Ancient Marianas History

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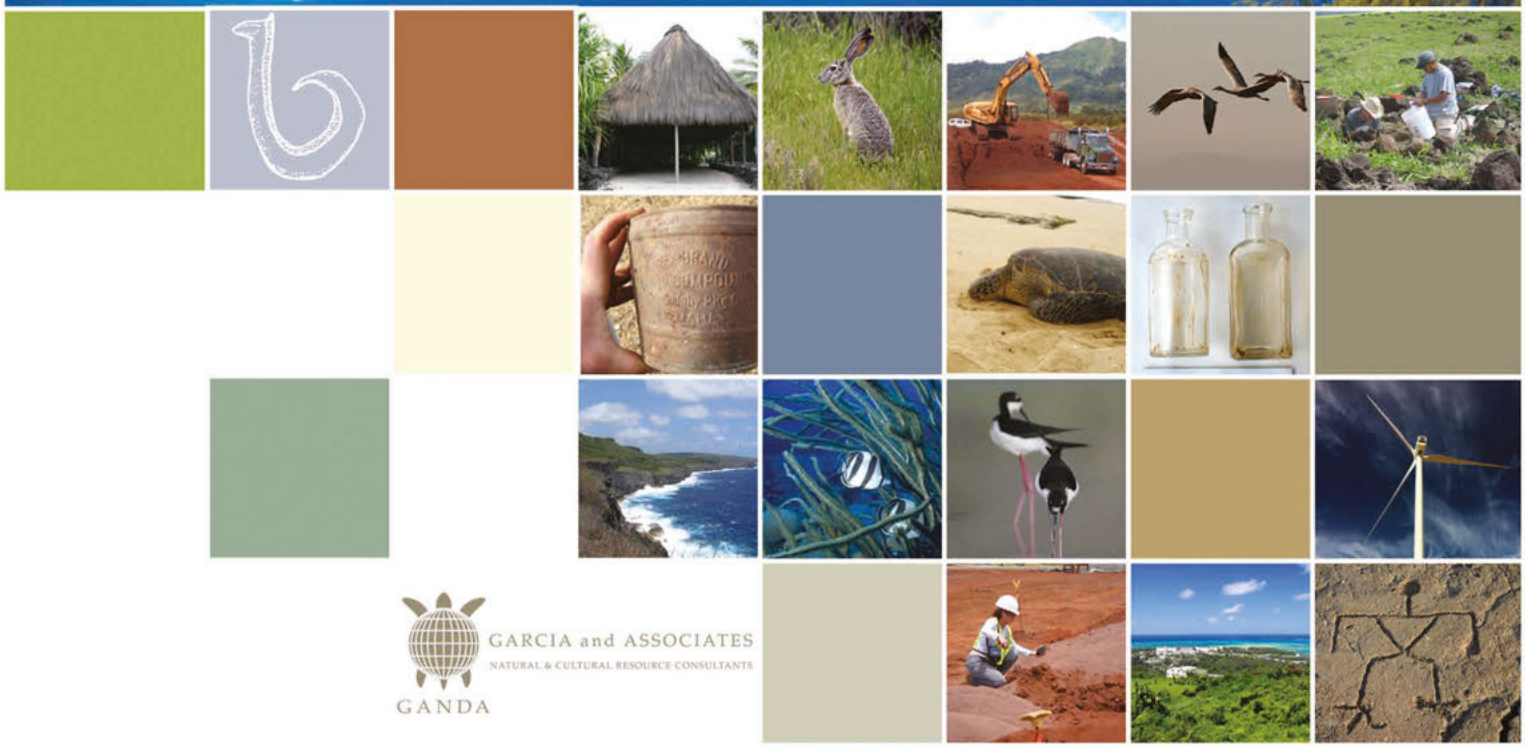

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Reading Marianas Landscapes:
Environmental Histories, Legends, and Ecotropes

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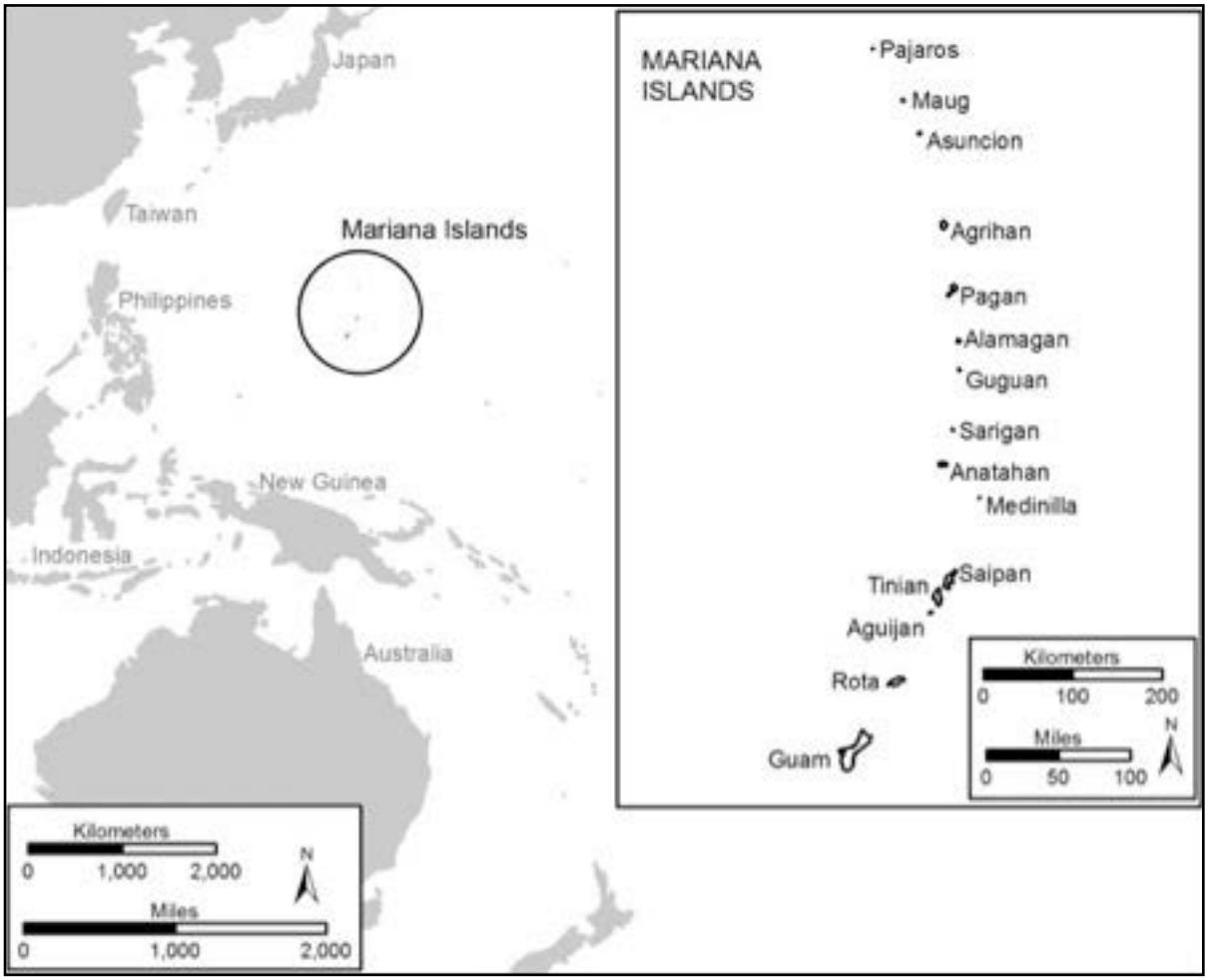
Abstract: *Models and metaphors about the environmental history of Guam and the Marianas range from Chamorro legend to cultural history to scientific and scientistic narratives. They include origin accounts in legend and in migration models; observations and interpretations about vegetative communities, such as savannahs; marine productivity and fisheries practice; and settlement pattern shifts from coastal to highland. Most archaeological models are normative, gradualist, and neoevolutionary. This paper examines several models or metaphors that have currency in the regional literature in light of recent data about Holocene environmental trends and conditions. These include sea level change, impacts of climate and climate change, and radiocarbon dating from paleosols, bioclastic sands, calcrete formations, and also biostratigraphic paleoenvironmental data from the region. A robust model of environmental change emerges, closely connected with social and cultural change in the region. The paper concludes with consideration of future impacts of climate change in the region.*

Introduction

The title for this paper is meant to be facetious, referring to a late 20th century divide in archaeological discourse. In the 1970s Lewis Binford and others introduced "processual" archaeology that professed to be scientific and hypothetico-deductive, compared to the descriptive and culture history goals of previous generations of archaeologists. The processual movement still dominates the discipline, despite sputtering into a few dead-ends, seeking finally "lawlike generalizations" instead of the scientific laws originally sought. Since the late 1980s archaeological discourse has also accommodated historical and interpretive endeavours, now sometimes dubbed "post-processual" or "processual plus"(Hegmon 2003) if there is a dash of science in the narrative.

