How old is the Babo Balukbuk Site? The Use of Tradeware Ceramics and Radiocarbon Dating in Identifying the Age of Porac, Pampanga, Philippines

Rhayan G. Melendres[1,2]

Abstract

Central to the process of doing archaeology is the necessity for understanding the chronological sequencing of archaeological entities and past events and understanding the method that was used in doing so. Without a firm grasp of this sequencing, archaeologists would not be able to deal with issues of behavioural process and evolution. For this reason, dating the past has been one of the most crucial methodological problems facing archaeologists. Two sources of dating were used in identifying the age of Babo Balukbuk, Porac, Pampanga, Philippines namely: tradeware ceramics dating and radiocarbon dating. The system that I developed that was published earlier will be employed in identifying and documenting the tradeware ceramics found in the site. Also, the radiocarbon dates will be used to validate and cross-check the dates of the ceramics. Then, this paper will discuss the results of these dating techniques and their implications and significance in understanding better the pre-Spanish people of Pampanga, Philippines.

[1]Assistant Professor 7, University of the Philippines Diliman, Extension Program in Pampanga
[2]Ph.D. Student, Archaeological Studies Program, University of the Philippines
Email: rhayan30@yahoo.com

Introduction

One of archaeologists' traditional objectives in excavating sites is to date them (Rice 1987; Wisseman 1994). Central to the process of doing archaeology is the necessity for understanding the chronological sequencing of archaeological entities and past events, and understanding the method that was used in doing so. Without a firm grasp of this sequencing, archaeologists would not be able to deal with issues of behavioural process and evolution (Michaels 1989). For this reason, dating the past has been one of the most crucial methodological problems facing archaeologists (Renfrew and Bahn 2000; Sinopoli 1991; Thomas and Kelly 2006).

Pottery has long been a significant tool in chronological building in archaeology (Rice 1987). Rice articulated that the abundance of ceramics at archaeological sites throughout the world, just like in the Philippines, make them very sensitive and insightful instrument for delineating stylistic changes through time and for tracing cultural identity and relations. Ceramics, because of its many utilitarian and socio-cultural functions, easy transportability, durability, and numerous shapes, styles and decorations, make them very significant in dating and understanding a particular site (Melendres 2008, 2012).

In the Philippines, the use of tradeware ceramics as basis for dating a particular site is a common practice. Sites such as burials, habitations, and shipwrecks in the Philippines that are dated using tradeware ceramics include Butuan, (Peralta 1980; Scott 1982; Watt 1981), Santa Ana (Fox and Legaspi 1977; Locsin and Locsin 1967), Bolinao (Legaspi 1974), Calatagan (Barretto-Tesoro 2007; Fox 1959; Janse 1941); Bais (Tanjay Region), (Junker 2000), Cebu (Hutterer 1973; Nishimura 1992), Hatcher Shipwreck (Curtis 1985), Santa Cruz Shipwreck (Orillaneda 2008), Lena Shoal Shipwreck (Goddio *et al.* 2002), and Pandanan Shipwreck (Diem 2001; Loviny 1996).

For this research, two sources of dating were used in identifying the age of Babo Balukbuk, Porac, Pampanga, Philippines namely tradeware ceramics and radiocarbon dating. The system that I developed (Melendres 2008, 2012) will be employed in identifying and documenting the tradeware ceramics found in the site. Also, the radiocarbon dates will be used to validate and cross-check the dates of the ceramics. A background about the site will be discussed. Then, this paper will discuss the results of these dating techniques and the implications in understanding the pre-Spanish history and culture of Pampanga, Philippines.

The Archaeology of Babo Balukbuk, Porac, Pampanga

The excavation area is officially named Dizon 1 and situated in Babo Balukbuk in Hacienda Dolores, Porac, Pampanga, Central Luzon, Philippines (Figure 1). The area is a sugar plantation owned by Mr. Nestor Dizon. A Global Positioning System (GPS) reading locates it at 15^0 05′ 27″ north atitude and 120^0 31′ 26″ east longitude and has an approximate elevation of 150 metres above mean sea level (Dela Torre 1999).

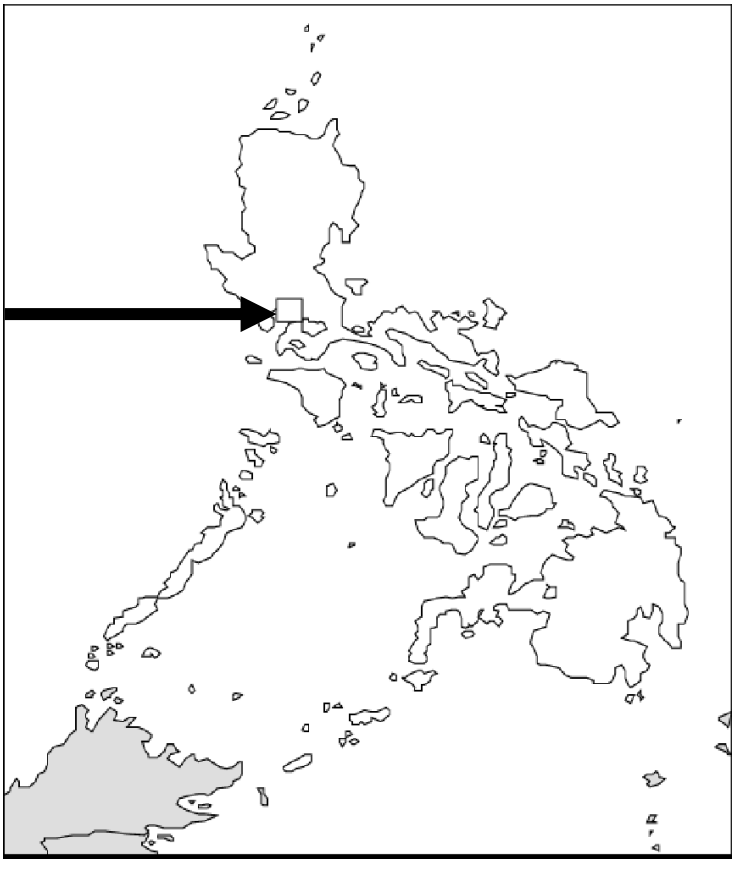

Figure 1: Map of the Philippines showing the Province of Pampanga.

The earliest archaeological exploration and excavation in Porac was from 1935-1936 which was carried out by G.M. Goodall and two Filipino assistants (Beyer 1947). Then in 1959 and 1960, Robert Fox excavated in Balukbuk and Gubat (Fox 1960a, 1960b, 1960c). The next exploration of the area was done in 1993 when some people from the National Museum conducted an archaeological impact assessment in Porac (Bautista *et al*. 1993). Afterwards, three excavation seasons followed in 1999, 2001, and 2002 were conducted in the sugarcane plantation of Mr. Nestor Dizon in Sitio Babo Balukbuk (Dela Torre 1999; Dizon 2002; Paz 2003).

Working on the results of previous excavations (Dela Torre 1999; Dizon 2002) and several surface surveys, the excavation team was able to confirm that the general land area contained substantial quantities of material culture. For the 2002 excavation, "the site was mapped based on the reference points of the previous excavations. The same datum point was used to extend the grid map. For mapping consistency in the area, a 4m X 4m grid with a north-south orientation was adopted across the site" (Paz 2003: 8). The site was excavated utilising an open area excavation procedure which was done by following the natural stratigraphic layers on a larger scale without maintaining baulk walls along opened grid squares of the excavation area. An area of 28m X 24m was opened by the end of the excavation season (Figure 2).

