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Evolution of human-land relations from 7100aB.P.-3700aB.P. in the Southern Jiangsu region

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Abstract. The article explores the evolution of human-land relations, especially the process of land-use conversion, in the Southern Jiangsu region during the 7100aB.P.-3700aB.P. time period from the spatial cultural distribution of archaeology, the spatial morphology of settlement sites and the Holocene environmental changes.The results show that the archaeological cultures of the Southern Jiangsu region interacted with environmental changes during this period, and that in the transitional phase of the 7100aB.P.-3700aB.P. Huaxia culture, the degree of land use of ancient humans deepened, and human response to nature gradually changed to proactive measures.

Keywords. Southern Jiangsu,neolithic,human-land relations,environmental changes

Introduction

The Southern Jiangsu region, located in the area south of the Yangtze River in Jiangsu Province, consists of the five cities of Nanjing, Zhenjiang, Changzhou, Wuxi, and Suzhou, and its scope is roughly located in 118.3°–121.3°E, 32.6°–30.7°N, with an area of 27,872 km^2. The study area is located in the mid-latitudinal zone on the east coast of the Asian continent, and climatically it has a subtropical humid monsoon climate, with a relatively distinct season, and geomorphologically it is It is mainly dominated by plains, with hills and low mountains concentrated in the central and western parts, and the vast Taihu Lake Plain in the eastern part (Fig. 1).

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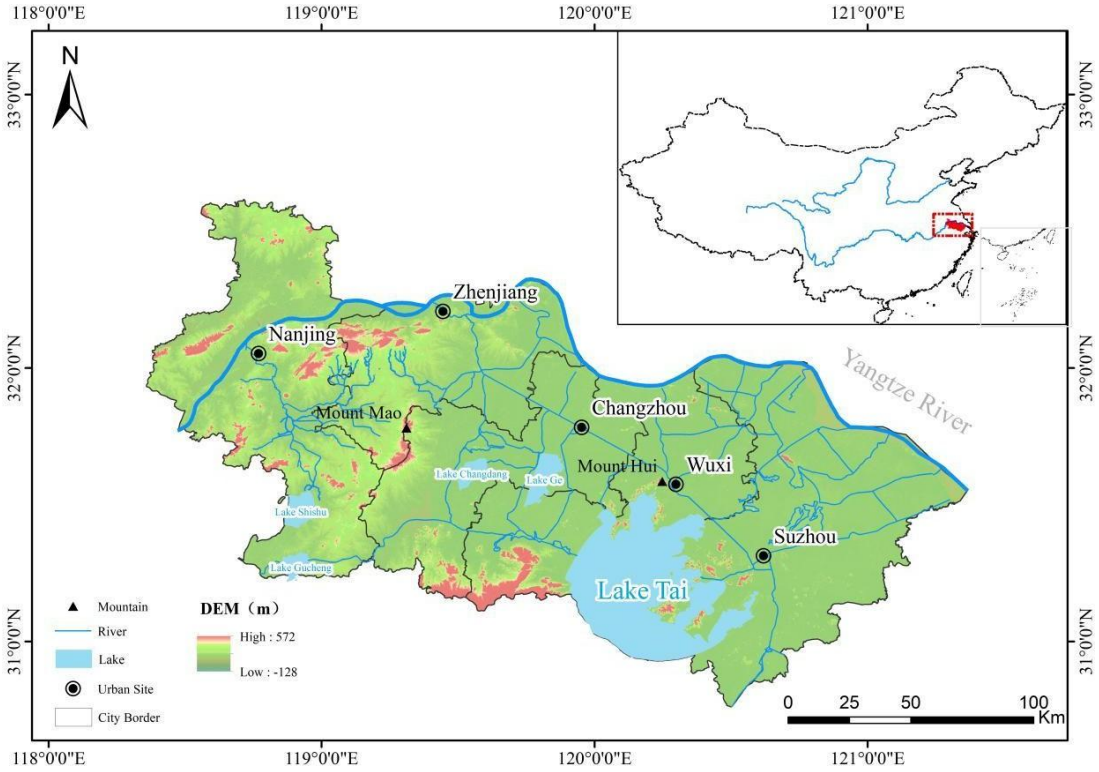
Fig. 1 Topographic and geomorphological overview of Southern Jiangsu Province



As a key region in the evolution of civilisation from the Neolithic to the early Bronze Age in eastern China, the development of prehistoric societies and the changes in the natural geographic environment showed a complex coupling relationship.7100aB.P. to 3700aB.P. was a period of significant climatic fluctuations in the Holocene in the monsoon region of East Asia, with frequent sea-level rise and fall, and also an important stage of the successive evolution of the region from the Majiabang Culture, the Songze Culture, the Liangzhu Culture, and the Mazhubang Culture, which were the most important cultures in China. It is also an important stage in the successive succession of the region from Majiabang Culture, Songze Culture and Liangzhu Culture. The large number of Neolithic sites in the region (more than 136 sites in the region, including 18 in Nanjing, 12 in Zhenjiang, 16 in Changzhou, 23 in Wuxi, and 67 in Suzhou) reflects the fact that this is an important archaeological and cultural centre in the Yangtze River Delta and even in the lower reaches of the Yangtze River (Fig. 2) . As can be seen from the kernel density map (Fig. 3), the Neolithic culture range of the Southern Jiangsu region shows an ‘east-heavy, west-light’ distribution pattern, but with the change of time, the cultural distribution range of the study area also has different manifestations.

