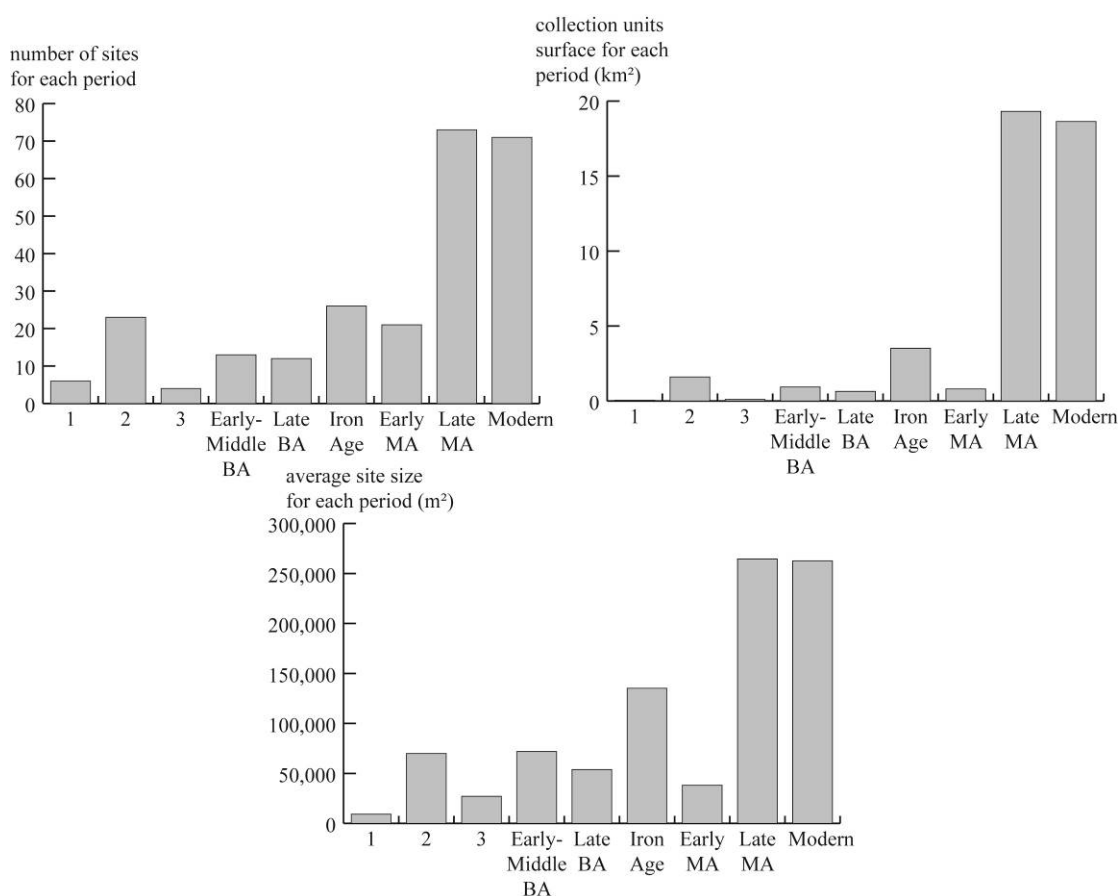


Figure 2. The Yueliang survey data: number of sites, collection units surface and average site size by periods

Overall, most of the sites are on phaeozems and chernozems, and only a few sites are within the range of gleysols. During all periods, the human groups have avoided alkaline soil (arenosols) which are not easy to drain. The distribution always favors aeolian sediments and loess, presumably because of their utility for agriculture or the diversity of wild plant species that these soil types will support.

4.1. Initial Occupation: Period 1 (10,900-8000 BC)

The first human activities detected in this region coincide with the Early Holocene and are represented by the earliest pottery in Northeast China, and one of the earliest in northeast Asia (Wang and Sebillaud 2019). The sherds of this period are vegetable tempered yellow-brown paste, belonging to the Houtaomuga phase I culture and the Changtuozi 1 type (10,900-8000 BC) (Jin et al. 2011).

One of the most exciting results of our survey is the identification of six sites (five previously unknown) with these very early sherds, present in 18 collection units (127 sherds on 4.5 ha or 45,000 m²). These sherds were associated with large quantities of small lithic tools, mostly bladelets, scrapers, bladelets cores, and arrowheads. The six sites of this period are very small, with an average size of 9284 m² (0.93 ha). Four of the six sites belonging to this period are distributed in the northwestern part of the survey area, and the other two are located in the southwest, along the shores (Fig. 3). The largest site is Houtaomuga. This distribution leaves open vast available land resources. The distribution of sites in the north is relatively dense, which may explain why these four sites are quite small. There are only two sites in the south, Houtaomuga is the dominant center. The water level during Period 1 was not higher than 130 m, this is the highest possible level for any period, and a high water level could also explain the scarcity of the sites. The rank-size curve for the Period 1 sites is slightly convex (the coefficient of A is low), which shows a low degree of integration (Fig. 4). During this very early period, no regional settlement organization seemed to have formed yet, and the activity and impact of the few human groups inhabiting this landscape is very scarce.

The excavations of the Houtaomuga site show the absence of architectural features during this period. The fauna remains were dominated by shells and fish. No traces of tools were found on the large quantity of unearthed shells. Around 8000 BC, most of the plants belonged to meadow vegetation (Tang et al. 2013). Residue analysis shows that the pots were used for cooking freshwater animals (Kunikita et al. 2017; Wang and Sebillaud 2019). The abundance of microlithic tools collected during survey and the relative rarity and uniformity in shape and facture of these early pottery sherds points out to mobile foraging groups (Bar-Yosef and Belfer-Cohen 1989: 456). The subsistence was most probably mainly based on shell collection and fishing.

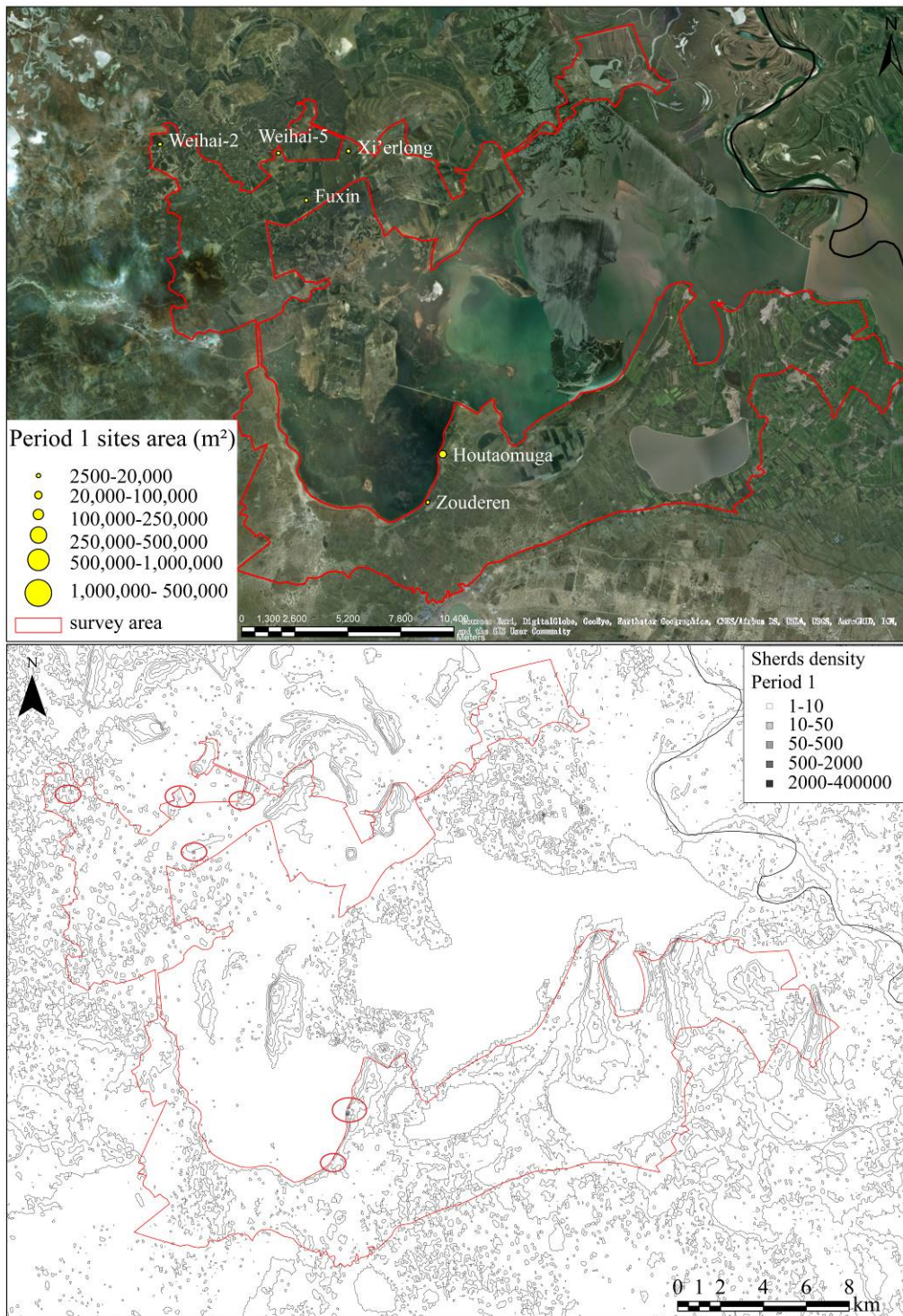


Figure 3. Distribution of Period 1 remains

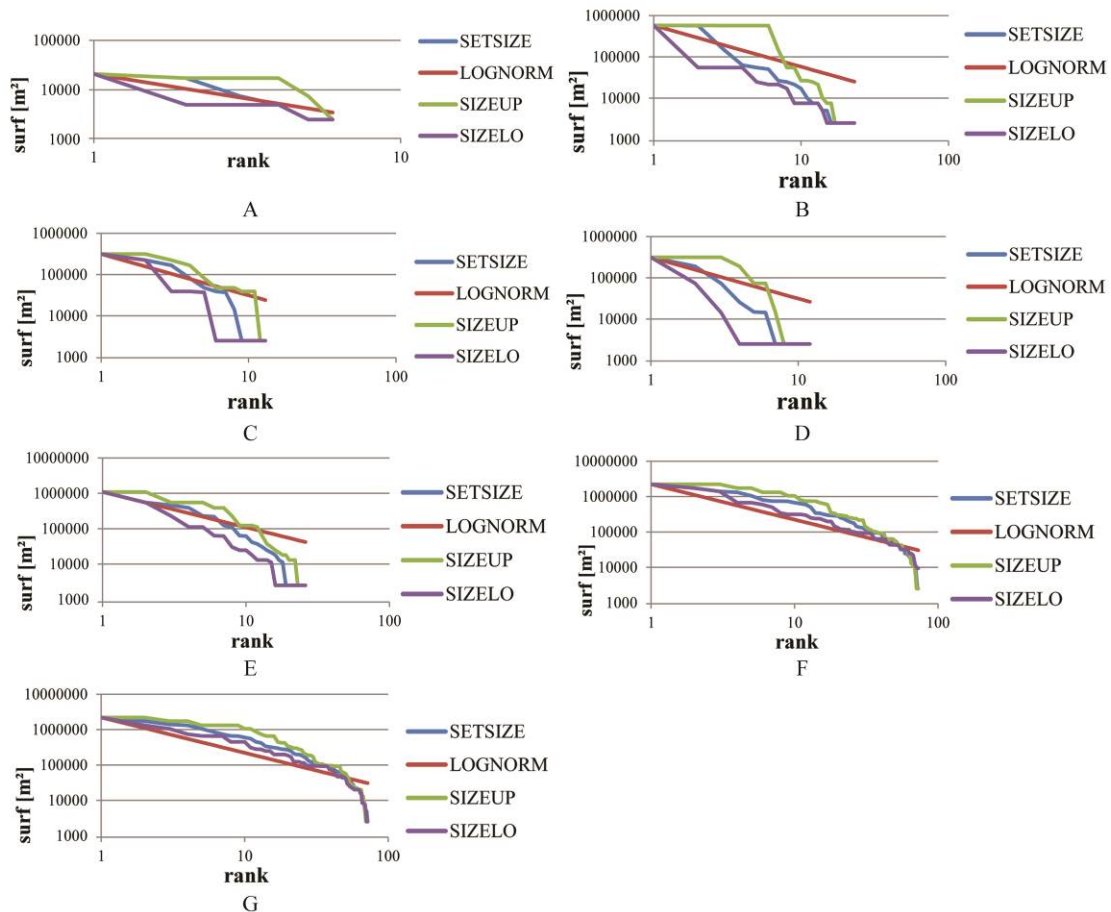


Figure 4. Rank-size graphs for each period of the Yueliang survey (67% confidence)
 A. Period 1, $n=6$, $A=0.094$; B. Period 2, $n=23$, $A=-0.497$; C. Early to Middle Bronze Age, $n=13$, $A=-0.289$; D. Late Bronze Age, $n=12$, $A=-0.791$; E. Early Iron Age, $n=26$, $A=-0.312$; F. Late Middle Age, $n=73$, $A=0.254$; G. Modern period, $n=72$, $A=0.249$.