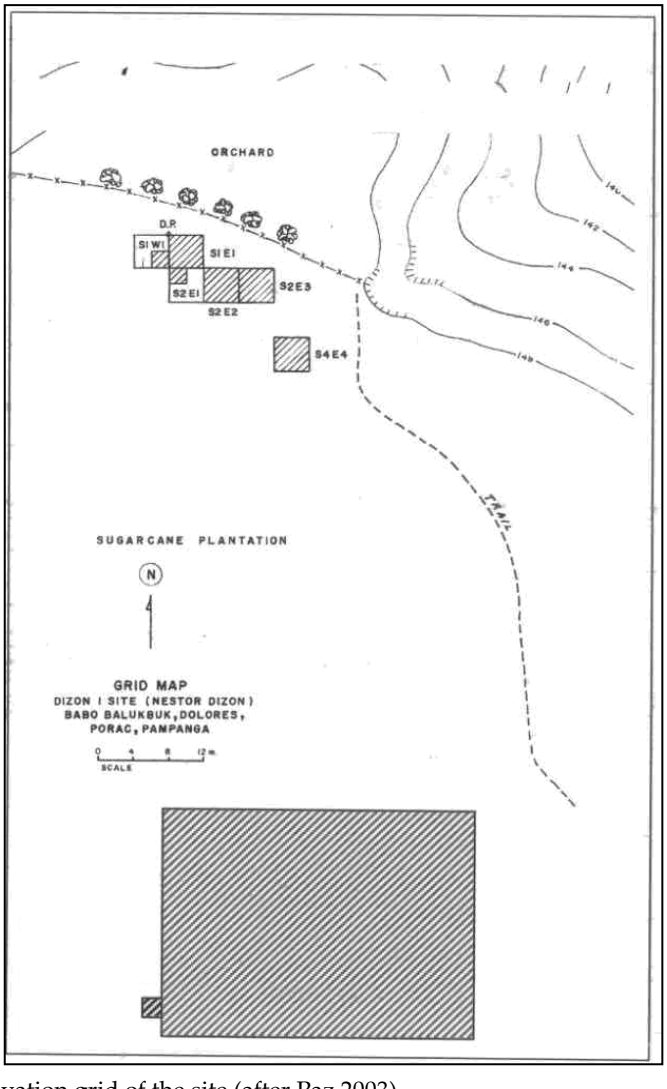

Figure 2: Excavation grid of the site (after Paz 2003).

Stratigraphy and the Archaeological Materials and Features found in the Site

Stratigraphic units and features were labelled as "context" The different natural layers in the site may be described as follows (Figure 3) (after Paz 2003).

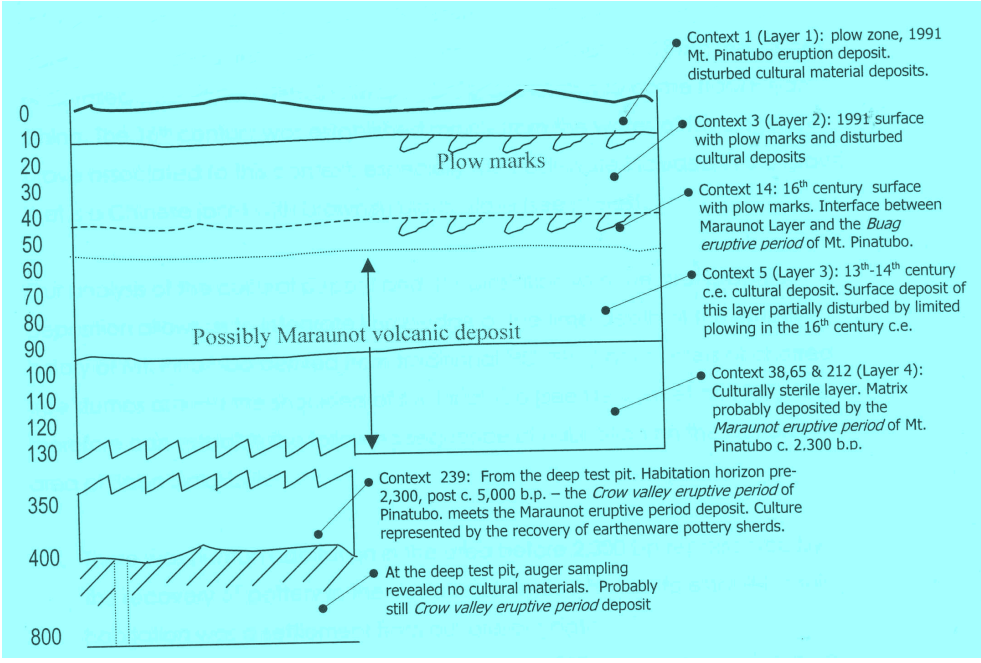

Figure 3: Stratigraphy of the site where the number means depth in centimeters (after Paz 2003).

Context 1 (Layer 1) is the top soil of the area which is mainly composed of volcanic sand from the 1991 eruption of Mount Pinatubo. Through field walking, the vegetation, soil characteristics, surface features, and artefacts were noted. Most of the artefacts found were broken pieces of earthenware and tradeware. Below Context 1 is Context 3 (Layer 2). It is composed of loose volcanic sand which is dark brownish in colour with a lot of organic materials such as roots of cassava and sugar cane. Broken pieces of artefacts, mostly earthenware and tradeware, were also found in this layer. Context 14 is the interface between Context 2 and the next context which is Context 5. It is a mottled layer of sand with distinct features of plough marks. Also, one burial and multiple globular earthenware pots were found in this layer. Context 5 (Layer 3) is composed of loose light yellowish brown sand with extensive *in situ* deposits and features such as burials, pit-middens, hearths, plough marks, and post holes. Layer 4 is made up of Contexts 38, 65, and 212. It is a sterile layer of sand

since no cultural materials were recovered here. However, at the depth of 3.5 meters below the datum point, three pieces of angular earthenware sherds were found in the deep trench.

Almost 85% of the materials recovered in Babo Balukbuk were earthenware sherds. In contexts 14 and 3 however, large pieces were mostly recovered –globular type earthenware vessels (Figure 4). Earthenware rims, bodies, bases, handles, spouts, and covers were recovered in different stratigraphic layers in the site. There were some sherds that had soot or carbon traces in their exterior and interior surface. This suggests that they were used for cooking. Some sherds were decorated using different techniques such as carving, combing, incising, impressing and a combination of these. The most common design element in Babu Balukbuk earthenware assemblage is incising the pots with lines below the rim or neck area. Also, Paz (2003) reported that some of the earthenware sherds have rice impressions of both the grain and the husk. This may suggest that rice was used as a temper.

Figure 4: A globular pot found in the habitation area of Context 5 (after Paz 2003).

Barretto (2003) classified the metal implements found in the site into two. The first of the two types are the metal implements (Figure 5) that were recovered from burial contexts (7 pieces) and the second category are those that were recovered from non-burial setting (13 pieces).

Due to the acidity of the matrix of the site, there was a mark absence of skeletal materials, thus, identification of graves is a bit complicated. Only the presence of teeth enamel, arm bones inside a bangle and the associated grave goods or furniture like tradewares, bangles or bracelets and beads provided evidence that they were indeed burials.

Figure 5: Metal Implement found in a burial in Context 5 (after Paz 2003).