The study of human-earth relations in the Neolithic period in this region has produced many results. Cao, G. & J. Wang (2005) through a review of the research on the environmental evolution of the Yangtze River Delta (YRD) from 1980 to 2000, pointed out that there is a two-way feedback mechanism between the natural environment and human activities in the YRD during the Holocene period, i.e., the environmental change profoundly affects the human activities, while the human activities will generate dynamic feedback and adaptive adjustment based on the environmental change. Huang, L. (2009) through quantitative analysis of the spatial and temporal distribution of sites, revealing that changes in the number of Neolithic sites

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around the Taihu Lake Basin are closely related to climate fluctuations, the scope of sea invasion and the evolution of vegetation, manifested in the overall increase in the number of sites in the Majiabang to Liangzhu cultures, of which the middle of the Liangzhu period due to environmental adaptability to enhance the expansion of the land after the receding of the sea to reach the peak, and the Songze early and Liangzhu late due to the impact of the climate dry and cold or the impact of sea invasion appeared in the stages of the trough. Chen, J. (2015) explains the process of Taihu Lake watershed change through historical geography, and argues that the change of Taihu Lake watershed has shaped the cultural pattern and social development trend of the region to a certain extent. Yu, L. (2018) innovatively integrates GIS spatial analysis and hydrological geomorphological data, focusing on the impact of ancient river channels and hydrological environment on cultural development in the Taihu Lake Basin, and speculates that the demise of the Liangzhu culture may be related to flooding. Xiao, Y. (2019) proposes that climate, topography, water system density and soil type constitute the core environmental variables for the siting of Neolithic sites in the Circum-Taihu Lake Basin, and that the complexity of their social organisation reflects their dynamic adaptations in cultural evolution.However, although existing studies reveal the coupled relationship between environmental evolution and cultural development at the macro scale, they still lack a systematic deconstruction of the response mechanism of heterogeneity of geographical units within the region. Therefore, this paper focuses on interpreting the human-earth relationship in the period from 7100a B.P. to 3700a B.P. in the Southern Jiangsu region through the environmental evolution, archaeological and cultural distribution, and morphological characteristics of settlement sites. (The data in this paper are all from the Atlas of Chinese Cultural Relics - Jiangsu Branch, and the way of determining the size of the site is: 1-10,000 square metres is a small settlement; 10,000-1,000,000 square metres is a medium-sized settlement; and ≥100,000 is a large settlement.)

Technium Social Sciences Journal
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Fig. 2 Distribution of Neolithic Sites in the Southern Jiangsu Region

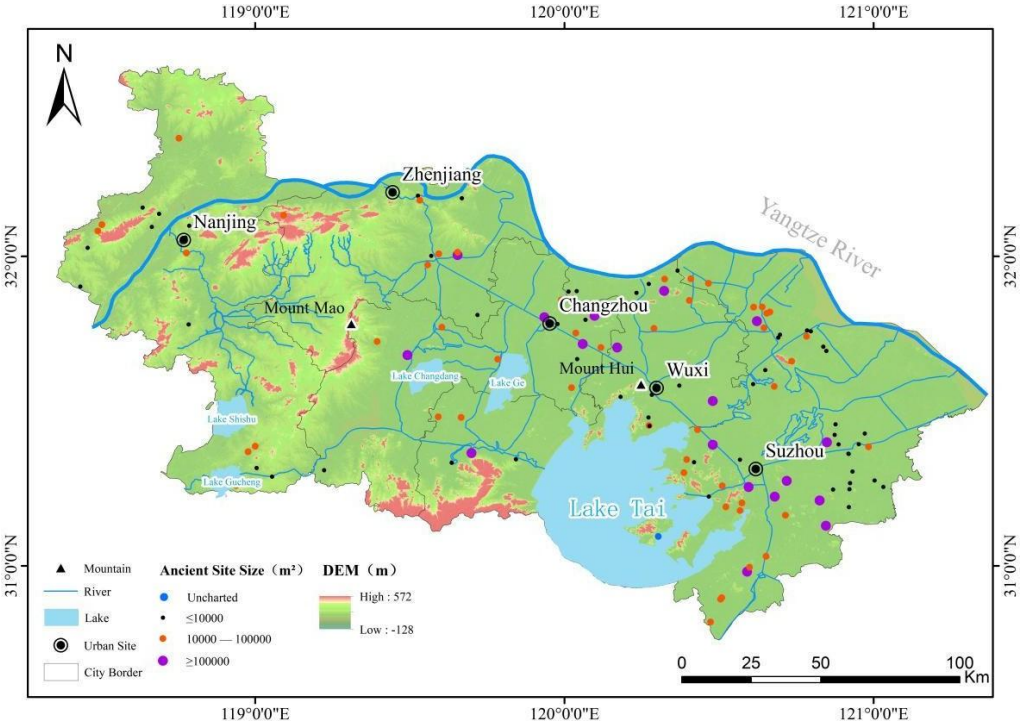
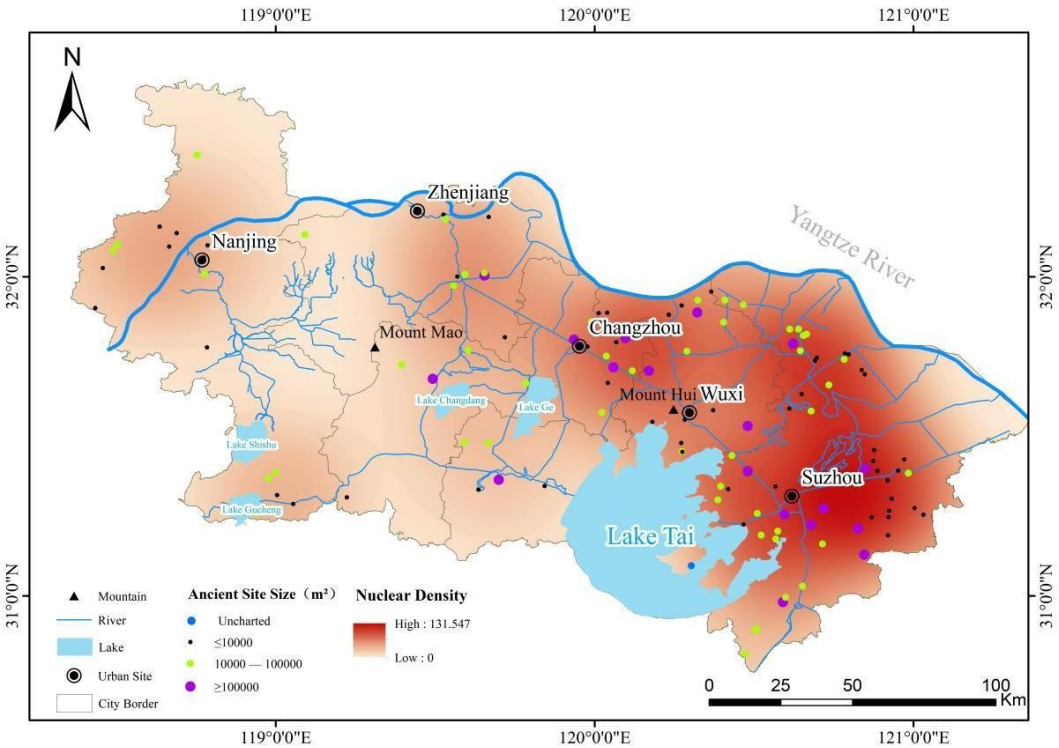