4.2. Period 2: Increasing Population (8000-3500 BC)

The Period 2 pottery is made of shell tempered brown-yellow sandy clay, sometimes with printed nails or added cordon patterns, similar to the material of Shuangta phase I (8000-7000 BC), Huangjiaweizi culture (4100-3600 BC) and mostly attributed to the culture of Houtaomuga phase II (8000-4300 BC) and III (4300-3500 BC) (Wang 2018).

One hundred and fifty-two collection units (1843 sherds on 38 ha or 380,000 m²) were identified, still often associated with large quantities of bladelets, scrapers, bladelets cores and arrowheads. The Period 2 sites are larger, with an average size of 69,940 m² (6.99 ha), and are distributed along the shores (Fig.5). One large site is located in the north and the southeast. In the central and northern areas, there are more small sites creating a relatively uniform distribution. The southern sites are sparser. This development happened during a climatic improvement: around 7000-3000 BC, the temperature increased by 1 to 3.5 °C; the rainfall increased too, by 30 to 400 mm (Yu et al. 2013; Zhao et al. 2013). The water level was not higher than 128 m; this slightly lower level exposed more of the lakeshore, creating more options land-use than the previous period.

Despite the chronological gap existing with the previous period, sites occupied during Period 1 are still used. The relatively high topography of these locations shows that places less susceptible to flood were continuously preferred.

The rank-size curve initially shows a convex sequence linked to the largest sites, but most of it is concave (relatively high A coefficient) (Fig. 4). The degree of integration has strengthened to some extent. The settlements experienced a relatively

simple economic development, with low levels of competition.

Between 4300 and 3500 BC, the first architectural features appeared at Houtaomuga, the first “village” in northwest Jilin. Excavations data show that the plants and animals used by then were all wild (Wang et al. 2017). The survey data also show an abundance of microlithic tools reaffirming a subsistence economy mainly based on fishing, hunting and gathering.

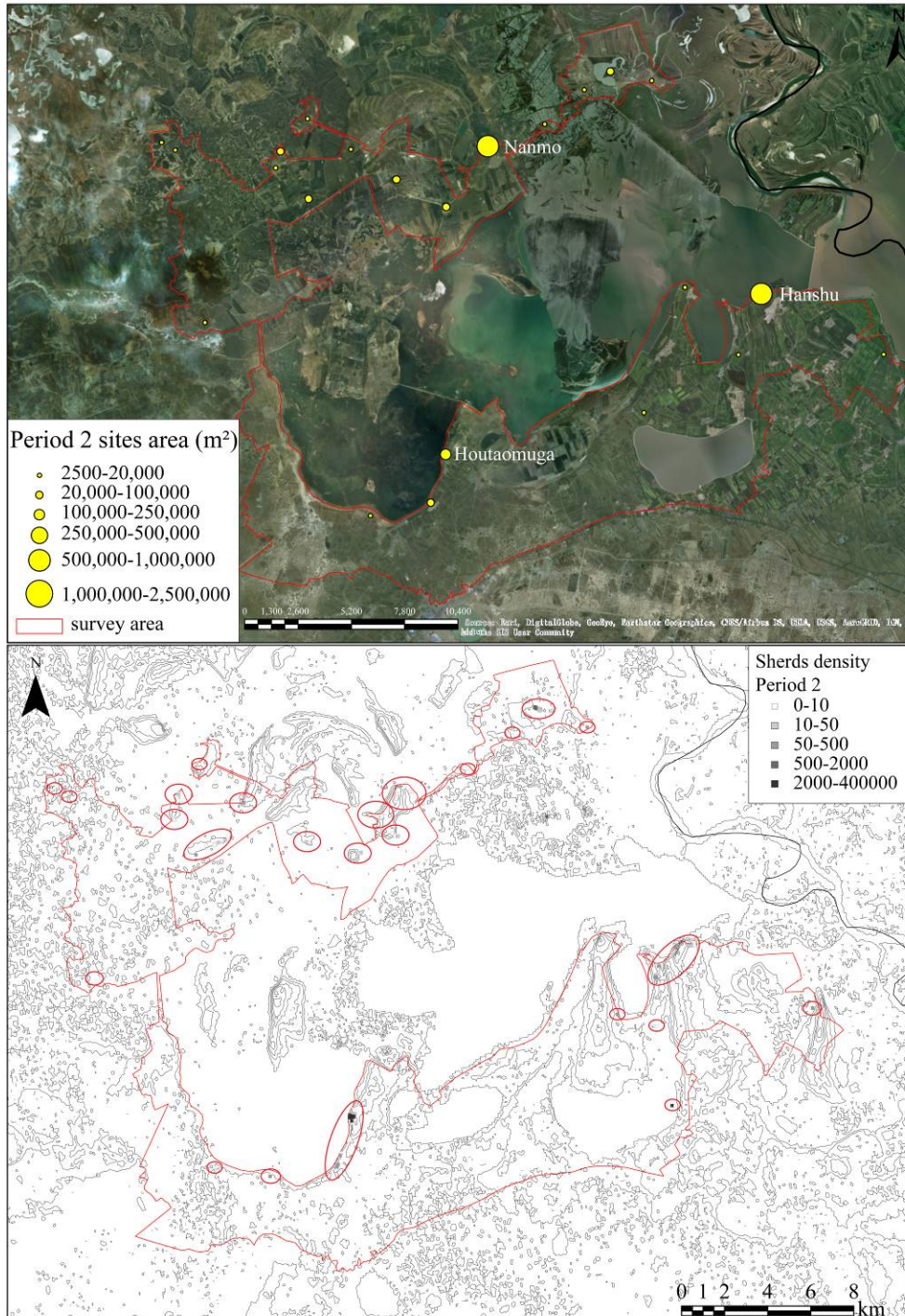


Figure 5. Distribution of Period 2 remains

4.3. Period 3: Initial villages (3500-2900 BC)

The Period 3 sherds are red-brown, tempered with fine shell powder and sand, close to the Houtaomuga phase IV culture (3500-2900 BC).

Only 27 collection units (432 sherds on 6.75 ha or 67,500 m²) belong to this period, which is not surprising since the period is much shorter than the prior periods. Given that this period is 600 years long, the intensity of occupation is roughly the same, however, it is organized slightly differently. The sites are smaller, with an average of 27,140 m² (2.71 ha). Four sites are all on the lake shores: one north and three south of the lakes (Fig. 6). Two of these sites were occupied during the previous period, but their size has substantially diminished.

While the occupation of the hinterland decreased, the village at Houtaomuga continued to develop, inside a double ditch enclosure, the architectural features have more elaborate superstructures (Wang et al. 2017). The faunal record is marked by an important change, as auroch (*Bos primigenius*) bones appear in large quantities, attesting to intense hunting practices and an important change in the subsistence strategies (Cai et al. 2018). The survey data show that the population aggregated on a higher elevation, within what by this point has all of the characteristics of a typical village. There is evidence of the production of varied vessel shapes and sizes, pointing to the appearance of a domestic or household-based economy and longer-term occupation of the site than in previous periods.

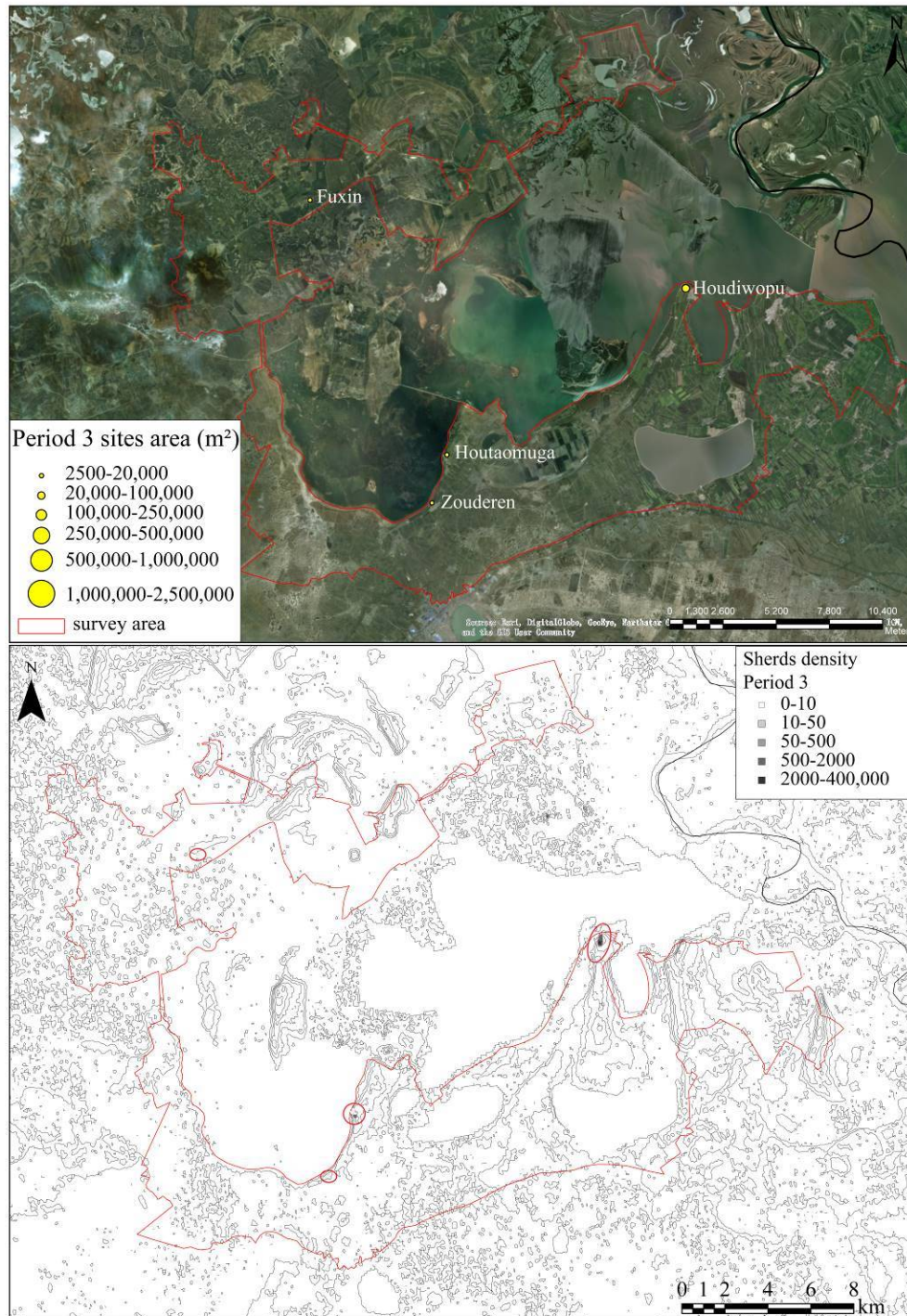


Figure 6. Distribution of Period 3 remains

4.4. Early to Middle Bronze Age (2000-1000 BC)

The Early to Middle Bronze Age period corresponds to the Xiaolaha (ca. 2000-1600 BC) and Gucheng (ca. 1300-1000 BC) archaeological cultures. The sherds of the Xiaolaha type are grey to black, coarse and polished. Gucheng style sherds have a brown coarse paste and a corded surface, often bearing added cordons, sometimes in association with geometrical comb motifs.

One hundred and sixty-eight collection units (2593 sherds on 42 ha or 420,000 m²), forming much larger sites (71,870 m² or 7.19 ha on average), belong to this period. Most of the sites are located in the east (Fig. 7). The northeastern sites are relatively small and evenly distributed. The larger sites, Hanshu and Houdiwopu, are

located in the southeast and could have had a hierarchical relationship or different functions than the other average-size sites. This distribution could have played a role in controlling the Nenjiang River communication axis. In the north, the distance between these sites is 0.8-2.6 km, they are aligned along the shore, outlining a path to this river.

The rank-size curve for this period is mostly close to a log-normal distribution (low A coefficient) (Fig. 4), which indicates that there may be a settlement system with a higher degree of regional integration, with more hierarchical social organization and integrated economy. In the right part of the curve (small sites), the concave aspect suggests that a dominant center may appear in this area. The emergence of this new settlement pattern takes place during the end of the Holocene warm period (2300-1800 BC), making way for a colder and drier period (1800 BC-300 AD) (Yu et al. 2013; Zhao et al. 2013). The water level was lower (not higher than 124 m), freeing a lot of new land.