Thirteen bangles of varied sizes were recovered from eight burials in the site (Figure 6) (Barettto 2003). The bangles were later on analysed through Energy Dispersive X-Ray (EDX) connected to a scanning electron microscope (SEM) to determine their chemical composition (Carlos 2007). Based from the analysis, the bangles were brass as they were mainly composed of copper and zinc.

Figure 6: Brass Bangle found in a burial in Context 5 (after Paz 2003).

Aside from earthenwares, tradewares, metal implements and brass bangles, other artefacts and ecofacts were recovered in Babu Balukbuk. Mortars, spindle whorls, pestles, and polished pumice stones were found in the site (Melendres 2008; Paz 2003). In addition, 50 pieces of Chinese beads strung into a bracelet and used as a burial accessory were also found. The beads were associated with one bangle and one brown stoneware jarlet. *Oryza sativa* L. (rice), as well as some nuts and other plant remains and wood fragments, were also recovered through wet flotation method (Paz 2003). Animal bones and teeth were also found in the site. Moreover, archaeological features such as postholes, hearths, middens (Figure 7), and plough marks (Figure 8) were also documented.

Figure 7: Midden in Context 14.

Figure 8: Plough marks in Context 14 (after Paz 2003).

Types and Associated Dating of Tradeware Tradeware Ceramics from Babo Balukbuk

Using the system I proposed (See Melendres 2008, 2012), the tradeware tradeware ceramics of Babo Balukbuk were identified, analysed and documented.

Past excavations in Porac especially those conducted by Robert Fox in 1950s dated the lowest layer of Babo Balukbuk as belonging to the Tang period (Fox 1960a, 1960b, 1960c). This dating is mainly based on the lead glazed wares found in the site (Addis 1969). In 2002, four sherds from lead glaze wares were found in the site. A sherd from a small pouring vessel with moulded petal design with green lead glaze, a sherd of a broken spout from a green lead glazed kendi and two sherds from a body of an unknown vessel were unearthed (Figure 9). Addis (1969) believes that these lead glaze pieces were not from the Tang period (618-906 AD); instead they represent the continuation of a Tang tradition into later times. The dating of these ceramics is 13th to 14th century current era (C.E.), significantly younger than previously thought using a less system-

atic identification of the ceramics. Other sites were dated to the Tang dynasty due to the presence of these lead glazed ceramics such as Hacienda Ramona Site in Porac, Pampanga, Tabon Site in Vallehermosa, Negros Oriental, and Cagayan Site in Sulu Province (See Beyer 1947). Moreover, Chin (1988) said that lead glaze wares found all over Southeast Asia (mainly produced in Fujian in the 13th-14th centuries C.E.) show a buff or grey body with green and amber or brown glazes which have a tendency to flake. These attributes can be seen with the lead wares found in Babo Balukbuk.

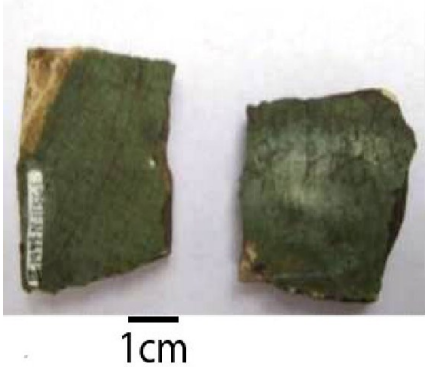

Figure 9: Chinese green lead glaze ware sherds (III-1999-N-115662-63) found in the habitation area in Context 5 (13th– 14th centuries).

Additional support of this dating is that these wares were found in a stratigraphic layer where Longquan celadon (Figures 10-11), Dehua whiteware (Figure 12), and Chinese stoneware (Figures 13-14) were used as grave goods in some of the burials. Examples of Longquan celadons that were found in the site are twin fish dish, fluted dish, bowls with petal designs and jarlets. As for Dehua whiteware, simple and coarse dishes and fluted dishes were found in the site.

Figure 10: Longquan celadon twin fish dish (III-1999-N-21005) found in a burial in Context 5 (Height: 4cm; Diameter: 13cm; 13th – 14th centuries).

Figure 11: Longquan celadon jarlet (III-1999-N-21006) found in a burial in Context 5 (Height: 6cm; 13th – 14th centuries).

Figure 12: Dehua whiteware fluted bowl (III-1999-N-21004) found in a burial in Context 5 (Height: 3cm; Diameter: 11cm; 13th – 14th centuries).

Figure 14: Chinese light brown stoneware jarlet (III-1999-N-21002) found in a burial in Context 5 (Height: 10cm; 13th – 14th centuries).

With the establishment of the Ming dynasty in AD 1368, Emperor Hongwu restored the tributary system and prohibited the Chinese from participating in private Southeast Asian overseas trading (Hall 1968; Moorhead 1965; Tan 1997). The decree was issued to abate the attacks of Japanese and local pirates on regions along the coasts in South China. Thus, foreign trade was promulgated as a government monopoly. The new policy was so restrictive that even the construction of private ships for long distance voyage was prohibited (See Tan 2007). It was only at the end of the 16th century that the trade ban was revoked by Emperor Wanli (Guy 1980; Tan 2007).

Because of this trade ban, few early Ming blue and white ceramics can be found in the Philippines compared to the Middle and Late Ming blue and white ceramics which Tan (1997) referred to as "Interregnum Period." Even if there is an existing trade ban in China, this did not stop the Chinese from undertaking illicit trading and smuggling of Chinese products to mainland and island Southeast Asia specially of trade ceramics (Tsao 1962). Chinese blue and white and celadon were still available during the late 15th and early 16th century C.E. in the Philippines such as those found in Lena Shoal (Goddio *et al.* 2002), Pandanan (Loviny 1996), and Santa Cruz (Orillaneda 2008) shipwrecks. In fact, Babo Balukbuk contained blue-and-white dishes from Jingdezhen (Figure 15) plus Guangdong (Figure 16) and Longquan celadons from this period which suggests that smuggling of Chinese products during the early Ming dynasty was so prevalent in the Philippines that even the polities that are not located near the coastlines can even acquire these objects.

Figure 15: Jingdezhen blue-and-white sherds (III-1999-N-12179-82) found in a midden in Context 14 (Late 15th- 16th century).

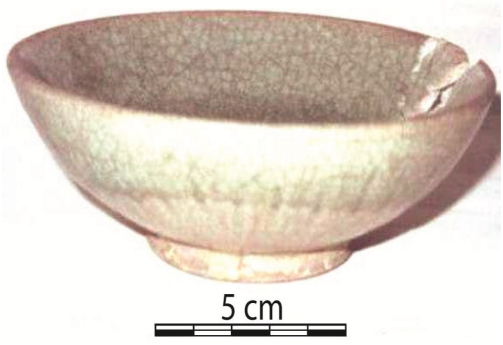

Figure 16: Guandong celadon bowl (III-1999-N-21009) found in a burial in Context 14 (Height: 5cm; Diameter: 14.3cm; Late 15th-16th century).

During this Chinese trade ban, many Southeast Asian ceramics notably those from Si Satchanalai and Mae Nam Noi, Thailand and Binh Dinh, Central Vietnam filled the vacuum left by the Ming period ceramics (Diem 2001; Loviny 1996). Tradeware tradeware ceramics excavated from Babo Balukbuk reveal a remarkable assemblage from different kiln complexes within China and Southeast Asia. Many celadons from Si Satchanalai, Thailand were found in the site (Figure 17).