Fig. 3 Neolithic culture kernel density map of the Southern Jiangsu region



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Human-land relations during the Majiabang culture period

According to ^{14}C dating and related data, the Majiabang culture developed between 7100aB.P.-5900aB.P (Zheng, D, 2023). It is one of the earlier known archaeological cultures in the Southern Jiangsu region, and the distribution of sites is mainly concentrated on the eastern shore of Taihu Lake (Fig. 3), which accounts for a relatively low number of sites throughout the entire Southern Jiangsu period of various cultures. The total number of its sites is 33 (Fig. 4), with 8 large-scale settlements, 14 medium-scale settlements, 10 small-scale settlements, and 1 settlement of unknown size (Fig. 5), mostly distributed in the direction of the Taihu Lake Plain in the east-central part of the southern Jiangsu region. Among them, there are fewer large-scale sites, and the more representative one is the site of Samsung Village, which is now located in the south-east of Xigang Town, Jintan City, Jiangsu Province, about 2 kilometres to the north of Samsung Village, on the east side of Maoshan Mountain Range, the demarcation line between Ningzhen Hills and Taihu Plain, and on the west side of the Danjinli Caohe River, which belongs to the plains with low topography, with a total area of more than $10\times10^4m^2$ (Wang, G. & J. Zhang, 2004). Settlement sites around the dense network of rivers, high terrain, the distribution of housing sites are dense postholes, showing that it has a carefully planned, well-planned layout of the characteristics of other Majiabang culture sites, such as Changzhou City, Wuxi City, Hongkoudun and other sites, the same reflects the Majiabang culture period of the settlement sites of the large-scale and layout of the characteristics of the precision.

Majiabang culture in the various sites found in the production tools, mainly for stone tools, which is mainly ground stone tools, the typical type of tools are stone adze and stone axe, is used for grubbing and cutting tools, in addition, there are also stone axe, stone chisel, stone knife and other production tools.Whether from the adjacent areas of archaeological culture compared, or from the Majiabang culture sites appear production tools speculation, this Neolithic culture is agricultural production, but from the site of the excavation of charred rice grains can be seen, its proportion in the recipes accounted for a relatively small number of more than 10,000 square metres of the southern region of the number of the size of the colony accounted for a large number of, which determines that these agricultural production can not meet the needs of large-scale settlement of the population. From the unearthed large-scale animal remains as well as ancestral meat recipes analysis (Hu, Y et al., 2007), fishing and hunting collection still occupy a large proportion of the cultural and economic components of the Majiabang culture, and it can be seen that this broad-spectrum type of land use with a combination of primitive agriculture and fishing and hunting collection is the basis for the development of ancient human settlements.

It is known that the cultural development of the Majiabang culture took place from 7100aB.P.-5900aB.P., and that 7200-5900aB.P. was the more favourable period of the Holocene climate. What is reflected is that the mean annual temperature in the mid-latitudes was 3-4°C higher than today, and the warm-temperate deciduous broad-leaved forest belt was pushed northward by three dimensions, when the Yangtze River Basin was 2.7°C higher than today (Shi, Y et al., 1992). Recent studies also show that based on the Holocene multimedium climate evolution curve in eastern China, and the correspondence study of climate events, the centre time of the Great Warm Period should be 7.2 KaBP, which is a high temperature period between the strong cold event of 8.2 KaBP and the strong cold event of 6.2 KaBP (Wang, J et al., 2022). Under the condition of rising precipitation and temperature, dense river network and luxuriant vegetation, the Southern Jiangsu region located in the lower reaches of the Yangtze River at this time had a relatively good palaeoclimate environment. Liu Huiping and other

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scholars in the Shanghai-Suzhou-Hangzhou area site of the sporulation analysis study also pointed out that the Majiabang culture period of warm and humid, the average annual temperature of 18.3-19.0℃, higher than today's 3-3.2 ℃, and the average annual precipitation of 1169-1538mm (Liu, H. & K. Wang, 1998). This also proves that the survival and development of ancient human beings at this time had a relatively good environmental basis.