The excavations at the Hanshu site show the appearance of domestic animals and plants during this period. But wild plants, mammals, fish and shell constitute the majority of the samples (Chen et al. 2011). Many net weights were found during survey, evidence of the importance of net-fishing practices. The sherds show different quality of fabrics (fine and coarse) and vessels sizes, depending on functions, probably linked to developments of household activities and changes in diet and eating practices. In this new settlement organization, subsistence was still mainly based on fishing and hunting.

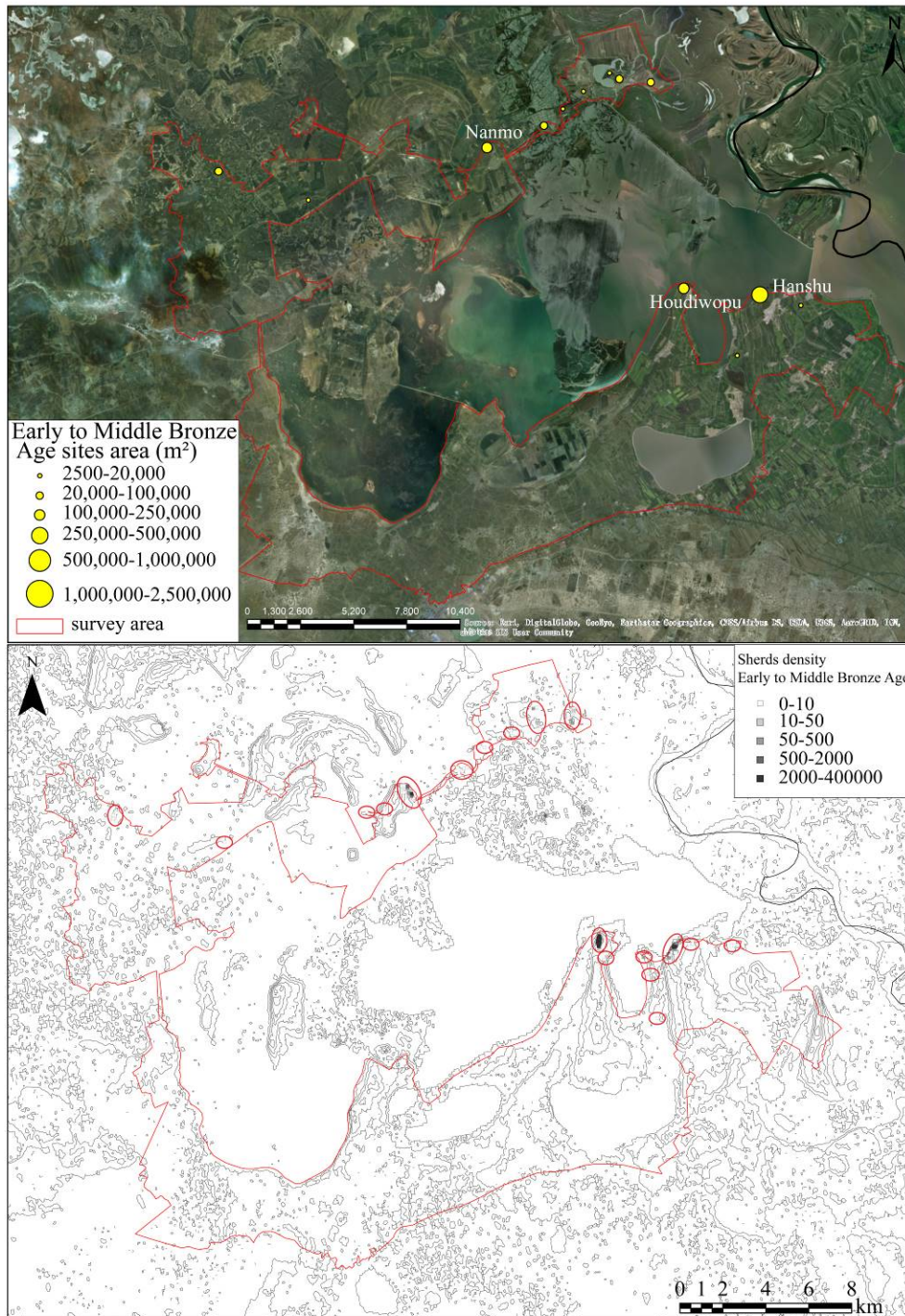


Figure 7. Distribution of Early to Middle Bronze Age remains

4.5. Late Bronze Age (1000-500 BC)

During the following phase, the Baijinbao culture, sherds are mostly made of yellow-brown fine paste, polished and decorated with geometrical and animal themes comb patterns.

One hundred and fifty-nine collection units (4370 sherds on 39.75 ha or 397,500 m²) belong to this period. The 13 sites are in continuity with the previous period. They are slightly smaller, with an average of 53,871 m² (5.39 ha). Their distribution remains basically the same, stable water levels (not higher than 124 m) participate to this continuum, but new sites appear in the southeast, and the northern sites shrink (Fig.8). Hanshu and Houdiwopu maintain their complementary role as settlement

centers. Burials have previously been found in the smaller sites, like Houtaomuga and Dongshantou (Zhang 1963). In the survey area, and more largely in the Song-Nen Plain, a clear spatial division between settlements and cemeteries appears during the first half of the 1st millennium BC, evidence of new land-use conception.

The rank-size curve is quite concave (high A coefficient) (Fig. 4), indicating a highly centralized system, the focus on the largest sites is much greater than before.

The Late Bronze Age levels of the nearby Baijinbao site have mainly yielded fish and shells. The proportion of wild mammals was still higher than domestic animals (mainly dogs), and although a few samples show the presence of cultivated millet (Chen 2004; Heilongjiang 2009; Chen et al. 2011). A lot of net weights collected during survey belong to this period, keeping the emphasis on net-fishing practices. The appearance of pot-support (*zhizuo*) sherds in the survey collections indicates that cooking jars are maintained in a simmering position over the fire (Skibo 1992: 137). The Late Bronze Age survey sherds are clearly divided into two types of fabrics: fine paste often decorated sherds from serving implements and coarse corded sherds from cooking pots. This seems to indicate a further specialization of pottery production and function among sedentary households. A new type of polished stone tool (rounded angle triangle with a hole in the middle) appears among the collected stone tools, which might indicate a new emphasis on land-clearing and/or some kind of manual soil plowing. Still, most of the available data indicate that the subsistence was still mainly based on fishing, hunting, and gathering.

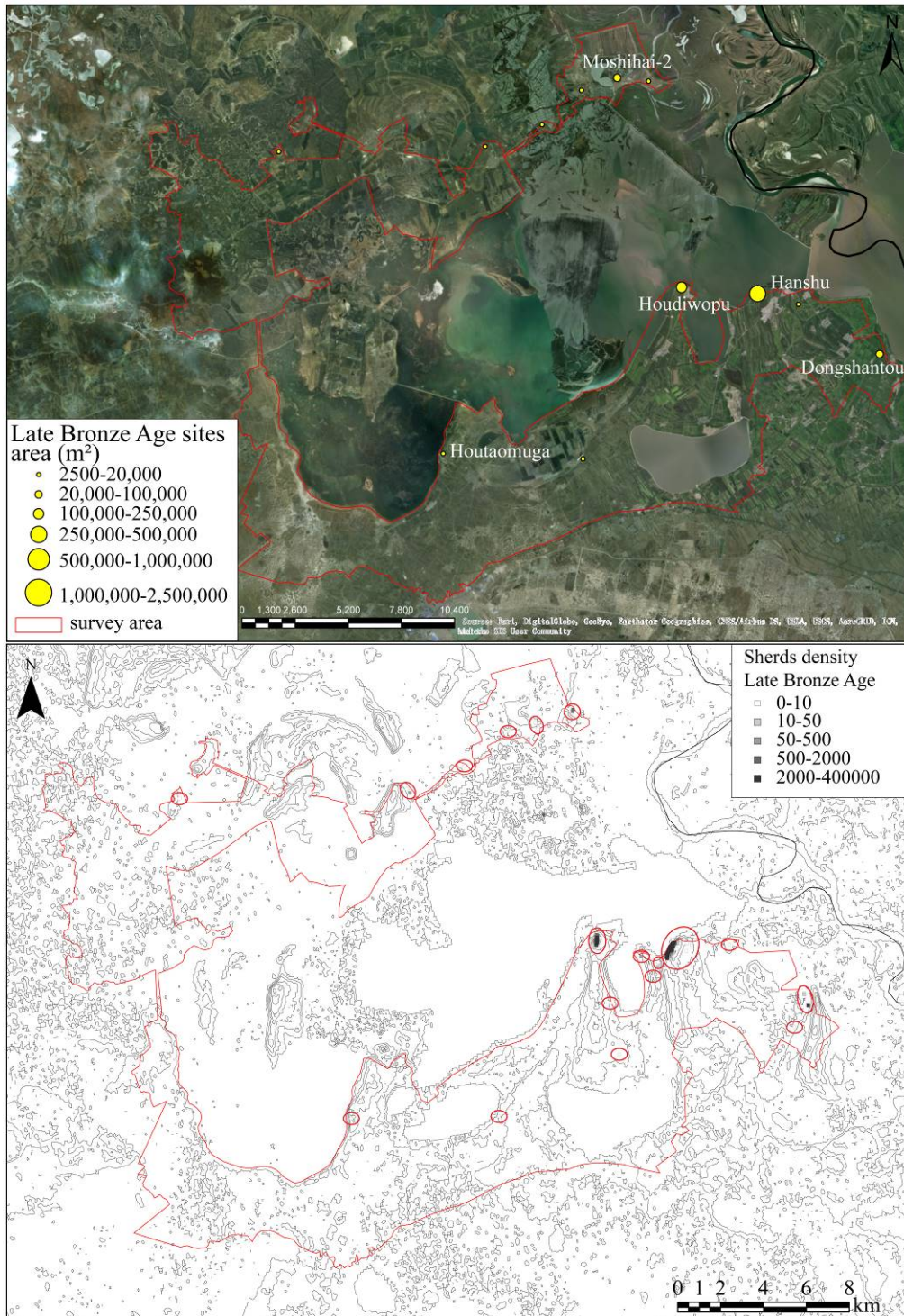


Figure 8. Distribution of Late Bronze Age remains

4.6. Early Iron Age (500 BC- 0)

The Early Iron Age sherds are typical from the Hanshu phase II culture: yellow-brown paste tempered with fine sand, decorated with comb patterns, cord-marks or red engobe.

Six hundred and seventy-one collection units (14,000 sherds on 167.75 ha or 1,677,500 m²) show a significant increase in the intensity of occupation. The sites are significantly larger (135,195 m² or 13.52 ha on average). A stable water level might have participated in this development. Although most of the larger sites are still located in the east, new large sites appeared in the north (Fig. 9). The Houdiwopu,

Hanshu and Houtaomuga sites in the southeast continue to develop, and many new secondary sites emerged around them. This settlement system is organized around multiple centers, and the site hierarchy becomes clearer.

During this period, the north bank and the south bank may constitute two relatively independent settlement systems, the center of the northern system being the Moshihai-3 site, and the center of the southern system being the Hanshu site. Two large sites occupy strategic locations to control the access to the Nenjiang River.

The rank-size curve is close to a log-normal distribution (low A coefficient) (Fig. 4), indicating that the settlement system is integrated and the presence of a hierarchical social organization, as well as an integrated economic system.

The fauna from the Hanshu site indicates that the proportion of wild mammals is still greater to domestic livestock (Jilin 2018). A small number of wild legume seeds and cultivated millet were found. In addition, the human remains of the Houtaomuga cemetery show that the population mainly relied on fishing and hunting, with a small proportion of agriculture (Zhang et al. 2015). Analysis of dental lesions in children also shows that diversified subsistence modes may have balanced mortality due to environmental conditions. This broad-spectrum economic model helped to increase immunity and resistance to environmental stress (Merrett et al. 2015). Bronze objects are rare in this region, but small bronze ornaments were also discovered during survey. The proportion of collected net weights in the survey sherds rises, keeping the emphasis on fishing activities. The sherds collected during survey show different quality of fabric (fine and coarse), of surface treatment (corded, smooth, or painted red) and various shapes and functions (cooking tripods and jars, serving goblets, pouring vases), which indicates a more sedentary household economy and an increase in production specialization. The proportion of grinding tools is higher than for the previous period, which could point to a higher proportion of grains in the diet. But overall, the subsistence economy still mainly relies on fishing and gathering.

