

What's new and what's cooking in the *latte* period pots

DARLENE R. MOORE

Micronesian Archaeological Research Services, Mangilao, GU 96923

Abstract—Analyses of pottery collections recovered from *latte* period archaeological sites on Guam reveal considerable variation across several attributes including rim thickness, rim stance, orifice diameter, and exterior surface treatment. While it has been proposed that some unique attribute configurations occur late in the ceramic sequence, it has not been clear whether they date to the late *latte* period or the early Spanish period (post-A.D. 1521). Recent pottery analyses, correlated with radiocarbon dates having small standard deviations, are reviewed and they suggest that new vessel forms were added to the ceramic sequence in the 1400s. It has been argued that the *latte* period pots were appropriate for boiling certain starchy foods. Results of recent studies of charred residue on pottery fragments are presented and they lend support to and expand ideas about *latte* period pot usage. Possible climatic changes are discussed as potential factors leading to some of the temporal changes in the pottery sequence. This paper provides a data set for Guam that can be compared to similar pottery data sets from other islands in the Marianas to better understand the nature and timing of the regional diversity that developed in the *latte* period pottery industry.

Introduction

Although fragments of broken clay pots are abundant at most archaeological sites dating to the *latte* period (c. A.D. 900-1521) on Guam, whole vessels, or even partially restorable vessels from this time, are quite rare. This means that most of what currently is known about the *latte* period pottery industry has been gleaned primarily from pot fragments. Their abundance at the various types of archaeological sites indicate that clay pots were an essential part of the *latte* period technological system and they were used and discarded in a wide variety of geographic settings. While people probably continued to produce traditional pottery into the Spanish period, no descriptions of the indigenous pottery industry have been located.

Because Guam's *latte* period pottery assemblage differs slightly from Saipan (Graves et al. 1990) and the other Mariana Islands, the following discussion focuses on Guam's pottery. To facilitate future inter-island comparisons, separate detailed occurrences of *latte* period pottery attributes, correlated with radiocarbon dates, should be compiled for each island. Such a study is beyond the scope of this article.

Guam's *latte* period pots are generally described as having a globular shape with a thickened, incurving rim called Rim Type B (after Spoehr 1957) and a rounded, or slightly rounded conical, bottom (Reinman 1977). Various sizes were made. The vessels are generally round in plan, with estimated orifice diameters ranging from 8–50 cm (Reinman 1977:77). Estimated heights range from 14 to more than 30 cm tall (Moore 2002). Generally, wall thicknesses vary from 8–12 mm, and the wall thickness gradually increases toward the slightly thicker (15–17 mm) base. The colors range from reddish brown, to brown, to brownish gray. The common surface treatment is plain, although a number of roughened finishes occur, including combed (originally defined by Spoehr 1957:114 as cord-marked), punctate, scraped, stamped, striated, trailed and wiped/brushed. An applied coat of white paint or lime plaster is also present during this time. Rare decorative elements include finger-impressions or incised lines applied to vessel shoulders and the lips of some rims (Reinman 1977; Thompson 1932). Linear grooves, or channels, that may have secured cords suggest that some pots were equipped with a cord network that provided a way to suspend the pot, made it easier to transport, or to secure a lid (Moore 2002). Some grooves appear to have been purposefully filed, or abraded, possibly in an attempt to shape a tool from a broken pot (Davis et al. 1992; Reinman 1977). Typically, volcanic inclusions, including rare quartz grains, are visible in the clay matrix of *latte* period pot fragments.

Prior to A.D. 900, vessels with slightly thickened, incurving rims replaced earlier shallow, flat-bottomed pans with unthickened rims (called Rim Type A, after Spoehr 1957). Butler (1990) drawing on the work of previous researchers in the Marianas (Moore 1983; Ray 1981; Sant and Lebetski 1988; Spoehr 1957; D. Thompson 1977; L. Thompson 1932) as well as his own work on Rota, described the changes that occur in vessel form around the beginning of the *latte* period. He argued that the combination of the rounder shape, the coarse volcanic temper inclusions, and the relatively thick, porous walls, produced a pot more suitable than the pan for boiling or steaming certain starchy foods. In addition to cooking, he proposed that some vessels would have made appropriate food and/or water storage containers. The *latte* period pottery assemblage appears to represent major changes in function, leading Butler (1990:39) to suggest that they were related to shifts in subsistence practices (see also Moore 1983). Most archaeologists would agree that the *latte* period ceramic assemblage reflects new food preparation methods, and food and/or water storage requirements.

What's New?

Reinman (1977:59, 75), who noted both rounded and conical base sherds, Type B rims of various widths, as well as different Type B rim stances in his *latte* period pottery collections from Guam, was unable to confirm any significant

temporal changes within the period. Over the next few decades as more archaeological research was completed, it became apparent that some of the pottery traits noted by Reinman were temporally significant. For example, during the *latte* period on Guam rim width increased, vessel size increased, the percentage of roughened exterior surface treatments increased, and the conical base as well as everted rims appeared (Graves 1983; DeRoo and Goodfellow 1998[IV]:149; Moore 1994, 2002, 2004; Moore et al. 1993; Moore and Amesbury 1989).

Figure 1, based on changes observed in the pottery recovered from the Mangilao Golf Course project, illustrates the different vessel forms associated with the early, middle, and late portions of the *latte* period (DeRoo and Goodfellow 1998[IV]:136). This mitigation project, completed at the Huchunao archaeological site located on Guam's northeast coast, documented a large *latte* village containing a number of well preserved *latte* sets, stone mortars, and intact subsurface cultural deposits, containing abundant pottery, artifacts, and cultural features. The pottery analyst, Brian DeRoo, provided detailed pottery descriptions correlated with radiocarbon dates. Late in the *latte* period sequence, there was an increase in the number of pots with small (less than 20 cm) and large (greater than 35+ cm) orifice diameters. This trend was matched by a decrease in the number of pots with mid-range orifice diameters (20–34.9 cm) (DeRoo and Goodfellow 1998:IV-130). Pots with thick, everted rims, narrow orifice diameters, and conical shaped bases appeared. While these traits were recognized as late occurrences, because the standard deviation of some of the associated radiocarbon dates extended into the early Spanish period, it was unclear whether they dated to the end of the *latte* period, or after initial Spanish contact in 1521.

In order to gain additional insight regarding the *latte* period ceramic assemblage and to refine when the various transformations and additions occurred, recent pottery data associated with *latte* period radiocarbon dates having relatively short temporal spans were reviewed. Particular attention was paid to the distribution of rim width, rim stance, and conical bases. In the absence of whole pots and/or ethnographic records regarding their production and use, the rim profile and estimated orifice diameter often provide the most information about the original vessels (Rice 1987:241).

At least three different rim stances (incurved, everted, and vertical) have been identified in *latte* period pottery collections (Figure 2). Both the incurved (Figure 2, a–d) and the everted rims (Figure 2, e–h) derive from a pot with a restricted orifice, while the more vertical rims derive (Figure 2, i–k) from a less restricted, or open, orifice. Often the vertical rims have a boldly combed, or trailed exterior surface treatment with fairly deep, parallel lines, or grooves, oriented perpendicular to the rim. Generally, the wall below the widest part of the rim thins gradually, creating a wedge-like profile with slightly thicker walls (10–

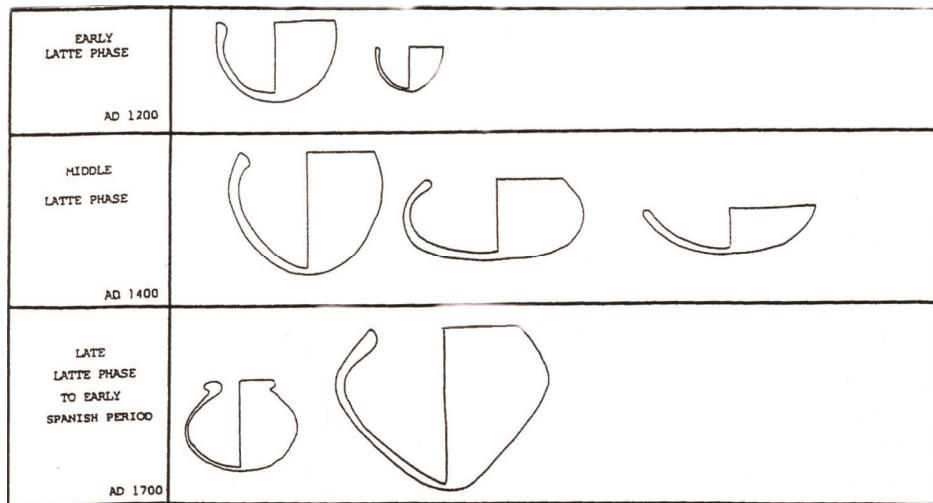


Figure 1. *Latte* period vessel forms from the Mangilao Golf Course (from DeRoo and Goodfellow 1998:Vol. II:136). No scale included in the original figure.