They usually have some scars from firing supports on their bases and black speckles on their body. These wares were mainly dishes, bowls and jars dating between 14th to 16th centuries C.E.. But for Dizon 1 site, these Thai celadons most likely date to the 15th to 16th centuries C.E. due to the fact that no 14th century C.E. Chinese wares, blue-and-white in particular, were found in the site. Diem, an Asian Studies graduate of Murdoch University who specialises on Vietnamese and other Southeast Asian ceramics, (personal communication, June 2002) agreed and suggested that one sherd from a stoneware jar was probably made from Mae Nam Noi kiln in Central Thailand in the 15th to 16th centuries C.E. (Figure 18).

Figure 17: Thai celadon bowl sherds (III-1999-N-20649-56) found in the habitation area in Context 14 (14th-16th centuries).

Figure 18: Stoneware jar sherd from Mae Nam Noi, Thailand (III-1999-N-12088) found in a midden in Context 14 (15th – 16th centuries).

Babo Balukbuk is quite rich in tradeware ceramics not only from China and Thailand but also from Vietnam and Burma. Some of the large celadon dishes found in the site (Figure 19) were similar to those found in the Twante district in Burma (Myo and Rooney 2001). These ceramics share the characteristics of celadon found in Twante kilns such as having a glassy and crazed olive green glaze that is flaking and pooling in some areas of the ceramic.

They are also thickly potted. The dating for these ceramics is late 15th to 16th century. These large celadons were similar to those found in the Santa Cruz shipwreck (Orillaneda 2008). If not for the cross referencing, these big celadon plates would most likely be associated with Kalong wares from Thailand which are dated to 15th to 16th centuries (Brown 1988; Myo and Rooney 2001).

This discovery added a new dimension to the history of tradeware ceramics in Southeast Asia that were excavated in the Philippines. This is due to the fact that aside from Babo Balukbuk, the only archaeologically excavated site with reported Burmese celadons in the Philippines was the Santa Cruz shipwreck (See Orillaneda 2008). That is why a re-examination of the unidentified celadon and supposed Kalong celadons in the Philippines is a must.

Figure 19: Sherd of a Burmese celadon plate (III-1999-N-11377) found in the habitation area in Context 14 (Late 15th – 16th century).

Moreover, ceramics manufactured in Binh Dinh, Central Vietnam were recovered from the site. In the 15th century, this region was known as Vijaya, the capital of Champa whose people spoke an Austronesian language (Diem 2001). Example of Binh Dinh potteries found in Babo Balukbuk includes a sherds from stoneware jars with the remains of a single handle with pressed ends with caramel brown glaze (Figure 20) and a sherd of a dish with opaque greenish grey glaze and sign of stacking ring in the middle (Figure 21). Similar types of these ceramics were excavated from the Pandanan shipwreck (Diem 2001). The dating of these ceramics is 15th century because Diem (2001) believes that the ceramic production ceased in Binh Dinh in 1471 when Viet forces conquered Vijaya and annexed the region as part of the Dai Viet Kingdom.

Figure 20: Vietnamese stoneware jar sherd (III-1999-N-14503) found in the habitation area in Context 14) (15th century).

Figure 21: Sherd of a Vietnamese stoneware dish (III-1999-N-13691) found in the habitation area in Context 14 (15th century).

In Babo Balukbuk, "Swatow" type (Zhangzhou) porcelains (Figure 22) were also recovered. Five sherds of underglaze blue-and white porcelain from a bowl, dish, and plate were found in the site. Unfortunately, due to the agricultural activity in the site, they were found in different contexts from Layer 1 to Layer 3. Thus, inferring about their context of usage is a bit complicated. "Swatow" ware derived its name from Shantou in China (Swatow in Dutch records), an old junk port along the southern coast of Guangdong near Fujian (Adhyatman 1999; Tan 2007). However, Chinese scholars prefer to use the name Zhangzhou instead of Swatow because they are really being manufactured in Zhangzhou and are just being exported from the port of Swatow (Tan 2007). These ceramics were dated to 16th-17th centuries C.E. (Adhyatman 1999; Tan 2007). However, with the presence of the Zhangzhou ware, we can conclude that the Babo Balukbuk site was still being used by people until the early part of the Spanish contact.

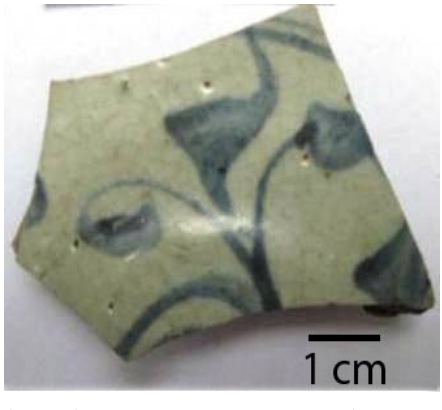

Figure 22: Sherd of a Zhangzhou or "Swatow" ware plate (III-1999-N-11602) found in the habitation area of Context 14 (16th – 17th century).

Cultural Layers of the Tradeware Ceramics of Babo Balukbuk

There are two pre-Spanish contact layers in the site. The cultural layers (Contexts 14 and 5) were dated using the tradeware ceramics that were used as grave goods in burials found in the site. The trade ceramics showed that they are from different time periods.

The first and older cultural layer (Context 5 [Layer 3]) is dated to 13th-14th centuries. The date was from the Longquan celadons (Figures 10-11), Dehua whitewares (Figure 12) and the Chinese stoneware jars (Figures 13-14) that were used as grave furniture. Aside from burial contexts, the same types of trade ceramics were found in the habitation area of the site as well as in pit-midden contexts (Melendres 2008). Examples of Longquan celadons that were also found in the site are twin fish dish, fluted dish, bowls with petals designs and jarlets.

As for Dehua whitewares, simple and coarse dishes and fluted dishes were found in the site. Moreover, a Chinese brown stoneware jarlet (Figures 13-14), a dark caramel glazed jarlet, and a black jarlet were recovered in the site in both burial and non-burial settings. This suggests that these materials were not just funerary and ritual objects but are also used for utilitarian purposes such as for food and water containment.

On the other hand, the second and younger cultural layer of the site (Context 14) is dated to late 15th-16th centuries. In this layer, a burial with two trade ceramics were found. A Guangdong celadon dish of Longquan prototype (Figure 16) with thickly applied sea-green glaze and light grey body seen on the broken section of the mouth rim was excavated together with a whiteware jarlet (Figure 23). There is no available reference for the whiteware jarlet however the celadon dish is similar to the celadons found in the Santa Cruz shipwreck which were dated to late 15th-16th centuries (Orillaneda 2008).

Thus, this cultural layer is dated to late 15th century to 16th century C.E.. Aside from these grave goods, this cultural layer is associated with Southeast Asian ceramics like Vietnamese stoneware dishes and jars (Figures 20-21), Burmese celadon plates (Figure 19), Thai stoneware jars (Figure 18), Thai celadon dishes (Figure 17) as well as Chinese blue and white dishes (Figure 15) and plate and celadons dishes and bowls which are dated 15th-16th centuries.

Figure 23: Whiteware jarlet (III-1999-N-21010) found in a burial in Context 14 (Height: 3.7 cm; late 15th to 16th century).

Radiocarbon Dates of Babo Balukbuk and Mount Pinatubo Eruption

After the 1991 eruption of Mount Pinatubo, a multi-disciplinal study of Mount Pinatubo's previous eruption was undertaken (Newhall *et al.* 1996; Gaillard *et al.* 2004; Gailliard *et al.* 2007). Geological data and satellite images were used to reconstruct how the landscape of Central Luzon was modified by the cyclical eruptions of Mt. Pinatubo. In the study, archaeological data, historical and archival record and oral accounts were also gathered to give an insight into how the eruption of the volcano and its aftermath affected the people on and around Mt. Pinatubo (Gailliard *et al.* 2007).