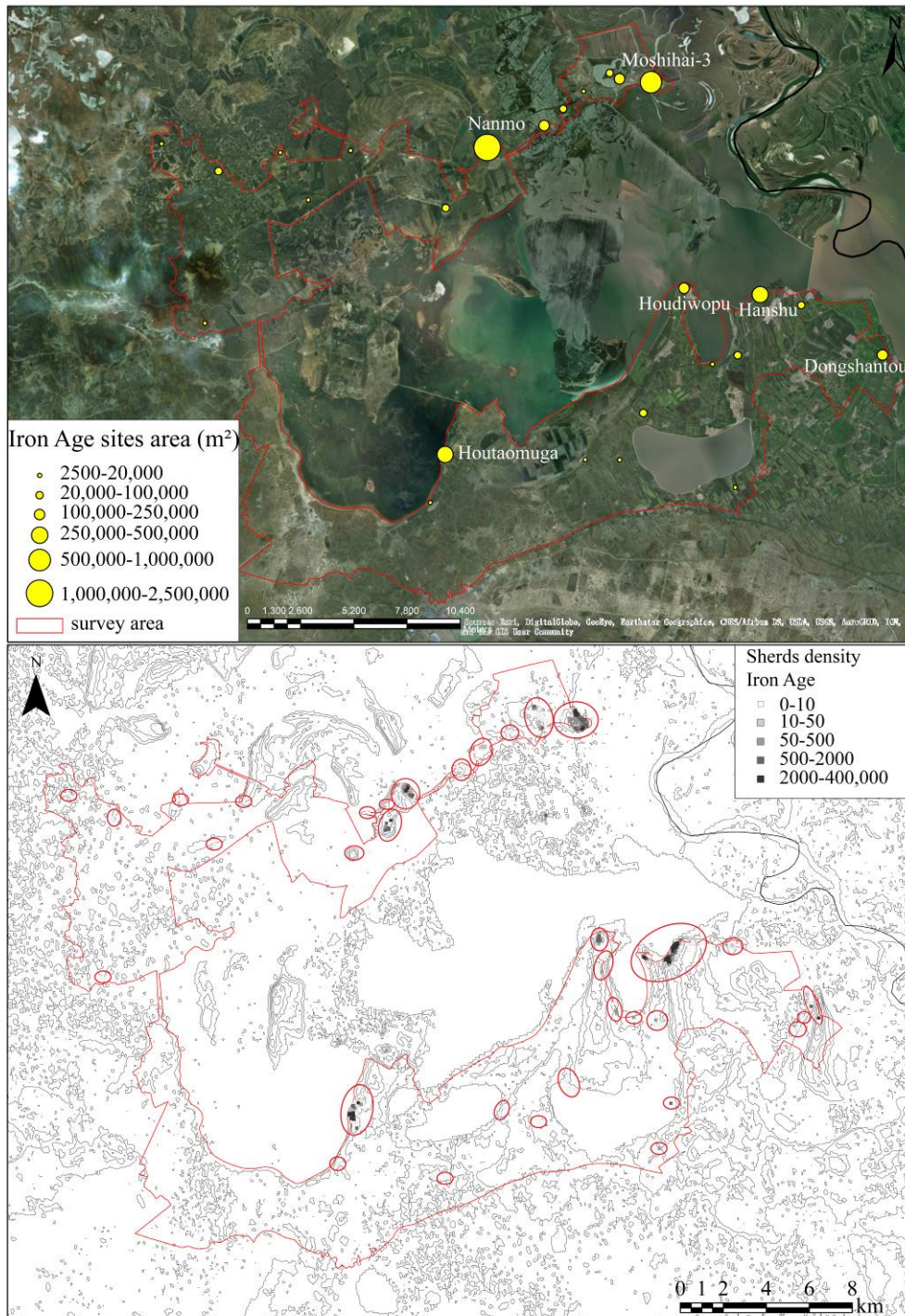


Figure 9. Distribution of Early Iron Age remains

4.7. Early Middle Age (200-900 AD)

Sherds belonging to the period between the 3rd and the 8th c. AD are very scarce, but quite conspicuous, with a thick coarse sandy red or grey-brown paste, associated with the local Xianbei or pre-Khitan cultures.

Sixty-two collections units (with only 82 sherds on 15.75 ha or 157,500 m²) were found. This marks a significant decline compared to the previous period. Very small sites (38,206 m² or 3.82 ha on average) appear along the shores in the southwest (Fig. 10). This quasi-abandonment of the region takes place during a sub-warm and humid period (300-1000 AD) (Yu et al. 2013; Zhao et al. 2013), although the water level did not change significantly. The resources may have decreased. This abandonment might

also be connected to changes in the subsistence model.

The Xianbei are believed to originate from the Hulunbuir steppes in northeast Inner Mongolia, the historical narrative is that when they spread into the Song-Nen Plain, they transformed the original fishing and hunting economy to a relatively developed nomadic/herding economy. The early Khitan groups were also documented as a nomadic ethnic group active in northeast Asia during the Sui and Tang dynasties (late 6th to early 10th c. AD) (Marsone 2011), having pastured in the Song-Nen grasslands as well. The survey materials attributed to this period might correspond to these groups' new activities in the area. The central settlement for this region might not be within the scope of the survey. These small sites may be related to temporary activities, seasonal fishing activities, or simply indicate frequent travel along the waterways suggested from the historical data.

There are very few excavated materials belonging to this period in the region. The cemetery of Da'an Fish Factory excavated in 1974 yielded burials with offerings such as shells, bows, arrows and armor plates (Jilin 1975). The vegetation was then dominated by forests and grasslands. Buckwheat appeared during the 1st millennium BC, marking a very late emergence of agriculture in the region (Makohonienko et al. 2004). The fish nets still present among the survey materials, the low site density and dispersed distribution of these sites might indicate a dissolution of the sedentary household activities system in the area, replaced by a new way of life, based on practices which leave a lower density of archaeological material, such as pastoralism or a return to mobile hunting and gathering. All the data indicate that the main economic activities might have been hunting, fishing and animal husbandry.

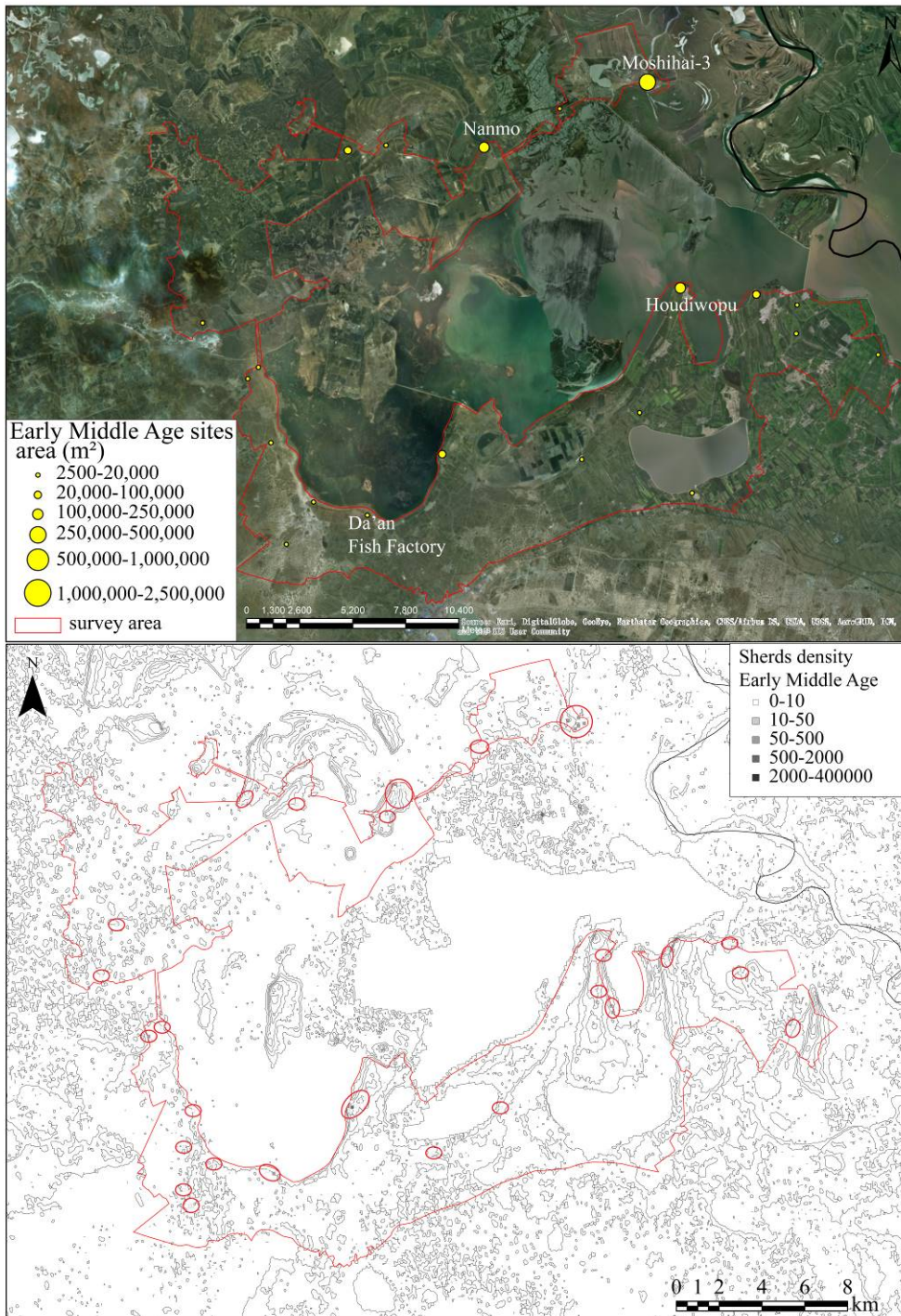


Figure 10. Distribution of Early Middle Age remains

4.8. Late Middle Age (900-1300 AD)

The sherds belonging to the Late Medieval or Liao-Jin period are of a fine grey paste with folded rims, plain surfaces or comb motifs. Architectural materials such as bricks and tiles, as well as net weights, were abundant.

These sherds have been found in 3989 collections units (95,254 sherds on 997.25 ha or 9,972,500 m²), they are overwhelmingly present at all the sites. The increase in the number of sites, site size (264,572 m² or 26.46 ha on average), and sherds density reveal an unprecedented new settlement system (Fig. 11). A large number of people may have come to the area to open up forests and drain marshes, bringing in new lifestyles. The development of a myriad of small sites and farmsteads further from the

waterfront reflects the intensification of agricultural production and a new use of the hinterland.

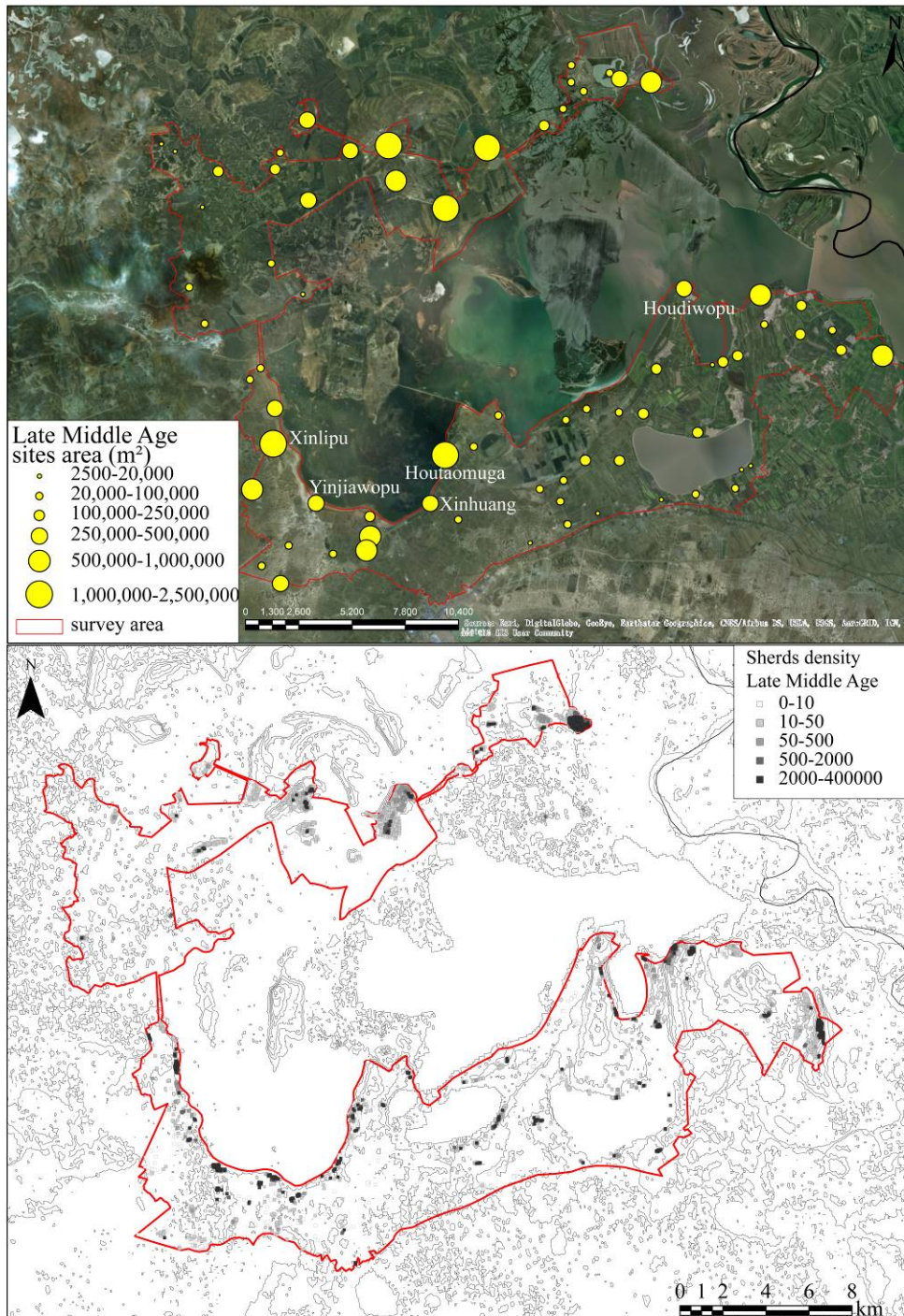
The sites' distribution is relatively uniform, with an average distance of 3-5 km between each site. The distribution in the south is more scattered than in the north, the settlement pattern is probably related to the ancient exchange network system. This network is tied into a number of economic activities: a large architectural complex was found in Xinlipu, a salt production workshop was excavated in Yinjiawopu (Sebillaud et al. 2017), a city wall and imported stoneware are documented in Xinhuang, an iron-smelting site was found in Houtaomuga, and a cereal transportation canal with medieval boat remains was excavated between the two lakes at Houদিwopu (Chen and Li 1982). Large sites may have served functions as intermediary towns between large centers and villages.