In this natural environment, through the spatial distribution of sites of Majiabang culture period in Southern Jiangsu Province can be seen (Fig. 4), basically distributed in the proximity of rivers and lakes on the hillock, terrace or mound, in such a geomorphological background, the surrounding lakes and rivers can provide a certain source of meat, the growth of forests in the surrounding area can be stable to provide the collection of food, in the context of the environment can be stable to provide the means of production. In such an environment that can provide stable means of production, this is undoubtedly an excellent place for the Majiabang culture to flourish.

In addition to large and medium-sized settlement sites, the number of small settlement sites is low, but still cannot be ignored. The author believes that the terrain height difference is one of the important factors that determine the degree of preservation and continuation of the Majiabang culture sites and even the size of the area, located in the Jinxi area of the southern border of Jiangsu Province to a certain extent by the influence of the high sea surface in the Middle Holocene, which is presumed to be a bay, lagoon environment (Meng, Y et al., 2014). This proves the situation of humid climate and expanding geographical water surface at that time, and the large and medium-sized sites are basically distributed on several metres high post and mound, which shows that the large and medium-sized sites at that time have certain waterproofing ability. Zhang, Q., et al. (2004) think that most of the houses in Majiabang are mainly dry-rail type buildings, most of them are distributed in the hillside and the lake branch shore a little high on the hillock, mound, this form of housing construction and the characteristics of the ancestors to choose the high and live in the climate also reflects the humidity at that time, the ground water expansion of a kind of environmental conditions. This can also prove the author this inference. In 7500-6000 years ago, the most sea invasion, the Yangtze River estuary retreat to Zhenjiang and other places (Pan, F et al., 1984), from the small site of the excavated relics of the view, the dry columns of the base of the columns, so it had to migrate to a high place or migrate to other large settlements, which inferred that the small site of the waterproof ability to be weak, but also during this period of time, the site area of these sites is small and difficult to exist for the reason.

The spatial distribution of Majiabang in Southern Jiangsu Province, according to the spatial distribution map and the analysis of nuclear density (Fig. 4 , Fig. 6), the development of Majiabang culture can not be radiated to the entire Southern Jiangsu Province. From the region as a whole, the development of Majiabang culture centre of gravity for the Taihu Lake area around the Su, Wu, Chang three cities, the western Ningzhen area is basically not affected by the expansion of Majiabang culture, according to paleogeographic studies, at this time in the southern Jiangsu region in the geomorphology of the west rise and fall of the east of the lifting of the oblique movement is more pronounced, the ancient ground under the undulation of the formation of the Ningzhen area of the mountainous terrain(Pan, F et al., 1984), the natural geomorphology of this is not conducive to the production of the life of the ancient mankind, and this time This natural landscape is not conducive to the production and life of ancient mankind, and at this time, the ability of human beings to transform nature is weak, which may also be one of the reasons why there are very few Majiabang cultures in Ningzhen.

Technium Social Sciences Journal
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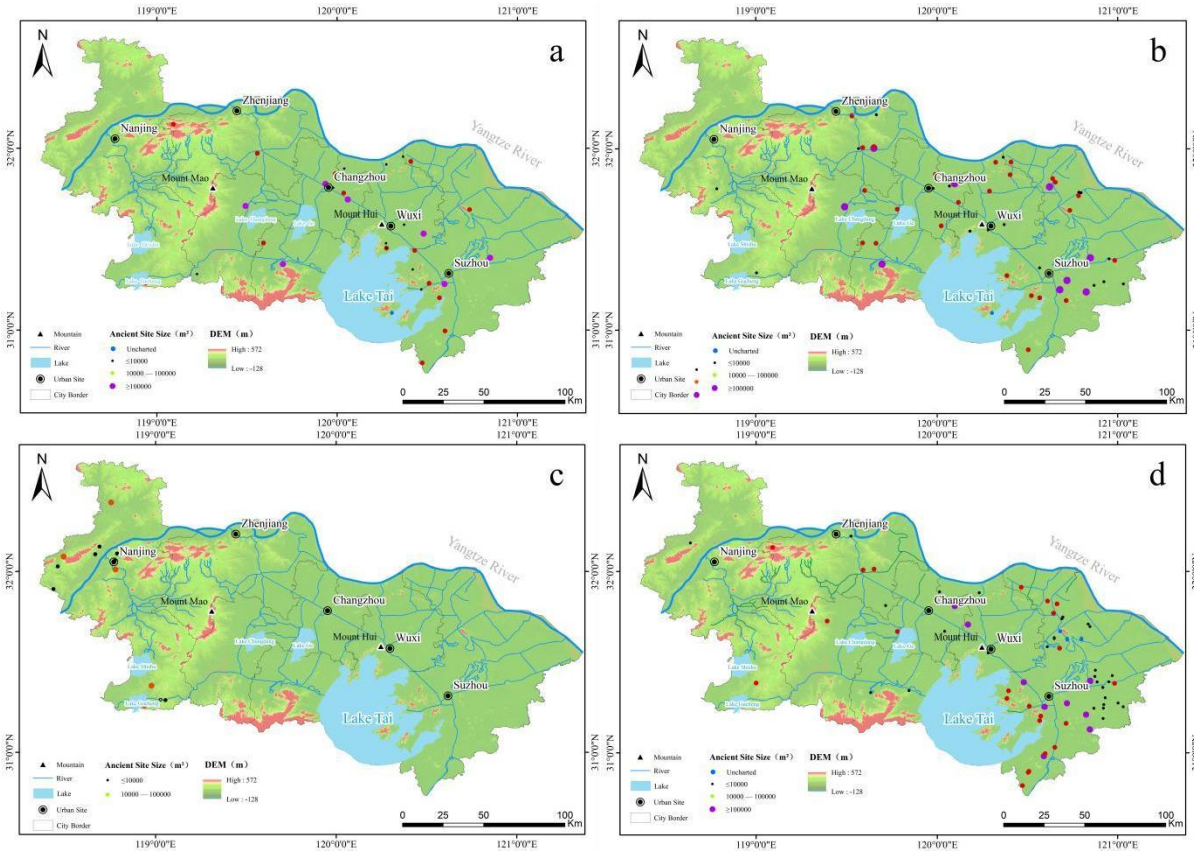
To sum up, during the Majiabang culture period, the land use of ancient mankind is still a combination of primitive agriculture and fishing and hunting economic structure, this broad-spectrum land use thanks to the Holocene warm and humid, abundant precipitation and hydrological resources under the premise of the richer, and at the same time, the dissemination of Majiabang culture by the impact of the natural topographical constraints to the Maoshan Mountain Range basically stopped, showing that at this time, Southern Jiangsu Province, the culture of the Neolithic culture as a whole is 'strong in the east and weak in the west' pattern can also reflect that mankind is more dependent on the natural environment less influence on the natural environment. Neolithic culture as a whole was 'strong in the east and weak in the west' pattern, which also reflects that human beings are more dependent on the natural environment, and ancient human beings have less influence on the natural environment.