12 mm) below the lip (Figure 2, k). Estimated orifice diameters range from 36–44 cm (Moore 2008; Moore and Amesbury 1989:42). If this range is correct, then it appears that pots with this rim stance have wide mouths, measuring 30 cm, or more in diameter. Information regarding the height of these vessels is lacking, though they are more than 10 cm tall (Moore 2008). At the Manenggon sites, where the vertical, boldly combed rims were quite rare, four calibrated (2 sigma) radiocarbon dates associated with them range from A.D. 1025–1435 (Hunter-Anderson et al. 1994:IV:1.10). The corresponding radiocarbon dates suggest that this rim stance appeared early in the *latte* period sequence and it will not be further considered here. The two rim configurations considered here are incurved and everted.

Incurved Rims

The most common rim stance is incurved, with a round shape to the rim lip, and a plain or roughened exterior surface (Figure 2, a–b). The incurved rims range in thickness from about 10–34 mm, but most fall within the 15–20 m range (Davis et al. 1992:165). Based on the estimated orifice diameters associated with these rims, different sized pots were made, but as yet it has not been possible to link rim or wall thickness to vessel size. Table 1 shows the dimensions for seven reconstructed, whole, or nearly whole *latte* period pots with incurved rims from Guam. In this group, rim thickness ranges from 13.5–24.5 mm, and estimated orifice diameters range from 24–45 cm. One of the thinner rims has the widest

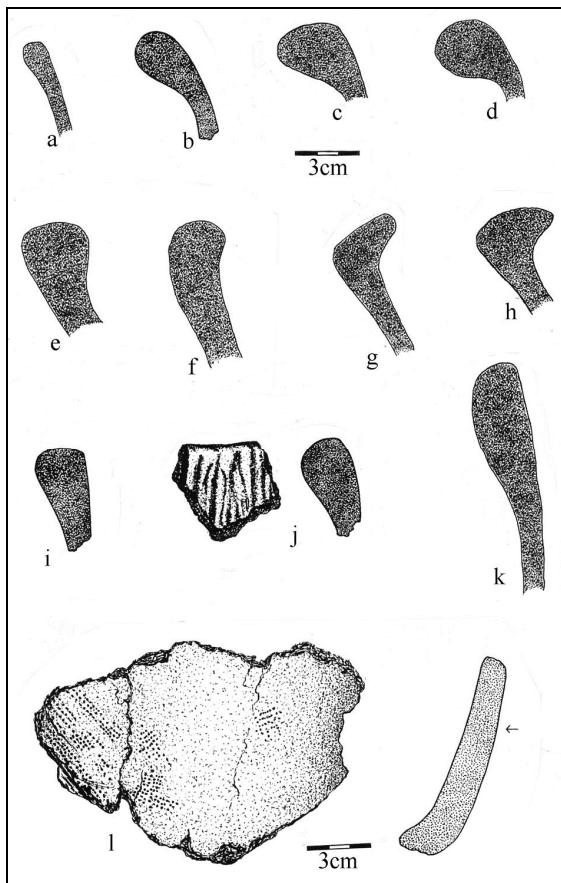


Figure 2. Profiles of selected *latte* period pottery rims and a conical base. The exterior is to the right. a-b incurving stance; c-d exceedingly thick incurving stance; e-f everted stance; g-h flanged stance; i-k more vertical stance; l conical base with stamped impression on the exterior surface.

orifice diameter (45.7 cm), and it is associated with a calibrated (2 sigma) radiocarbon date with a range of A.D. 1220–1410. The date indicates that globular pots with wide mouths were made during the 1300s. In this group, the pot with the conical base has the narrowest orifice (24 cm). Four of the pots on Table 1 have a plain finish and three are wiped. Charred remains on the interior base of one plain pot suggest that it could have served as a cooking vessel.

During the *latte* period, the width of the incurved rims increases from those with fairly narrow (10–15 mm) measurements at the beginning to those that are more than 30 mm wide later (Table 2; Figure 2, c–d). Because the thinner Type

Table 1. Dimensions of reconstructed *latte* period pots with incurved Type B rims.

Rim Width (mm)	Wall Thickness (mm)	Orifice Diameter (cm)	Vessel Height (cm)	Maximum Girth (cm)	Surface Treatment and Base Shape	Calibrated radiocarbon age (years A.D.)	Reference
13.5– 17.0	3.9–15.1	45.7	30.5	at rim	Plain	1220–1410	Beardsley 1993:187– 188
14	5.5–8.0	24	24	29	Wiped	No dating	Davis et al. 1992:190
24.5	10.5	28	20	32	Plain	No dating	Davis et al. 1992:197
n/a	n/a	38	23–25	41	Wiped	1200–1400	DeRoo and Goodfellow 1998:IV– 100
17	8–10	29	24	32	Plain	1200–1400	Moore 1994:3.57
					Round base		
17	7–12	32	14+	39–40	Wiped	Modern date	Moore 1994:3.57
n/a	n/a	n/a	32	40	Plain	1145–1280	Reinman 1977:39, 59
					Round base		

B rims continue throughout the period, it is the addition of thicker rims that increases the range of rim thickness in a given pottery collection as shown on Table 2. The data in Table 2 indicate that the exceedingly thick rims (30 mm+) are present by the mid-1400s, clearly prior to the first contact with the Spaniards in A.D. 1521. For example, the dates on Table 2 from the Asanite and Layon sites have fairly narrow ranges that strongly support the idea that the thick rims were present by 1460. A sample of charcoal from the lower portion of the 20–25

Table 2. Range of rim thicknesses from cultural deposits with radiocarbon dates that fall within the *latte* period and early Spanish period (A.D. 1521–1668).

Site name and reference	Type of feature dated	Beta number	Calibrated radiocarbon age (years A.D.)	Type B rims	Range of rim thickness (mm)
Ugum, Guam (Moore et al. 1992)	Earth-oven	54950	1480–1665	29	11–31
NP3, Manenggon, Guam (Moore 1994)	Fea. 3, Earth-oven	56085	1435–1656	4	13–31
Ylig Trench, Guam (Moore and Amesbury 1989)	Earth-en	29925	1415–1645	53	12–34
Asanite, Guam (Amesbury and Moore 2010)	Charcoal-rich area	265655	1400–1460	35	17–33
Site 2, Layon, Guam (SWCA in prep.)	Charcoal-rich area	285262	1400–1450	61	11–46
Site 50, Nimitz, Guam (Moore and Hunter-Anderson 2001)	Earth-oven	127748	1390–1490	10	18–39
Sandcastle, Guam (Moore et al. 1990)	Earth-oven	28524*	1289–1449	44	15–36
PIC, Guam (Moore et al. 1993)	Trash pit	60869*	1287–1422	5	15–29
Villa Kanton Tasi, Guam (Moore et al. 2002)	Burial Area A, L. II	147236	1180–1310 or 1370–1380	7	12–24
Manenggon, Guam (Moore 1994)	NP 4, <i>Latte</i> Set, U 18, 25–26	56086	1042–1390	4	9–12
Manenggon, Guam (Moore 1994)	M236, Rockshelter	48409	1021–1296	2	16–18
Naton, Guam (Hunter-Anderson et al. 1998)	F3, Earth-oven	86989	855–1035	4	11–23
Pago, Guam (Moore 2007)	Earth-oven	207483	870–1020	5	20

*re-calibrated; see Amesbury (1999)