The rank-size curve is convex, near log normal distribution (low A coefficient) (Fig. 4), the degree of integration in the region was relatively low, with apparent competition for land. However, the Liao-Jin settlement system is much larger than the survey area. The dominating center was located outside of the survey area. According to historical records and previously published archaeological materials, the investigation area is located between the two largest urban sites in the northwestern part of Jilin Province (Chengsijiazi and Tahucheng) (Jilin et al. 2016; Jilin 2017). Taking in account the geographical conditions, the most efficient path between these two cities goes through the Yueliang survey area. Its economic and settlement organization might have benefited from this location.

By that time, the distribution of the collection units show that the water level was at its lowest, not higher than 122 m. Not only present on the shores anymore, human activities also developed towards the progressively deforested and drained hinterland. During this period, Northeast China was affected by the Medieval warm period (800-1200 AD), summer precipitation in the area increased significantly, summer temperatures were warmer than today, enhancing the summer monsoon circulation, providing more favorable conditions for agriculture (Ren and Zhang 1996). From 900 to 1100 AD, the forest was degraded and the vegetation was dominated by grasses. The landscape was increasingly opened by human activities, accelerating wind erosion and weathering. The scale of human activities and the impact on vegetation during this period were roughly equivalent to those in modern times (Makohonienko et al. 2004). By then, crops account for 70% of plant seeds. They were mainly millet, barley, wheat, oats, buckwheat, soybeans, and beans (Yang et al. 2010).

The grain transportation canal of Houদিwopu indicates the importance of cereal production. The excavations at the Yinjiawopu site revealed that buildings with *kang* heating systems and brick walls were used during this period. The salt production workshop shows how new resources were exploited and exchanged (Sebillaud et al. 2017). The main sources of meat were fish (34%) and mammals (31%, mainly pigs, cattle and horses), followed by mussels (22%) and birds (4%). The discovery of seashells also indicates the existence of long-distance trade (Liang et al. 2018). The quantity of sherds discovered during survey shows the sudden development of the architectural ceramic materials (brick and tiles) and pottery production industry. The homogeneity of the sherds shows that the production was standardized in a way to fit in a set of criteria that has an immense distribution area. From the Republic of Mongolia, to Inner Mongolia, Liaoning, Jilin and Heilongjiang provinces in China, the Late Medieval sherds all present this high temperature fired, wheel-made, clear grey fine fabric (Ross-Sheppard 2016). The vessels shapes in the survey materials belong mostly to serving and storing containers, the collected iron cauldron rims and sherds correspond a new way of cooking linked to the *kang* heating and cooking domestic architectural design. These innovations point to a somewhat more comfortable sedentary way of life, which makes it possible to accommodate a larger

population. Numerous net weights were also collected; they are made of the same grey fabric than the pottery, but have a new tubular shape and are smaller than the ones from the previous periods. This might indicate the appearance of new types of net and innovations net fishing practices. Even though the way of life clearly was sedentary, and agriculture and animal husbandry developed to sustain the large population of this period, fishing and hunting remained very important in the economy.



4.9. Modern period (1800-1949 AD)

The sherds from the Modern period are fine dark grey smoothed ware fired at high temperatures. Most of the porcelain sherds have a beige paste with blue and

white decor. Architectural ceramic materials like bricks and tiles were also collected.

The absence of materials attributed to the Yuan (13 to 14th c.) or Ming Dynasties (14 to 17th c.) can be explained by the fact that this region is very distant from the main economic centers of both empires, and that the lifestyle and material culture may have not changed much between the 13th and the 19th c. Therefore, part of the sherds attributed to the Late Medieval and Modern periods may in fact have been produced in-between.

Modern sherds were found in 3742 collection units (33,364 sherds on 935.5 ha or 9,355,000 m²). The number of sites and their average size (262,580 m² or 26.26 ha) remain stable. The settlement organization shows a clear continuity with the Late Medieval period and is also in direct relation with nowadays villages' distribution (Fig. 12). But the densities of sherds are lower, the level of activity weaker. The southern part of the survey area, especially the shore, has the highest density of coins; this could indicate that the main mode of transportation and commerce was along the river and lake bank. .

The rank-size curve is very similar to the previous period's graph (Fig. 4). Most of the sites were still in use, but they all are slightly smaller. The degree of integration of the settlement system was low. No main center was found in the area, because the main trade and industrial center was located in Anguang Town.

So far, Chinese archaeology has not focused on the late historical periods, data are scarce, but historical texts provide some environmental context. At least until the 1980's, most of the cultivated land was still planted with sorghum, millet and soybeans, and corn became the main crop only in during the last three decades (Lee and Campbell 2007: 7). Production of fish, shells and crabs have a very important place in today's economy. The material collected during survey does not differ much, in objects types and relative proportions, from the previous period material. And we could infer that, domestic economy and subsistence pattern might have not changed much during the 2nd millennium AD.

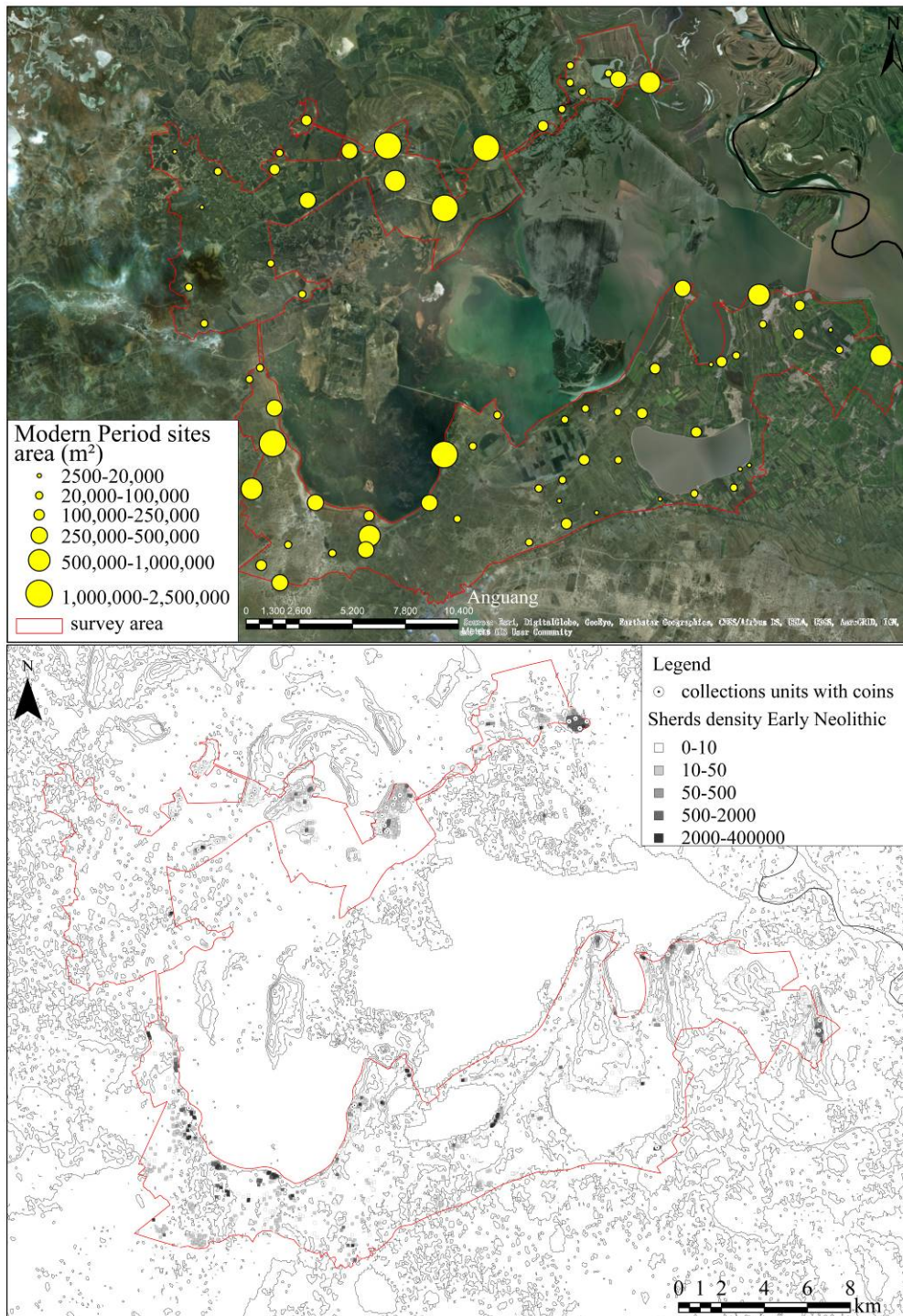


Figure 12. Distribution of Modern period remains

5. Discussion: Comparison with other survey results in Liaoxi region

In the Yueliang region, water access was never a problem, actually, water was rather a restrictive factor with an important influence on the distribution of human activities. During the entire trajectory of this region, ancient groups chose higher grounds, probably as a protection from other groups and from the frequent floods, as well as a strategic location for resource management. In this water-dominated landscape, the economic activities are closely related to this element, for resources, transportation and protection.

regional site densities (Shelach et al. 2013; Teng et al. 2014). In southeastern Inner Mongolia, Xinglongwa (6200-5400 BC) and Zhaobaogou (5400-4500 BC) culture sites “provide the earliest evidence for sedentary agriculturalist society in Northeast China” (Shelach and Teng 2013), but it was not until Period 3 that there is any evidence for agriculture even being a small part of the subsistence in the western Song-Nen Plain. The Late Neolithic was a time of marked social change around the core region of the Hongshan culture (Nelson 1990; Guo 1995): the Niuheliang, Upper Daling and Chifeng surveys’ records show clear evidence of this phenomenon (Peterson et al. 2014). The Hongshan core-area is associated with ceremonial architecture, its settlement pattern is characterized by hamlets and farmsteads (Drennan et al. 2017a), located between uplands and lowlands, where wild resources continued to be exploited, but the importance of domesticated increased considerably and site locations were influenced by risk buffering strategies (Drennan et al. 2020). In the Liangcheng region, signs of conflicts emerge, as fortifications appear in the mountains. But as we move further from the core of the Hongshan region, the ceremonial architecture disappears and scattered small sites like those found in Zhangwu and Fuxin characterize the occupation. In the Yueliang region, the Hongshan Period coincides with an increase in population in the Houtaomuga village and outside of this village, the site densities are similar to Zhangwu and Fuxin’s situation.

Amalgamating systematic regional surveys could be a way to further understand the phenomenon of the first villages in other parts of Northeast China, and to delineate the influence sphere of the Hongshan phenomenon. Carrying more surveys in other parts of Northeast China, north of the Liaoxi region, in distinct environmental conditions, could shed light on other settlement patterns, associated with different subsistence strategies and site location choices. For example, systematic regional survey in the Dongliao River Valley in southwest Jilin province, which is located between the eastern part of Inner Mongolia and the northern part of Liaoning (Duval et al. 2019), would shed light on the settlement pattern on this “cross-road” area of previously traditionally researched archaeological cultures. This type of work in the Liaodong peninsula could show the specificity of the easternmost extension of the Hongshan culture influence, the characteristics of a sea-based economy, and could reveal the presence or absence of interactions with Shandong region through maritime exchange. Finally, the Heilongjiang province is an important territory to understand the link between all what has been discovered so far in a somewhat meridional Northeast China with the rest of Northeast Asia, and surveys in the Upper Nen River Valley, in the Sanjiang Plain or in the northern most Fuyuan region would provide data to compare settlement patterns to research in Mongolia and Russia and the larger Northeast Asian region.