Fig. 4 Spatial distribution map of Neolithic cultures in Southern Jiangsu: **a** Majiabang culture;
b Songze culture; **c** Beiyinyangying culture; **d** Liangzhu culture



Human-earth relations during the Songze and Beiyinyangying cultures

According to ^{14}C dating and related data, the development time of Songze culture was 5300aB.P.-5000aB.P., and the time of North Yinyangying culture was also in this interval (Zhang, Z, 2009), which is an important time period for the culture to turn to civilisation. According to the spatial distribution and kernel density (Fig. 4, Fig. 6), the distribution of Neolithic sites in the southern Jiangsu region during this period can be described as a

Technium Social Sciences Journal
Vol. 71, 285-299, May, 2025
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'blossoming' trend, the culture radiated to the whole region, is a more developed stage of the development of the Neolithic culture in the southern Jiangsu region, bounded by the Maoshan Mountain Range, east of the Songze culture site distribution area around the Taihu Lake area, west of the northern yinyangying culture distribution zone (Fig. 4, Fig.6). Yinyangying culture distribution zone to the west . There are 52 Songze culture sites in this area, of which 9 are large sites, 24 are medium-sized sites, 18 are small sites, and 1 is unknown. North Yinyangying culture sites total 17, basically small and medium-sized sites, of which there are no large settlements, 5 medium-sized settlements, 7 small settlements, and 1 unknown settlement (Fig. 5), compared with the Majiabang culture period, this section of the site in the southern region of Jiangsu Province, whether in terms of the number of sites, the size of the site, or the radiation range of the culture, are more and wider than the former.

Representative of the Songze culture in the study area is the Dongshan Village site, which is located in the city of Zhangjiagang, slightly north of the central part of the site is a slope about 2 metres above the surrounding area, where the cultural layer accumulation is the richest, and it is the central area of the entire site, which was nearly 4 metres above the surrounding farmland at the time of the survey in 1989. A total of five houses were found in the habitation area of the site, one of which has a rectangular gentle slope in the middle of the western part of the house site, which is presumed to be a doorway, and in the middle of the southern and northern parts of the site, respectively, rectangular and square earthen pillar bases were found, which are slightly higher than the habitation surface, and are presumed to be the site of a single large room, which was supported by using the middle pillar. A more elaborate architectural layout can be seen. At the same time found a large-scale burials, with the burials unearthed large stone battle-axe, long stone adzes, ceramic large mouth jar and other ceremonial nature of the burial objects, indicating that at this time there has been an early stage of the existence of the ceremonial system (Zhou, R et al., 2010), indicating that this period of the Songze culture period of ancient human social development than the Majiabang more developed. The representative site of the Beiyinyangying culture is the Beiyinyangying site, located in Gulou District, Nanjing City, Beiyinyangying 8, located in the ancient Jinchuan River on the east bank of the earth platform, about 5 metres above the level ground on the elliptical mound, the cultural layer is about 4 metres thick, a total of four layers, the fourth layer of the Neolithic cultural accumulation, the number of burials is amazing, up to more than 270 (Administration, N. C. H, 2008), so from the discovery of the burials can be seen here the ancient humans Therefore, from the burial discovery, it can be seen that the ancient human beings in this area survived in large numbers, and the development of their funeral culture also implies the enhancement of the social consciousness ability of human beings in this period.

The level of production of Songze culture and North Yinyangying culture also shows its progress, the specific performance is the emergence of a large number of more finely ground stone tools, such as stone rings, stone spinning wheels, stone ploughs, etc., the emergence of stone ploughs and Majiabang culture agricultural stone tools compared to the turnover tools have made great progress, and at this time, the climate of the period of Songze culture and North Yinyangying culture is basically for the continuation of the Holocene Great Warm Period. From the peat as well as sediment sporulation, when the vegetation for the evergreen broad-leaved forest, deciduous broad-leaved mixed forest is dominated, can be seen in its warm and humid climate environment (Jing, C, 1989), and through the hydrological data show that 8.6Ka-4.4Ka, in the Holocene effective moisture maximum value (Wang, X. & X. Huang, 2019). Obviously, in this climatic environment, it will be more favourable to agricultural production. Of course,

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the maintenance of more than the Majiabang culture period, large-scale settlements, agricultural production technology to improve the level of the settlement is the foundation of the existence of the settlement, for example, at this time, the use of stone ploughs and other advanced soil turning tools, for agricultural production and enhance the population has a great advantage, but also reflects the level of agricultural land use at that time is much higher than the Majiabang culture period.

