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A CHINESE OBSERVATORY SITE OF 4,000 YEARS AGO

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The southern part of the Shanxi Province has been considered as the region where the capital of the Xia Dynasty (ca. 2,000–1,600 B.C.), the first Chinese Dynasty, was located. In this area, more than eighty archaeological sites of the Longshan Culture (ca. 3,000–2,000 B.C.) have been reported, including the most famous one at Taosi Village, Xiangfen County, Shanxi Province, which was found in the 1950s. From 1978 to 1984, large-scale excavations were carried out at this site. The data from more than 1,300 tombs and a large number of houses indicate that the contemporary society was hierarchical. Other unearthed artifacts included an enormous number of implements and utensils (made of stone, pottery and wood), and sacrificial items such as large chime stones and drums. It has been confirmed by radiocarbon dating that the Taosi Culture existed from 2,500 to 1,900 B.C.

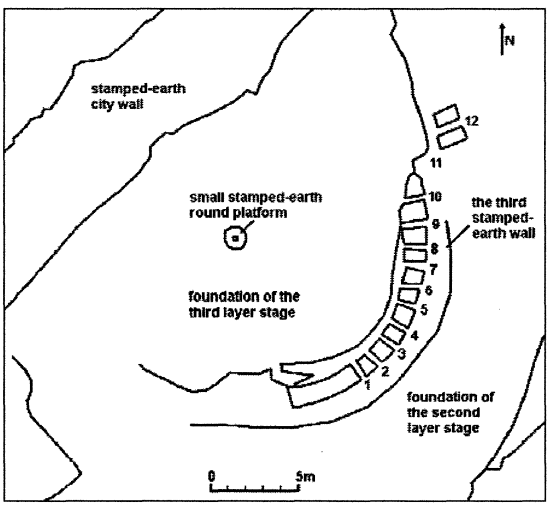


Figure 1: Sketch of the central part of Site II FJT1.

Most recently, the Archaeology Institute of Chinese Academy of Social Sciences, the Archaeology Institute of Shanxi Province and the Culture Relics Bureau of Linfen City (abbreviated hereinafter as AICASS, AISP and CRBLC, respectively) have jointly conducted a further round of excavations. They have found and identified a small city of early Taosi Phase, a large city of middle Taosi Phase, another small city of middle Taosi Phase, areas for sacrifice and storage, palaces, etc. The most exciting discovery is Site II FJT1, a large round stamped-earth building (AICASS, AISP, and CRBLC, 2003).

The large city of middle Taosi Phase is approximately square in shape and its area is almost 3 million square meters. Its southeast wall is shared by a rectangular enclosure, which is the so-called small city of middle Taosi Phase and is regarded as the area for sacrifices. Site II FJT1 is located in this small city, immediately adjacent to the city wall of the large city, and comprises a three-layered semi-round stage that faces southeast and is surrounded by three stamped-earth walls. Along the top layer stage are a set of curved stamped-earth pillars whose bases are 2~3m in depth (see Figure 1). Those extant pillars are 6~10cm high and contain intervening gaps that are filled with unstamped earth. Excavations show that the tops of the pillars, the three walls, and the wall of the large city are roughly at the same level, which is about 1m below the current ground level (see Figure 2).

Archaeologists at the site immediately realized that these pillars possibly belonged to a building that was used to observe sunrise and determine the seasons (He Nu, 2005). In order to test this hypothesis, they spent a whole year making sunrise observations. First, they determined the center of the circles to which the curved wall and the pillars belonged. The distance between the center and the inner side of gaps 1-10 in Figure 1 is ~10m. From the center, one can see through all of these gaps. Then, the archaeologists made a 4-m high iron frame, which was adjustable so that it could be positioned in each of the twelve gaps. By setting up the iron frame, the archaeologists were able to reconstruct the ancient observations.

According to the observations, the Sun was seen through gap 7 when the bottom of the Sun just touched the top of a mountain to the east on both the Spring and Autumn Equinoxes. However, the Sun could not

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be seen through gap 2 when the Sun rose on the Winter Solstice (the bottom of the Sun just touched the top of the mountain): instead, by the time it was visible through gap 2 several minutes later, the Sun was already above the mountain. Considering the half degree change in the obliquity of the ecliptic over the past 4,000 years, an astronomical calculation shows that a 'sunrise' just take places at the center of gap 2 on the Winter Solstice! The same situation occurred on the Summer Solstice: a calculation proved that 4,000 years ago sunrise was visible through 12 gap (Wu Jiabi, and He Nu, 2005)—whereas it is not visible today.

These observations and modern astronomical calculations provide convincing evidence that one reason for the construction of these stamped-earth pillars was to observe sunrise and determine the seasons. As for some of the other gaps between the pillars, it is suggested that they were used to determine certain dates of the contemporary calendar. For instance, gap 1 was possibly connected with lunar observations.

It needs to be pointed out that the center used by the archaeologists to observe sunrise had not been excavated when they conducted their observations. Subsequent excavations showed that there was a small round stamped-earth platform under this spot. The difference between the center of that spot and the center of the platform was only 4 cm! This discovery provides further evidence that Site II FJT1 was an astronomical observatory (AICASS, AISP, and CRBLC, 2005).

Subsequent excavations did not reveal any site used for sunset observations.

It has been confirmed, both by early Chinese texts and by astronomical relics, that it had all along been a tradition for the Chinese to determine seasons and calendar dates by measuring the length of the solar shadow at noon. This is an obvious difference between Chinese civilization and other civilizations of the world. In early Chinese texts, there are very few, if any, records about determining the seasons through observation of the sunrise or sunset. Furthermore, no Chinese sites used to observe sunrise or sunset had been found prior to the discovery of II FJT1. Therefore, this discovery is of great significance to historians of Chinese astronomy. Archaeological evidence and astronomical analyses both show that it is a Chinese observatory site that was built about 4,000 years ago.

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Figure 2: Scene of excavation, and showing the iron frame.

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