The 3rd millennium BC is not documented in the Yueliang survey, but in the Liaoxi region, it clearly represents a “rupture of some kind” (Drennan et al. 2020). This period is not documented well enough over the entire area of Northeast China and local cultural sequences are based on very scarce data. Future excavations will shed light on this gap, for example, in the Song-Nen region, excavations at sites like Honghe are key to get a better understanding of the transition between Late Neolithic and Early Bronze Age settlement patterns and subsistence strategies (Heilongjiang 2019).

The paleoenvironmental research in western Liaoning shows that the climate during the 2nd millennium BC was warm and humid; this phenomenon coincided with an increase in site size and the number of sites in most regions (Drennan et al. 2004; Teng and Shelach 2011). In the Yueliang region, a new system emerged during this period, which saw continuous development during the following millennium. The Chifeng, Daling and Zhangwu regions all show hierarchized settlement systems; this

tendency was also identified in Fuxin, but only during the second half of the 2nd millennium BC. The Liangcheng region constitutes an exception to this pattern. During the Late Bronze Age, while some authors have found that the region has become dryer and cooler, recent evidence suggests that settlement patterning and organization is a mosaic of different situations. The number of settlements in parts of western Liaoning and the Yueliang region decreased slightly, but there is a significant difference in scale for this phenomenon in the two regions. The Late Bronze Age is, in fact, a period revealing a mosaic of situations: quite stable in the Yueliang region, the settlement system in the Chifeng revealed fewer larger sites, in Zhangwu fewer sites and slightly smaller. Both of these showing a reorganization but not a decline in population. In the Upper Daling however, it was a period of steep growth of a clearly hierarchical and integrated system.

The settlement system continuously developed during the Early Iron Age in the Yueliang region, in the context of a warmer climate and increased precipitation, but this did not happen in the Liaoxi region, where a new organization emerged, integrating the area into the narrative of historical China's dynasties. In the Liangcheng region, the new system of numerous plain sites was well integrated, but in Western Liaoning (Chifeng, Upper Daling and Zhangwu), this period is marked by a steep decrease, the integration of the region into the Yan State seems to have deeply disrupted the land-use.

Except in the Yueliang survey, the Middle Age was not divided into two phases. So, in Chifeng, Upper Daling and Zhangwu regions, the settlement pattern is comparable to the Late Middle Age in the Yueliang region: it reaches the highest number of sites, the highest population level and the highest level of land use. The high and sudden development of the Late Medieval period happened during the "medieval warm period" with better environmental conditions, and the development of the Liao and Jin Empires in Northeast China, which seems to have brought new populations and lifestyles. But, in the setting of warmer conditions after 300 AD followed by the colder episode of the "Late Antique Little Ice Age" (530-660 AD) (Büntgen et al. 2016), in the Yueliang region, the 1st millennium AD marks a sharp decline in activity. It makes the appearance of the intense exploitation and settlement in the region during the 2nd millennium AD all the more spectacular. The very low density of remains during the Early Middle Age in the Yueliang region indicates that the 1st millennium AD might be an interesting period to focus on in the future. There are very few archaeological data in the west of Jilin province for this period, often attributed to the Xianbei groups, but in the east of the province, this is the era of development of the powerful states of Koguryo and Bohai with multi-level well-integrated settlement systems, large cities and a fierce military history. Meanwhile, in the Liaoxi region, the Xianbei and other groups established the Three Yan kingdoms, and other entities, like the proto-Khitan, were active, leaving very different material remains.

Comparing the diachronic changes of the settlement patterns in these regions, it is clear that before the Late Middle Age, there is no common linear evolution encompassing the entire "Northeast China" and there is marked variation in settlement patterns even subregions, as mentioned in the Late Bronze Age comparison above.

The Yueliang region was not integrated into Central Chinese political sphere until very late, it belonged to other networks, exchanged and was influenced by the northeast part of Inner Mongolia (the Hulunbuir steppes), the west of the Heilongjiang province (the Daxing'an mountains and Upper Nen River Valley), southeast Siberia and Transbaikalie in Russia.

The changes in environmental conditions must have played a role in these differences in trajectories, but how these changes impact resources locally is diverse, as is the social response to this change. The environmental conditions cannot entirely

or directly explain the variations in the settlement patterns, they provide a context, which helps us to imagine the landscape in which strategic subsistence and location choices were made. If affluent conditions might have played a role in the emergence of sedentism in the Liaoxi region (Shelach et al. 2019), a chronological correlation does not equal causation (Drennan et al. 2020), and we need to look for series of choices and the reasons behind them, that appear in the settlement patterns of each period. All this also shows the importance of multi-scale analysis. Only in the long-term scale can we discover the complete process of the evolution of a settlement system. Moreover, the regional systematic survey is the only method that can offer elements to clarify the evolution process of settlement patterns over a large area. But such surveys have to continue to be carried out in eastern Liaoning, northeastern Inner Mongolia, Jilin province and Heilongjiang in order to get a better understanding of the mosaic of trajectories existing in Northeast China.

An increase of systematic regional surveys in different parts - more northern parts - of Northeast China, intensive surveys at the households level in chosen localities (Drennan et al. 2017b), lithic, paleoenvironmental and fauna analysis are essential to better characterize settlement patterns, as well as the “nomadic” or “hunting and fishing” concepts, widely used to describe subsistence strategies, but which remain broad and blurry. It also shows how, under similar macroscopic climate conditions, there are a lot of inter-regional variations: human groups implemented different resources management strategies and made different lifestyle and economic choices.

6. Conclusion

The Yueliang survey provides new data pertaining to the very long transition from hunter-gather societies to agricultural sedentary communities in northwest Jilin. It shows that the traditional evolutionist or neo-evolutionist model - a linear evolution from hunting and gathering to Neolithic farming - is not suitable for all the regions of Northeast China. Moreover, the late emergence of agriculture did not hinder the evolution and complexity of society in this region. Jia Weiming once pointed out the weakness of linear evolution theory because of its assumption that there is "an ideal environment which is stable, consistent and with no interruption, obstruction, competition or resistance" (Jia 2008), because in fact "'hunting and gathering' is a more varied and complex subsistence adaptation than originally conceptualized" (Stephens et al. 2019). For over thirteen millennia, the subsistence strategies in this region included a wealth of resources utilization methods and combinations of management models.

The first systematic regional survey in Jilin province reveals that the models from the southern part of the Northeast China Plain cannot be generalized and applied to the whole region; in other words, the Liaoxi region's data cannot be used as a synecdoche, to represent the entirety of Northeast China. Rather, the mosaic of settlement patterns, trajectories and subsistence economies in Northeast China has just begun to show its diversity. Future surveys in Jilin province, north-eastern Inner Mongolia and Heilongjiang may continue to surprise us, showing how diverse the solutions were during each period. Focussing on a very long trajectory is an important way to get a better understanding of the interactions between humans and the environment, and is one of the only ways to get a broad understanding of how it changed.

Spatial analysis and settlement pattern analysis, especially when focused on human-scale landscapes such as river valleys, can capture the complexity and diversity of human subsistence systems better than older, simplistic models. The neo-evolutionist model of linear social development is not reflected in the archaeological record of Northeast China. The variety of subsistence “mixes” coexisting in Northeast

China shows complex and evolving economic strategies, changes in the use of resources, and resistant groups, which are not captured by the overused dichotomies of sedentism vs. nomadism, hunting-gathering vs. farming. The modelling of adaptive systems should be looked at river basin by river basin, in order to grasp the complexity of settlement patterns and ways of life in this vast and geographically diverse region.

Multidisciplinarity sustained dialogue between specialists is the way to avoid what Lothar von Falkenhausen identified as “the historical orientation of Chinese archaeology” (Falkenhausen 1993). To contextualize spatial and settlement pattern analysis, more paleoenvironmental research is especially needed in China.

Disclosure statement

No potential conflict of interest was reported by the authors.

Geolocation Information

The Yueliang survey area is located in Northeast China around the coordinates 45°38'40.80"N, 123°42'16.50"E, in Da'an City and Zhenlai District, northwest Jilin Province.

Acknowledgments

We are grateful to the anonymous reviewers for their helpful comments.

References

- Banning, E. B., 2002. *Archaeological Survey*. New York: Kluwer Academic/Plenum Publishers. <https://doi.org/10.1007/978-1-4615-0769-7>.
- Bar-Yosef, O., Belfer-Cohen, A., 1989. The origins of sedentism and farming communities in the Levant. *Journal of World Prehistory*. 3 (4), 447-498. <https://doi.org/10.1007/BF00975111>.
- Büntgen, U., Myglan, V. S., Charpentier, F., Ljungqvist, M., McCormick, Di Cosmo, N., Sigl, M., Jungclaus, J., et al., 2016. Cooling and societal change during the Late Antique Little Ice Age from 536 to around 660 AD. *Nature Geoscience*. 9 (3), 231-236. <https://doi.org/10.1038/ngeo2652>.
- Cai, Dawei, Zhang, Naifan, Zhu, Siqi, Chen, Quanjia, Wang, Lixin, Zhao, Xin, Ma, Xiaolin, Royle, T., Zhou, Hui, Yang, Dongya, 2018. Ancient DNA reveals evidence of abundant aurochs (*Bos primigenius*) in Neolithic Northeast China. *Journal of Archaeological Science*. 98, 72-80. <https://doi.org/10.1016/j.jas.2018.08.003>.
- Chen, Xiangwei, Li, Dianfu. 1982. *Da'an xian wenwu zhi* [Da'an Cultural Monograph], Jilin sheng wenwuzhi bianweiyuanhui, Changchun.
- Chen, Quanjia, 2004. Baijinbao yizhi (1986 nian) chutu de dongwu yicun yanjiu. [Research on faunal remains from the 2004 excavation of the Baijinbao site]. *Beifang wenwu*. 4, 1-6.
- Chen, Quanjia, Wang, Fagang, and Wang, Chunxue, 2011. Nenjiang liuyu Qingtong shidai shengye fangshi yanjiu. [Research on Bronze Age subsistence modes in the Nengjiang Valley]. *Huaxia kaogu*. 2, 46-53.
- Chifeng International Collaborative Archaeological Research Project, 2003. *Nei Menggu dongbu (Chifeng) quyü kaogu diaocha jieduanxing baogao* [Preliminary report on the regional archaeological survey of Eastern Inner Mongolia (Chifeng)]. Science Press, Beijing.
- Dabbas, M., Delétang, H., Ferdière, A., Jung, C., Zimmermann, H., 2006. *La Prospection*. Errance, Paris.
- Doelman, T., Jia, P. W., Torrence, R., Popov, V., 2014. Remains of a puzzle: the distribution of volcanic glass artifacts from sources in Northeast China and Far East Russia. *Lithic Technology*. 39 (2), 81-95. <https://doi.org/10.1179/0197726114Z.000000000035>.

Drennan, R. D., Linduff, K., Shelach, G., 2004. Early Complex Societies in NE China: The Chifeng International Collaborative Archaeological Research Project. *Journal of Field Archaeology*. 29 (1/2), 45-73. <https://doi.org/10.1179/jfa.2004.29.1-2.45>.

Drennan, R. D., Peterson C. E., 2004. Comparing Archaeological Settlement Systems with Rank-Size Graphs: A Measure of Shape and Statistical Confidence. *Journal of Archaeological Science*. 31, 533-549. <https://doi.org/10.1016/j.jas.2003.10.002>.

Drennan, R. D., Peterson, C. E., Lü, Xueming, Zhu, Da, Hou, Shenguang, 2014. Settlement and Social Dynamics in the Upper Daling and Chifeng Regions of Northeast China. *Asian Archaeology*. 2, 50-76.

Drennan, R. D., Lü, Xueming, Peterson, C. E., 2017a. A place of pilgrimage? Niuhefang and its role in Hongshan society. *Antiquity*. 91 (355), 43-56. <https://doi.org/10.15184/aqy.2016.227>.

Drennan, R. D., Peterson, C. E., Lü, Xueming, Li, Tao. 2017b. Hongshan households and communities in Neolithic northeastern China. *Journal of Anthropological Archaeology*. 47, 50-71. <https://doi.org/10.1016/j.jaa.2017.03.002>.

Drennan, R. D., Peterson, C. E., Berrey, A. C., 2020. Environmental risk buffering in Chinese Neolithic villages: Impacts on community structure in the Central Plains and the Western Liao Valley. *Archaeological Research in Asia*. 21, 1-12. <https://doi.org/10.1016/j.ara.2019.100165>.

Dunnell, R. C., Dancey, W. S., 1983. The Siteless Survey: A Regional Scale Data Collection Strategy. *Advances in Archaeological Method and Theory*. 6, 267-287. <https://doi.org/10.1016/B978-0-12-003106-1.50012-2>.