Scientific observation is still fundamental to most archaeological investigations, and description and analysis are based on rigorous measurement and observation, but sometimes the science is used to validate interpretations that are not based on scientific method, but are nonetheless represented to be rigorous and objective. Among the archaeological studies in Guam and the Marianas there are a few of

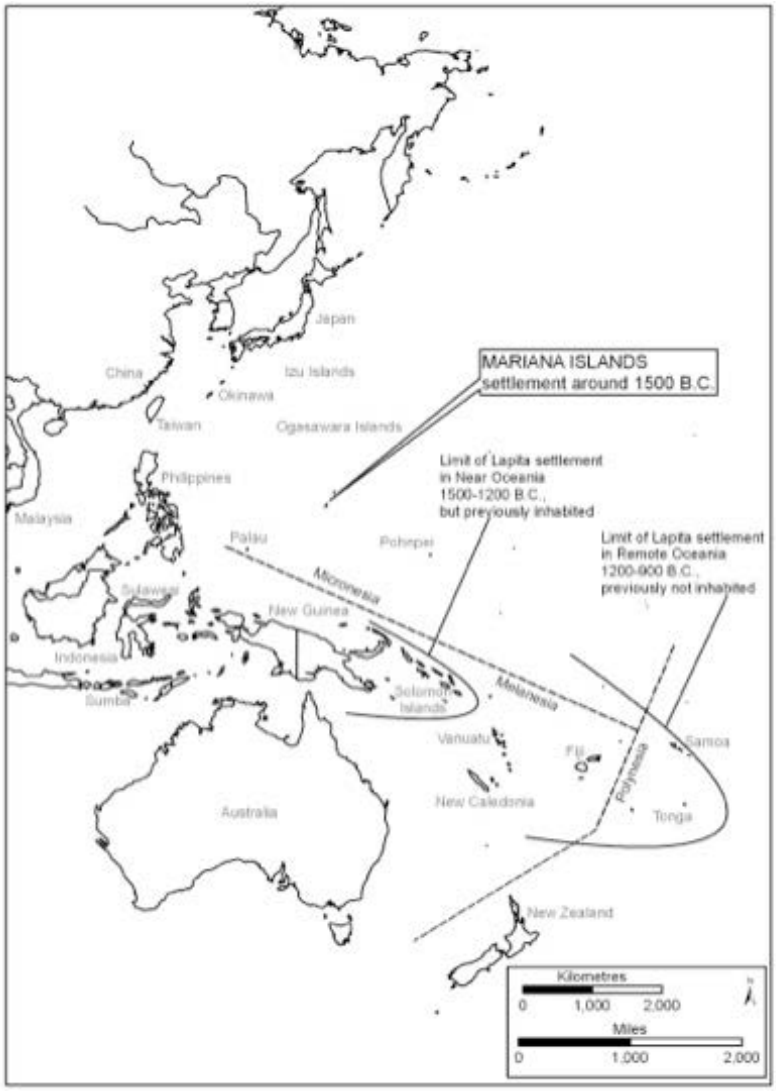
these representations that have been embedded in the current and the generally cited literature as scientific "fact"(Figure 1).



In this paper I will examine a few of these that are based on interpretation of environmental history for the region, and will suggest some alternative models as well as perhaps some ways to support the existing story-line. These story-lines are the "ecotropes" in the title, suggesting that even when we use scientific data and scientific techniques, we are still telling stories and using figures of speech, or tropes, to interpret the archaeological data that we find in our projects. These stories are open to discussion, examination, and re-interpretation just as scientific findings are thrashed about, but shouldn't be confused with science. Interpretations that are clothed as scientific but in fact are loosely fitting tropes are "scientistic" rather than scientific. They are interpretations, not scientific inference[1].

1 Thanks to Dr. Stephen Acabado for this distinction.

A few of these interpretations are embedded in the regional literature. One of the most cited is a controversy that has raged for over a decade between the assertion that Guam may have been settled as early as 4,000 years ago, and a counter assertion that the sedimentary record actually demonstrates natural pre-settlement savannah landscapes on Guam. The claims are based on the appearance of charcoal in dated cores from several sites in Guam and the Marianas that are interpreted as showing burning in the landscape 4,000 or more years ago. A second knowledge claim, also based on radiocarbon dating and human use of the environment, asserts that there were waves of settlement from coastal villages that responded to climatic triggers and population pressure to selectively utilize interior terrain. A third that we will examine, of recent origin on Guam, but asserts that Chamorros gathered pebbles and spread them under their houses and in their yards to make "pebble floors". Each of these interpretations is based on archaeological observations from survey, excavation, or from controlled coring, and each is therefore based on scientific method, technique, and data.



Origin Myths and Early Settlement

The commonly recognized and agreed age of earliest settlement in the region is 3,500 years ago (years before present, or ybp) (Figure 2). This is based on several excavations, mostly in coastal terrain, where the presence of red-slipped, calcareous-tempered pottery is associated with radiocarbon dates from that era. The deposits are often found immediately above the relict beach from that period, or above beach rock that has been dated to that period. The age of the earliest settlement is therefore constrained by environmental features that could not have appeared earlier because the features themselves did not yet exist. This has been well documented in several recent investigations (Peterson and Carson 2009; Carson 2011, Carson and Peterson 2010, Dickinson 2000). Similarly, we needn't bother looking for settlement earlier than about 2,000 years ago on the numerous atolls throughout Micronesia because they were not emergent or capable of supporting life before a lowering of sea level about that time (Dickinson 2000). This is not to say that earlier settlement is not possible on the high islands, but coastal terrain would not be the place it would be found. Rather, rock shelters or buried paleosols in alluvial terraces or open terrain would more likely have remnants of any earlier settlement. None has yet been found in the region earlier than 3,500 ybp.

None of this scientific discourse appears to have been connected with Chamorro mythology. In Chamorro legend there are at least a couple of related origin myths that have been recorded. Puntan was a supernatural spirit who was brother to Fu'una (the sister), who decided to die so that his sister could use his body parts to create the universe. His body became the earth. In some legends, Mt. Barrigada was created from his stomach, and other place-names around Guam refer to other parts of his body. His whole body was formed into the island of Guam (Griffin, Peterson, and Carson 2008). In another legend, the god Chaifi was making souls in a wood fire and as he threw too much wood in the fire, an explosion ensued and one soul escaped and fell on Fua as a calcified rock. In time the rock became a man who made more souls by mixing some red earth and molding it in the shape of a man. Chaifi tried to kill him by sending a typhoon, but the man survived and made many more people to populate the island (Van Peenen 2008:4).

Neither of these legends addresses the scientific data, nor do they make spiritual claims about the antiquity or the source of people who came to the region. In one account, "Dinagi Laolao", outsiders were discouraged from immigrating, but were ultimately absorbed into a local but no long superhuman culture (Thompson

2012:12): (one legend)…tells how the Chamorro came to call the rock "Gapang". The word means "unfinished task", and originates from a tale about how a group of superhuman giants tried to stave off the arrival of outsiders. The giants sent two young boys to drop a giant boulder in Hagåtña Bay to block the invasion of foreigners. But the boys were tricked by a twinkling star, and failed to bring the rock to Hagåtña. The island was invaded, and today's non-superhuman people are a product of the two culture mingling.

People on Guam seem to have been pretty rooted here by the time the Spanish arrived in the 16th and 17th centuries, as they lacked voyaging canoes and didn't report legends about voyaging. It's mainly from linguistic analysis linking Chamorro to Malay-Polynesian and from some genetic studies that we are confident the origins of Chamorro were roughly from mainland Asia and Island Southeast Asia, though whether that was a linear or a mosaic migration is still debated (Trejaut et al. 2011). In any case, the best evidence for the appearance of people on Guam remains those sites with radiocarbon ages from no earlier than 3,500 years ago.

Contestable Cores

In the course of analyzing sediment cores from wetlands on Guam and the Marianas, Steve Athens presented the finding that charcoal began appearing in the core samples in strata that he identified as early as 4,000 to 4,400 ybp (Athens and Ward 1999; 2005). This charcoal, he reasoned, was from fires that could not have been from natural sources, as the pollen data from his cores confirmed that the potential natural vegetation of Guam was tropical forest. Therefore fire implied human intervention. The radiocarbon ages were based on only a few radiocarbon samples analyzed from each of the cores.

Athens noted this trend in a core from the Laguas drainage near Apra Harbor, Guam (Athens 1999), and also from the Susupe Marsh in Saipan (Athens 2005). His interpretation of the initial appearance of charcoal is that this must have been directly correlated with radiocarbon ages obtained from very small shell or sediment samples from either core. However, other inferences could be made based on the detailed analysis that Athens provides. He notes significant changes in the lithology of the sediments in the deposits where the radiocarbon age was 4500 ybp, and again, about 50 cm higher, where the next radiocarbon age in the core was about 3600 or 3700 ybp in both cores (Figures 3-5).

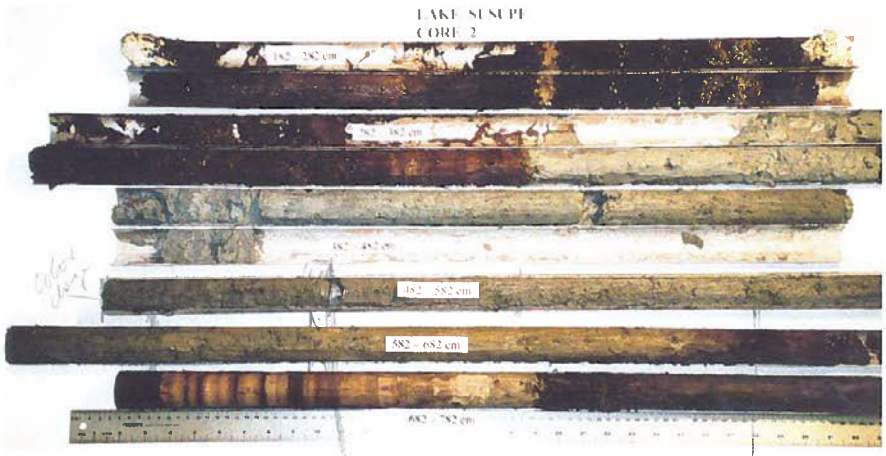


Photo 13. Overview of opened Core 2, Lake Susupe. Top of core is upper left, bottom is lower right. The top three drives are shown with both sides of the split tube segments, while only one side of the tube segment is shown for the bottom three drives. The ruler is scaled in inches (bottom row of number) and centimeters (top row).

Figure 6. Profile of Core 2, Lake Susupe. Calibrated radiocarbon date ranges (1 sigma) are indicated on the profile along with sampling intervals for pollen.

