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AMS RADIOCARBON DATING OF AN ANCIENT POTTERY WORKSHOP IN HEPU COUNTY, CHINA

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ABSTRACT. An ancient pottery workshop belonging to the Han Dynasty was excavated in Caoxie village, Hepu County. Caoxie village is an important archaeological site in Hepu County, Beihai City, in south China's Guangxi Zhuang Autonomous Region. It is believed that Hepu County was the oldest departure point on the ancient maritime trading route during the Han Dynasty (206 BC to AD 220) due to the ideal natural geographical conditions and the existence of a large number of Han tombs. Radiocarbon measurements on wood and charcoal samples from the Caoxie village site were performed at the Peking University AMS facility (PKU-AMS), Beijing, and the Centre for Isotopic Research for Cultural and Environmental Heritage (CIRCE) at Naples Second University, Italy. Calibrated ages were obtained with code CALIB 5 (Stuiver and Reimer 1993). The results of these measurements are presented and the related chronology is discussed.

INTRODUCTION

Chaoxie village is located in the southern part of Guangxi Zhuang Autonomous Region, southern China (109°11′E, 21°40′N; see Figure 1). According to historical records, Hepu was once known for producing pearls. It was declared a county in 111 BC during Emperor Wudi's reign during the Western Han Dynasty (206 BC to AD 24). It is well known that maritime trading routes played an important role in the commerce of ancient China. Hepu was recorded in the famous ancient book *Hanshu* and in other literature as one of the departure harbors, but no ancient government office building has so far been discovered. Locating the position of the ancient government office building is very important for restoring the history of ancient Hepu, and for understanding its status in ancient China.

From October 2007 to January 2009, a pottery workshop was excavated in Caoxie village, Hepu County, by the Guangxi Provincial Institute of Cultural Relics and Archaeology; the Department of History, Xiamen University; and the Museum of Hepu (Xiao 2008). Usually during the Han Dynasty, the position of an old workshop is in, or very close to, the center of a town. The discovery of the pottery workshop will be helpful in trying to find the site of the old city government office.

Several samples have been collected from the Caoxie village site for radiocarbon analysis. ^{14}C measurements were performed at the Peking University AMS facility (PKU-AMS), Beijing, and the Naples Second University AMS facility (CIRCE), Italy. This paper describes the importance of the Caoxie village site, its ^{14}C sample measurements, and their age calibration.

CAOXIE VILLAGE SITE

The Caoxie village site encompassed a total area of about 18,000 m^2, including more than 20 ancient kilns in good condition (Xiao 2008). It is located near Beihai City in Hepu County, Guangxi Zhuang Autonomous Region. The site is on a mesa in the southwest area of the village, to the east of a

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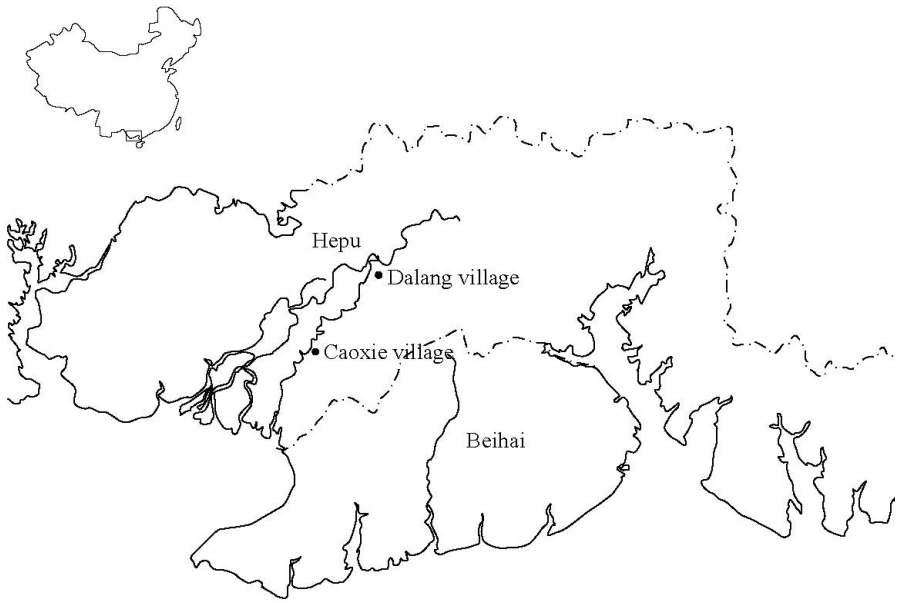

Figure 1 Location of Caoxie village site in Hepu County. The figure also shows the location of Hepu county in southern China.

branch of the Nanliu River, and on the western side of a canal (Figure 1). The distance between the site and the coast is about 10 km. The site was discovered in the mid-1980s (Xiong and Wang 2004), but systematic excavation of the first 2 kilns (with an area of 1000 m^2) was not performed until October 2007 (Xiao 2008). Many fragments of pottery, mostly flat tiles and tubular tiles, were distributed on the surface of the site. The thickness of the fragmented pottery layer is up to 2 m.