Of course, at this time within the two cultures are also very different, in the number of sites and the scale of the North Yin Yang Ying culture seems to be much worse than the Songze culture, but this is due to the geographical environment, the ancient mankind at this time, although the agricultural technology has been greatly improved, but still not conducive to the hills in the mountains for rice planting, most of the North Yin Yang Ying site is concentrated in the Yangtze River Plain, the mountainous and hilly areas are very few, and also proved that the distribution of sites by the topographical factors are very heavy, according to modern archaeological research by the Taihu Lake area Majiabang culture and the Songze culture. Also proved the distribution of the northern yinyangying culture sites by the influence of topographical factors is quite heavy, according to modern archaeological research, the northern yinyangying culture by the Taihu Lake area of the Majiabang culture and the influence of the Songze culture, the interaction is relatively close (Chen, G. & P. Xu, 2014), but due to geomorphological factors, this cultural dissemination is still subjected to a greater barrier, of course, this definition is only temporary, and need to be further in-depth archaeological work to carry out in future! The definition is only temporary, and further archaeological work is needed to support it.

To sum up, the climate environment in this period for the continuation of the Holocene Warm Period, agricultural development is more rapid, land use level increased significantly, the Songze culture in the southern region of Jiangsu Province and the northern yinyang culture of close interaction, although by the impact of factors such as topography, but also constitutes the southern region of Jiangsu Province in this period of the ‘sky full of stars’ type of neolithic culture development pattern, this period of agricultural development is more rapid. Agricultural development is more rapid, the development of human society and the ability to adapt to nature has improved, this may also be adapted to the lower reaches of the Yangtze River culture to civilisation transformation of the important evidence.

Technium Social Sciences Journal
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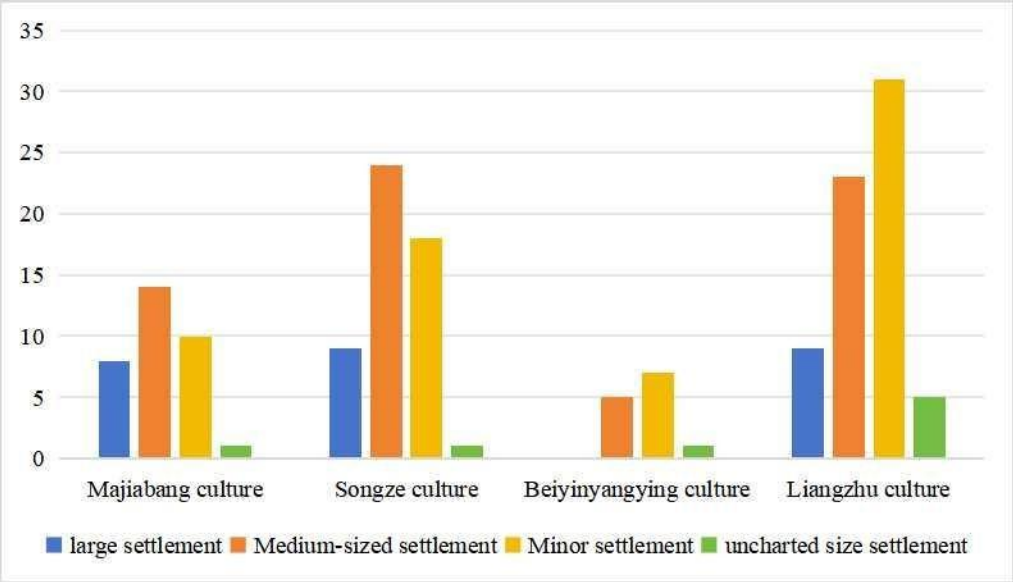
Fig. 5 The number of Neolithic settlement site sizes in the Southern Jiangsu region



Human-earth relations in the Liangzhu culture period

According to ^{14}C dating and related data, the age of Liangzhu culture can be divided into early, middle and late phases, with the early phase 5000-4000 years before present, the middle phase about 4500-4000 years before present and the late phase about 4000-3700 years before present, with a total development time of 5000aB.P.-3700aB.P. (Zhang, Z, 2009). The number of its sites in the southern part of Jiangsu Province reaches as many as 68, which is the most of all archaeological cultures in the region. The specific site size is, 9 large settlement sites, 23 medium-sized settlement sites, 31 small settlement sites, and 5 unknown-sized settlements (Fig. 4), according to the spatial distribution of the sites can be seen, mainly concentrated in the eastern part of Southern Jiangsu Province around the east coast of Taihu Lake area on the plains and depressions.

Liangzhu culture in the southern region of Suzhou is more representative of the settlement site for the site of nickel, this place is Suzhou Kunshan town of Zhengyi north nickel village, south from Zhengyi town of about 2 kilometres, 10.5 kilometres from the east of the city of Kunshan in the Yangcheng Lake and the puppet lake in the narrow zone between the site of the original central mound, called 'nickel hill', about 6 metres above ground level The north-south length of 70 metres, east-west width of 30 metres, an area of more than 2,000 square metres (SuZhou Museum, A. I. o. C. R. i. K, 2000), the site covers a total area of 40 × 105m2, the site depth of the third layer of the Liangzhu culture layer, the tools of production are relatively rich, mainly stone axes, stone adzes, stone knives, stone sickles, etc. (Wang, Z. & Z. Chen, 1984), some of which are ground stone tools have appeared in the first three cultural periods, in the Liangzhu culture has maintained a certain number of these artifacts These artefacts are basically related to agriculture, in addition, in other large sites, such as the Yuecheng site, also appeared in some of the back of the middle of the short handles of the cultivator, grinding one-sided concave arc edge of the sickle and other more delicate agricultural production tools (Wang, Z. & W. Li, 1982). All these prove that agricultural production had reached a considerable level at this time.