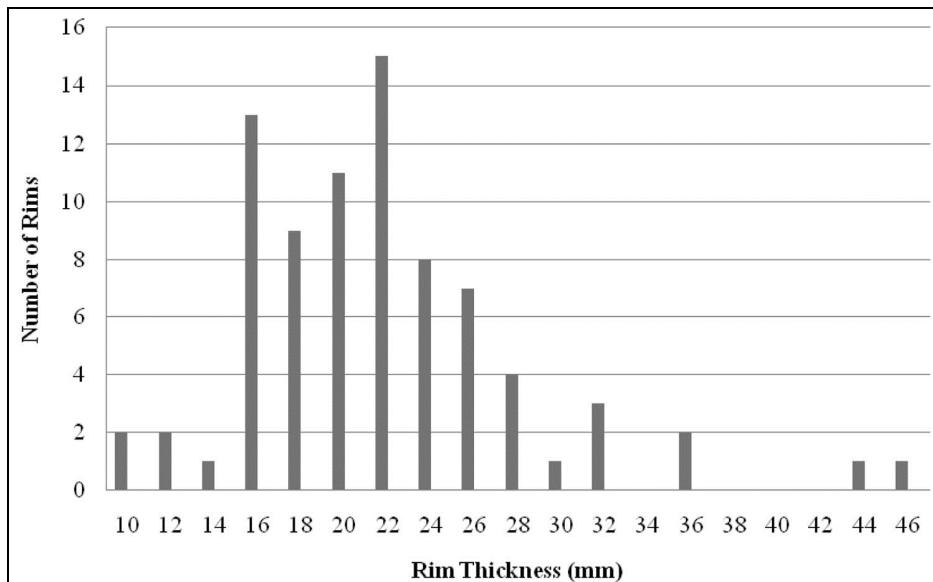


Figure 3. Distribution of rim thicknesses for a collection of 80 late *latte* period pottery rims (Moore 2010).

cm thick buried cultural deposit yielded a radiocarbon date, calibrated at 2 sigma, with a fairly narrow range of A.D. 1400–1460 (Beta-265655). This cultural deposit contained no historic material (Amesbury and Moore 2010).

The surface finishes on these thick rims are plain or rough. The rough category includes wiped/brushed and an overlapping swiped or combed technique. Wall thicknesses below the rim range from 8–11 mm. Estimated orifice diameters range from 20–48 cm (Moore and Amesbury 1989:41–42), which is fairly similar to the orifice diameters for the vessels with thinner rims. Even though some of the reported orifice diameters for the exceedingly thick rims are fairly wide, the thick rimmed vessels may have been used for storage. It is unlikely that they functioned as cooking pots because the extreme variation between the thick rim and the thinner wall would have caused thermal stresses and eventual pot failures due to the uneven transmission of heat across the pot. If they had been used as cooking pots, the thick rims should be well represented in pottery collections. However, they are relatively rare. A collection of 80 late Latte Period rims from Layon, Guam (SWCA in prep.) contained only eight (1%) rims with thicknesses of 30 mm or more (Figure 3) (Moore 2010).

Incurving Flanged and Everted Rims

The increase in rim width around A.D. 1400 is matched by an increase in the variation of rim shape and rim stance. Some very thick incurving rims have a

Table 3. Estimated orifice diameters for Incurving Flanged and Everted Rims.

Rim thickness (mm)	Wall thickness (mm)	Surface treatment	Estimated orifice diameter (cm)	Reference
19	9	Plain	14	Layon, Guam (SWCA in prep.)
46	10	Brown	28	Layon, Guam (SWCA in prep.)
32	14	Wiped	22	Asanite (Amesbury and Moore 2010)
34	8	Wiped	22	Blue Water, Agana Bay (Moore 2008)
34.5	11	Plain	25	Pago (Moore 2007:85)
36	12	Plain	30	Pugua Point (Moore 2000: notes)
37	12	Plain	25	Pago (Moore 2007:85)
41	10	Incised	24	Ordnance Annex (Moore 2002: notes)
50	13.5	Plain	26	Ordnance Annex (Moore 2002: notes)

thickened exterior flange or bolster (see Figure 2, g–h). Often these flanged rims are found on the surface or in deposits mixed with historic material, and in the past it has not been clear if they dated to late prehistoric or early historic times. Both flanged and everted rims are present in the Layon collection, and everted rims (see Figure 2, e–f) are present in the Asanite collection (see Table 2), indicating that both rim stances were present by A.D. 1450–1460.

Because the flanged rims are often surface finds, there has been some question as to their origin as well as their timing. Two undated, flanged rims from Pago, Guam (Moore 2007) were sent to W. R. Dickinson for petrographic examination. Dickinson (2007) stated that the temper in the two rims was closely related to the “volcanic sands rich in the brownish to reddish glassy lithic fragments so common in volcanic sand tempers from Guam” (Dickinson et al. 2001), indicating that these two rims, and probably those from other sites, were locally made and not introduced to the island from somewhere else.

The estimated orifice diameter for nine flanged and everted rims ranges from 14–30 cm (Table 3). Although there is some overlap, this range is somewhat narrower than the range for exceedingly thick incurving rims (20–48 cm), suggesting that the vessels with flanged and everted rims served a different purpose than those with exceedingly thick incurving rims. A vessel with an

everted or flaring rim and a narrow orifice are traits that create a good container for storing water or other liquids. Rice (1987:241) noted that a flared rim acts like a spout or a funnel depending upon whether the container is being emptied or filled. A thicker lip also strengthens the rim against accidental breakage, it may be used to lift the container, and a flange provides a place for a cover to be tied below the rim (Rice 1987:241).

Conical Base

Another pottery trait that appears in the ceramic sequence by A.D. 1460 is the thick conical base (Table 4; see Figure 2, l). Reinman (1974, 1977) noted this basal form but provided no detailed information regarding its appearance in the ceramic sequence, its thickness or its associated surface finishes. As noted above, conical base sherds were recovered from Mangilao Golf Course where they were thought to occur late in time (DeRoo and Goodfellow 1998:IV-136; see Figure 1). Conical base sherds have been recovered from other sites, including Villa Kanton Tasi (VKT) and the Pacific Islands Club (PIC) in Tumon (Moore et al. 2002; Moore et al. 1993), Blue Water in East Agana Bay (Moore 2008), Asanite (Amesbury and Moore 2010), Tarague (Moore 1996), and Pugua Point (Moore 2000). While the conical bases occur in the *latte* period ceramic sequence about the same time as the exceedingly thick incurving rims, the flanged rims, and the everted rims; the precise rim stance that is associated with them remains unclear.

The exterior surfaces of these conical base sherds have plain, stamped, wiped/brushed or a combination of these finishes. One stamped treatment appears to have been achieved by pressing the exterior side of a bivalve into the lower portion of the pot during its manufacture, possibly to compact the clay, or shape the base. The shell left an impression in the clay (see Figure 2). Generally, the thicknesses of sherds from a conical base are greater than those from a pot with a rounded base. In a given group of *latte* period pottery fragments, it is not always possible to recognize a sherd from the base of a rounded pot solely by its thickness. On the other hand, a sherd from the base of a conical pot can be identified rather easily.

In addition to being thick, two of the conical base sherds in Table 4 have grooves or channels on their exterior surfaces. The grooves could have held cords. If so, the grooves suggest that the pots were hung, or suspended. It is unclear whether these vessels would have hung over a fire as a cooking pot. If they were, the cord, which appears to have continued under the base, would have been exposed to the heat source (Figure 4). However, Rice (1987:242) noted that both round and conical pot forms make good cooking pots because their “contours expose a greater surface area to the flames.” Reinman (1977:82) stated that his grooved sherds were associated with “concentrations of charcoal and fire-cracked rock” Possibly some pots with thinner conical bases were made for

Table 4. Conical base sherds from deposits with radiocarbon dates that fall within the *latte* period and early Spanish period (A.D. 1521–1668). In some cases the dated material was recovered from an excavation level not directly associated with the base.