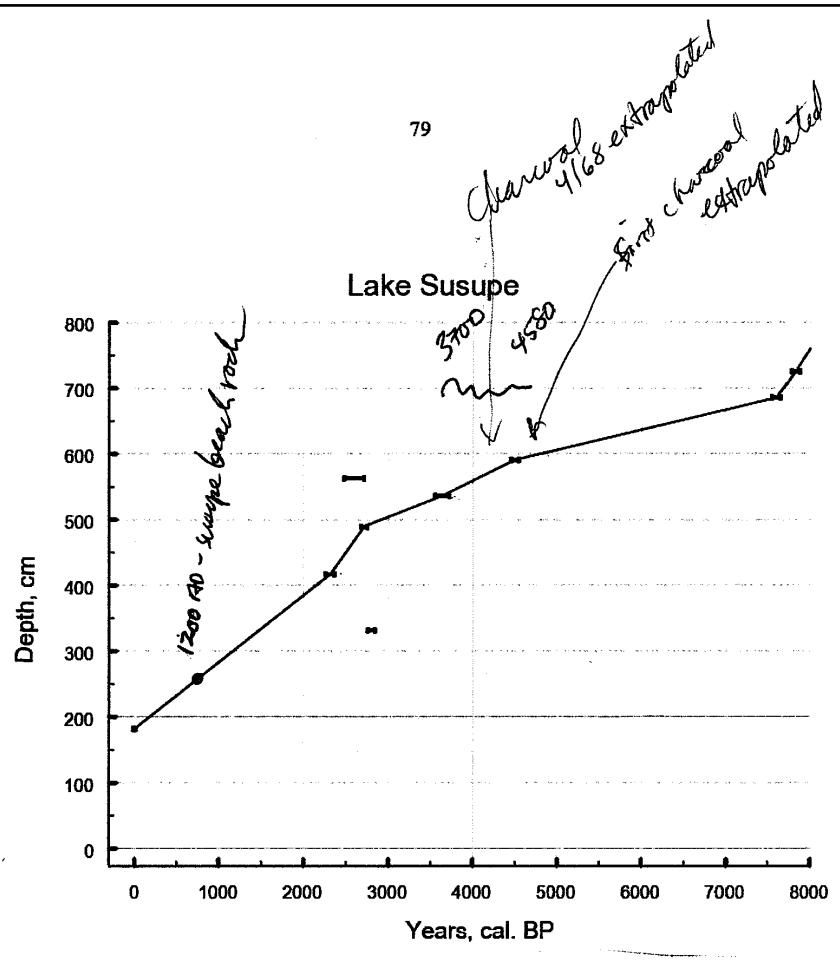


Figure 7. Depth-age plot of calibrated radiocarbon dates from Core 2 using a linear interpolation model connecting the mid-point of each date range (1 sigma) with the surface (lake bottom) age set at zero at 182 cm below the lake surface.

The change in lithology is correlated with significant change in the pollen spectrum as well, as much higher Rhizophora pollen was found compared to the earlier sediments, and the sediments rather abruptly have a much higher organic content. Athens attributes this shift to lowering sea level that would have reduced the salinity and the habitat would be characterized as brackish mangrove swamp. In the Susupe core two radiocarbon ages are out of sequence in the age ranges, and one age of around 2400 to 2700 ybp was found sandwiched between the older, deeper 4500 ybp age and the shallower 3600 ybp age. He attributes this possibly to mixing of sediments from bioturbation, but excludes this from serious consideration as a factor in interpreting the age correlation of the appearance of charcoal. In both cores the concentration of charcoal is a light "dusting" in the lower sediments that correlate with the 4500 ybp age range, and increase from as low as 0.9 mm^2/cc to 6.8 mm^2/cc in sediments that are shallower than the 3600 ybp age range for the Laguas core, and similarly higher concentrations in the Susupe core. The microfossils, including pollen, pteridophyte spores, and charcoal were "usually less than the 200 micrometers size fraction"(Athens and Ward 2005:37). The size of the charcoal particles was not specified, but most pollen are in the range of 10 100 micrometers in size, and the charcoal most likely was in the same size fraction.

Athens work has been pioneering in its detailed and rigorous collection and analysis, and is generally comparable in quality and interpretation to data accumulating from paleoenvironmental proxies throughout the region. However, the interpretation that the first appearance of the charcoal is correlated with 4500 ybp deposits that are thus 1000 years older than the earliest known human settlement in the islands is not parsimonious. There are at least two alternate inferences, one based on vertical translocation from bioturbation, and another that the tiny charcoal particles originated from fires in mainland Asia, as well as the contrary interpretation of Hunter-Anderson that the charcoal is from local natural fires. Athens acknowledges the likely mixing of materials in the Susupe core that in fact produced two out-of-sequence radiocarbon ages. The finest particles are the most likely to be vertically transported by bioturbation, and so tiny charcoal particles and also the minute shell that Athens selected for dating were prone to displacement from crab, worm, and other organisms. The zones of higher concentrations of charcoal, from which the charcoal was diffusing downward, is more likely the site of primary deposition. That zone is correlated with radiocarbon ages post 3600 ybp in both cases. There is a growing literature on charcoal taphonomy with detailed analyses demonstrating how especially small particles of

charcoal move vertically through mass wasting of wet soils, mechanical movement by falling into voids, and transport by crab burrowing, annelid worms, and root growth and decay (Théry-Perisot et al. 2010). There is a decay ratio from the source or primary deposition zone that is consistent with the dispersal of small particles of charcoal (and shell) reported in the core and pollen analyses from Athens' projects. The area of highest concentration and greatest diversity of particle sizes should be assumed to be the primary deposition, and from the reports this appears to have been post-3500 or even post 3000 ybp in all the coring projects.

Radiocarbon dates from Ritidian in Guam were obtained from marine shell, small pieces of coconut charcoal, and algal bioclasts. Coconut charcoal has been recommended for dating because fragments are easily identified seed and are from a single year of growth. However, it should be collected from a constrained context and not loose in massive sediments, as it is highly susceptible to vertical transport. Coconut charcoal was relatively much younger than the other dating materials in all units where comparative sampling was done. In the Unai Bapot project reported by Geoff Clark "all of the small charcoal produced exactly the same date from top to bottom, regardless of changing strata, pottery, and shellfish materials… my work found no charcoal at all below the 3,000 year old layer…Craib's earlier work also noted that the charcoal was either non-existent or else rare and not to be trusted."(Carson, personal communication). Théry-Perisault et al (2010) note that "worms can shift archaeological features by nearly 5 mm per year…(but) only small particles, i.e. below 2 mm. can be affected by these processes." (2010:148). In the wet marsh soils reported by Athens from the period from 4500 to 2800 ybp, this vertical movement was lubricated and more subject to translocation vertically than in upland soils.

A second major interpretive problem lies in the assumption of linear correlation of age progression proposed by Athens for his projects. Aligning the ages, and ignoring any that are out of sequence, Athens implies that sediments are gradually accumulating and that an "actual" age can be assigned to intervening depths of sediment. This assumption is not consistent with geomorphic expectations, where sediment deposition and soil formation processes are often disjunctive and sudden, with alternating cycles of degradation and aggradation based on changing precipitation and storm intensity. A prolonged drought, for example, followed by a typhoon, is especially erosive as the dry soil cannot absorb the moisture and is easily eroded. Storm surges likewise can transport lagoonal materials onshore and form deep sudden deposits; at the same time mass wastage from upslope can

redeposit materials rapidly over lower terrain. Recent excavation at Lake Susupe above the southwest shore documents beach rock dating to ca. A.D. 1200 at an elevation "3-5 feet" above mean sea level, buried under 70 cm of poorly consolidated slump that appears to have undergone incipient pedogenesis, also dating to A.D. 1200-1300. These radiocarbon ages demonstrate rapid and deep deposition. According to Athens model for linear interpolation, these deposits should have been 4.3 4.8 meters below the lake surface of Lake Susupe. Rather, they are from the lake surface elevation up to 50 cm above. This rather dramatic difference in depositional history will be discussed in greater detail as part of an ongoing project addressing the punctuated and disjunctive character of landform evolution related to climate change in the region (Peterson and Acabado 2012).

Athens' interpretation of this period where charcoal is first found in the core sediments conforms to a climatic period that has been well-documented globally as the 4000-ybp-event (Liu and Feng 2012). In South China and the western Pacific there was a sudden and intense change to extended El Nino conditions that would have produced much drier conditions. The end of El Nino years are well-known to be supportive of conditions for typhoons tracking through Guam and the Marianas. These conditions appear to have impacted the Laguas drainage and the Susupe Marsh in the period around 4,000 years ago. Lowering sea level, expected as much as 20-30 cm as water sloshed eastward in the Pacific Ocean, would have accompanied these climate trends. This significant event could have produced disjunctive deposition or erosive episodes. The change in lithology in both cores during this period supports this likelihood and undermines confidence in a linear trend of age and sediment (Peterson and Acabado 2012).

When Athens first proposed an early age for early charcoal, he assumed human agency and therefore earlier settlement; a controversy was ignited, so to speak, when Rosalind Hunter-Anderson argued instead that the early charcoal represented evidence for natural, pre-human settlement savannah formation in the islands, where lightning-ignited grassland fires was maintaining savannah habitat much as the Great Plains prairies are sustained in North America (Hunter-Anderson 2009). Athens's pollen data for the periods before 3-4,000 ybp do not support grassland terrain, and uniformly demonstrate tropical forest vegetation in all the cores he collected and analyzed. That aside, and contra biogeography studies of the tropical Pacific, Hunter-Anderson argued for an interpretation of emergent savannah habitat. As can be seen from a critical examination of the depositional history of the cores, neither narrative addresses the actual age ranges

and the impact of bioturbation, which in reality conform to the period of earliest human settlement and not before. Further, climate data proxies from Asia indicate that the period up until 4100 years ago was relatively wet, with intensive drought suddenly emergent at that time. Was the effect of El Nino and regional drought facilitating opportunities for lightning-strike fires in Guam and the Marianas?