Newhall *et al.* (1996) have named the most recent pre-1991 eruption of Mt. Pinatubo, "Buag," after a village in San Marcelino, Zambales located near the Marella River. Radiocarbon data from charcoal and wood, lahar and fluvial deposits from Marella River (397 ± 70 B.P.; 560 ± 60 B.P.; 600 ± 60 B.P.; 635 ± 80 B.P.; 760 ± 60 B.P.), O'Donnell (400 ± 80 B.P.), Abacan (410 ± 55 B.P.; 470 ± 50 B.P.; 570 ± 70 B.P.), Upper Sacobia (460 ± 30 B.P.), Pasig-Potrero (630 ± 70 B.P.; 950 ± 70 B.P.), Bamban (660 ± 80 B.P.), Bucao (730 ± 80 B.P.) and Guagua-Pasac (1730 ± 40 B.P.; 1800 ± 40 B.P.) were collated and presented in the study of Gaillard *et al.* (2007: 228-230). However, most of these dates are from materials that are not *in situ* but are from dated lahar, fluvial, and lake deposits that occur in the O'Donnell, Sacobia, Abacan, Pasig-Portrero, Marella and Bucao River valleys (Newhall *et al.* 1996). Included in the study were the two radiocarbon dates from Babo Balukbuk (See Table 1). Radiocarbon dating of charcoal

samples recovered in Babo Balukbuk inside a buried hearth in Context 14 yielded ages of 455 ± 40 B.P. and 415 ± 40 B.P. (Paz 2003). Using OxCal v3.10, the radiocarbon dates from Babo Balukbuk were calibrated and converted to Before Present (B.P.) and Current Era (C.E.) dates. The calibrated ages of the charcoal found in a hearth in Babo Balukbuk are 1420-1530 C.E. and 1400-1520 C.E..

Table 1: Radiocarbon Dates of Babo Balukbuk (modified from Paz 2003; Gaillard *et al.* 2004; Gaillard *et al.* 2007). ^{14}C age was defined by the use of the Libby half life of 5568 years. Calibration ages have been computed through the calibration curves of Stuiver and Reimer (1993) and using OxCal v3.10. The calibrated ages are the statistically-most-likely equivalent in calendar years before 1950 (B.P.) using 2-sigma range.

Lab. Number	Material	Occurrence	^{14}C Age (B.P.)	Calibrated Age (B.P.)	Calibrated Age (C.E.)
WW – 4684	Charcoal	Cultural Layer (Context 14)	415 ± 40	530 - 420	1420 – 1530 C.E.
WW – 4683	Charcoal	Cultural Layer (Context 14)	455 ± 40	550 - 430	1400 – 1520 C.E.

From the previous publications (Newhall *et al.* 1996; Paz 2003; Gaillard *et al.* 2004; Gaillard *et al.* 2007), there are only five dated materials that are recovered from *in situ* context or from primary deposits. These includes the charcoal from a pumiceous pyroclastic-flow deposit in Upper Sacobia-Abacan River, charcoal from Buag, Kakilingan, San Marcelino, Zambales, uncharred root of a tree growing on the bank or floor of Pasig-Portrero River and two charcoal samples from a buried hearth in Context 14 in Babo Balukbuk.

These are presented in Table 2 where it shows the comparison of the radiocarbon dates from the date of the manufacture of the trade ceramics. Data presented includes the source and nature of the material, the dating technique that was used in analysing the material, the date of the material in current era and the reference/s for the identification and date of the material being analysed.

Table 2: Comparison of Radiocarbon Dates and Dates of Trade Ceramics from Babo Balukbuk

Source and Nature of the Material	Dating Technique	Date in Current Era (C.E.)	Reference/s for the Identification and Date
Charcoal from a pumiceous pyroclastic-flow deposit in Upper Sacobia-Abacan River	C14 Dating	1460 - 1520	Newhall *et al.* (1996)
Charcoal from Buag, Kakilingan, San Marcelino, Zambales	C14 Dating	1400 - 1500	Newhall *et al.* (1996)
Uncharred root of a tree growing on the bank or floor of Pasig-Portrero River	C14 Dating	1320 - 1460	Newhall *et al.* (1996)
Charcoal in a buried hearth in Context 14 in Babo Balukbuk	C14 Dating	1420 – 1530	Paz (2003); Gaillard *et al.* (2004); Gaillard *et al.* (2007)
Charcoal in a buried hearth in Context 14 in Babo Balukbuk	C14 Dating	1400 – 1520	Paz (2003); Gaillard *et al.* (2004); Gaillard *et al.* (2007)
Chinese green lead glazed dish found in the habitation area of Context 5 (Figure 9)	Date of Manufacture	1279 - 1368	Adhyatman (1990:161); Chin (1988:56)
Longquan celadon twin fish dish found in a burial in Context 5 (Figure 10)	Date of Manufacture	1279 - 1368	SACS (1979: 176-183); Zhu (1998: 236-237); Wang (2002: 90)
Longquan celadon jarlet found in a burial in Context 5 (Figure 11)	Date of Manufacture	1279 - 1368	SACS (1979: 172-173); Zhu (1998: 198-199)
Dehua whiteware fluted bowl found in a burial in Context 5 (Figure 12)	Date of Manufacture	1279 - 1368	Tan (1993: 11); Li (1993:21); Peng (1998:32)
Chinese dark brown stoneware jarlet found in a burial in Context 5 (Figure 13)	Date of Manufacture	1279 - 1368	(Guy 1986: 81)
Chinese light brown stoneware jarlet found in a burial in Context 5 (Figure 14)	Date of Manufacture	1279 – 1368	(Guy 1986: 81)
Sherds of Jingdezhen blue and white dish found in a midden in Context 14 (Figure 15)	Date of Manufacture	1488 – 1505	Gotuaco *et al* (1997: 134); Peng *et al.* (2002: 48)
Guandong celadon bowl found in a burial in Context 14 (Figure 16)	Date of Manufacture	1488 – 1505	Crick (2001); Orillaneda (2008:55)
Thai celadon bowl found in the habitation area in Context 14 (Figure 17)	Date of Manufacture	1400 - 1500	Brown (1988); Dofflemyer (1989: 48-51); Adhyatman (1990: 312-317); OCSP (1991: 62-86)
Thai stoneware jar from Mae Nam Noi found in a midden in Context 14 (Figure 18)	Date of Manufacture	1400 - 1500	Diem (personal communication, 2002.)
Burmese celadon plate found in the habitation area in Context 14 (Figure 19)	Date of Manufacture	1488 – 1505	OCSP (1991:86); Myo and Rooney (2001); Crick (2001); Orillaneda (2008)
Vietnamese stoneware jar with caramel glaze found in the habitation area in Context 14 (Figure 20)	Date of Manufacture	1400 - 1471	Diem (1996: 100-101); Diem (2001: 33)
Vietnamese stoneware dish found in the habitation area in Context 14 (Figure 21)	Date of Manufacture	1400 - 1471	Diem (2001: 28-36)
"Swatow" Zhangzhou plate found in the habitation area of Context 14 (Figure 22)	Date of Manufacture	1573 - 1619	Adhyatman (1999); Tan (2007)