Duval, P., Sebillaud, P., Jing, Zhongwei, 2019. Changshan (Chine) : l'enregistrement du corpus céramique par la MAFNEC, in: Dessaint, M., Gorin, C., Del Medico, C. (Eds.), *Méthodes d'enregistrement des données en archéologie*. Éditions de la Sorbonne, Paris. <https://books.openedition.org/psorbonne/38632?lang=fr>.

Falkenhausen, L. von, 1993. On the historiographical orientation of Chinese archaeology. *Antiquity*. 67 (257), 839-849. <https://doi.org/10.1017/S0003598X00063821>.

Food and Agriculture Organization of the United Nations (FAO), 2006. *World reference base for soil resources 2006 - A framework for international classification, correlation and communication*, UNO, Rome.

Guo, Dashun, 1995. Hongshan and Related Cultures, in: Nelson, S. M. (Ed.), *The Archaeology of Northeast China - Beyond the Great Wall*. Routledge, London, 1995, pp. 21-64.

Heilongjiang sheng wenwu kaogu yanjiusuo, 2009. *Zhaoyuan Baijinbao - Nenjiang xiayou yi chu Qingtong shidai yizhi de jieshi* [Zhaoyuan Baijinbao - The Discovery of a Bronze Age Site of the Lower Nenjiang], Science Press, Beijing.

Heilongjiang sheng wenwu kaogu yanjiusuo, 2019. Heilongjiang Qiqiha'er shi Honghe yizhi Xinshiqi shidai yicun fajue jianbao. [Preliminary archaeological excavation report on the Neolithic remains at the Honghe site in Qiqiha'er, Heilongjiang]. *Kaogu*. 8, 46-70.

- Indrisano, G. G., 2006. Subsistence, Environmental Fluctuation and Social Change: A Case Study in South Central Inner Mongolia. Ph. D. diss., Pittsburgh University, Pittsburgh.
- Indrisano, G. G., Linduff, K. M., 2013. Expansion of the Chinese Empire into its Northern Frontier (ca. 500 BCR-0 CE) - A Case Study from South-Central Inner Mongolia, in: Areshian, G. (Ed.), *Empires and Diversity: On the Crossroads of Archaeology, Anthropology, and History*. Cotsen Institute of Archaeology Press, Los Angeles, pp. 204-242.
- Jia, P. W., 2008. The Transition to Farming in Northeast China: a Model and Application. *Before farming*. 4, 1-21.
- Jilin sheng bowuguan wenwu dui, Jilin daxue lishi xi kaogu zhuanye, 1975. Jilin Da'an yuchang gudai mudi. [The ancient cemetery of Da'an fishing factory]. *Kaogu*. 6, 356-362.
- Jilin sheng wenwu kaogu yanjiusuo, Baicheng shi wenwu baohu guanlisuo, Baicheng shi bowuguan, 2016. Jilin Baicheng Chengsijiazi chengzhi jianzhu taiji fajue jianbao. [Preliminary report on the excavation of the architectural remains of the Chengsijiazi city-site in Baicheng, Jilin]. *Wenwu*. 9, 39-55.
- Jilin sheng wenwu kaogu yanjiu suo, Jilin daxue Bianjiang kaogu yanjiu zhongxin, 2017. *Qianguo Tahucheng — 2000 nian kaogu fajue baogao* [Qianguo Tahucheng - Excavation Report of the 2000 Excavation], Science Press, Beijing.
- Jilin sheng wenwu kaogu yanjiu suo, Jilin daxue Bianjiang kaogu yanjiu zhongxin, Jilin daxue Kaogu xueyuan, 2018. *Da'an Hanshu - Qingtong shidai yizhi kaogu fajue baogao* [Da'an Hanshu - Report on the Archaeological Excavation of a Bronze Age Site], Science Press, Beijing.
- Jin, Xudong, Chu, Jingang, Wang, Lixin, 2011. Jilin Tongyu xian Changtuozi sichu yizhi de diaocha. [Survey on the four Changtuozi sites in Tongyu, Jilin]. *Beifang wenwu*. 3, 3-6.
- Johnson, G. A., 1980. Rank-Size Convexity and System Integration: A View from Archaeology. *Economic Geography*. 56 (3), 234-247. <https://doi.org/10.2307/142715>.
- Kunikita, Dai, Wang, Lixin, Onuki, Shizuo, Sato, Hiroyuki, Matsuzaki, Hiroyuki, 2017. Radiocarbon dating and dietary reconstruction of the Early Neolithic Houtaomuga and Shuangta sites in the Song-Nen Plain, Northeast China. *Quaternary International*. 441, 62-68. <https://doi.org/10.1016/j.quaint.2017.01.031>.
- Lee, J. Z., Campbell, C. D., 2007. *Fate and Fortune in Rural China: Social Organization and Population Behavior in Liaoning 1774-1873*, Cambridge University Press, Cambridge. <https://doi.org/10.1017/CBO9780511563058>.
- Liang, Qiyao, Chen, Quanjia, Sebillaud, P., Wang, Lixin, 2018. Jilin Da'an shi Yinjiawopu yizhi chutu de dongwu guge yicun yanjiu. [Research on the faunal remains from the Yinjiawopu site in Da'an, Jilin]. *Beifang wenwu*. 1, 50-59.
- Liaoning sheng wenwu kaogu yanjiusuo, Zhongguo renmin daxue lishi xueyuan, 2015. 2014 nian Niuheiliang yizhi xitongxing quyue kaogu diaocha yanjiu. [Archaeological systematic regional survey research on the Niuheiliang site in 2014]. *Huaxia kaogu*. 3, 3-8, 62.

Liu, Shuang, 2019. *Zhongguo Dongbei diqu Jiushiqi shidai wanqi yizhi heiyaoyan zhipin yuanliao lai yuan tansuo* [The Provenance of Obsidian Artifacts from the Upper Paleolithic Sites in Northeast China], Science Press, Beijing.

Liu, Xiaoxi, Sebillaud, P., Wang, Lixin, 2016. Jilin sheng Da'an shi 2012-2013 nian quyuxing xitong diaocha jianbao. [Preliminary report on the 2012-2013 regional systematic survey in Da'an, Jilin]. *Bianjiang kaogu yanjiu*. 19, 27-45.

Makohonienko, M., Kitagawa, Hiroyuki, Naruse, Toshiro, Nasu, Hiroo, Momohara, Arata, Mitsuru, Okuno, Toshiyuki, Fujiki, Liu, Xin, Yoshinori, Yasuda, Yin, Huaining, 2004. Late-Holocene natural and anthropogenic vegetation changes in the Dongbei Pingyuan (Manchurian Plain), Northeastern China. *Quaternary International*. 123-125, 71-88.
<https://doi.org/10.1016/j.quaint.2004.02.010>.

Marsone, P., 2011. *La Steppe et l'Empire - La formation de la dynastie Khitan (Liao) IVe-Xe siècle*, Les Belles Lettres, Paris.

Merrett, D.C., Zhang, Hua, Xiao, Xiaoming, Zhang, Quanchao, Wei, Dong, Wang, Lixin, Zhu, Hong, Yang, Dongya, 2015. Enamel Hypoplasia in Northeast China: Evidence from Houtaomuga. *Quaternary International*. 405, 11-21.
<https://doi.org/10.1016/j.quaint.2015.06.004>.

Nachtergaele, F., Velthuisen, H. Van, Verelst, L., Wiberg, D., 2012. *Harmonized World Soil Database (version 1.2)*, FAO, Rome.

Nelson, S. M., 1990. The Neolithic of northeastern China and Korea. *Antiquity*. 64 (243), 234-248. <https://doi.org/10.1017/S0003598X0007784X>.

Peterson, C.E., Drennan, R. D., 2005. Communities, Settlements, Sites, and Surveys: Regional-Scale Analysis of Prehistoric Human Interaction. *American Antiquity*. 70 (1), 5-30.
<https://doi.org/10.2307/40035266>.

Peterson, C. E., Lü, Xueming, Drennan, R. D., Zhu, Da, 2010. Hongshan chiefly communities in Neolithic northeastern China. *PNAS*. 107 (13), 5756-5761.
<https://doi.org/10.1073/pnas.1000949107>.

Peterson, C., E., Lü, Xueming, Drennan, R. D., Zhu, Da, 2014. *Hongshan Regional Organization in the Upper Daling Valley*, Center for Comparative Archaeology Department of Anthropology, University of Pittsburg.

Ren, Guoyu, Zhang, Lansheng, 1996. Zhongshiji wennuanqi qihou bianhua de huafen huashi jilu. [Pollen Fossil Records of Climate Change in the Medieval Warm Period]. *Qihou yu huanjing yanjiu*. 1, 81-86.

Ross-Sheppard, C., 2016. The archaeology of Kitan/Liao subaltern unglazed earthenware ceramics: optical, petrographic and geochemical approaches. Master thesis, McGill University, Montreal.

- Shelach, G. 2002, *Leadership Strategies, Economic Activity, and Interregional Interaction - Social Complexity in Northeast China*, Kluwer Academic Publishers, New York.
<https://doi.org/10.1007/b110507>.
- Shelach, G., Teng, Mingyu, 2013. Earlier Neolithic Economic and Social Systems of the Liao River Region, Northeast China, in: Underhill A. (Ed.), *A Companion to Chinese Archaeology*. Blackwell Publishing, Chichester, pp. 37-54. <https://doi.org/10.1002/9781118325698.ch3>.
- Shelach, G., Teng, Mingyu, Wan, Xiongfei, 2013. Report on the 2012 Field Season of the Project Origins of Agriculture and Sedentary Communities in Northeast China. *Asian Archaeology*. 1, 11-25.
- Shelach, G., Teng, Mingyu, Goldsmith, Y., Wachtel, I., Stevens, C. J., Marder, O., Wan, Xiongfei, et al., 2019. Sedentism and plant cultivation in northeast China emerged during affluent conditions. *PLOS ONE*. 14 (7), 1-14. <https://doi.org/10.1371/journal.pone.0218751>.
- Sebillaud, P., Liu, Xiaoxi, Wang, Lixin, 2017. Investigation on the Yinjiawopu Site, a Medieval Salt Production Workshop in Northeast China. *Journal of Field Archaeology*. 47, 1-15. <https://doi.org/10.1080/00934690.2017.1358030>.
- Skibo, J. M., 1992. *Pottery Function - A Use-Alteration Perspective*, Springer, New York.
<https://doi.org/10.1007/978-1-4899-1179-7>.
- Stephens, L., Fuller, D., Boivin, N., Rick, T., Gauthier, N., Kay, A., Marwick, B., et al., 2019. Archaeological Assessment Reveals Earth's Early Transformation through Land Use. *Science*. 365 (6456), 897-902. <https://doi.org/10.1126/science.aax1192>.
- Tang, Zhuowei, Wang, Lixin, Duan, Tianjing, 2013. Jilin Baicheng Shuangta yizhi baofen fenxi yu gu huanjing. [Pollen analysis and paleoenvironment at the Shuangta site in Baicheng, Jilin]. *Kaogu xuebao*. 4, 534-536.
- Teng, Mingyu, 2009. *GIS zhichi xia de Chifeng diqu huanjing kaogu yanjiu* [GIS-based Environmental Archaeological Research on the Chifeng Region]. Science Press, Beijing.
- Teng, Mingyu, Shelach, G., 2011. Climate Change during the Past 10,000 Years, in the Chifeng International Collaborative Archaeological Research Project (Ed.), *Settlement Patterns in the Chifeng Region*, . University of Pittsburgh Center for Comparative Archaeology, Pittsburgh, pp. 39-43. <https://doi.org/10.1353/asi.2016.0003>.
- Teng, Mingyu, Shelach, G., Wan, Xiongfei, Marder, O., Wachtel, I., 2014. Liaoning Fuxin diqu quyuxing kaogu diaocha jieduanxing baogao (2012-2013). [Preliminary report (2012-2013) on the systematic regional survey in Fuxing, Liaoning]. *Beifang wenwu*. 3, 3-10.
- Wang, Lixin, Huo, Dongfeng, Fang, Qi, 2017. Jilin Da'an Houtaomuga yizhi fajue de zhuyao shouhuo. [Main results of the excavations at the Houtaomuga site in Da'an, Jilin]. *Bianjiang kaogu yanjiu*. 21, 321-333.
- Wang, Lixin, 2018. Houtaomuga Xinshiqi shidai yicun ji xiangguan wenti yanjiu. [Research on the Neolithic remains at Houtaomuga and related questions]. *Kaogu xuebao*, 2. 141-164.

Wang, Lixin, Sebillaud, P., 2019. The Emergence of Early Pottery in East Asia: New Discoveries and Perspectives. *Journal of World Prehistory*. 32 (1), 73-110. <https://doi.org/10.1007/s10963-018-9126-y>.

Williams, J. T., 2014. Staple Economies and Social Integration in North-East China: Regional Organization in Zhangwu, Liaoning, China. Ph. D. diss., Pittsburgh University, Pittsburgh.

Williams, J. T., 2015. Demography and Conflict during the Warring States and Han periods in Northern Liaoning. *Asian Archaeology*. 3, 1-10.