Recent research in charcoal particle size and taphonomy indicates that very small particles, less than 20 micrometers, were likely airborne and could have easily been transported from great distances, much as East Asian smog is often seen today in Guam if the wind shifts from the west. Taphonomic studies demonstrate that local fires deposit macroscopic charcoal particles within hundreds of meters from the fire. The largest particles reported by Athens are below that range, and the fine particles detected in Ward's pollen counts are in the range that could have been aerially transported. Indeed, "…preliminary findings from Africa and areas in the Northern Hemisphere suggest that dust may be being redistributed globally (Sturman et al., 1997). Even the timing of the fire may not be consistent with the timing of sediment deposition at the site under investigation. Chacoal being entrained in a dust storm event, may have been deposited in Australia some time before the dust event, and become available due to erosion or a particularly arid event"(Butler 2008:126). From this perspective, aridity in East Asia, even as far inland as the Taihang Mountains in central China, perhaps during the period of the 4,000 year event, may have led to fires and dust storms that redeposited charcoal-laden dust in the Susupe and Laguas marshes of Guam and the Marianas.

Thus, either bioturbation or aerial transport are parsimonious models for the appearance of charcoal found in minute quantities in the region, and testing for either of these hypotheses could include identification of the source material, size-range analysis consistent with recent charcoal taphonomy studies (Scott 2010), and more detailed and constrained dating strategies to account for punctuated geomorphic events. There might even emerge a rapprochement between Athens and Hunter-Anderson in the decade-long controversy of 4,000 year old charcoal particles in the paleoenvironmental record of Guam and the Marianas.

Latte Period Settlement of the Manenggon Hills

Another interesting but also controversial interpretation of a radiocarbon chronology comes from the Manenggon Hills in Guam was proposed by Rosalind Hunter-Anderson (2010). The model incorporates several assumptions, some explicit, others opaque, about islands settlement in Micronesia. Hunter-Anderson

has in several articles proposed an early transient coastal settlement pattern, with a model of population packing on the coast leading to secondary settlement of the interior. It's obvious that the first settlers arrived on the coast, but there is no data privileging the interpretation of interior settlement as a secondary phenomenon. However, discovery problems from early sites include burial above the mid-Holocene shoreline, sometimes two meters deep 100+ meters inland from the present beach; degradation as well as burial of sites in upland terrain; and very little excavation or subsurface survey in high potential terrain like alluvial floodplains such as the Hagatna River or the Talafofo River. Fred Reinman's survey of Latte sites on Guam reported as many from the interior as the coast, in river valleys and in upland terrain. In fact, the largest villages and the largest Latte sets were reported in Pulantat, Alamogosa Springs, and Lost River, the latter near Fena Lake (Reinman 1974). Numerous artifact scatters are found in the interior, and likely many more have been destroyed by farming and land development than will ever be known.

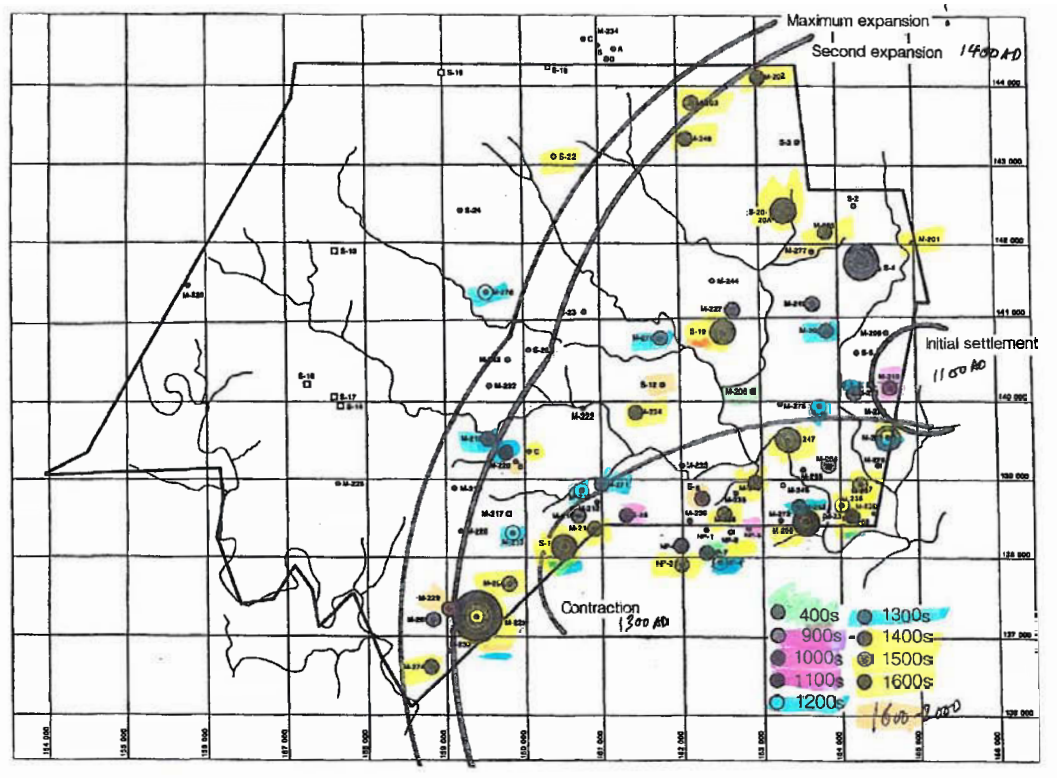
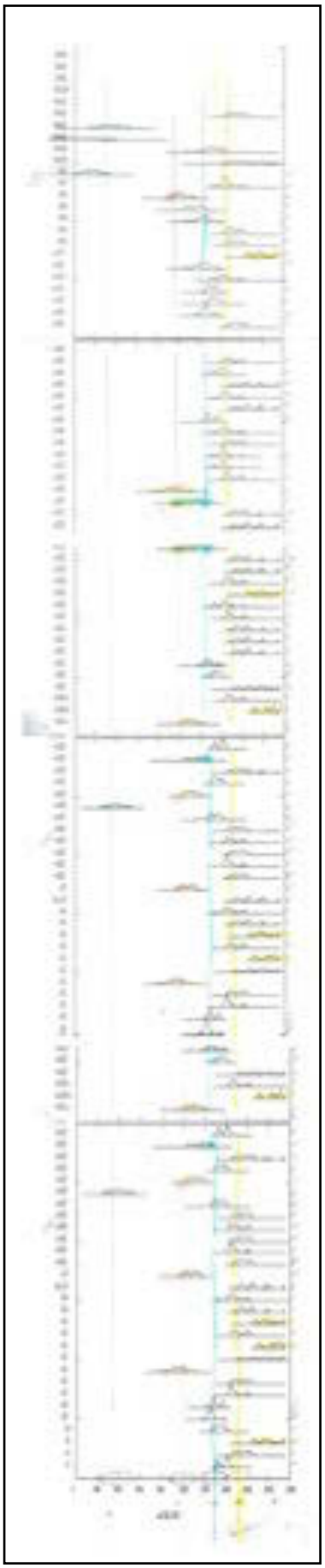


Figure 1.2. Map of project area showing spatial extent of initial settlement and periods of expansion and contraction.

Such was the case with the Manenggon Hills survey done by Hunter-Anderson, Moore, and Amesbury in the 1990s (1995). In a large open area of 1350 acres a pedestrian survey and monitoring of ground clearing led to the discovery and reporting of 86 sites. Most appeared to be Latte period. From among these charcoal was collected and over 73 radiocarbon ages were determined from 48 sites. The age ranges were analyzed to see if any settlement pattern could be discerned. Hunter-Anderson proposed a model of waves of settlement prompted by equable periods with retrenchment and abandonment during dry periods (Hunter-Anderson 2010)(Figure 6). Her model roughly approximated expectations from expansive farming during the Little Climatic Optimum and abandonment during the Little Ice Age. The model was based on several commonly held assumptions of the processual era of archaeological interpretation.

Esther Boserup's (1965) population pressure model of diminished fallow periods was popular as an explanation for migration from increasingly populated core settlements. The mechanical application of the model to Guam was consistent with then-current anthropological interpretation. The assumption of a tension between interior-coastal, upland-lowland settlement regimes was also popular at the time, with variants like Bronson's (1977) dendritic riverine settlement model that assumed tiered hierarchies of settlements from *sitios* to barrios to villages to municipalities, and also specialized land use and developed landscapes such as terracing and construction of land boundaries and landesque property rights. Another less explicit assumption was the sedentariness of land use, neglecting the possibility that landuse was ephemeral, unbounded, irregular, and mosaic in character rather than defined and definite. Another implicit assumption was a rather limited view of catchment areas and human scale. Nowhere on Guam is the interior more than a few kilometers away, and is easily walked in a few hours. The pattern of residence and usufruct in the early Spanish period involved maintenance of matrilineal residency in villages but also management of *lanchos* in the interior. The same person of the same family might be in multiple localities through the course of a single day, so there is no essential quality of settlement that is characterized as a wave of permanent settlements ebbing and flowing into the interior.

The radiocarbon chronology depicted this mechanical settlement however, and did not account for the rich possibilities of ephemeral or swidden gardening, and the narrative implied a direct concordance of sites, dates, and clinal patterns from coast



to highland (Figure 7). Hunter-Anderson proposed percentages of sites within each century based on the centroid of each radiocarbon age. Unfortunately for this distribution, radiocarbon ages are probabilistic, statistical representations. The actual age of the radiocarbon sample is equally likely to have been any calendar date within the range of probability, usually calibrated to 2 sigma, or 95% probability. More sophisticated calibrations based on radiocarbon ages of tree rings account for variability of atmospheric radiocarbon isotopes, and from these likely calendar dates are proposed. However, these are not absolute and not congruent with only the centroid of the conventional age spectrum. Arranging the spectra for the Manenggon Hills radiocarbon chronology shows rather that 55% of the ages fall into the period A.D. 1400 to 1600; another 23% fall within the range A.D. 1200 to 1400. Seven ages overlap from A.D. 900 to 1100 and six are from A.D. 1600 to 1800. Four of the ages are from the period A.D. 200 to 400. These were not relevant to Hunter-Anderson's model, but demonstrate very early use of the interior despite her assumption that early settlers clung to the shoreline.