Mt. Pinatubo erupted around 500 B.P. to 600 B.P. or 1350 to 1450 C.E. (Newhall *et al*. 1996; Paz 2003; Gaillard *et al.* 2004; Gaillard *et al*. 2007). Based on the dates of manufacture of trade ceramics found in Babo Balukbuk and the radiocarbon dates from charcoal samples of a buried hearth found in the site, the locality was already being used by people before and during the Buag (latest pre-1991) eruption of the Mt. Pinatubo and was continually used even after the eruption, thus, it was never abandoned. Furthermore, Newhall *et al*. (1996) concluded that the pre-1991 eruption of Mount Pinatubo is of the same size and magnitude as that of the 1991 eruption of the volcano. Thus, it is quite possible that the people of Babo Balukbuk just rebuilt their settlement after the eruption and continued their way of life in the site. This can be proven by the cultural evidences found in the site such as a burial, postholes for houses, hearths, plough marks, earthenware vessels, and trade ceramics that are dated post 500-600 B.P.. Examples of trade ceramics that are manufactured after the Buag eruption of Mt. Pinatubo that are found in Context 14 (interphase layer of Layer 3 and Layer 2) and Context 3 (Layer 2) in Babo Balukbuk includes Jingdezhen blue and white (Figure 15), Guandong celadons (Figure 16), celadons from Si Satchanalai (Figure 17), Thai stoneware jar (Figure 18), celadons from Twante district in Burma (Figure 19), Vietnamese stoneware jar and dishes (Figure 20 - 21) and Zhangzhou porcelain (Figure 22).

Tradeware Ceramics as Heirloom Pieces

Guy (1986) characterised the "heirloom problem" in analysing tradeware ceramics temporality. This means that some of the potteries found in a site are much older compared to the other ceramics found in that same stratigraphic layer. The database (Melendres 2008) developed for this study is helpful in identifying the sequence and contemporaneity of the ceramics dates. The database is a system of determination where relevant information about a particular ceramic are noted and recorded such as the artefact number, condition of the ceramics, ceramic type, artefact form, part of the ceramic, description of the ceramic, archaeological context where the ceramic was found in the site, provenance and dating. Also, references that pertain to the ceramic being analysed are also listed as well as the level of confidence of the identification. This means that the database gives a clear picture of the entire ceramic assemblage of the site as well as the prevalence of a particular type of tradeware ceramic in the site.

In Babo Balukbuk, a whiteware box with qingbai glaze that has a shape like a gourd or melon with lines radiating from the exterior bottom was found in the habitation area of Context 5 (Layer 3) in the site. It was manufactured in Fujian, China in the 12th-13th centuries C.E. or during the Sung dynasty in China. This means that it is older than the other ceramics in Layer 3 which are all dated to 13th-14th centuries C.E.. It is one of a kind in the ceramic assemblage. This may suggest that it was an heirloom piece.

Significance of Tradeware Ceramics for the People of Babo Balukbuk

The determination - identification and dating - of the tradeware ceramics from Babo Balukbuk revealed that the site was used from 13th century C.E. up to the early Spanish contact around 16th century. Aside from dating the site, ceramics are indications of some of the behaviour and cultural practices of the people of Babo Balukbuk.

People of Porac seem to have elaborate funerary practices just like the other pre-Spanish people in the Philippines. In Babo Balukbuk, especially between 13th to 14th centuries, they buried the dead near their houses and near their agricultural lands or even probably under their houses (Paz 2003; Melendres 2008). This is indicated by several types of habitation evidences such as postholes, plough marks, hearths, and middens near the graves (Paz 2003; Melendres 2008). They also practiced inhumation wherein the dead body was covered with textile first before burying them (Barretto 2003). This was asserted by Barretto (2003) when she found cloth impressions and patterns on some of the metal implements used as grave goods. In Porac, aside from metal implements, beads and bronze bangles, tradeware ceramics were placed in the grave. Most were whiteware dishes with qingbai glaze, celadon dishes, jarlets and some stoneware jars. Ethnographic records signify several reasons for the committal of materials with the dead. According to Barretto (2000:108), these grave furniture could be used as "gifts for the ancestors and gods", "implement for the journey to the afterlife" and as a "protection to drive away evil spirits". Thus, funerary goods or items must therefore be of immense value for the dead especially in the afterlife (Barretto 2003). The practice of burying the dead with grave accompaniment continued up to the late 15th -16th centuries. This was established when a burial with a whiteware jarlet (Figure 23) and a Guangdong celadon dish (Figure 16) as grave goods were found in Context 14 in the site.

The presence of tradeware ceramics in Babo Balukbuk indicates a vibrant trade or exchange relations between the locals of Babo Balukbuk and nearby polities in what is now Pampanga from 13th to 16th centuriues. Early Spanish accounts reported that Pampangans or Kapampangans as keen traders and had trading relations with China, Moluccas, Malacca, Acheh, Brunei, and other Kingdoms in Southeast Asia (Blair and Robertson 1903-1909 as cited in Larkin 1993). Vlekke (1965) even avows that Pampangans went to Batavia (Indonesia) as late as the first half of the 17th century which is even after the subjugation of Pampanga by the Spaniards. In Babo Balukbuk, however, the people were not directly involved in trade with foreigners since the site is far from the coastline. Instead, most likely they dealt with local traders from Pampanga. Porac from 1571 (the year of Spanish conquest of Pampanga) up to the present time was largely a forested area (Larkin 1993). This suggests that forest products were possibly their main products for exchange. Some examples of forest products that are of utmost important for the Chinese and other foreign traders, which are very much available in Porac, includes beeswax, timbers and wood, fur and skin of forest animals and feathers of birds (See Scott 1994).

Concluding Remarks

Ceramics has long used in archaeology as a tool in chronology building (Orton *et al.* 1993; Rice 1987). Dating the site using the date of manufacture of the trade ceramics is reliable if certain conditions are met. Firstly, the site should be properly excavated and recorded. The layer in the stratigraphy of the site where the trade ceramics were excavated should be properly recorded. Also, the context of use of the trade ceramics in the site should be noted and recorded i.e. burial or non-burial contexts. Moreover, cross referencing is important in identifying and dating trade ceramics specially those that were manufactured in China and Southeast Asia. Cross referencing means that you check the literature for the latest bibliographic sources i.e. kiln site reports, archaeological site reports, catalogue of exhibitions and other ceramic publications, which pertain to the ceramic form and type that you found in the site. The more cross-referencing you do the higher the reliability of your identification and dating.

In Babo Balukbuk, a complete database of all the trade ceramics found in the site was created and developed (Melendres 2012). For each

ceramic type and form found in the site, data about its identification, dating and references were researched and recorded including the location where the ceramic was found in relation to the stratigraphy of the site as well as its archaeological context or usage. The results showed that there were different kinds of tradeware ceramics that were used by the people of Babo Balukbuk. There were Chinese celadons, white wares, blue-and-white wares, and stonewares. There were also some Southeast Asian ceramics such as wares from Si Satchanalai and possibly from Mae Nam Noi, Thailand, ceramics from Binh Dinh Central Vietnam, and celadons from Twante District from Burma. The system that was employed to identify, evaluate, and document the tradeware ceramics in the site also supported the analysis that there were two cultural layers as demonstrated by the ceramics that were used as grave goods. The first cultural layer (Context 5) is dated to 13th-14th centuries C.E. and the second layer (Context 14 and 3) is dated to mid to late 15th-16th centuries C.E..

