The oldest bark cloth beater in southern China (Dingmo, Bubing basin, Guangxi)

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1. Introduction

“Strong and independent reconstructions within both archaeology and comparative linguistics point to the same basic historical conclusions, these being that the antecedents of these early Neolithic and Austronesian-speaking societies were one and the same, and developed in an ultimate sense on the mainland of East Asia, most probably within the southern Chinese coastal provinces of Zhejiang, Fujian, and Guangdong.”

Bellwood, 2007: 36

Multiple lines of independent evidence support the argument that the origins of the Austronesian peoples may be found in East Asia, and likely southern China (Bellwood, 1979, 1988, 1992, 1996, 2007). Within southern China, the area surrounding the Pearl River Delta has received the most attention (Deng, 1992, 2011; Kwang, 1994; Zang, 1999; Tang, 2000b, 2003, 2008, 2011; Jiao, 2002; Jiao and Fan, 2010; Wu, 2010). This may be because the Pearl River Delta region can be considered the actual area of Austronesian origins, or because there have been more archaeological excavations in this part of southern China.

The archaeological evidence generally used to support the Austronesian expansion is the combination of artifacts (e.g., wooden boats, net sinkers, pottery spindle whorls, bark cloth beaters, etc.) that initially appear in southern China and then expanded eastward into Oceania, younger from west to east (Bellwood, 1996; Cameron, 2007). Although actual evidence of wooden boats in this spatial-temporal point does not currently exist, wooden boats dating to the Neolithic do exist in East Asia [e.g., Kuahuqiao (China) (Jiang, 2004); Bibongri (Korea) (Baee and Kim, 2010)]. The spread of plant and animal domesticates also support this west to east expansion (Groves, 1995). The focus of the current study is on one component of this archaeological toolkit: bark cloth beaters.

Understanding the origin and spread of bark cloth technology is important, not only because bark cloth has been and is still used as clothing, but because it has also been used as paper in different regions of southern China, Southeast Asia and Oceania (Gao, 2007; Cameron, 2006, 2007). Current evidence indicates that bark cloth beaters appear in the archaeological record first in southern China and that the technology was part of the toolkit that accompanied human dispersals eastward (Shun, 1963; Bellwood, 1996; Tang, 2000a, 2011; Cameron, 2006, 2007). The earliest reported bark cloth beater, dating to 6600 BP, was discovered at the Xiantouling Site in Shenzhen, Guangdong Province, China (Peng et al., 1990; Ye, 1993;
An, 1998; Li and Liu, 2007; Tang, 2013). Here, we present evidence of a bark cloth beater that is approximately 1300 years older than the artifact from Xiantouling: Dingmo (Bubing basin, Guangxi).

2. Background

Dingmo is an open-air cave site (106°59.04'E, 23°32.638'N) located in the Bubing basin, Guangxi Zhuang Autonomous Region, in southern China (Fig. 1). The site is situated at an elevation of 138.3 m above sea level. Archaeological research in the Bubing basin can be traced to the 1980s when a field team from the Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences and the Guangxi Museum conducted field surveys in the neighboring Bose basin (Fig. 2). Because of the presence of vertebrate fossils inside and lithic artifacts in front of the cave, the site was assigned to the Late Paleolithic, as defined by Gao and Norton (2002) and Norton et al. (2009) among others (Li et al., 1985; Zeng, 1999). In order to better understand the meaning of the Dingmo Site, excavations were conducted by the Guangxi National Museum in 2009–2010 and jointly by the Guangxi National Museum and the Tiandong Museum in 2010–2011. The total area of the Dingmo Site is about 1000 m² (restricted to just the front of the cave). The recent excavations focused on the northern part of the site and encompassed 32 m². A 5 m × 5 m grid was laid out in the front of the cave where the stone artifacts were originally discovered. In addition, a 1 m × 7 m trench was excavated along the northeast margin of the site. Pits were excavated down at 10 cm arbitrary increments, artifacts and fossils were three dimensionally piece plotted, photographed, and then removed. The pits were excavated down to the bedrock to understand the full stratigraphic profile. The stratigraphic sequence is as follows (Fig. 3):

Layer 1. Brown-gray top soil containing large plant roots and a few stone artifacts;
Layer 2. Shallow red sandy clay, containing large stone artifacts and some vertebrate fossils;
Layer 3. Red sandy clay, yielding abundant stone artifacts, including the bark cloth beater (Fig. 4).

A total of 2433 stone artifacts were recovered during the excavations (see Fig. 5). The artifact assemblage is comprised of cobbles, hammer stones, anvils, whetstones, choppers, and debitage. The majority of the artifacts were discovered in Layer 3, along with the bark cloth beater. Both chipped and ground stone tools are present in Layer 3. In addition to the bark cloth beater, other ground stone tools include stone adzes. Most of the artifacts were primarily produced on locally available sandstone. A number of lithics found on the eastern side of the site were at various stages of tool manufacture. We interpret this latter area to have served as a stone knapping locale, primarily because the stone artifacts and debitage were particularly densely packed (Fig. 6).