This representation of the radiocarbon ages from the Manenggon Hills does not show any waves of settlement, nor any clear climatic analogue. The fewest sites were from the LCO, the most sites were post 1400. This could have reflected gradual population increases, changes in agricultural practice such as new cultigens, or bimodal landscape use of both coast and interior by the same families or individuals. There is no necessary or sufficient relationship between site ages and any of the a priori assumptions in Hunter-Anderson's model. The published article of the model does not provide sufficient of the raw data to test the model.

The compliance report does contain more detail such as the location, context of the samples that were collected for dating, and in some cases the stratigraphy of the sites. If that data could be compiled into a GIS model where the context, the calibrated ages, and the location of the dated sites could be viewed, this model could be evaluated based on the physical data. Using the conventional radiocarbon ages reported by Hunter-Anderson, calibrating them using INTCAL09 Database (Talma and Vogel 1993), and displaying the age ranges within the 95% probability range (2 sigma), it can be seen that the age ranges overlap within a different spectrum than proposed by Hunter-Anderson. Using these age ranges, the initial Latte period settlement is within the range 900 to 1200 A.D.; the intermediate period is from 1200 to 1400; the period of highest site numbers is 1400 to 1600; and the last period, post 1600 A.D. is likely a fall-off in rural sites as the Spanish practice of *reducción* would have transferred permanent residency to the villages, and most likely the remaining sites in the interior were part-time *lanchos* or perhaps settlements for the Jesuit ranchos.

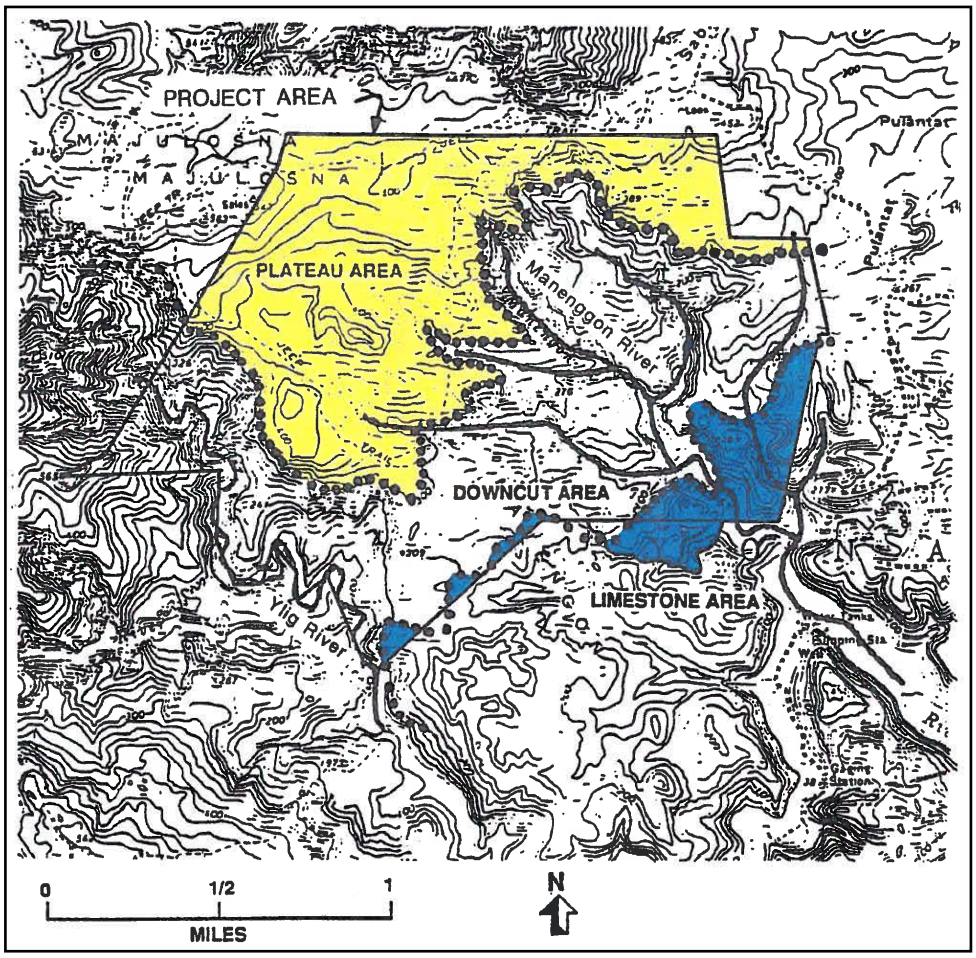


Figure 1.3. Physiographic divisions of the project area. Limestone Area, blue; Downcut Area, white; Volcanic Plateau Area, yellow. Afere Dames and Moore (1990).

The site map from the project actually shows a very close congruence with arable land overlying the limestone substrate (Figure 8). The "plateau area" occupying nearly half of the project area has few sites, but is rough, steep and with poor soils overlying volcanic substrate. The Pulantat clay is a deep, well-drained clay that can be used for subsistence farming and even commercial farming in slopes of less than 7% (Figure 9). The area with the highest site density from all periods of occupation is primarily in Pulantat soils and also in the confluence of numerous streams with alluvium as well as available water. Sasalaguan clay, also a productive soil for either subsistence or commercial farming, comprise another large percentage of land where the preponderance of sites are located (Young 1985). The correlation of productive soils and water availability is far more compelling, and supports that people selected the best land during each period of settlement, with a growing population that spiked during the period from 1400 to 1600 A.D. Was this expansion of settlement determined by changing climate during the Little Ice Age? Or perhaps by introduction of new cultigens or new strategies for subsistence or swidden farming?

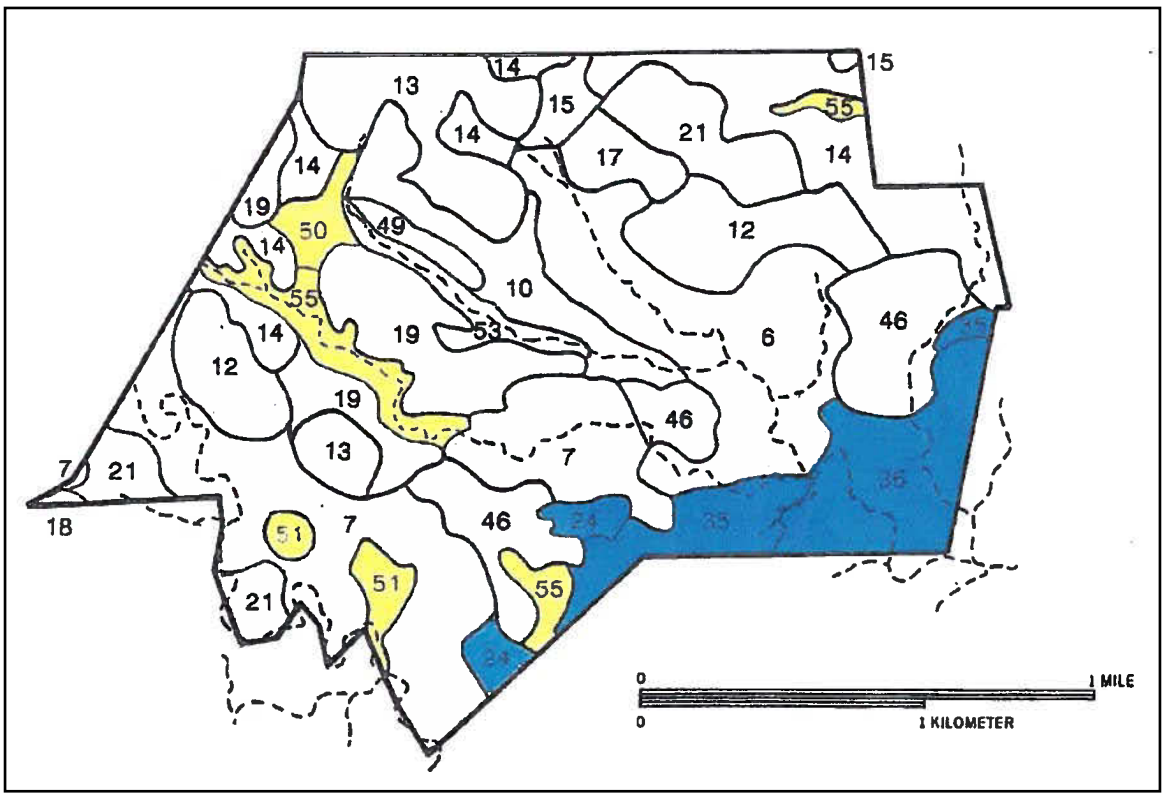


Figure 1.4. Soils of the Project Area. Area in blue contains soils over limestone, areas in yellow are wetland soils. After Young (1988).

In a relatively open and under-populated landscape where people could develop a variety of land use practices, there is no necessity to assume maximizing over optimizing strategies. Historical contingencies and cultural practice may have influenced settlement choices as much as necessity. In Dalaguete, Cebu, farmers kept a stilt-house balay on the coast for fishing. On Saturdays in the 1930s the family would walk to the shore, the men would fish all night, the family would attend mass at the Baroque 18th century church, and then all would return to their farm several kilometers inland and uphill (Seki 2000). This bimodal pattern might not be recognized in modeling of sites found in an archaeological survey, as the command of separate and qualitatively different residences would most likely be interpreted as the coastal Guamanians vs. the mountain Manga'chong, much as historians have assumed since the errant phrase recorded from Fray Juan Pobre about the low caste from the hills (Peterson 2011). There may have been plenty of opportunity for farmers and fishermen, and farmer/fishermen, without having to worry about the Red Queen.