Technium Social Sciences Journal
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However, the environmental conditions in this period are not good compared to the previous three archaeological cultures, and may be worse, which are mainly reflected in the climatic changes. Ge Qian, Liu Jingpu and other scholars pointed out that after 5.1KaB.P. winter winds began to be strong, the Holocene Warm Period into the decline stage (Ge, Q et al., 2011), and in the middle and late Liangzhu culture, the climate has a clear trend of cooling, some scholars pointed out that in the period from 4.3Ka to 3.4Ka, subtropical and temperate trees were widely replaced by grasses around the coastal environment (Ye, L et al., 2022). The climate change marks the Holocene climate optimum period is going to end, the natural environment has a tendency to decline, but the cultural connotation expressed by Liangzhu culture is just the opposite, whether it is the number of sites scale, or the excavated stone tools, jade, pottery craft, burials, etc., all show that this period is the most developed Neolithic culture, and this cultural development and the natural environment is inversely proportional to the natural environment, which is worthy of scrutiny.

At this time, the ability of people to adapt to transform nature is more strengthened, human beings in order to deal with the environment to do a lot of precautionary measures, through the spatial distribution map as well as the nuclear density map can be seen (Fig. 4, Fig. 6), the distribution of sites by the Taihu Lake as the centre of the gradual dispersal of the eastern part of its cultural radiation is less than the cultural scope of the 5300-5000 years of the period of the South Jiangsu region, but at this time, the eastern part of the Taihu Lake Plain sites as well as the density of the population to reach At this time, the number of dry pollen in the Liangzhu culture layer increased dramatically, showing that under the dry and cool climate, the area of lakes and marshes was further reduced, thus creating a wider space for the development of ancient mankind (Ni, H. & L. Ji, 1997). A large number of wells were found in many Liangzhu culture sites, such as the Juan Tang Bee site, the Zhujing site, the Shidun site, the South Luodun site, the Chenghu site, etc. (Administration, N. C. H, 2008), which is an important measure for ancient humans to cope with the dry climate and the decline of water resources, which was used to maintain the irrigation of agriculture and the development of the society in the settled areas. Therefore, it is not surprising that the settlement could develop such a large population base.

Of course, this does not mean that the development of Liangzhu culture is not subject to the natural environment, the natural environment on the production of ancient human life influence factor is still very heavy. In the middle and late Liangzhu culture, the living environment of ancient human beings in the southern part of Jiangsu Province gradually deteriorated. In the late Holocene, the proportion of C4 plants in southern China, including the Yangtze River Delta, increased, which may reflect the aridity of the climate in the late Holocene, and on the other hand, it may also be influenced by human activities (Cui, L et al., 2019). In a study related to the evolution of underwater sedimentation and anoxic development in the Yangtze River Delta region during this period, Tingting Xu and Xu Shi pointed out that with climate change, freshwater discharge increased in the middle Holocene (8-5 KaBP) and decreased sharply in the late Holocene (5-1 KaBP) (Xu, T et al., 2020), and that the drought event of 4.5-4 KaBP may be related to the widespread 4.2 Ka climatic event, resulting in a highly unstable hydro-climatic condition of the Yangtze River Delta. highly unstable hydroclimatic conditions (Li, X et al., 2024). It is inferred that the effective water resources in the southern Jiangsu region were on a decreasing trend at this time, and hydrological disaster events occurred, with flood events and drought events likely to exist in the lower reaches of the Yangtze River around 4000 aB.P. and 3800 aB.P., respectively (Shi, W et al., 2010). These

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unfavourable climatic environments undermined the self-healing power of the society at the end of the Liangzhu culture, thus breaking the balance between manpower and environment. Ultimately, it may have been an important reason for the difficult and tortuous direction of its culture.

In the spatial layout, with the Maoshan Mountain Range as the boundary, the western part of the Southern Jiangsu Province, Ningzhen mountains, the number of Neolithic sites in this period has been greatly reduced, from the analysis of the nuclear density map, the plains on the east shore of Lake Taihu constitute the Liangzhu culture circle, and its cultural radiation only reaches the Maoshan Mountain Range, the Ningzhen mountainous areas basically no trace of the dissemination of the Liangzhu culture, in addition to the northern yinyangying culture seems to have disappeared, the reason for which, the author believes that In addition to the limitations of the mountainous living environment, after the Holocene early and mid-long period of collection of fishing and hunting, the survival of these areas of the resources were consumed in large quantities, and at this time the ability of people to transform the environment is limited, so the means of production can not be sustained restoration, agriculture can not expand the scale of planting, so the western part of the southern region of the Ningzhen mountain site is small in number and the ancient Chinese people were forced to transfer.

In summary, Liangzhu culture is still enjoying the benefits of the Holocene Warm Period, the unprecedented development of ancient human society, to the middle and late Liangzhu culture, the climate gradually shifted from warm and humid to dry and cool, to a certain extent, affecting the production and life of the ancient human beings in the southern region of Jiangsu Province, but this period of mankind's ability to adapt to and transform the natural environment has increased, and the development of agriculture is more developed than that of the previous three cultural periods. In addition, the density of Liangzhu culture and the number of sites in the southern region of Jiangsu Province is far more than the previous three cultural periods, but due to topographic and geomorphological factors, Maoshan Mountain Range to the west of the Ningzhen mountains at this time almost become a Neolithic culture of the ‘vacuum zone’, the Neolithic culture range is gradually to the ‘east and west’ pattern change. The Neolithic culture range gradually shifted to the ‘east-light and west-heavy’ pattern.

