

# The collapse of Neolithic Culture around 4000 cal. yr BP in the Wensi River Basin, Shandong, China

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**Abstract**—To explore cause of collapse of Neolithic Culture around 4000 calendar(cal.) yr BP in the Wensi River Basin, Shandong, China, data of archaeological sites and features of artifacts both Longshan Culture and Yueshi Culture were collected. Based on the GIS software, the spatial and temporal pattern of sites were built. Results reveal that the advanced Shandong Longshan Culture was replaced by the lagged Yueshi Culture around about 4000 cal. yr BP, which mainly reflected at the sites number significant decrease and more lagged pottery production. The cold event occurred around about 4000 cal. yr BP in northern China may played an important role in the collapse of Longshan Culture.

**Keywords:** the Neolithic culture; environment change; the Wensi River Basin; 4000 cal. yr BP

## I. INTRODUCTION

The relationship between human civilization and environmental change is one of the important issues in environmental archaeology<sup>[1]</sup>. Some researches have proposed clearly that a sudden climatic shift to more cold/arid conditions caused the rapid collapse of culture at around 4000 cal. yr BP<sup>[1-4]</sup>. At present, signs indicating the collapse of Neolithic Culture around Central China include: (1) fewer archaeological sites found, and sites found in more restricted areas; (2) less sophisticated materials utilized than in subsequent cultural phases; (3) disappearance or a sharp decrease of large-scale architecture such as centralized ritual burial areas and highly labor-intensive walled settlements<sup>[5]</sup>.

In China, around 4000 cal. yr BP is the key stage for Chinese civilization, and much Neolithic Culture fell, while the Central Plain of China entered the threshold of civilization exclusively. The advanced Shandong Longshan Culture (about 4600-4000 cal. yr BP) was replaced by the lagged Yueshi Culture (about 4000-3500 cal. yr BP) in Shandong Province, east China. Wensi River Basin, Southwest Shandong Province, is one of the most flourishing regions in ancient culture, and it also is the transition of Haidai District to Luohe Cultural District in China. However, few studies have been made about the relationship the collapse of Neolithic Longshan Culture and environmental change in this region.

Therefore, this study aims 1) to characterize the spatial and temporal Variations of Neolithic archeological sites of Shandong; 2) to investigate the evidences of collapse of Neolithic Culture in Features of artifacts; and 3) further to

explore the relationship between human civilization and environmental change around 4000 cal. yr BP.

## II. STUDY AREA AND METHODS

### A. Study area

Wensi river basin (referring to Dawenhe-Sishui river Basin) is located in southwest of Shandong Province, where agriculture is strongly subjected to climatic and hydrological conditions (Fig.1). The Basin has an area of 2,5571 km<sup>2</sup>. Today, has a warm-temperate monsoonal climate, with a mean annual temperature of 12-14°C, and a mean annual precipitation of 590-820 mm. This area elevates in the northeast part and slopes gently in southwestern directions. Over 1,000 m above sea level, it is composed of the Taishan, Culaishan and Mengshan mountains.

Archaeological discoveries show that the Neolithic Culture of this area developed in a sequence from Houli Culture (about 8500-7700 cal. yr BP) —Beixin Culture (about 7300 - 6100 cal. yr BP) —Dawenkou Culture (about 6100 - 4600 cal. yr BP) —Longshan Culture (about 4600 - 4000 cal. yr BP) to Yueshi Culture (about 4000-3500 years ago).

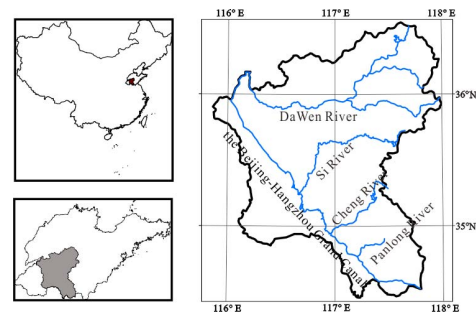


Figure 1. Map showing the location of study area.

### B. Methods

The *Atlas of Chinese Cultural Relics (Shandong Volume)* compiled by a group of researchers records exhaustively information on the Neolithic archeology<sup>[6]</sup>. Taking the *Atlas* as sources of data, we build a database of archaeological sites both Longshan Culture and Yueshi Culture, and for this study, including the positions, agricultural system, architecture and environmental proxy. Using the ArcGIS software, we obtain the spatial pattern of archeological sites. Because no exact

ages for these sites can be presented from this book, we cannot build up a time series on the variations of archeological sites. In this paper we only compare the frequency of Archeological Sites per 100-year interval in Longshan Culture and Yueshi Culture.