The radiocarbon dates were used to validate the dating of the site based on the date of the trade ceramics found in the same layer. Radiocarbon dating of charcoal samples recovered in Babo Balukbuk inside a buried hearth yielded ages of 455 $\pm$ 40 B.P. and 415 $\pm$ 40 B.P. (Gaillard *et al.* 2004; Gaillard *et al.* 2007; Paz 2003). The data shows that the radiocarbon dates from Babo Balukbuk and the trade ceramics from the same layer are consistent with one another (Table 2). The radiocarbon dates ranges from 1400-1530 C.E. while the manufacture dates of trade ceramics ranges from 1400-1505 C.E.. Also, comparing radiocarbon dates from geologic samples around Mt. Pinatubo, the charcoal found in a buried hearth in Babo Balukbuk and the date of manufacture of trade ceramics found in the site, we can conclude that the site was continually used by the people.

Finally, dating the site using the manufacture dates of the trade ceramics is as effective as radiocarbon dating as long as the conditions that were listed above were met. It is as effective yet inexpensive way of dating a particular site.

Acknowledgements

This article was part of my master's thesis submitted to the Archaeological Studies Program of the University of the Philippines in 2008. I am most grateful to Dr. Victor Paz, my thesis adviser, for the guidance and encouragement. I am also thankful to Dr. Grace Barretto-Tesoro, Dr. Eusebio Dizon, Dr. William Longacre, Ms. Allison Diem, and Ms. Joy Bel-

monte for their insightful comments. I would also like to show appreciation to Dr. Jean-Christophe Gaillard for the radiocarbon dates and Dr. Armand Mijares for the calibration of the dates cited and used in this article. I am also indebted to my two anonymous reviewers and Dr. Grace Barretto-Tesoro for comments on earlier drafts of this paper. However, any omissions or errors remain my responsibility.

References

Addis, J. 1969. Chinese Porcelain Found in then Philippines. *Transactions of the Oriental Ceramic Society* 37: 17-36.

Adhyatman, S. 1990. *Antique Ceramics found in Indonesia:* Jakarta: The Ceramic Society of Indonesia.

Adhyatman, S. 1999. *Zhangzhou (Swatow) Ceramics Sixteenth to Seventeenth Centuries Found in Indonesia*. Jakarta: The Ceramic Society of Indonesia.

Barretto, G. 2000. A Survey of Literature on Indigenous Burial Practices and their Archaeological Implications. *Kasarinlan* 15: 95-122.

Barretto, G. 2002. *Evaluating Status in Philippine Prehistory through Grave Goods*. Master's Thesis. Archaeological Studies Program, University of the Philippines.

Barretto, G. 2003. "Blades and Bangles: Status Marker in Porac, Pampanga," in *Semantics and Systemics: Philippine Archaeology*. Edited by A. Dela Torre and V. Paz, pp. 96-103. Manila: Katipunan Arkeologist ng Pilpinas, Inc.

Barretto-Tesoro, M.G.L. 2007. *Social Identities and Earthenware Functions in the 15th Century AD Philippines*. Doctoral Dissertation. University of Cambridge, United Kingdom.

Bautista, A., M. Aguillera, J. Santiago, and E. Dizon. 1993. Archeological Impact Assessment in Pampanga and Tarlac. *Unpublished manuscript*. Manila: National Museum of the Philippines.

Beyer, H.O. 1947. Outline Review of Philippine Archaeology by Islands and Province. *Philippine Journal of Science* 77 (3-4): 205-390.

Blair, E. and J.A. Robertson, eds. and trans. 1903 – 1909. *The Philippines, 1493 – 1898*. 55 volumes. Cleveland: Arthur H. Clark Company.

Brown, R. 1988. *The Ceramics of Southeast Asia: Their Dating and Identification*. Kuala Lumpur: Oxford University Press.

Carlos, J. 2007. EDX-SEM Analysis of Porac Bracelets. *Testpit* 10: 25.

Chin, L. 1988. *Ceramics in the Sarawak Museum*. Sarawak: Sarawak Museum.

Crick, M. 2001. *The Santa Cruz Wreck 2001: Preliminary Archaeological and Ceramic Cargo Study*. Manila: Far Eastern Foundation for Nautical Archaeology.

Curtis, J.B. 1985. Transition Ware Made Plain: A Wreck from South China Sea. *Oriental Art* 31 (2): 161-173.

Dela Torre, A. 1999. *Archeological Excavation of Dizon I (Nestor Dizon) Site, Sitio Babo Balukbuk, Barangay Hacienda Dolores, Municipality of Porac, Province of Pampanga: A Preliminary Report of the First Phase (April 17-May 6, 1999)*. Unpublished manuscript. Quezon City: University of the Philippines-Archaeological Studies Program.

Diem, A. 1996. *Relics of a Lost Kingdom: Ceramics from the Asian Maritime Trade*. Makati: Asiatype, Inc.

Diem, A. 2001. The Significance of Pandanan Shipwreck as Evidence of Fifteenth Century Trading Relations with Southeast Asia. *Bulletin of the Oriental Tradeware Ceramics Society of Hongkong* 12: 28-36.

Dizon, E. 2002. Southeast Asian Protohistoric Archeology at Porac, Pampanga, Central Luzon, Philippines: An Integrated Report of the Systematic Archeological Excavation of Dizon I Site (III-1999-N) at Sitio Babo Balukbuk, Barangay Hacienda Dolores, Porac, Pampanga. *Unpublished Manuscript*. Quezon City: University of the Philippines-Archaeological Studies Program.

Dofflemyer, V. 1989. *Southeast Asian Ceramics from the Collection of Margot and Hans Ries*. California: Pacific Asia Museum.

Fox, R. 1959. The Calatagan Excavations: Two Fifteenth Century Burial Sites in Batangas, Philippines. *Philippine Studies* 7 (3): 325 – 390.

Fox, R. 1960a. Fieldnotes of Archeological Fieldwork in Gubat and Balukbuk, Porac, Pampanga. *Unpublished manuscript*. Manila: National Museum of the Philippines.

Fox, R. 1960b. Report on the First Month of Excavation at Porac, Pampanga. *Unpublished manuscript*. Manila: National Museum of the Philippines.

Fox, R. 1960c. Report on the Second Month of Excavation at Porac, Pampanga. *Unpublished manuscript.* Manila: National Museum of the Philippines.

Fox, R. and A. Legaspi. 1967. *Excavations at Santa Ana*. Manila: National Museum Publications.

Gaillard, J.C., F.G. Delfin, E.Z. Dizon, V.J. Paz, E.G. Ramos, C.T. Remotigue, K.S. Rodolfo, F. Siringan, J.L.A. Soria, and J.V. Umbal. 2004. Socio-economic Impact of the c. 800-500 yr B.P. Eruption of Mt. Pinatubo (Philippines): Hypotheses from the Archaeological and Geographical Records. *Proceedings of the Society of Philippine Archaeologists* 2: 46-58.

Gaillard, J.C., F.G. Delfin, E.Z. Dizon, V.J. Paz, E.G. Ramos, C.T. Remotigue, K.S. Rodolfo, F. Siringan, J.L.A. Soria, and J.V. Umbal. 2007. "Planning for the Future: A Multidisciplinary Approach to reconstructing the Buag Episode of Mt. Pinatubo Philippines," in *Living under the Shadow: Cultural Impact of Volcanic Eruptions*, pp. 225 - 252. Edited by J. Grattan and R. Torrence. Walnut Creek: Left Coast Press.