Vertebrate faunal remains have been reported from both within the cave and the front area; the latter area is the focus of our current study (Table 1). Biostratigraphy suggests the deposits in the cave are older and probably from the Late Pleistocene. Presence of the extinct Palaeoloxodon namadicus supports this relative age. Only extant faunas were reported from the deposits we excavated in front of the cave, suggesting a more recent Holocene age.

### Table 1

Vertebrate fossils discovered at Dingmo cave and Dingmo Site.

<table>
<thead>
<tr>
<th>Locality</th>
<th>Taxon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dingmo cave</td>
<td>Homo sapiens, Macaca sp., Alluropoda melanoleuca, Stegodon orientalis, Megalotigrus augustus, Palaeoloxodon namadicus, Pongo sp., Rhinoceros sinensis, Sus scrofa, Rusa unicolor, Babalus sp., Arctonyx collaris, Ursus thibetanus, Ovis sp.</td>
</tr>
<tr>
<td>Dingmo Site</td>
<td>Macaca sp., Hystric subrictata, Ursus sp., Sus scrofa, Cervus sp. Bovidae.</td>
</tr>
</tbody>
</table>

Four charcoal samples were sent to the Xi'an Center for Accelerator Mass Spectrometry (Table 2). The AMS dates indicated the site was occupied between 7900 and 4800 BP. The oldest date (7900 BP) derives from Layer 3 (the same stratigraphic level as the bark cloth beater). Neither the charcoal sample nor the bark cloth beater appears to be intrusive from an over- or underlying layer in any way. Thus, we can say with some degree of confidence that the Dingmo bark cloth beater is likely around 1300 years older than the Xiantouling artifact.

### Table 2

Report on AMS14 dating result of the Dingmo Site.

<table>
<thead>
<tr>
<th></th>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>XA7219</td>
<td>60 cm</td>
<td>–26.16</td>
<td>0.31</td>
<td>59.46</td>
<td>0.21</td>
<td>1477 ± 37</td>
<td>4734 ± 76</td>
</tr>
<tr>
<td>XA7250</td>
<td>120 cm</td>
<td>–22.11</td>
<td>0.42</td>
<td>41.57</td>
<td>0.16</td>
<td>5355 ± 35</td>
<td>6136 ± 83</td>
</tr>
<tr>
<td>XA7233</td>
<td>125 cm</td>
<td>–28.57</td>
<td>0.25</td>
<td>11.58</td>
<td>0.07</td>
<td>5744 ± 74</td>
<td>6556 ± 48</td>
</tr>
<tr>
<td>XA7222</td>
<td>160 cm</td>
<td>–26.16</td>
<td>0.31</td>
<td>48.92</td>
<td>0.15</td>
<td>7052 ± 05</td>
<td>7898 ± 34</td>
</tr>
</tbody>
</table>

[Laboratory: Institute of Earth Environment, Chinese Academy of Sciences, Xi'an Center of Accelerator Mass Spectrometry (China)].

3. Dingmo bark cloth beater

One stone bark cloth beater was excavated in situ from stratigraphic Layer 3. Made from a light brown sandstone cobbble, the bark cloth beater is generally trapezoidal with a rectangular shaped beater face. The Dingmo beater has 6 horizontal grooves, with groove spacing about 0.55 cm and each groove having a depth of about 0.1 cm. Eight vertical grooves are also present, with groove spacing about 1.6 cm. The vertical grooves are shallower than the horizontal grooves, only about 0.05 cm in depth. The vertical and horizontal grooves intersect at about 90° angles. The beater face has clear abrasion marks that likely reflect long term use.

Both the body and workface of the tool are round and grooved to enable it to be hafted onto a wooden handle. The handle is about 2 cm at its widest point and from 0.1 to 0.4 cm in depth.
The handle is smooth, presumably resulting from the stone and the handle rubbing against each other. Overall, the beater is 6.13 cm long, 6.79 cm wide, 2.27 cm thick, and has a mass of 170 g.

4. Dingmo bark cloth beater: comparative perspectives

“It is not generally known that the earliest evidence for barkcloth anywhere in the world comes from archaeological sites along the southeast coast of China where tools used for barkcloth production have been found in Neolithic contexts dating back more than 6000 years.”

Cameron, 2006: 137

Tolstoy (1991) has identified two types of stone bark cloth beaters in the archaeological record: the composite type and the club type. The composite type is considerably older, first occurring in the archaeological record around 8000 BP whereas the club type first occurs around 4000 BP (Table 3). The composite type consists of a stone workface that would have been attached to a wooden handle. This is indicated by two depressed belts at the butt where the handle was attached. The handle is incorporated within the club type which has one or two beating faces, either smooth or within the club type which has one or two beating faces, either smooth or with grid-like or rhombic grooves. The Dingmo bark cloth beater is of the composite type, which is common in southern China.