### III. RESULTS AND DISCUSSION

#### A. Spatial and Temporal characteristics

Fig. 2 shows the map of geographical distribution of Neolithic archeological sites both Longshan Culture and Yueshi Culture. The Longshan Culture (about 4600-4000 cal. yr BP) is the most flourishing and glorious period of prehistoric culture in Shandong province<sup>[7]</sup>. As shown in Fig.2, more than 152 sites have been excavated in Wensi river basin and almost extending across the basin, indicating that the region was densely populated at that time.

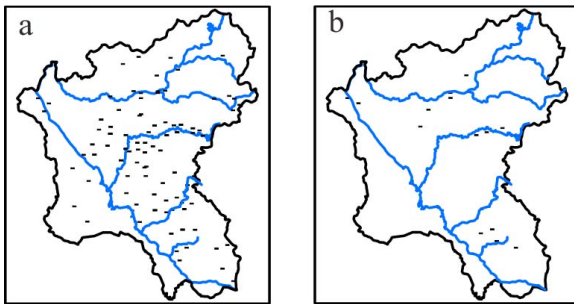


Figure 2. Spatial and temporal pattern of Neolithic site in the Wensi River Basin (a. Longshan Culture; b. Yueshi Culture)

Yueshi Culture (about 4000-3500 cal. yr BP), equivalent to the Xia Dynasty to the early Shang times in the Chinese historical records. The numbers of archeological sites are significantly lower than that of Longshan Culture, and only 17 sites have been excavated. And the sites mainly restricted in the both sides of Dawenhe River and Sishui River, hills and plains in the eastern Weishan Lake, indicating that the region was sparsely populated at that time.

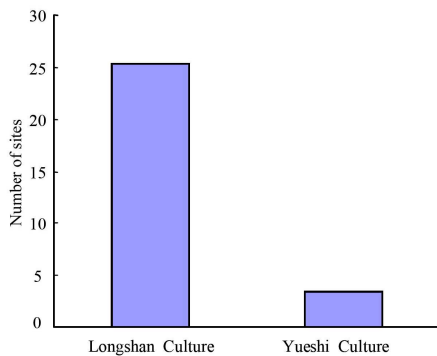


Figure 3. Numbers of archaeological sites per 100-year

Figure 3 shows that the numbers of archaeological sites per 100-year of different cultures (edited from The Editorial Board of an Atlas of Chinese Cultural Relics, Shandong Volume, 2007). The numbers of archaeological sites decreased

significantly from 25.3 of the Longshan Culture to 3.4 of the Yueshi Culture.

#### B. Features of artifacts

Table 1 shows that the features of artifacts. Longshan Culture in Shandong mainly is characterized by the abundance of black pottery, with are a small number of terracotta, yellow and white pottery. Black pottery, thin shiny black mud, scholars is known as the “eggshell black”. Black eggshell is the most representative pottery, reflecting a highly developed level of ceramics. In the technological level, a lot of progress has been made, among which rotation system technology has been widely used. Compared with the Longshan Culture, Yueshi Culture in pottery production is more lagged not only in technology but also in type. At the site of Yinjiacheng in Sishui County, the type of pottery in the Longshan Culture accounted for 56, and almost all pottery was used the rotation system technology; in the Yueshi Culture, the number dropped to 20, and a considerable part pottery was used man-made technology.

TABLE 1 FEATURES OF ARTIFACTS BOTH LONGSHAN CULTURE AND YUESHI CULTURE

	Longshan Culture	Yueshi Culture
Pottery type	Abundance of black pottery A small number of terracotta, yellow and white pottery	A small number of black pottery
Pottery Production	Abundance	Sparse
Technological level	Rotation system technology	Man-made
Eggshell black	More	No found

In short, archaeological excavation revealed that the advanced Shandong Longshan Culture was replaced by the lagged Yueshi Culture around about 4000 cal. yr BP, which mainly reflected at the sites number significant decrease and more lagged pottery production.