More than 50 regularly arranged ditches, wells, hoards, and ash pits have been discovered encircled by the kilns. The assembly line for pottery production is very obvious at this site. Such a large grouping of kiln sites still intact is a rare case in early history, and indicates that the area once was an important center for pottery production. Judging from the inscriptions on the tiles, it is believed that the kilns were also used to provide construction materials for the local government.

Excavation of the Caoxie village site is very important for archaeological research and attempts to locate the departure point of a maritime trading route in ancient China. Before excavation of the Caoxie village site, more than 2000 Han tombs were discovered and a wealth of daily utensils and tools were unearthed in the tombs. We can identity that some of utensils and tools were produced in this pottery workshop according to the shape and inscription of the fragments. Moreover, an ancient sea wharf was excavated about 10 km from Caoxie, in Dalang village (Figure 1), Hepu County, in 2003 (Xiao 2008). The ancient sea wharf and the large number of Han tombs are very important evidence to support the theory that Hepu is the oldest seaport in China's ancient maritime trading route.

SAMPLE PREPARATION AND MEASUREMENT

Samples for ^{14}C dating were selected based on the quality of their context and material preservation. All the samples came from the tools for pottery production. Details of the samples are as follows:

Code BA081117 (charred rattan): Taken from a basket that was used for storing or shipping soil and other material;

Code BA081118 (wood): Taken from a shaft of a shovel or hoe used for digging;

Code DSH1338 (wood): Taken from the bottom of a pit;

Code DSH1339 (wood): Taken from the bottom of a drainage ditch;

Code DSH1341 (wood): Taken from the bottom of a pit.

Two samples (BA081117 and BA081118) were pretreated by the acid-alkali-acid (AAA) method and prepared by the hydride reduction method at the School of Archaeology and Museology of Peking University, and were measured using the Peking University AMS (PKU-AMS) system (Liu et al. 2007). This compact AMS system is based on a National Electrostatics Corporation (NEC) Model 1.5SDH-1 Pelletron accelerator with a maximum terminal voltage of 500 kV to produce 1 MeV carbon ions in the 1+ charge state. The other samples were prepared by the modified zinc reduction method (Passariello et al. 2007; Marzaioli et al. 2008) at the CIRCE laboratory, Naples Second University, and measured with the CIRCE 3MV AMS system (Terrasi et al. 2007, 2008).

CALIBRATION

The conventional ^{14}C ages obtained are reported in Table 1, together with the calibrations applied using CALIB 5 (Stuiver and Reimer 1993) and the calibration curve IntCal04 (Reimer et al. 2004). For each sample, the calibrated age intervals (at confidence levels of 68% [1 σ] and 95% [2 σ]) are given. Since the portion of calibration curve covering the period 1900–2300 cal yr BP is not very smooth, fluctuations in the curve can result in points where a line of constant ^{14}C age intersects the calibration curve in several places. In this case, several calibrated age intervals are given, with different relative probabilities corresponding to each ^{14}C age (Table 1).

Table 1 ^{14}C and calibrated ages of Caoxie village site samples.

			Calendar age range (BC)	
Lab code	Sample material	^{14}C age (BP)	1 σ (68.2%)	2 σ (95.4%)
BA081117	Charred rattan	2120 ± 35	19 (1) 95 BC	349 (0.08) 310 BC 208 (0.92) 45 BC
BA081118	Wood	2165 ± 40	355 (0.51) 289 BC 232 (0.49) 165 BC	364 (1) 96 BC
DSH1338	Wood	2206 ± 29	358 (0.13) 344 BC 323 (0.42) 278 BC 258 (0.14) 241 BC 238 (0.31) 205 BC	374 (1) 199 BC
DSH1339	Wood	1927 ± 76	38 (0.04) 27 BC 24 (0.06) 10 BC 3 BC (0.84) AD 139 AD 160 (0.02) 165 AD 196 (0.02) 208	111 BC (1) AD 255
DSH1341	Wood	2222 ± 32	364 (0.13) 350 BC 305 (0.87) 209 BC	382 (0.22) 336 BC 331 (0.78) 203 BC

RESULTS AND DISCUSSION

The measured ^{14}C ages and calibrated calendar ages of the samples from the Caoxie village site are shown in Table 1. The calendar ages of all the samples cover a period from 382 BC to AD 255 (95%

confidence level). Usually, the manufacture date of the basket (BA081117, charred rattan) is very close to the service date, and the life of basket is only couple of months when used for shipping or storing the material in the pottery workshop. The ^{14}C dating results, especially that of sample BA081117 (charred rattan), indicate that the ancient pottery workshop belongs to the early or middle period of the Western Han Dynasty. According to the shape of the tiles and the inscriptions on the tiles or bricks excavated at the Caoxie village site, we can estimate that the pottery workshop was in use during the Han Dynasty. The ^{14}C ages are in good agreement with the expected values, and provide significant evidence to support the theory that Hepu is one of China's oldest maritime ports.

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