Site name and reference	Beta number	Calibrated radiocarbon date (years A.D.)	Base sherds	Surface treatment	Thickness (mm)
Pugua Point 13.2, L. I, 48 cm bd (Olmo et al. 2000; Moore 2000)	123991	A.D. 1640–1950	0	0	0
Pugua Point 13.2, L. IV, 75–85 cm bd (Olmo et al. 2000; Moore 2000)	Not dated	Not dated	1	Stamped	19
Pugua Point 13.2, L. V, 90 cm bd (Olmo et al. 2000; Moore 2000)	123992	A.D. 1020–1190	0	0	0
Tarague, Guam, 7-1614, TU2, L.II (Liston 1996; Moore 1996)	92497	A.D. 1440–1654	1	Stamped, wiped	17.5
Pacific Islands Club, Tumon (Moore et al. 1993; Amesbury 1999)	60870	A.D. 1419–1648	1	Stamped, grooved	13–17
Asanite (Amesbury and Moore 2010)	265655	A.D. 1400–1460	1	Plain, grooved	10–25
Villa Kanton Tasi, L. I (Moore et al. 2002)	Not dated	Not dated	1	Wiped	20–33
Villa Kanton Tasi, L. II (Moore et al. 2002)	147236	A.D. 1180–1310 or A.D. 1370–1380	0	0	0

cooking while those with thicker conical bases were used for other purposes, such as storage or transport.

This review suggests that vessel forms with new traits were added to the *latte* period ceramic sequence by the mid-1400s. Pottery analysts should continue to record information about basal and rim sherds, including rim thickness, wall thickness, rim orientation, rim stance, surface treatment, and orifice diameter in order to gain additional information about *latte* period vessel forms, their usage, and their temporal significance. The data can then be compared with other data sets to gain information about similarities and differences with respect to site types and spatial variation, which in turn can lead to a better understanding of the *latte* period social organization and inter- and intra-island interaction.



Figure 4. Conical base sherd from Asanite, Guam showing the smoothed edge of a curved groove at the bottom of the sherd.

What's Cooking?

It has been proposed that the rounded pots of the early *latte* period were appropriate vessels for boiling starchy foods. Dates for the advent of starchy food plants (including yams, taro, bananas, sugarcane, sweet potatoes, and rice) that could be boiled remain indefinite, although there is archaeological evidence that some root plants were present by the beginning of the *latte* period (Moore 2005). For example, yam (*Dioscorea*) pollen is associated with a calibrated (2 sigma) radiocarbon date with a range of A.D. 670–880 (Hunter-Anderson 2005a), and taro (*Colocasia esculenta*) pollen from the 167–169 interval of Laguas Core 2 is associated with a radiocarbon date of A.D. 843 (Athens and Ward 1999:151). Rice impressions and accidental bits of rice in pottery sherds associated with a radiocarbon date with a range of A.D. 1284–1425 suggest that rice was present by the mid-1300s (Hunter-Anderson et al. 1995:72), if not earlier (see Gosser et al. 2002:51).

Evidence that rice may have been grown earlier on Guam is provided by a rice impression noted on an undated calcareous tempered sherd with an unthickened rim (DeFant et al. 2008). These two traits (calcareous temper

inclusions and the unthickened rim form) are more often associated with pottery manufactured prior to the inception of the *latte* period. While more secure evidence is necessary to confirm the earlier introduction of rice, it seems plausible that this crop could have been grown on Guam prior to the mid-1300s.

In recent years, pottery sherds with charred remains on their surfaces have been analyzed in order to identify starch grains and other biogenic particles which could indicate what products had been cooked or prepared in the pots (Moore 2002; see also Crowther et al. 2003; Loy 2001a; Loy 2001b; Loy and Crowther 2002). Table 5 presents the results of the analysis of 35 pottery sherds (32 dating to the *latte* period and three dating to the pre-*latte* period).

Of the 32 *latte* period sherds, 29 derived from the body of the vessel, two were from the base, and one was a thickened rim (15 mm thick). Charred residue was visible on each sherd's interior surface. If the sherds represent cooking pots, then the *latte* period cooking pots had a variety of surface finishes including plain (n=17), wiped/brushed (n=10), faintly combed (n=4), and punctate (n=1).

While it was anticipated that the residue on the interior of the sherds resulted from cooking activities, the possibility remains that post-depositional processes are responsible for the accumulation of some of the starches and raphides noted (i.e. the pottery fragment being tossed in a trash pile along with peelings, leaves and stems of plants or placed in an earth-oven). In any event, the results provide information about the kind of plants utilized at the sites.

Taro starch was identified on 15 sherds (13 *latte* period sherds and two pre-*latte* sherds), and both taro starch and taro raphides were identified on three other *latte* period pottery sherds. In other words, evidence of taro was identified on more than half of the sherds in this group. Among the other plant remains identified on the sherds were a rice phytolith on a *latte* period sherd, *Cordyline* starch on three sherds (two *latte* period and one pre-*latte*), and sugarcane on one *latte* period sherd. Starch, raphides, plant hairs, cellulose and tissue on 15 of the sherds could not be identified further (Moore 2002:46).

The results of the residue analyses support Butler's (1990) idea that starchy foods were prepared in the *latte* period pots. Clearly, taro was one of the starchy plants. In modern times taro is usually prepared by peeling the corms, cutting them into pieces and boiling them in pots, or roasting them in an earth-oven, until they are soft (Sproat 1968:19–20). While there was more than one way to prepare taro during the *latte* period, perhaps boiling it in a pot, if one was available, was faster and easier than roasting it in an earth-oven. Alternatively, cultural practices may have dictated how taro was to be prepared, depending upon the nature of the meal or event.

The rice phytolith suggests that rice was another kind of starch that was cooked in the pots, although rice starch has yet to be identified in the residue on pot fragments. In the early 17th Century, a pounded rice gruel was consumed on various ceremonial occasions, the liquid drunk from a "mortero" or spouted

Table 5. Sherds from Guam with residue analyzed by Loy (2001a; 2001b), Loy and Crowther (2002), and Crowther et al. (2003).

Project name and site number	Catalog	Cultural period	Vessel part	Surface treatment	Temper*	Wall thickness (mm)	Results
OA ¹ 1914	16	<i>Latte</i>	Body	Wiped	VST	6	Unidentified starch, discarded in raphide-rich environment
OA ¹ 1931	38	<i>Latte</i>	Body	Faintly Combed	VST	4.5	Unidentified starch, discarded in raphide-rich environment
OA ¹ 1931	40a	<i>Latte</i>	Body	Plain	VST	5	Unidentified raphides and starch
OA ¹ 1931	40b	<i>Latte</i>	Body	Plain	Not observed	5	Unidentified starch
OA ¹ 1931	40c	<i>Latte</i>	Body	Plain	Not observed	8	Unidentified raphides and starch
OA ¹ 1915	84	<i>Latte</i>	Body	Wiped	Not observed	6.5	Unidentified raphides, starch, and cellulose
Agat IOB ²	11	<i>Latte</i>	Body	Plain	Not observed	10	Unidentified raphides and starch
Tumon, VKT ³	62	<i>Latte</i>	Body	Wiped	Not observed	7.2	Unidentified starch
Tumon, VKT ³	130	<i>Latte</i>	Body	Wiped	Not observed	6	Unidentified starch
Tumon, VKT ³	190	<i>Latte</i>	Base	Wiped	Not observed	11–12	Unidentified starch
Nim ⁴ 50	9	<i>Latte</i>	Body	Plain	VST	7–11	Rice phytolith, taro starch
Nim ⁴ 50	251	<i>Latte</i>	Body	Faintly Combed	VST	8	Taro starch
Nim ⁴ 50	253	<i>Latte</i>	Body	Wiped	VST	7–11	Taro starch