#### C. Mechanism of collapse of Neolithic Culture

The causes of the collapse of Neolithic Culture around 4000 cal. yr BP have been long debated. Generally, archaeologists have attributed their collapse solely to human factors, such as social, political, and economic factors. Zhang (1994) proposed that invaders with a more advanced technology were responsible for the sharp break between the Longshan Culture and the subsequent Yueshi Culture<sup>[8]</sup>. However, these social explanations cannot account for the synchronicity of collapse of several Neolithic Cultures at a large regional scale.

Yu (1992)<sup>[9]</sup> attributed the collapse of the Shandong Longshan Culture to flooding disasters. This hypothesis was echoed by some geographers<sup>[5,10,11]</sup>. However, some archaeologists have disputed this environmental hypothesis by arguing that: (1) flooding may have occurred many times during the Neolithic period, and so there is little reason to suggest that flooding at this time had a more adverse effect on the development of Neolithic Cultures; (2) although the low topography of eastern and southern China is more prone to

flooding, the landforms are complex, with hills, mesas, high terraces, and low mountains occupying a vast area. These reaches could have provided a refuge for ancient people fleeing floods. Advanced societies could not be destroyed completely by only a flood. Compared with the collapse of Neolithic Cultures in the southern China, the attribution of the collapse of the Qijia and Laohushan Cultures to natural disasters has not provoked much debate. However, the lack of geological evidence has precluded a good understanding of the impact of climatic events on the collapse of Neolithic Cultures in the northwestern monsoon marginal areas.

Recently, more and more geological evidences have yielded substantial data on past environmental and climatic changes in China. Around 4000cal. yr BP, climate have underwent a distinct a cold event, also referred as “*Holocene Event 3*”. For examples, an Huailai County, Hebei Province, north China, pollen and oxygen isotope records on a well-dated peat core clearly indicate an exceptional cooling episode at 4600–4200 calendar yr BP<sup>[3]</sup>. In Northeast China, well-dated pollen records indicate a drier/cooler episode at 4000–3500 calendar yr BP characterized by a decrease in the annual pollen flux and the number of tree and shrub assemblages<sup>[12]</sup>. In the Yishuihe River Basin of near the Wensi River Basin, pollen and oxygen isotope records on a well-dated peat core also clearly indicate this cold event from 4090 to 3830 calendar yr BP.

The extent of influence of environmental change, especially the extreme climate change on human activities is mainly determined by the mode of production. The mean annual temperature drop means the cold spring and the winter coming earlier than usual. The crops cannot be mature because of the shortened growth period. Owing to the poor harvest several years running or total crop failure, crop seeds may be lost extremely and the farming activity cannot be recovered normally in a short period of time. The agricultural economy of Longshan Culture in the Wensi River Basin was dominated by planting. In the stage of Longshan Culture the rice occupied a more important position than millet in the south part of Shandong. The research of phytolith of soil samples at the sites of Zhuanglixi in Tengzhou and Liangchengzhen in Rizhao further confirmed this<sup>[13]</sup>. The rice was planted extensively with the significant yield growth, which is the material basis for the unprecedented flourishing of population and thriving of Longshan Culture.

The rice has a high demand to the temperature and precipitation compared with dry farming crop such as millet, etc. In the early and middle stage of Longshan Culture, rice occupied the first place, millet came second<sup>[14]</sup>. The temperature dropped at about 4000 cal. yr BP, which made the weather condition can't satisfy the need of the rice growth nicely. Although the millet bears the coldness, the yield is too low and can't make up the huge food shortage. Because of limited food, the stockbreeding cannot last any more; in addition, the cold weather can threaten the gathering economy directly, which also intensified the conflict between population and resources and resulted in the formation of population pressure. Accordingly, the sharp decrease of population reflected in the archaeology is the sites number sharp

reduction. The Longshan Culture, which conceived numerous civilization factors declined in about 4000 cal. yr BP, followed by the more lagged Yueshi Culture.

#### IV. CONCLUSION

To explore cause of collapse of Neolithic Culture around 4000 cal. yr BP in the Wensi River Basin, Shandong, China, database of archaeological sites both Longshan Culture and Yueshi Culture and artifacts were collected. Based on the GIS software, the spatial and temporal distributions of sites were builded. Results reveal that the advanced Shandong Longshan Culture was replaced by the lagged Yueshi Culture around about 4000 calendar (cal.) yr BP, which mainly reflected at the sites number significant decrease and more lagged pottery production. The cold event occurred around about 4000 cal. yr BP in northern China played an important role in the collapse of Longshan Culture.

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