Pebble Floors

There was quite a bit of excitement and publicity in late 2011 when Latte period burials and habitation features were unearthed near the Ylig Bridge in Yona. Archaeologists identified a feature discovered in the strata of the excavation as similar to features found on American Samoa as well as possibly in Micronesia. Thin strata of pebbles were found in areas defined as possible habitation, with postholes indicating structures likely were above what were interpreted as "pebble floors".

There are contemporary structures in American Samoa where pebbles in floors several inches thick are laid within rockwork that lay out the foundation of the traditional fale house. The National Park Service has proposed restoring one of these structures from historical evidence for the Samoan village of To'aga. From another website, "The floor of a Samoan house consists of a circular terrace, raised some two feet above the level of the ground. It is surrounded by a shallow ditch, and it is made of large and small stones, closely fitted together, and covered with a final layer of small white coral pebbles from the beach. This forms the carpet of the house, and is known as "Samoan feathers," from the fact that it also forms everybody's bed at night, covered with a mat or two." Spoehr has documented pebble features in sites that he excavated in Saipan (Spoehr 1957:36)

The subsurface structure of the site proved to be relatively simple. The top stratum was composed of gray sand, varying with the latte area from 0.5 to 1.0 foot in thickness. This stratum was probably, to a large extent, wind-blown. On windy days, sand from the beach blew into our faces. In addition, sand has undoubtedly been washed down from the area above the site. Below the top stratum lay a thin layer, approximately 0.2 to 0.5 foot thick, of coral pebbles. This layer was present within the area enclosed by the stone shafts and extended toward the seaward side of the house. The coral pebble stratum was visible on the XX' profile (see fig. 12). I would interpret this coral pebble layer as representing the ground surface at the time the house was occupied. Today in the Marshalls, as well as in many other parts of Micronesia, it is customary to spread coral pebbles under and around houses. The coral pebble surface prevents mud from forming in rainy weather and reduces dust during dry spells. In the case of Marshallese houses raised on posts above the ground, the area under the floor becomes a work area, particularly for the women. This area always has a coral pebble floor. The latte house at Objan apparently possessed this common Micronesian feature.

For those who don't think there might have been strong connections with the Eastern Carolines and the rest of Micronesia during the early Latte period, this ethnographic analogy might not be compelling, but Spoehr does link Chamorro culture in its broader context to support his suggestion that the accumulation of pebbles was purposeful and part of the house construction, as part of a shared Micronesian pattern.

As an alternate hypothesis however, and using a processual hypothetico-deductive approach, consider Spoehr's description of the windy locality, so much so that the sand stung their faces while working on the site. A common effect of strong winds is deflation of fine particles, leaving heavier, larger clasts or particles conflated on the surface. This is called a "deflational lag surface". As the finer silts and sands are blown away, the other, heavier particles, collapse into a single stratum whereas previously they were unsorted in what had been lagoonal detritus settling in the back reef zone of the shore. Given a certain velocity of wind, persistence, exposure of the house on an elevated surface, and effect on the previously lagoonal deposits of the prograded beach terrain following lowering sea level in the era 1800 ybp, the "floor" of sorted pebbles could have been a natural construction that was selected for the house location because of its suitable and relatively more comfortable surface. Still a pebble floor, but with the agency transferred to selection rather than construction of the surface.

A similar convenience was likely in the Kohala fields of western Hawai'i Island. A consortium of archaeologists have worked there in the last decade to investigate the evolution of the Hawaiian agricultural field systems (Kirch 2010). As neo-evolutionists, they depict the terraced and walled field enclosures as the product of coordinated labor, evidence of increasing complexity and population pressure. Alternatively, in their ethnography of farming in Hawai'i, Handy and Handy (1972) describe how Hawaiian farmers in O'ahu planted windrows with sugar cane at the borders of their sweet potato fields. In time, the windrows were several inches higher than the fields and formed enclosing walls. This had several advantages, in that these marked boundaries, created micro-climates that were resistant to dessication from the wind, and produced shade, also a water-control feature in the otherwise potentially dry slopes. Rather than human labor organized by chiefdoms, these were sophisticated farmers who let nature work for them. The agency was natural, with some smart management by native farmers.

Interpretation or Inference

Three Guam knowledge claims regarding paleoenvironment, interior settlement, and pebble floors have been considered in this paper. These are interesting but not incontrovertible interpretations of environmental history and archaeology. They are subject to re-examination, and in the light of some subsequent data or contradicting geomorphic processes, may not be the most parsimonious interpretations. As distinct from scientific inferences, they are a narrative of interpretation, and contributions to the changing tableaux of Micronesian lore. They also borrow from the dominant paradigms of their disciplines, whether processual or post-processual, or processual-plus, as Michelle Hegmon (2003) proposed.

Many of the environmental tropes used by archaeologists rely on gradualist assumptions of change. Sea-level change is characterized as gradual, occurring over hundreds of years, likely not perceived by short-lived humans, or even recorded in traditional lore. Recent work by climatologists and also on archaeological and geomorphic features demonstrates that more likely sea-level change was often dramatic and punctuated. Sloshing from year-to-year from ENSO shifts can result in sudden increases of 20-30 cm in a year, as documented in 2011 for the western Pacific (Merryfield 2011). This is related to ENSO, not necessarily eustatic or global sea-level change, which appears to be increasing at an average 3 cm/year. Even so, the global sea level rise could be catastrophically high if either the Greenland ice sheet or the West Antarctica ice mass collapsed into the

ocean or melted precipitously. Sea level rise on the order of 1-2 meters could occur within weeks; worse scenarios predict up to 6 meters. Otherwise, predictions of 1-2 meters globally by the year 2100 could occur in punctuated rather than gradual rises. Recent geoarchaeological data from Guam and the Philippines illustrate records of this sudden change over the past few millennia (Peterson and Carson 2009; Peterson 2012).

Mosaic and network models are increasingly popular in population ecology, biogeography, and in complexity models, and are beginning to appear in linguistics, population genetics, and archaeological models (Donahue and Denham 2010; Trejaut et al. 2011; Gray Drummond, and Greenhill 2009). In these models normative assumptions such as wave migrations are challenged by evidence showing patchy and sporadic phenomena. Pockets of related populations of a language community found throughout Island Southeast Asia, may be more representative of the kind of migration and population dispersal that occurred during the Malayo-Polynesian migration from East Asia, Southeast Asia, Island Southeast Asia, and Near Oceania in the era 3,000 to 4,000 ybp (Peterson 2009). Results from population genetics studies are also proposing a similar patchy, mosaic, and networked dispersal of human genes (Trejaut, et al. 2011). This has led generally to a re-thinking of the "out of Taiwan" model for "Austronesian migration" that has been hegemonic among migration models for four decades since first proposed by Peter Bellwood.

Bellwood's model emerged from a gradualist paradigm dominant in the 1970s, proposed by Renfrew and others to depict the clinal settlement of Eastern Europe during the Neolithic period. Even there it may have been more particularistic (Butzer, personal communication), but the wave model dominated migration theory for several decades. In Asia, the idea of an Austronesian migration was novel and clever, but has never captured the historical context of marginalized sea nomads who lived at the edge of empire along the coast of South China. The emergence of sophisticated, bronze-making peoples who built walled towns and formed proto-state polities as early as 4,500 years ago has not been fully known until the emphasis in the last decade on excavation of large sites in China in the previous Five Year Plan for archaeological investigations. Discovery and excavation of these sites in the last decade has been robust, and they are now reported throughout China (Liu 2004, 2009; Liu and Chen 2009). Likely the site of Beinan in southern Taiwan was associated with this rise in proto-state formation in the period 4,000 to

4,500 years ago, but has never been linked to the concept of a migration of seafaring coastal dwellers during the same period (Lien and Sung 1986).

Possibly a combination of events, connected to sudden climate change during the 4,000 year event, degrading mangrove habitat (Berdin et al. 2000), impoverishing inshore and pelagic fisheries, and exerting political and military pressure in competition for coastal resources uprooted these sea nomads and flushed out several generations of fishing people like bees in a swarm who then launched forth in mosaic migration throughout the region (Peterson 2009). The historian James Scott noted that the sea nomads of the South China and the Philippines Seas shared a marginalized, non-hierarchical, loosely organized lifeway with the highland peoples of central Southeast Asia, that he characterized in his volume *The Art of Not Being Governed*. He noted, "Coastal environments, particularly in Southeast Asia, have also provided cover for rebels and those who would evade the state…the mangrove habitat, with its impossibly tortuous passages, recondite to anyone except those with long experience, perhaps represents something of an ideal setting for evasion.

As protective cover it probably has no equal…like the hills, the swamps, marshes and mangroves are places to repair to and potentially places from which to raid. But above all, they are places of low-stateness, where populations that would for whatever reason evade the writ of the state can find refuge" (Scott 2009:171-2), as did Robert Suggs (1960), when he proposed that the coastal peoples of South China were pushed out by early state formation in mainland East Asia, a proposal that was quickly overpowered by Bellwood's strident theory of an Austronesian migration "out of Taiwan." History may be recycling older ideas and returning to what might have been valid but was thrown out with the washwater.

The ramifications for settlement of Guam and the Marianas of these migration debates are very relevant to the origin and source locations for gene flow and language communities of those who settled this region beginning in the era 3,500 years ago. Along with revisiting ideas that may benefit from new data or approaches, or by changing the field of view, the scale of perception, or revising basic assumptions, we may arrive at new perceptions of what we find in archaeological sites and landscapes. This is what makes it interesting for those who do it. The prior models are not necessarily wrong but may benefit from heuristic overhaul from the vantage points of new paradigms or methodologies. The few examples examined here are cases to consider in that light.