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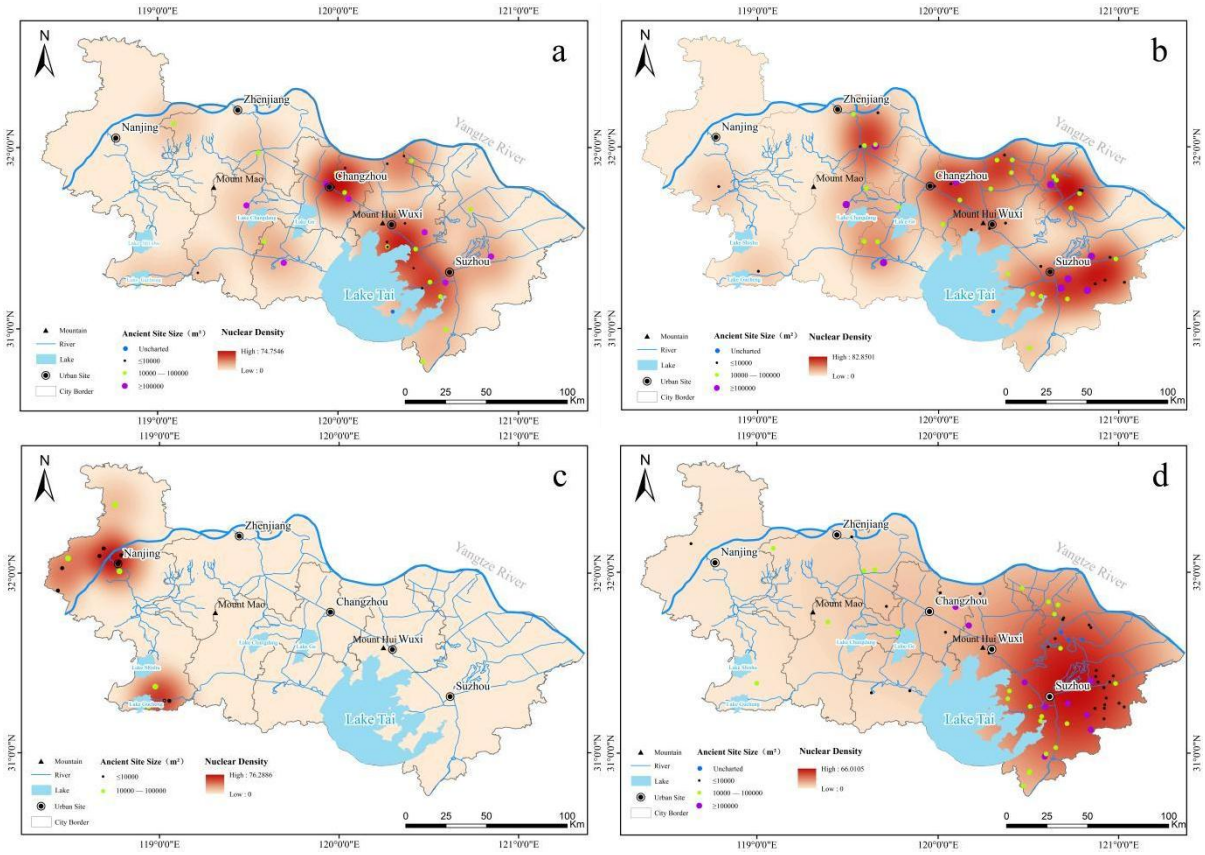
Fig. 6 Kernel density map of Neolithic cultures in Southern Jiangsu: **a** Majiabang culture; **b**
Songze culture; **c** Beiyinyangying culture; **d** Liangzhu culture



Conclusion

From the spatial cultural distribution of archaeology, the spatial morphology of settlement sites and the environmental changes in the Holocene, the article analyses the evolution of human-land relations in the Southern Jiangsu region in the time period of 7100aB.P.-3700aB.P., especially the process of land-use transformation, and the results show that the development of the archaeological cultures of the Southern Jiangsu region and the environmental changes during this period interacted with each other, and that in the transitional stage of the transformation civilisation of the Ma Jiabang culture, the degree of land use of ancient mankind has been deepening, as shown by the fact that in the Majiabang culture, the human response to nature has gradually turned to be proactive. In the 7100aB.P.-3700aB.P. transitional stage of the transformation of Chinese culture and civilisation, the degree of land use of ancient mankind has been deepening, and the human response to nature has gradually turned into an initiative, as shown in the Majiabang culture period, the land use of mankind is based on the combination of primitive agriculture and fishing and hunting and gathering economic structure, mankind is more dependent on the natural environment, the ancient mankind's impact on the natural environment is relatively small, and the cultural scope of the ‘East is strong, West is weak’. The cultural scope was ‘strong in the east and weak in the west’. In the period of Songze and North Yinyangying cultures, agricultural development was more rapid, and the ability of human society to develop and adapt to nature was improved, and

the cultural scope was ‘full of stars’. Liangzhu culture period, developed agriculture, human adaptation to the natural environment and transformation ability significantly enhanced, the cultural scope still maintains the ‘east heavy west light’.

Through the study of human-earth relations in the Southern Jiangsu region during that period, we can gain a deeper understanding of how ancient humans in the lower reaches of the Yangtze River adapted to the ever-changing natural environment and explore the clues to the development of civilisation from it, as well as further deepen our understanding of the changes and evolutions of human activities under different climatic conditions, based on the interactions between human beings and the environment at that time.

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