Project name and site number	Catalog	Cultural period	Vessel part	Surface treatment	Temper*	Wall thickness (mm)	Results
Nim ⁴ 50	254	<i>Latte</i>	Body	Wiped	VST	7–11 (groove)	Taro starch
GL ⁵ -10b	88	<i>Latte</i>	Body	Wiped	VST	7–11	Taro starch
GL ⁵ -30	144	Pre- <i>latte</i>	Base	Mat	CST	18	Taro starch, fish scale
GL ⁵ -4	162	<i>Latte</i>	Body	Plain	VST	8	Taro starch, taro raphides
GL ⁵ -2	188	<i>Latte</i>	Body	Wiped	VST	10	Taro starch, shellfish
GL ⁵ -2	215	Pre- <i>latte</i>	Body	Plain	CST	711	Taro starch, shellfish, unident.
GL ⁵ -30	231	<i>Latte</i>	Base	Punctate	VST	16–23	Unident. starch, cellulose fibers
WA ⁶ E-20	43a	<i>Latte</i>	B Rim	Plain	VST	8–15	Taro starch, possible <i>Cordyline</i>
WA ⁶ E-20	43b	<i>Latte</i>	Body	Faintly Combed	VST	8	Taro starch
WA ⁶ E-20	43c	<i>Latte</i>	Body	Wiped	VST	8	Taro starch
OA ⁶ -20	238	<i>Latte</i>	Body	Plain	VST	8.5	<i>Cordyline</i> starch, sugarcane phytoliths, feather fragments
OA ⁶ -20	314	<i>Latte</i>	Body	Plain	VST	6	Taro starch
OA ⁶ -38	339a	<i>Latte</i>	Body	Plain	VST	6	Unident., uncooked starch, plant hairs, calcium oxalate platelets, fiber mass, grainy, pleochroic tissue
OA ⁶ -38	339b	<i>Latte</i>	Body	Plain	VST	4	Unident. plant

Project name and site number	Catalog	Cultural period	Vessel part	Surface treatment	Temper*	Wall thickness (mm)	Results
OA ⁶ -39	349	<i>Latte</i>	Body	Faintly Combed	VST	8	hairs, cooked starch, possible muscle tissue Taro starch
OA ⁶ -30	395	<i>Latte</i>	Body	Plain	VST	7–11	Taro starch
OA ⁶ -11	515	<i>Latte</i>	Body	Plain	VST	8	Taro starch, taro raphides
OA ⁶ -11	516	<i>Latte</i>	Body	Plain	VST	10	Taro starch, taro raphides
OA ⁶ -11	518	<i>Latte</i>	Body	Plain	VST	8	Unident., heated starch, calcium oxalate platelets
OA ⁶ -12	519	<i>Latte</i>	Body	Plain	VST	9	Taro starch
NCTAMS ⁷	446	<i>Latte</i>	Base	Plain	VST	7–11	Unident., cooked starch, grainy pleochroitic tissue
Hi 11							
GL ⁵ -4	165	Pre- <i>latte</i>	Base	Plain	CST	12	<i>Cordyline</i> starch

OA¹=Ordnance Annex (Dixon et al. 2004)

Agat IOB²=Inn on the Bay, Agat Corridor (Hunter-Anderson 2002)

Tumon VKT³=Villa Kanton Tasi (Moore et al. 2002)

Nim⁴=Nimitz Hill (Moore and Hunter-Anderson 2001)

GL⁵=GLUP (Hunter-Anderson et al. 2001)

OA⁶/wA⁶=Ordnance Annex (Hunter-Anderson and Moore 2002)

NCTAMS⁷=Naval Computer and Telecommunications Area Master Station (Olmo et al. 2000)

*Temper, CST=calcareous sand temper, VST=volcanic sand temper

vessel (Driver 1989:30). This detailed account of pre-colonial customs and practices in the Marianas lacks a description of rice cooking, however.

The starch from the *ti* plant (*Cordyline fruticosa*) identified on two *latte* period sherds and one pre-*latte* sherd provides evidence that the rhizomes from this plant were probably cooked in the pots. Raphide fragments that resemble

those observed in *Cordyline* leaves suggest that the leaves of this plant also were used. Baking or roasting the rhizomes is the common method of preparing them in Polynesia, where the plant is known to have many uses (Hinkle 2007).

Although *C. fruticosa* is native to the Pacific Islands, on Guam it is known by its Spanish name, Baston de San Jose, rather than a Chamorro term, leading Stone (1970–71:130–131; see also Safford 1905:382) to propose that its introduction to the Marianas dates to historic times. Our review of the historic records of the Marianas found no description of this plant being utilized, although it was observed growing near houses at the end of the 1800s (Safford 1910). Athens and Ward (1999:151) report it in Zone C of their Laguas core, which supposedly dates to 4405–2956 years B.P. (Athens and Ward 1999:146). If the starch, raphide, and fossil plant identifications are correct, apparently the plant known as Baston de San Jose was present and utilized prehistorically on Guam.

Sugarcane (*Saccharum officinarum*) phytoliths observed on one *latte* period sherd suggest that this plant was also utilized, but how it was prepared and consumed remains uncertain. When sugarcane juice is extracted and boiled, it crystallizes and forms a mixture of sugar and molasses (Taggart and Simon 1953). In historic times, Chamorros boiled sugarcane juice to make a crude, moist sugar called *panoche* (Safford 1905), or a thick syrup called *panocha* (Topping et al. 1975). Sugarcane is generally considered a supplementary food plant (Barrau 1961), although it has been found to form a major part of the diet of some groups in the highlands of New Guinea (Daniels and Daniels 1993). While it has not been considered a dietary staple in the Mariana Islands, it could be inferred from the archival information that parts of this plant were cooked in the *latte* period pots. Stable isotope analysis of *latte* period skeletal material suggests sugarcane may have been an important dietary component prior to the introduction of sweet potatoes (Ambrose et al. 1997).

It is likely that other plant products and other kinds of foods were cooked in *latte* period pots in addition to those listed here. For example, angular, fractured aragonite on one *latte* sherd and one pre-*latte* sherd may represent marine shell particles left behind when the mollusks were steamed, or boiled, in the pots (see Table 5). Other observations of unusual materials include a few downy feather fragments. While the feather fragments may not provide evidence that fowl was cooked in the pot, they do indicate the presence of fowl at this site.

Discussion

The review of the ceramic data indicates that a major pottery transformation took place near the beginning of the *latte* period, around A.D. 900. This transformation involved the utilization of different temper inclusions, different rim forms, the application of different surface treatments, and the production of a new globular vessel form that was appropriate for boiling or steaming foods. This

transformation has been linked to changes in subsistence patterns and the increased need to boil starchy foods, including yams, taro and rice (by the mid-1300s, if not before). This idea was supported by the results of the residue analysis, which indicates that taro, rice, and several other plant products were cooked or processed in the same vicinities that yielded the pot fragments.

During the *latte* period, perhaps as early as A.D. 1300, larger pots were added to the ceramic assemblage. Then by A.D. 1450–60 pots with thick conical bases, pots with exceedingly thick incurving rims (some with exterior bolsters), and others with an everted stance were added to the assemblage. These new pots were made and finished using techniques and materials similar to those used to make other *latte* period vessels, which suggests that they were not direct imports to the island. What prompted the addition in the 1400s of several new vessel forms to the *latte* period assemblage?

Possible Climatic Factors

The period from A.D. 900–1300 is known as the Little Climatic Optimum (LCO), a time when there may have been fewer El Nino events in the Pacific, which may mean a time of fewer droughts (Nunn 2007). If rainfall was more consistent on Guam during the LCO, then it is likely that agricultural efforts would have yielded reliable harvests. A steady supply of food, in turn, could lead to an increase in population (Hunter-Anderson 2005b, 1994[IV]:2.21; Amesbury and Hunter-Anderson 2003). Archaeological evidence that can be interpreted as population growth during this time includes the larger pots of the middle *latte* period. The idea being that larger pots were needed to prepare greater quantities of food to feed more people, and/or to store excess foods or grain supplies.

Other archaeological evidence of population growth during this time is the number of archaeological sites at Manenggon Hills, in Guam's southern interior (Hunter-Anderson 2009, 1994[IV]:2.21, and see Butler 1997 for a similar situation in Rota). The radiocarbon dates from Manenggon indicate that this part of the island's interior began to be used more frequently after A.D. 1000 and its increased use continued to the middle *latte* period (A.D. 1200–1400). Generally, but not always, expansion into an area requires more people.

In the 1500s, the Manenggon Hills archaeological record shows a decrease in the number of sites. The period from A.D. 1300–1850 is known as the Little Ice Age, a time when there may have been more El Nino events in the Pacific, which for Guam means a time of more droughts and possibly more storms (Amesbury and Hunter-Anderson 2008; Nunn 2007; Hunter-Anderson 2005c). If this is true, then perhaps by the late 1300s or early 1400s people occasionally suffered from a lack of water and food due to agricultural failures caused by droughts and/or typhoon damage.