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Regional Variation in the Late Prehistoric Pottery of the Mariana Islands

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Abstract: *Archaeologists working in the Marianas have noted differences in the Latte Period pottery from the various islands. This paper describes the pottery from Saipan and Guam and illustrates some of the differences in the various attributes, such as rim form, surface treatment, and temper inclusions. The paper seeks to understand when the pottery production techniques diverged and why the different approaches to its manufacture might have developed.*

Introduction

The Mariana Islands have a tradition of pottery production which spans some 3,000 years beginning with initial settlement around 1500 B.C. by people who brought with them the necessary skills to make vessels from the clay resources that they found in the islands. They continued making pots until sometime after European Contact in A.D. 1521. Descriptions of manufacturing techniques and information about the range of vessel forms made and how they were used are lacking in the historic literature. Thus, it is the archaeological record that provides information about the prehistoric pottery industry.

Archaeologists working in the Marianas have described the pottery fragments recovered from their various sites and developed ceramic sequences by correlating radiocarbon dates with certain pottery traits (Fig. 1). The archaeological evidence from Guam, Rota, Tinian, and Saipan indicates that major changes occurred in the pottery industry through time. The trends seem to be similar across the four islands where most of the archaeological investigations have taken place.

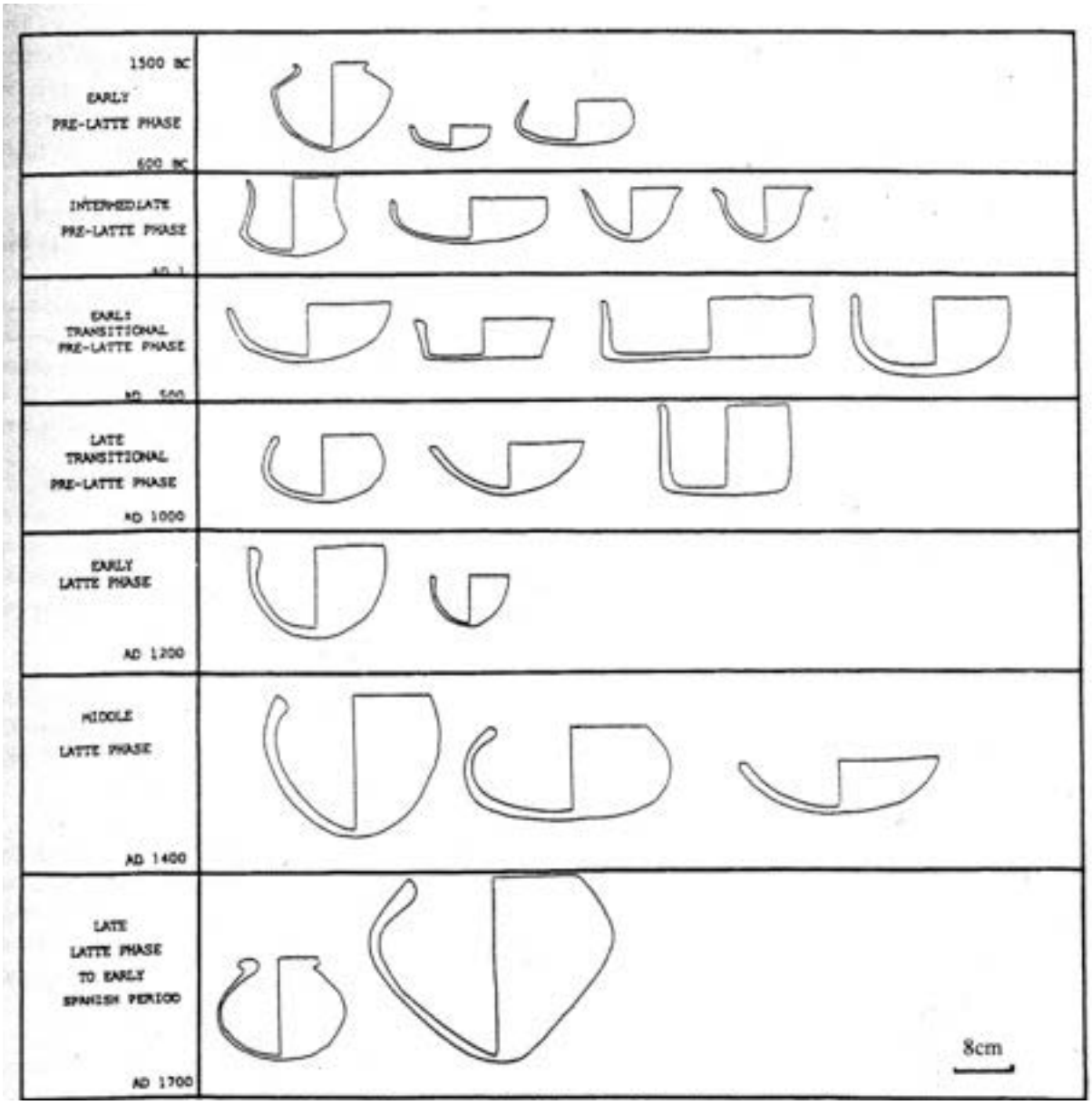

Figure 1. Pottery sequence from PHRI's Mangilao Golf Course Project on Guam's northeast coast. The top four rows illustrate the vessel forms of the Pre-Latte Period. The bottom three rows illustrate the vessel forms of the Latte Period. The figure is adapted from Dilli et al. 1998:IV-136.

The Latte Period began about A.D. 800/900 (Spoehr 1957) and the vessels associated with this time period include globular pots with incurving rims, open bowls, and large jars with restricted mouths. Most archaeologists agree that the Latte Period transformations in vessel forms, temper inclusions, and surface treatments were due to changes in the functions of the pots (Butler 1990; Moore 1983). The new pots were more suitable for food and water storage and for boiling large quantities of starchy tubers or roots, such as yams and taro.

While the trends across the region are similar, archaeologists noted that the Latte Period pottery from Saipan differs from Guam (Thompson 1932; Spoehr 1957; Reinman 1977; Graves et al. 1990). It has been shown that the pottery divergence included all four of the major islands in the region; with the pottery from Rota being more similar to Guam while the pottery from Tinian is more similar to Saipan (Graves et al. 1990). The focus of this paper is to describe the differences between Guam and Saipan, explore when they first developed, and propose the reasons why diversity arose.

Methods

Between the two islands of Guam and Saipan the pottery attributes which vary during the Latte Period are certain temper inclusions, rim form and shape, rim and wall thicknesses, and surface finish. A discussion of the differential distribution of these pottery attributes follows. The review compares the distribution of the various attributes in a limited number of Latte Period pottery assemblages from Guam and Saipan. The review is constrained by the subjective nature of some attribute designations such as surface finish, differences in the size of the various collections compared, potential differences in the dates of the various collections, the fact that not all researchers record the same information, and not all of the archaeological reports from each island were available for review.

The size of the various collections compared here varies from fewer than one hundred to more than a thousand sherds. The uneven sample sizes make it difficult to compare the results with confidence. While some of the collections are associated with radiocarbon dates that indicate that the sites were deposited during the Latte Period, the ages of others has been determined by their provenience, i.e. surface or upper levels of a deposit, associated artifacts, or associated architectural features such as latte sets. Furthermore, some of the radiocarbon dates have longer calendar ranges than others. These factors make it difficult to know whether collections from similar temporal intervals within the Latte Period are being compared. However, in spite of these constraints, general information about the differential distribution of the pottery attributes is presented.

Differential Distribution of Quartz Temper Grains

Generally, Saipan's pots contain abundant quartz inclusions while Guam's pots do not. The Saipan quartz grains are frequently large and easily visible with an unaided eye. Quartz occurs in some of Saipan's earliest pottery, when it is usually mixed with calcareous sands, and in some of its late pottery, when it is often mixed with volcanic sands (Fig. 2). Sometimes quartz appears to be the only visible

inclusion that has been added to the clay. However, whether the prehistoric potters purposefully added quartz to the clay or selected quartz-rich clay deposits to make their pots remains unclear. Perhaps both scenarios took place. That quartz continues to show up in some of Saipan's Latte Period pottery suggests that the potters regarded it as contributing favorable results to their products. Rice (1987) suggests that adding quartz to clay reduces vessel drying time, eliminates cracking, and limits shrinkage. On the other hand, she (Rice 1987) indicates that quartz can weaken the thermal strength of cooking pots.

Figure 2. Typical sherd from Saipan with a thickened rim, rim impressions, and quartz temper inclusions exposed on its exterior surface.

The differential distribution of large quartz inclusions in the pottery has to do with geology and geography. Saipan has exposures of dacitic rocks which contain considerable amounts of quartz (Schmidt 1957:127). As a result of weathering, patches of quartz-rich sands and gravels have accumulated on northern Saipan (Fig. 3; Cloud et al. 1956; McCracken 1953:269; Randall personal communication 1988; Dickinson et al. 2001). Guam also has exposures of volcanic rocks that contain quartz, but the quartz content is not high enough to be classified as dacite and accumulations of quartz-rich sands or clays are uncommon (Tracey et al. 1964). When local quartz occurs in Guam's pots, it most often appears as tiny bits rather than large grains. On Guam, when pottery with large quartz inclusions is identified, archaeologists often assign the origin of the sherd to Saipan, especially if it also exhibits some of the other pottery traits that are commonly associated with Saipan.

The occurrence of pottery with Saipan's quartz grains may be temporally sensitive on Guam. It is my impression that it occurs more often in pottery assemblages dating to the Pre-Latte Period than to the Latte Period. If this is true, it could suggest that the inhabitants of the Marianas were more mobile during Pre-Latte times (Moore 2002:10). Perhaps by the Latte Period, contact between Saipan and Guam was less frequent or more controlled. Alternatively, perhaps by then access to Saipan's quartz resources was limited or controlled.

Since Saipan's quartz resources occur on the northern part of the island, a comparison of the pottery assemblages from Saipan's Latte Period sites to see how the quartz-tempered sherds are distributed across the island, could help to clarify the accessibility issues regarding the quartz resources through time and space on Saipan.