Bark cloth beaters found in the Pearl River Basin, Taiwan, Indochina, and the Pacific display regional characteristics. The beaters from the Pearl River region, dated between 7000 and 5000 BP, are of the composite type. Five different shapes are represented: oblong; square with rounded single or double faces; both smooth and grooved (Peng et al., 1990; Ye, 1993; Tang and Huang, 1994; Zhao et al., 1997; Tang, 1999a, 1999b, 2013; Li and Liu, 2007). Similar stone cloth beaters have been found in Vietnam, dating between 4500 and 3500 BP. The composite type is the predominant form, whereas the club type is rare. These beaters are similar morphologically to those from the Pearl River Delta region but display greater variation in size, with some noticeably large forms represented (Tang, 2000a; Matsumura et al., 2008).

In the Pacific, the earliest excavated beater was found at Arku Cave in the Philippines, dated to ~2500 BP (Thiel, 1990). Most Pacific cloth beaters are oblong club types with an obvious step between the handle and the beater. They feature longitudinal grooves, and more than half of those found have double beating surfaces (Bellwood, 1979; Aragon, 1990).

In sharp contrast, only composite types have been found thus far in Guangxi and these date to between 8000 and 6000 BP (Qiu, 1992; Wei and He, 2003; He et al., 2005; Xie et al., 2007; Xie, 2012). They are usually oblong in shape with grooves. The Dingmo beater is similar morphologically to other Guangxi finds, but is more irregular in shape and its grooves are asymmetrical. The Dingmo specimen has a few shallow horizontal and vertical grooves, and has symmetrical grids on its workface (Peng et al., 1990; Li and Liu, 2007; Xie, 2012). In contrast, the Dingmo specimen has simple horizontal and vertical grooves.

5. Discussion

Bark cloth beaters are widely distributed at archaeological sites in Southeast Asia, including Hong Kong, Yunnan, Guangxi, Guangdong, Fujian, Taiwan and Hainan Provinces (China), and North Vietnam (Chen, 1961; Archaeology Team of Yunnan Museum (1973); Kan, 1977, 1981; Zhang and Qiu, 1983; Ye, 1993; Kwang, 1996; Zhao et al., 1997; Tang, 1999a, 1999b, 2013). People living in the mountainous regions of Yunnan and Hainan Island wore bark cloth and used the same production process to produce bark cloth to more recent times (Gao, 2007; Wu, 2010).
In Guangxi, six archaeological sites dated between 8000 and 3000 BP have produced bark cloth beaters. These were the sites of Dingmo, Gexingqiao, Liuzhuoling, Gantuoyan, Poliuling, and Yinxu (Qiu, 1992; Wei and He, 2003; He et al., 2005; Xie et al., 2007; Xie, 2012). The bark cloth beaters discovered in Guangxi are concentrated in the western area of the province, particularly along the You River and Hongshui River, upstream tributaries of the Pearl River Delta. Besides Dingmo, only Gexinqiao and Gantuoyan have chronometric dates (Gexinqiao: between 6000 and 5000 BP; Gantuoyan: between 4000 and 3000 BP). In addition, Chinese historical records from the Jin (AD 265-420), Ming (AD 1636-1644), and Qing (AD 1644-1700) dynasties confirm that bark cloth continued to be produced in many different areas of Guangxi into the more recent historical period (Qing, 2003).

Prior to the Dingmo discovery, the earliest known bark cloth beaters came from the Xiantouling Site in the Pearl River Delta, dated to ~6600 BP (Peng et al., 1990; Li and Liu, 2007). However, Dingmo is about 1300 years older with secure AMS dates placing it at about ~7900 BP. Besides being older, Dingmo does present other characteristics that distinguish it from the younger Xiantouling Site. For instance, at Dingmo there is a higher density of chipped stone tools, clear evidence of a stoneknapping workshop and no pottery. However, Xiantouling has few stone artifacts and many pottery sherds. It may be possible that Dingmo represents a temporary hunting and gathering camp site, while Xiantouling may have been more residential, where plants and animals were raised and consumed. The presence of bark cloth beaters at both Dingmo and Xiantouling suggests possible interactions between Guangxi and the Pearl River delta. Given the younger date for Xiantouling, there is a strong possibility that bark cloth technology originated in Guangxi and moved eastward at a later date.
6. Conclusions

Growing archaeological evidence suggests Austronesians originated in southern China, probably in the Pearl River region. Bark cloth beaters, that are the focus of this paper, were part of the Austronesian toolkit that was part of this expansion. This paper has demonstrated that the earliest evidence for bark cloth production comes from the Dingmo Site in Guangxi, dating to 7900 BP, predating the previously oldest known find by 1300 years. This suggests some type of interaction between Guangxi and the Pearl River Delta that included the movement of bark cloth beater technology (or peoples carrying such technology) west to east. Alternatively, the Pearl River Delta sphere of influence that resulted in the Austronesian expansions might be expanded to include neighboring Guangxi. Further research is required to further evaluate these various hypotheses. Minimally, the origin of bark cloth beaters can now be pushed back to ~7900 BP and further west to Guangxi at the Dingmo Site.

Acknowledgments

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