In response to these climatic challenges, perhaps the Chamorro people increased their efforts to stock supplies by producing new vessel forms in which

to store water, rice, dried foods (such as breadfruit), and flour (made from *gabgab* tubers, *Tacca leontopetaloides* and *fading* nuts, *Cycas micronesica*). The grooved sherds suggest that some vessels were secured with lids and/or suspended for easier transport or safe-keeping. In addition, people may have used the grooved pots to carry salt water from the beach to the coastal sites where they made salt with which to preserve fish. The Chamorro practice of salting fish to preserve it was recorded by Juan Pobre in 1602 (Driver 1989:16), nearly 250 years before the approximate end in 1850 of the Little Ice Age (Nunn 2007), a time when people would still have been coping with periodic food shortages. For example, Juan Pobre noted that people had little to eat at the end of the 1602 dry season (Driver 1989:30), which indicates that they may have experienced a drought in conjunction with the dry season. Whether or not there was a drought, or a drought brought on by an El Nino event, the lack of food indicates that the people had to deal with food shortages then, and perhaps earlier in the Little Ice Age as well.

Conclusions

There is still much to learn from Guam's *latte* period pottery. The results of a few compositional studies indicate that the pottery was not made at a single production center, and that a single site has pots made from different clays (Graves et al. 1990; Moore 2002). However, more effort is needed to understand where and how the pots were moved. Did pots made from a wider variety of clay sources accrue more often at coastal sites with latte features, than at sites without them? Similarly, were pots made from inland clay sources transported to coastal sites? If so, what social or other behavioral processes were responsible? What about the pots with exceedingly thick incurving, flanged and everted rims: how are they distributed across Guam's sites? Do they occur at all site types? Do these thick rims represent large vessels that mark a trend toward an increase in the storage of food and water as Hunter-Anderson (2009) suggested? Do the thick everted rims occur in Rota, Tinian, and Saipan about the same time that they appear on Guam?

What inferences can be drawn from the variation that occurs in the distribution of pottery attributes across the Mariana Islands during the *latte* period (Moore 2002; Graves et al. 1990)? The differences include an uneven distribution of rim types, rim stances, surface treatments, and quartz temper. For example, *latte* period pottery collections from Saipan contain more unthickened rims than similar collections from Guam, more rims with simple decorative indentations along the lip, more thickened rims with an undecorated flattened lip, sherds with thicker walls, fewer sherds with combed finishes, and more sherds with quartz inclusions (Graves et al. 1990). Graves et al. (1990:220) noted that during the *latte* period "two regional sub traditions developed, one based on

Saipan and Tinian, the other situated on Guam and possibly Rota.” The divergence is apparent by the beginning of the *latte* period, but the precise timing of its origin remains vague (Graves et al. 1990). When and why did it develop?

The occasional quartz-tempered *latte* sherd from Saipan has been observed on Guam and Rota (Butler 1997), and *latte* sherds from Guam have been found on Rota (Butler 1997), Tinian (Moore et al. 1997), and Aguiuan (Butler 1992). While it seems clear that no systematic pottery exchange occurred between Saipan and Guam during the *latte* period, the pottery distribution indicates that social interactions between the islands continued throughout this time (Dickinson et al. 2001; Graves et al. 1990) as people moved about and interacted with relatives and/or other allied social units on other islands.

Given the number of projects conducted in the Marianas over the past decades, the prehistoric ceramic record should be sufficiently robust to begin to answer some of these questions.

Acknowledgments

Various individuals, developers, and organizations, too many to mention individually, supported the field and/or laboratory work that this article draws upon. The staff of the Historic Preservation Office of the Guam Department of Parks and Recreation oversaw the completion of the various archaeological compliance projects. Mr. D. S. Zimmerman complied with the GovGuam Historic Preservation rules and guidelines by funding the archaeological mitigation on his property in Asanite. The Department of the Navy, Pacific Division and Andersen Air Force Base funded some of the research, and the archaeological consultants including Dr. J. S. Athens and Dr. D. Welch of International Archaeological Research Services, Inc., Mr. D. DeFant formerly with Paul H. Rosendahl, Inc. and SWCA Environmental Consultants, and Dr. B. Dixon formerly of Pacific Consulting Services, Inc. now TEC, and Dr. J. Peterson of MARC, University of Guam, involved Micronesian Archaeological Research Services (MARS) in their projects. For expertise and interests in their pottery-related fields, I thank Dr. W. R. Dickinson, Dr. T. H. Loy (deceased), Ms. A. Crowther, and Mr. M. Haslam. For her zeal in trying to understand past climatic events and their possible role in culture change, and for her inspiration, I thank Dr. R. L. Hunter-Anderson, formerly of MARS, and now the University of New Mexico, Albuquerque. Dr. M. Carson’s invitation to submit an article for this issue of *Micronesica* is much appreciated. Those who reviewed earlier versions of the paper including Ms. J. Amesbury, Dr. B. Butler, Dr. M. Carson and Dr. R. L. Hunter-Anderson are thanked for their time and for their thoughtful and helpful comments.

References

- Ambrose, S. H., B. M. Butler, D. B. Hanson, R. L. Hunter-Anderson & H. W. Krueger. 1997. Stable isotopic analysis of human diet in the Marianas archipelago, Western Pacific. *American Journal of Physical Anthropology* 104: 343–361.
- Amesbury, J. R. 1999. Changes in species composition of archaeological marine shell assemblages in Guam. *Micronesica* 31: 347–366.
- Amesbury, J. R. & D. R. Moore. 2010. Archaeological monitoring at Site 66-09-0050, Asanite Guam. Report prepared for D. S. Zimmerman. Micronesian Archaeological Research Services, Mangilao.
- Amesbury, J. R. & R. L. Hunter-Anderson. 2003. Review of archaeological and historical data concerning reef fishing in the U.S. Flag Islands of Micronesia: Guam and the Northern Mariana Islands. Report prepared for Western Pacific Regional Fishery Management Council, Honolulu. Micronesian Archaeological Research Services, Mangilao.
- Amesbury, J. R. & R. L. Hunter-Anderson. 2008. An analysis of archaeological and historical data on fisheries for pelagic species in Guam and the Northern Mariana Islands. Report prepared for Pelagic Fisheries Research Program, University of Hawaii at Manoa. Micronesian Archaeological Research Services, Mangilao.
- Athens, J. S. & J. V. Ward. 1999. Paleoclimate, vegetation, and landscape change on Guam: The Laguas Core. In B. Dixon, J. S. Athens, J. V. Ward, T. Mangieri & T. Rieth (eds.) *Archaeological Inventory Survey of the Sasa Valley and Tenjo Vista Fuel Tank Farms, Piti District, Territory of Guam, Mariana Islands*, pp. 121–151. Report prepared for Department of the Navy, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, Hawaii. International Archaeological Research Institute, Inc., Honolulu.
- Barrau, J. 1961. Subsistence Agriculture in Polynesia and Micronesia. Bernice P. Bishop Museum, Bulletin 223. Bishop Museum Press, Honolulu.
- Beardsley, F. R. 1993. Archaeological data recovery and monitoring of the Manenggon Hills Access Road Corridor, Guam. Report prepared for MDI Guam Corporation. International Archaeological Research Institute, Inc., Honolulu.
- Butler, B. M. 1990. Pots as tools: The Marianas case. *Micronesica Supplement* 2: 33–46.
- Butler, B. M. 1992. An Archaeological Survey of Aguiguan (Aguijan) Northern Mariana Islands. Micronesian Archaeological Survey Report Number 29. Commonwealth of the Northern Mariana Islands Division of Historic Preservation, Saipan.
- Butler, B. M. 1997. An archaeological survey of the east and southeast coast of Rota, Mariana Islands. Report prepared for Division of Historic Preservation, Department of Community and Cultural Affairs,