Williams, J. T., 2017a. Liaoning Zhangwu diqu Qingtong shidai shiqi fenxi yu juluo xingtqi yanjiu. [Use-wear analysis and research on settlement patterns of Bronze Age sites in Zhangwu, Liaoning]. *Bianjiang kaogu yanjiu*. 22, 109-124.

Williams, J. T., 2017b. Bronze Age Subsistence Change at Regional and Microscopic Scales in Northeast China. *Asian Perspectives*. 56 (2), 166-190. <https://doi.org/10.1353/asi.2017.0007>.

Yang, Chun, Xu, Kun, Zhao, Zhijun, 2010. Jilin sheng Baicheng shi Sunchangqing yizhi fuxuan jieguo fenxi baogao. [Flotation results of the Sunchangqing site in Baicheng, Jilin]. *Beifang wenwu*. 4, 48-51.

Yu, Kaifeng, Lu, Huayu, Lehmkuhl, F., Nottebaum, V., 2013. Mocishengbingqi he Quanxinshi danuanqi Zhongguo beifang shadi gu qihou dingliang chongjian chutan. [Study on Quantitative Reconstruction of Sandy Palaeoclimate in Northern China during the Last Glaciation and Holocene Warm Period]. *Disiji yanjiu*. 33 (2), 293-302.

Zhang, Hua, Merrett, D.C., Xiao, Xiaoming, Zhang, Quanchao, Wei, Dong, Wang, Lixin, Ma, Xiaolin, Zhu, Hong, Yang, Dongya, 2015. A Comparative Study of Oral Health in Three Late Bronze Age Populations with Different Subsistence Practices in North China. *Quaternary International*. 105, 44-57. <https://doi.org/10.1016/j.quaint.2015.05.029>.

Zhang, Zhongpei, 1963. Baicheng diqu kaogu diaocha shuyao. [On the Baicheng archaeological survey]. *Jilin daxue shehui kexue xuebao*. 1, 69-82.

Zhao, Shuang, Xia, Dunsheng, Jin, Heling, Wen, Yanglei, Liu, Jiabo, Liu, Bing, Li, Guanhua, 2013. Ke'erqin shadi guoqu jin 5000 nian gaofenbianlü qihou yanbian. [High-resolution climate evolution of the Horqin Sandy Land in the past 5000 years]. *Disiji yanjiu*. 3, 283-292.

Supplementary materials

Table 1 Overall survey data

Period	Number of collection units	Surface of collection units (ha)	Sherds	% of sherds	Density of sherds	% of the collection units
Period 1	18	4.5	127	0.08%	0.05/m ² 526.2/ha	0.4%
Period 2	152	38	1 843	1.21%	0.17/m ² 1 701.3/ha	3.6%
Period 3	27	6.75	432	0.28%	0.25/m ² 2 479.3/ha	0.6%
Early to Middle Bronze Age	168	42	2 593	1.7%	0.62/m ² 6 173.8/ha	4%
Late Bronze Age	159	39.75	4 370	2.87%	1.1/m ² 10 993/ha	3.8%

Early Iron Age	671	167.75	14 000	9.19%	0.83/m ² 8 345.75/ha	15.9%
Early Middle Age	62	15.5	82	0.05%	0.01/m ² 129.2/ha	1.5%
Late Middle Age	3 989	997.25	9 5254	62.57%	0.96/m ² 9 551.6/ha	94.4%
Modern Period	3 742	935.5	33 364	21.91%	0.36/m ² 3 566.4/ha	88.5%

Table 2 Survey results by period

Period	Number of sites		Surface area of collection units (ha)	Average site surface (ha)
Period 1	6	8%	5.5703	0.9284
Period 2	23	31%	160.8610	6.994
Period 3	4	5%	10.8561	2.714
Early to Middle Bronze Age	13	18%	93.4304	7.187
Late Bronze Age	12	16%	64.6454	5.3871
Early Iron Age	26	36%	351.5079	13.5195
Early Middle Age	21	29%	80.2317	3.8206
Late Middle Age	73	100%	1931.3777	26.4572
Modern Period	72	99%	1864.3224	26.2580

Table 3 Summary of systematic regional surveys' results in northeast China

Jilin - Yueliang Lake (284km ² , 50m)		Inner Mongolia - Liangcheng (307.8km ² , 25m)		Inner Mongolia - Chifeng (765.4km ² , 50m)		Liaoning - Upper Daling (200km ² , 50m)		Liaoning - Niuheiliang (42.5 km ² , 50m)		Liaoning - Zhangwu (173km ² , 50m)		Liaoning - Fuxin (104.46km ² , 20m)	
Period	Settlement	Period	Settlement	Period	Settlement	Period	Settlement	Period	Settlement	Period	Settlement	Period	Settlement
Period 1 (cultures of Houtaomuga phase I and Changtuozhi type A) (10900-8000 BC) ↑	Scattered, low number of small sites, mostly on the western part of the survey area											Xiaohexi culture (before 6200 BC) ↑	Rare and small sites, scattered distribution, mostly in the center and eastern part of the region, sedentism, hunting and gathering (288 sherds, 15 collection units, 6.724 ha, 6 sites)
Period 2 (cultures of Shuangta I, Houtaomuga phase III and Huangjiaweizi) (8000-3500 BC) ↑	Rise in sites number, emergence of large sites, beginning of hierarchization			Xinglong-wa culture (6000-5000 BC) ↑	Scattered, small sites, mainly on higher slopes, sedentism and beginning of agriculture, beginning of animals husbandry (17 sites)							Xinglongwa culture (6200-5000 BC) ↑	Numerous sites mostly small, relatively clustered distribution, a few large settlements, mainly distributed in the south of the region, sedentism and initiation of plant domestication, beginning of animals husbandry (1033 sherds, 72 collection units, 32.103ha, 12 sites)
				Zhaobao-gou culture (5000-4500 BC) ↑	More scattered small sites, distributed on higher slopes, sedentism and agriculture, beginning of animals husbandry (29 sites)							Zhaobaogou culture (5000-4500 BC) ↓	Decrease in sites number, small sites, low density, mostly distributed in the south of the region (561 sherds, 24 collections units, 12.197 ha)
Period 3 (culture of Haminmangha) (3500-2900 BC) ↓	Rare and small sites, no sign of hierarchization	Culture of Laohushan (2900-2100 BC) ↑	Numerous small sites, 8 large sites (4 with walls), mostly on south slope of mountains regions, low integration level, traces of social conflicts (48 sites, 777 sherds, 31 collections)	Hongshan culture (4500-3000 BC) ↑	Increase in sites number, clear hierarchization, distribution on slopes, social hierarchies, religious activity centers, sedentism and increased importance of agriculture, animals husbandry (160 sites)	Hongshan culture (4500-3000 BC) ↑	Numerous sites, mostly distributed on the riverside slopes, high level of hierarchization and integration, presence of settlement and religious centers, sedentism and increased importance of agriculture, animals husbandry (2755 sherds, 485 collection units, 87 ha, 134 sites)	Hongshan culture (4500-3000 BC) ↑	Numerous scattered small sites and farmsteads, major religious center (1911 sherds, 336 collections, 43.1 ha)	Hongshan culture (4500-3000 BC) ↑	Small sites, scattered distribution, low level of integration, sedentism and agriculture, animals husbandry (765 sherds, 152 collection units)	Hongshan culture (4500-3000 BC) ↓	Decrease in sites number, mostly distributed in the center of the region (324 sherds, 15 collections units, 5.679 ha)
				Xiaoheyuan culture (3000-2200 BC) =	Small and rare sites, catastrophic decline (435 sherds)							Xiaoheyuan culture (3000-2000 BC) ↓	Small and rare sites, catastrophic decline (122 sherds, 44 collection units, 9 ha)

Early to Middle Bronze Age (cultures of Xiaolaha and Gucheng) (2000-1000 BC) ↑	Increase in sites number, 2 large centers, settlement system reaching a certain level of integration, hierarchization and organization	Culture of Zhukaigou (2100-1500 BC) ↓	Decrease in sites number, continuity on several sites, no obvious integration characteristics (3 sites, 25 sherds, 7 collections)	Lower Xiajiadian culture (2200-1600 BC) ↑	Increase in sites number and surface. Defensive features (stone walls and ditches), clear hierarchization (three levels). Center sites, high level integration, agriculture, early state organization	Lower Xiajiadian culture (2000-1200 BC) ↑	Increase in sites number, but decrease in sites size, clustered distribution, autonomous districts, settlement hierarchization (3 to 4 levels), continuity in riverside slopes distribution, few center sites (3866 sherds, 600 collection units, 132 ha, 226 sites)	Lower Xiajiadian culture (2000-1200 BC) ↓	Scattered small sites and farmsteads (1689 sherds, 204 collections, 29.8 ha)	Gaotaishan culture (2000-1200 BC) ↑	Numerous small sites, a lot of new sites, relatively homogeneous distribution, a few large sites, hierarchization of the settlements (3 levels), center settlement sites (in the south), sedentism and agriculture, animals husbandry (4873 sherds, 581 collection units)	Lower Xiajiadian culture (2000-1400 BC) ↑ Gaotaishan culture / Weiyangzi culture (1400-1100 BC) ↑	Few sites, emergence of settlement hierarchization (2 levels), a few large sites with walls (2366 sherds, 105 collection units, 60.809 ha) Large increase in sites number and size, relatively homogeneous distribution, high level of land use, settlement hierarchization (3 levels), emergence of region centers (21442 sherds, 1101 collection units, 599.616 ha)
Late Bronze Age (culture of Baijimbao) (1000-500 BC) ↑	Increase in sites number, decrease in sites size, denser distribution, continuity of the settlement system, with integration or tendency towards unification			Upper Xiajiadian culture (1100-600 BC) ↑	Emergence of a new organization, important decrease in sites number, but increase of large settlements, agriculture and animal husbandry, richer burial offerings, social hierarchization	Upper Xiajiadian culture (1200-600 BC) ↑	Number of sites doubled, increase in sites size, continuity in riverside slopes distribution. Emergence of large settlements with particularly concentrated and dense materials, clear hierarchization and integration (5102 sherds, 645 collection units, 140 ha, 174 sites)	Upper Xiajiadian culture (1200-600 BC) ↓	Steep decrease in sites number and size (279 sherds, 23 collections, 3.5 ha)	Upper Xiajiadian culture, Upper Xinle culture, Shi'ertaiyingzi culture (1200-600 BC) ↓	Decrease in sites number and size, hierarchization of the settlements (3 levels), relatively small centre settlements in the north, low level of integration, sedentism and agriculture, animals husbandry (219 sherds, 62 collection units)	Linghe culture (1100-300 BC) ↓	Steep decrease in sites number and size (843 sherds, 41 collection units, 26.489 ha)
Early Iron Age (culture of Hanshu phase II) (500 BC-0) ↑	Increase in sites number, clearer hierarchical organization	Warring States period (500-200 BC) ↑ Han Dynasty (200 BC-200 AD) ↑	High number of small sites, sites in the low lands, agriculture, low level of political and economic integration. Zhao State Continuity, increase in sites number, clear hierarchization, agriculture	Warring States to Han (500 BC-200 AD) ↓	Scattered distribution, decrease in sites number and size, no center site. Yan State	Warring States to Han (500 BC-200 AD) ↓	Steep decrease in sites number, scattered distribution, disappearance of the large centres, ruralization. Yan State (3618 sherds, 960 collection units, 207 ha, 327 sites)	Warring States to Han (600 BC-200 AD) ↑	Numerous scattered small sites and farmsteads (1466 sherds, 348 collections, 45.5 ha)	Warring States to Han Dynasty and Xianbei (500 BC-200 AD) ↓	Very low number of very small sites, no integration, quasi abandonment of the region. Yan State Great Wall and Xianbei (155 sherds, 55 collection units)	Warring States to Han Dynasty (300 BC-200 AD) ↓	Quasi abandonment of the region (16 sherds, 3 collection units, 2.68 ha)
Early Middle Age (200-900 AD) ↓	The development trend stops, many sites disappear, and the largest site shrinks despite continuous use			Liao-Jin period (200-1200 AD) ↑	Highest sites number, activities more clustered	Liao period (200-1200 AD) ↑	Increase in sites number and size, high level of integration, innumerable hamlets and farmsteads, compact villages and a centre city-site (3957 sherds, 1413 collection units, 285 ha)			Khitans and Liao Dynasty (200-1200 AD) ↑	Numerous but small sites, homogeneous distribution, low level of integration and hierarchization, high land occupation	Liao (post 200 AD) ↑	Increase in sites number and size 2074 sherds, 200 collections units, 125.4291 ha)
Late Middle Age (Liao-Jin) (900-1300 AD) ↑	Emergence of numerous new sites, new large-scale organization developing into a hierarchical and competitive settlement system												

Modern period (1800-1949 AD) =	Stable settlement system, decrease in density												
--------------------------------------	---	--	--	--	--	--	--	--	--	--	--	--	--