Goddio, F., R. Scott, P. Lam, M. Crick, and S. Pierson. 2002. *Lost at Sea: The Strange Route of the Lena Shoal Junk*. London: Periplus Publishing.

Gotuaco, L., R. Tan, and A. Diem. 1997. *Chinese and Vietnamese Blue and White Wares found in the Philippines*. Makati: Bookmarks.

Guy, J. 1980. *Oriental Trade Ceramics in Southeast Asia 10th to 16th Century*. Sydney: National Gallery of Victoria.

Guy, J. 1986. *Oriental Tradeware Ceramics in Southeast Asia, 9th to 16th Centuries*. Singapore: Oxford University Press.

Hall, D.G.E. 1968. *A History of Southeast Asia*, 3rd ed. New York: St. Martin's Press.

Hutterer, K.L. 1973. *An Archaeological Picture of Prehispanic of Prehispanic Cebuano Community*. Cebu: University of San Carlos Press.

Janse, O. 1941. An Archaeological Expedition to Indo-China and the

Philippines: Preliminary Report. *Harvard Journal of Asiatic Studies* 6: 247-267.

Junker, L.L. 2000. *Raiding, Trading and Feasting: The Political Economy of Philippine Chiefdoms*. Quezon City: Ateneo de Manila University Press.

Larkin, J. 1993. *The Pampangans*. Quezon City: New Day Publishers.

Legaspi, A. 1974. *Bolinao: A 14th – 15th Century Burial Site*. Manila: National Museum Publications.

Li Zhi-yan. 1993. "Song and Yuan Dehua ware found in the Philippines," in *Chinese and Southeast Asian Whiteware Found in the Philippines*. Oriental Ceramics Society of the Philippines, pp. 15-29. Singapore: Oxford University Press.

Locsin, L. and C. Locsin. 1967. *Oriental Ceramics Discovered in the Philippines*. Tokyo: C. Turtle Company.

Loviny, C. 1996. *The Pearl Road: Tales of Treasure Ships*. Makati: By the Author.

Melendres, R.G. 2008. *Determination of Oriental Tradeware Ceramics and the Archaeology of Porac, Pampanga*. Master's Thesis. University of the Philippines.

Melendres, R.G. 2012. Determination of Oriental Tradeware Ceramics: A Proposed System for Identifying and Documenting Pottery in Philippine Archaeological Sites. *Hukay* 17: 61-78.

Michaels, G. 1989. "Dating the Past," in *An Introduction to Archaeology*. Edited by L. Adkins and R. Adkins, pp. 168-169. London: Apple Press.

Moorhead, F. 1965. *A History of Malaya and Her Neighbors*. Kuala Lumpur: Longmans of Malaysia.

Myo, T.T. and D. Rooney. 2001. Ancient Celadon in Myanmar: A New Ceramic Discovery. *Orientations* 32 (4): 57-61.

Newhall, C., A. Daag, F. Delfin Jr., R. Hoblitt, J. McGeehin, J. Pallister, M. Regalado, M. Rubin, B. Tubianosa, R. Tamayo Jr., and J. Umbal. 1996. "Eruptive History of Mount Pinatubo," in *Fire and Mud: Eruption and Lahars of Mount Pinatubo, Philippines*. Edited by C. Newhall and R. Punongbayan, pp. 165-195. Quezon City:

Phivolcs Press.

Nishimura, M. 1992. *Long Distance Trade and the Development of Complex Societies in the Prehistory of the Central Philippines: The Cebu Central Settlement Case*. Doctoral Dissertation. University of Michigan.

Oriental Ceramics Society of the Philippines (OCSP). 1991. *Chinese and Southeast Asian Greenware Found in the Philippines*. Makati: OCSP.

Orillaneda, B. 2008. *The Santa Cruz Shipwreck Ceramics: Understanding Southeast Asian Ceramic Trade during the Late 15th Century C.E.*. Master's Thesis. University of the Philippines, Diliman.

Orton, C., P. Tyers, and A. Vince. 1993. *Pottery in Archaeology*. Melbourne: University of Cambridge Press.

Paz, V.J. 2003. Advancing Settlement-Archaeology Studies Through Archaeobotany. Final Report. *Unpublished Report*. Quezon City: University of the Philippines-Archaeological Studies Program.

Peng, S. 1998. *Dated Qingbai Wares of the Song and Yuan Dynasties*. Hongkong: Chingle Foundation.

Peng S., M. Peng, and P. Lam. 2002. *Yuan and Ming Blue and White Ware from Jiangxi*. Hongkong: Chinese University of Hongkong and Jiangxi Provincial Museum.

Peralta, J. 1980. Ancient Mariners in the Philippines. *Archaeology* 33: 5.

Renfrew, C. and P. Bahn. 2000. *Archaeology: Theories, Methods and Practice, 3rd ed*. London: Thames and Hudson.

Rice, P. 1987. *Pottery Analysis: A Sourcebook*. Chicago: University of Chicago Press.

Scott, W.H. 1982. Boat Building and Seamanship in Classic Philippine Society. *Philippine Studies* 30: 335-376.

Scott, W.H. 1994. *Barangay: Sixteenth Century Philippine Culture and Society*. Quezon City: Ateneo de Manila University Press.

Sinopoli, C. 1991. *Approaches to Archaeological Ceramics*. New York: Plenum Press.

Southeast Asian Ceramic Society (SACS). 1979. *Chinese Celadons and other Related Wares in Southeast Asia*. Singapore: Arts Orientalis and SACS.

Stuiver, M. and P.J. Reimer. 1993. Extended 14C Database and Revised CALIB Radiocarbon Calibration Program. *Radiocarbon* 35: 215–230.

Tan, R. 1993. "Development of Chinese Whiteware with Reference to Philippine Finds," in *Chinese and Southeast Asian Whiteware Found in the Philippines*. Oriental Ceramics Society of the Philippines, pp. 1-14. Singapore: Oxford University Press.

Tan, R. 1997. "Development of Ming Mingyao Blue and White Ware with reference to Philippine Finds," in *Chinese and Vietnamese Blue and White Wares Found in the Philippines*. Edited by L. Gotuaco, R. Tan and A. Diem, pp. 79-108. Makati: Bookmark.

Tan, R. 2007. *Zhangzhou Ware Found in the Philippines: "Swatow" Export Ceramics from Fujian 16th – 17th Century*. Makati: Art Post Asia, Ltd.

Thomas, D. and R. Kelly. 2006. *Archaeology*, 4th ed. California: Thomson Wadsworth.

Tsao, Y. 1962. "Chinese Overseas Trade in the Late Ming Period," in *Second Biennial Conference Proceedings of International Association of Historians of Asia (IAHA)*, pp. 429-458. Taipei: IAHA.

Vlekke, B. 1965. *Nusantara: A History of Indonesia*. The Hague: W. van Hoeve.

Wang, Q. 2002. *A Dictionary of Chinese Ceramics*. Singapore: Sun Tree Publishing Limited.

Watt, J.C. 1981. The Ceramic Wares of Fukien of the Sung and Yuan Periods. *Trade Ceramics Studies* 1: 73-82.

Wisseman, S. 1994. "From Pots to People: Ceramic Production in the Ancient Mediterranean," in *Ancient Technologies and Archaeological Materials.* Edited by S. Wisseman and W. Williams, pp. 17-40. Amsterdam: Overseas Publishers Association.

Zhu, B. 1998. *Celadons from Longquan Kilns*. Taipei: Su Jia Publishing.