- Commonwealth of the Northern Mariana Islands. Center for Archaeological Investigations, Southern Illinois University, Carbondale.
- Crowther, A., M. Haslam & T. H. Loy. 2003. Residue analysis of ten potsherds from Guam. Report MARS 390. University of Queensland, St Lucia, Australia.
- Daniels, J. & C. Daniels. 1993. Sugarcane in Prehistory. Archeology in Oceania 28: 1–7.
- Davis, B. D., M. J. Tomonari-Tuggle, S. Wickler, & C. K. Favreau. 1992. Archaeological investigations at the Leo Palace Hotel Site, Naton Beach, Tumon Bay. Vol. I: Archaeological data recovery, burial recovery, and monitoring. Report prepared for Sumitomo Construction Company, Tamuning, Guam. International Archaeological Research Institute, Inc., Honolulu.
- DeFant, D. G., J. Eakin, & L. R. Leon Guerrero. 2008. Archaeological monitoring and data recovery, Fiesta Resort Guam Improvements Project. Paul H. Rosendahl, Ph.D., Inc., Hilo.
- DeRoo, B. & S. T. Goodfellow. 1998. Ceramic analysis. In B.J. Dilli, A .E. Haun, S. T. Goodfellow & B. DeRoo (eds.) Archaeological Mitigation Program, Mangilao Golf Course Project Area, Vol. II: Data Analyses, pp. IV-11-IV-185. Report prepared for Mr. Jetan Sahni, Guam. Paul H. Rosendahl, Ph.D., Hilo.
- Dickinson, W. R. 2007. Petrographic Report WRD-265. Report prepared for Micronesian Archaeological Research Services, Mangilao.
- Dickinson, W. R., B. M. Butler, D. R. Moore & M. Swift. 2001. Geologic sources and geographic distribution of sand tempers in prehistoric potsherds from the Mariana Islands. Geoarchaeology 16: 827–854.
- Dixon, B., D. Gosser, L. Gilda & R. Nees. 2004. Archaeological Survey and Limited Subsurface Excavations at the Naval Ordnance Annex and Waterfront Annex, Territory of Guam. Prepared for Department of the Navy, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, Hawaii. Pacific Consulting Services, Inc., Honolulu.
- Driver, M. G. 1989. The Account of Fray Juan Pobre's Residence in the Marianas 1602. Micronesian Area Research Center, University of Guam, Mangilao.
- Gosser, D. C., J. Allen, R. C. Nees, K. Aronson, C. R. O'Hare & M. R. Riford. 2002. Cultural resources survey of the Military Leaseback Area, Tinian, Commonwealth of the Northern Mariana Islands. Vol. 4: Laboratory analyses. Report prepared for Department of the Navy, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, Hawaii. Ogden Environmental and Energy Services Co., Inc., Honolulu.
- Graves, M. W. 1983. Appendix II: Archaeological analysis of ceramic material from the Asan Drainage Corridor. In R.L. Hunter-Anderson (ed.),

- Archeological Assessment, Drainage Channel, Asan Development Project, pp. App-II. Report prepared for the Guam Housing and Urban Renewal Authority, Government of Guam.
- Graves, M. W., T. L. Hunt, & D. Moore. 1990. Ceramic production in the Mariana Islands: Explaining change and diversity in prehistoric interaction and exchange. *Asian Perspectives* 29: 211–233.
- Hinkle, A. 2007. Population structure of Pacific *Cordyline fruticosa* (Laxmanniaceae) with implications for human settlement of Polynesia. *American Journal of Botany* 94: 828–839.
- Hunter-Anderson, R. L. (ed.) 1994. Archaeology in Manenggon Hills, Yona, Guam. Volumes I-IV. Report prepared for MDI Guam Corporation, Yona, Guam. Micronesian Archaeological Research Services, Mangilao.
- Hunter-Anderson, R. L. 2002. An archaeological study of the Togcha Beach, Agat burial recovery trench, the TYCOM Cable Station and Regional Operating Center in Piti and a report on the archaeological monitoring of cable trenching along Marine Drive, Route 2A and Route 2 from Piti to Biyae, Agat, and at Cable Landing Sites in Piti and Agat. Report prepared for M. A. Mortenson Company, Minneapolis, Minnesota. Micronesian Archaeological Research Services, Mangilao.
- Hunter-Anderson, R. L. 2005a. Archaeological monitoring and data recovery at TN-1-087 (S4) and Vicinity for the IBB Low Band Antenna Project, Northwest Tinian Island, Commonwealth of the Northern Mariana Islands. Report prepared for International Broadcasting Bureau (IBB), Saipan. Micronesian Archaeological Research Services, Mangilao.
- Hunter-Anderson, R. L. 2005b. An anthropological perspective on Marianas prehistory, including Guam. In L. D. Carter, W. L. Wuerch & R.R. Carter (eds.) *Guam History: Perspectives*, Vol. Two, pp. 20–59. Micronesian Area Research Center, University of Guam, Mangilao.
- Hunter-Anderson, R. L. 2005c. Ecological notes in support of designing ecosystem-based fisheries management plans for the Mariana Islands, Micronesia. Report prepared for Western Pacific Regional Fishery Management Council. Micronesian Archaeological Research Services, Mangilao.
- Hunter-Anderson, R. L. 2009. Last millennium climate changes and evolution of ancestral Chamorro culture in the Mariana Islands, Micronesia. Paper presented at the 19th Congress of the Indo-Pacific Prehistory Association, Hanoi, Vietnam.
- Hunter-Anderson, R. L., J. R. Amesbury & D. R. Moore. 1998. Results of monitoring and data recovery at Naton Beach, Tumon Bay, Guam. Report prepared for Architectural-Engineering Services, Inc. and Tanota Partners, Inc., Tumon, Guam. Micronesian Archaeological Research Services, Mangilao.

- Hunter-Anderson, R. L., B. Dixon & T. Mangieri. 2001. Cultural resources survey of five Navy Surplus Guam Land Use Plan Parcels, Territory of Guam. Report prepared for International Archaeological Research Institute, Inc., Honolulu, under contract with the Department of the Navy, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, Hawaii. Micronesian Archaeological Research Services, Inc., Mangilao.
- Hunter-Anderson, R. L. & D. R. Moore. 2002. Phase I and phase II archaeological survey at Waterfront Annex and Ordnance Annex, Territory of Guam. Report prepared for International Archaeological Research Institute, Inc., Honolulu, under contract to Department of the Navy, Pacific Division, Pearl Harbor. Micronesian Archaeological Research Services, Inc., Mangilao.
- Hunter-Anderson, R. L., D. R. Moore & J. R. Amesbury. 1994. Summary and synthesis. In R. L. Hunter-Anderson (ed.) Archaeology in Manenggon Hills, Yona, Guam, pp. in Chapter 1 in Volume IV. Report prepared for MDI Guam Corporation, Yona, Guam. Micronesian Archaeological Research Services, Mangilao.
- Hunter-Anderson, R. L., G. B. Thompson & D. R. Moore. 1995. Rice as a prehistoric valuable in the Mariana Islands, Micronesia. *Asian Perspectives* 34: 68–89.
- Liston, J. 1996. The Legacy of Tarague Embayment and its inhabitants, Andersen AFB, Guam. Report prepared for 36 CES/CEV, Unit 14007, Environmental Flight, Andersen Air Force Base, Guam. International Archaeology, Inc., Honolulu.
- Loy, T. H. 2001a. Cooking residues on four potsherds, Nimitz Hill, Guam. In D. R. Moore & R. L. Hunter-Anderson (eds.) Phase II archaeological survey: Detailed recording of sites on the lands to be retained by the Navy, Nimitz Hill, Territory of Guam, Mariana Islands, pp. B-1-B-30. Report prepared for Department of the Navy, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, Hawaii. International Archaeological Research Institute, Inc., Honolulu.
- Loy, T.H. 2001b. Analysis of six pottery sherds from the west coast of Guam. In R. L. Hunter-Anderson, B. Dixon & T. Mangieri (eds.) Cultural resources survey of five Navy Surplus Guam Land Use Plan Parcels, Territory of Guam, Mariana Islands, pp. F-1-F-21. Report prepared for Department of the Navy, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, Hawaii. International Archaeological Research Institute, Inc., Honolulu.
- Loy, T. H. & A. Crowther. 2002. Analysis of pottery sherds from two archaeological sites: Guam. In D. R. Moore (ed.) Guam's prehistoric pottery and its chronological sequence, pp. 125–157. Report prepared for Department of the Navy, Pacific Division, Naval Facilities Engineering

- Command, Pearl Harbor, Hawaii. International Archaeological Research Institute, Inc., Honolulu.
- Moore, D. R. 1983. Measuring Change in Marianas Pottery: The Sequence of Pottery Production at Tarague, Guam. Master's thesis, Behavioral Science, University of Guam, Mangilao.
- Moore, D. R. 1994. Prehistoric ceramics. Chapter 3 *In* R. L. Hunter-Anderson (ed.) Archaeology in Manenggon Hills, Yona, Guam, Vol. III, pp. 3.01–3.71. Report prepared for MDI Guam Corporation, Yona, Guam. Micronesian Archaeological Research Services, Inc., Mangilao.
- Moore, D. R. 1996. Pottery analysis. *In* J. Liston (ed.) The Legacy of Tarague Embayment and its inhabitants, Andersen AFB, Guam. Vol. I: Archaeology, pp. 160–186. Report prepared for 36 CES/CEV, Unit 14007, Environmental Flight, Andersen Air Force Base, Guam. International Archaeology, Inc., Honolulu.
- Moore, D. R. 2000. Pottery analysis, *In* R. K. Olmo, T. Mangieri, D. J. Welch & T. S. Dye. (eds.) Phase II archaeological survey and detailed recording at Commander, U.S. Naval Forces Marianas (COMNAVMARIANAS) Communications Annex (Formerly Naval Computer and Telecommunications Area Master Stations, Western Pacific [NCTAMS WESTPAC]), Territory of Guam, Mariana Islands, Appendix A, pp. 221–224. Report prepared for Department of the Navy, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, Hawaii. International Archaeological Research Institute, Inc., Honolulu.
- Moore, D. R. 2002. Guam's prehistoric pottery and its chronological sequence. Report prepared for Department of the Navy, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor. Micronesian Archaeological Research Services, Inc., Mangilao.
- Moore, D. R. 2004. Traditional ceramics. *In* B. Dixon, B., D. Gosser, L. Gilda & R. Nees (eds.) Cultural Resources Survey and Limited Subsurface excavations at Naval Ordnance Annex and Waterfront Annex, Territory of Guam, pp 51–84. Report prepared for Dept. of the Navy, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor. Pacific Consulting Services, Inc., Honolulu.
- Moore, D. R. 2005. Archaeological evidence of a prehistoric farming technique on Guam. *Micronesica* 38: 93–120.
- Moore, D. R. 2007. *Latte* period and Spanish period archaeology at Old Pago Guam. Report prepared for Richard Untalan and Guam Preservation Trust. Micronesian Archaeological Research Services, Mangilao.
- Moore, D. R. 2008. Pottery analysis from Blue Water. Manuscript prepared for SWCA Environmental Consultants, Guam. Micronesian Archaeological Research Services, Mangilao.
- Moore, D. R. 2010. Layon pottery analysis. Manuscript prepared for SWCA

- Environmental Consultants, Guam. Micronesian Archeological Research Services, Mangilao.
- Moore, D. R. & J. R. Amesbury. 1989. Archaeological investigations of the Ylig Trench, Yona, Guam. Report prepared for Juan Tenorio and Associates, Hagatna, Guam and Public Utilities Agency of Guam, Upper Tumon, Guam. Micronesian Archaeological Research Services, Inc., Mangilao.
- Moore, D. R., J. R. Amesbury & R. L. Hunter-Anderson. 1990. Archaeological investigations at the Sandcastle Site, Tumon, Guam. Report prepared for Maeda Corporation, Guam. Micronesian Archaeological Research Services, Mangilao.
- Moore, D. R., J. R. Amesbury, R. L. Hunter-Anderson & E. F. Wells. 1993. Results of archaeological data recovery during monitoring at the Pacific Islands Club property, Tumon, Guam. Report prepared for Pacific Islands Club, Tamuning, Guam. Micronesian Archaeological Research Services, Mangilao.
- Moore, D. R., J. R. Amesbury, R. L. Hunter-Anderson & E. F. Wells. 1995. Archaeology in Lancho Vista Subdivision, Yigo, Guam. Report prepared for Standard Builders Supplies, Inc., Tamuning, Guam. Micronesian Archaeological Research Services, Mangilao.
- Moore, D. R., R. L. Hunter-Anderson, J. R. Amesbury & E.F. Wells. 1997. Archaeological investigations in the Tachungnya Area, Tinian, CNMI. Report prepared for Juan Tenorio and Associates, Guam. Micronesian Archaeological Research Services, Inc., Mangilao.
- Moore, D. R., J. R. Amesbury, R. L. Hunter-Anderson & E. F. Wells. 2002. Results of monitoring and data recovery at Villa Kanton Tasi, Tumon Bay, Guam. Report prepared for Beachfront Development LLC, Tamuning, Guam. Micronesian Archaeological Research Services, Inc., Mangilao.
- Moore, D. R. & R. L. Hunter-Anderson. 2001. Phase II archaeological survey: Detailed recording of sites on the lands to be retained by the Navy, Nimitz Hill, Territory of Guam, Mariana Islands. Report prepared for International Archaeological Research Institute, Inc., Honolulu, under contract with the Department of the Navy, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, Hawaii. Micronesian Archaeological Research Services, Inc., Mangilao.
- Nunn, P. D. 2007. Climate, Environment and Society in the Pacific during the Last Millennium. Elsevier, New York.
- Olmo, R. K., T. Mangieri, D. J. Welch & T. S. Dye. 2000. Phase II archaeological survey and detailed recording at Commander, U.S. Naval Forces Marianas (COMNAVMARIANAS) Communications Annex (Formerly Naval Computer and Telecommunications Area Master Stations, Western Pacific [NCTAMS WESTPAC]), Territory of Guam, Mariana Islands. Report prepared for Department of the Navy, Pacific Division,

- Naval Facilities Engineering Command, Pearl Harbor, Hawaii. International Archaeological Research Institute, Inc., Honolulu.
- Ray, E. R. 1981. The material culture of prehistoric Tarague Beach, Guam. Unpublished M.S. thesis, Arizona State University, Tempe.
- Reinman, F. R. 1977. An Archaeological Survey and Preliminary Test Excavations on the Island of Guam, Mariana Islands, 1965-1966. Micronesian Area Research Center, University of Guam.
- Rice, P. M. 1987. Pottery analysis: A sourcebook. The University of Chicago Press, Chicago.
- Safford, W. E. 1905. The Useful Plants of the Island of Guam. Bulletin of the United States National Herbarium, Vol. 9. Government Printing Office, Washington, D.C.
- Safford, W. E. 1910. A Year on the Island of Guam. H. L. McQueen, Washington, D.C.
- Sant, M. B. & N. Lebetski. 1988. Ceramics. In B. M. Butler (ed.) Archaeological Investigations on the North Coast of Rota, Mariana Islands, pp. 179-253. Micronesian Archaeological Survey Report No. 23. Division of Historic Preservation, Department of Community and Cultural Affairs, Saipan.
- Spoehr, A. 1957. Marianas Prehistory, Archaeological Survey and Excavations on Saipan, Tinian, and Rota. Fieldiana: Anthropology 48. Chicago Natural History Museum, Chicago.
- Sproat, M. N. 1968. A Guide to Subsistence Agriculture in Micronesia. Agricultural Extension Bulletin No. 9. Publications Office, Saipan.
- Stone, B. C. 1970. The Flora of Guam. Micronesica Vol. 6. University Guam, Mangilao.
- SWCA. In prep. Archaeological investigations at Site 2, Layon, Guam. Report prepared for Winzler and Kelly, Guam. SWCA Environmental Consultants, Dededo.
- Taggart, W. G. & E. C. Simon. 1953. A Brief Discussion of the History of Sugar Cane. The Louisiana State Department of Agriculture and Immigration, Baton Rouge.
- Topping, D. M., P. M. Ogo & B. C. Dungca. 1975. Chamorro-English Dictionary. University of Hawaii Press, Honolulu.
- Thompson, D. 1977. Archaeological survey and test excavation along the leeward coast of Saipan, Mariana Islands, Part 1: A summary of methods and procedures. Report prepared for Historic Preservation Division, Commonwealth of the Northern Mariana Islands.
- Thompson, L. 1932. Archaeology of the Marianas Islands. Bernice P. Bishop Museum Bulletin 100. Bishop Museum Press, Honolulu.