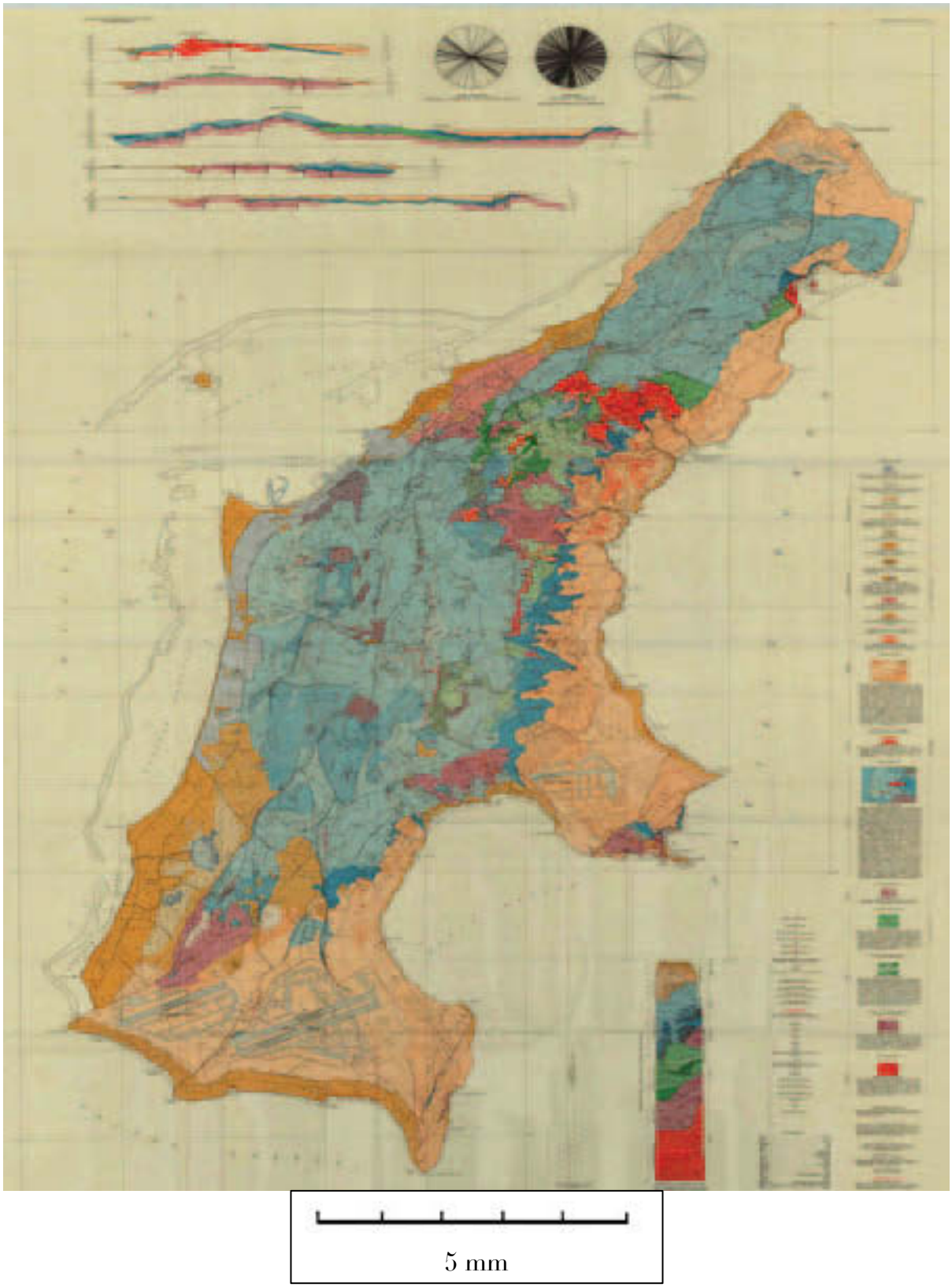

Figure 3. Geologic map of Saipan. The bright red and mottled orange colors in northern Saipan mark the distribution of quartz-rich rocks and quartz-rich sands and gravels. Taken from Cloud et al. 1956, June 20, 2012.

Differential Distribution of Other Latte Period Pottery Attributes

Rim Characteristics

Two major rim types occur in the Marianas Latte Period pottery assemblages. The two types were first described by Spoehr (1957); they are Type A and Type B (Fig. 4). The lips of the Type A rims have the same width or are narrower than the vessel wall. The lips of the Type B rims are thicker than the vessel wall. Both rim types appear through time, but their distribution varies during the Latte Period. On Guam, the percentage of Type A rims decreases and the percentage of Type B rims increases so that typically 90 percent, or more, of the rims in a Latte Period assemblage are thickened Type B (Reinman 1977).

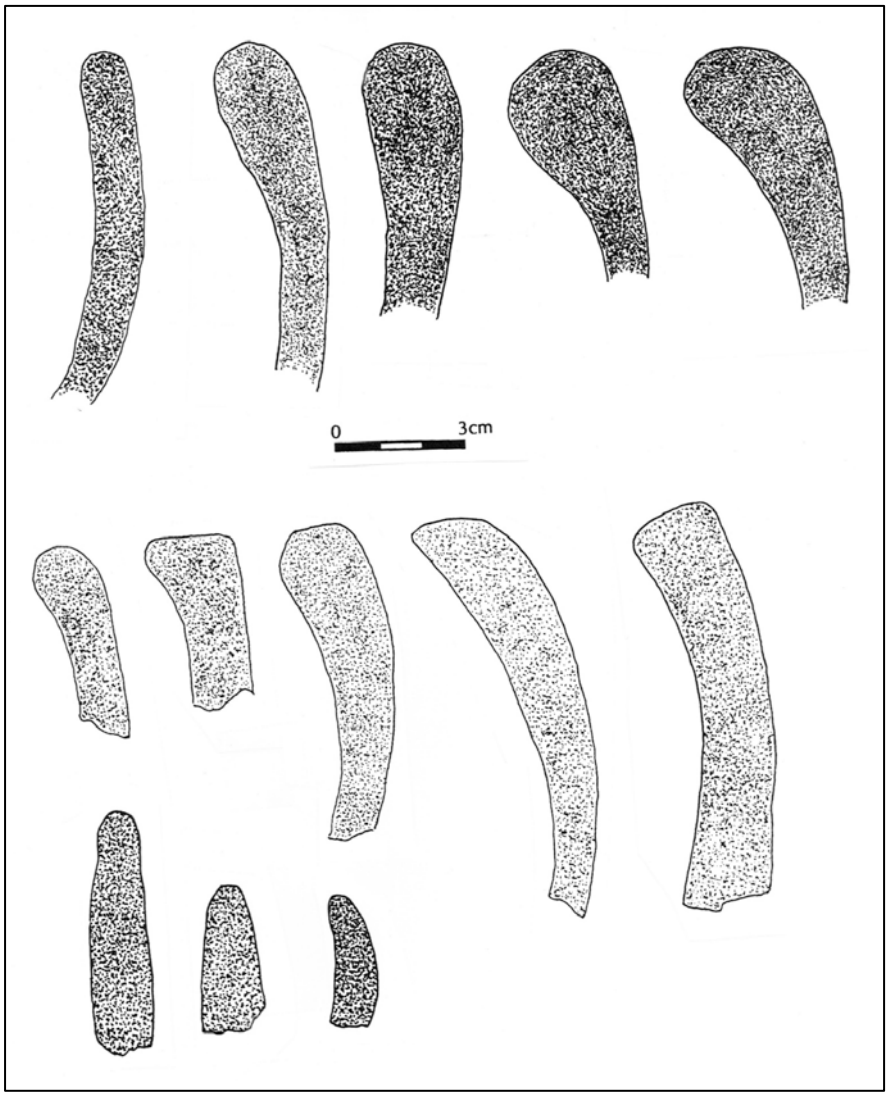

Figure 4. Latte Period Type A and Type B rims from Guam and Saipan. Rims in the top row are from Guam. Upper left rim is Type A, the rest are Type B. Rims in the middle and lower rows are from Saipan. Except for the Type A rim on the far right, the rims in the middle row are Type B, bottom row are Type A. Vessel exterior is to the right.

On Saipan, the percentage of Type A rims decreases too, but the Type B rims only increase to 70 percent, or less, of a Latte Period assemblage. In other words, during the Latte Period, pottery collections from Saipan contain more vessels with Type A rims and fewer vessels with Type B rims than do similar collections from Guam.

Rim width is another characteristic that varies across the two islands during the Latte Period. On Guam, the width of the few Type A rims in the pottery collections is quite narrow, generally measuring less than 10 mm. On the other hand, the width of the Type A rims in the Saipan collections is often greater than 10 mm, sometimes reaching a thickness of 19 mm (Hunter-Anderson et al. 1996:107). Since the Type A rims have the same thickness, or are narrower than the vessel wall, such a thick Type A rim means that the vessel wall was also very thick. The vessel with the thick Type A rim was probably a large, open bowl with a rounded base. In that regard, Saipan's Type A vessel form may be comparable to some of Guam's Type B vessel forms. No illustration of a reconstructed vessel with a Type A rim from Saipan was found during the literature review.

There is less variation in the width of the Type B rims across the two islands during the Latte Period. Type B rim width can range from 10.0 to 41.0 mm. The exceedingly thick rims (in excess of 30 mm) are considered to be temporal indicators of a late Latte Phase collection (post A.D. 1400) (Amesbury and Moore 2010; Graves 1983; Moore and Amesbury 1989). Similar exceedingly thick Type B rims occur on both islands (Hunter-Anderson et al. 1996:108) (Fig. 5), which suggests continued inter-island contact and shared cultural practices. It is likely that the late appearance of the very thick Type B rim is associated with a large storage jar with a restricted orifice. The jar suggests that food and/or water storage became more important then.

Figure 5. Exceedingly thick rims from the late Latte Period. The rims in the top row are from Saipan. The rims in the bottom row are from Guam. The scale is 3 cm long. The vessel exterior is to the right.

Rim shape is another characteristic that can vary across the two islands during the Latte Period. Both Type A and Type B rims can have a flat, rounded, or tapered shape. During the Latte Period, Guam's Type A rims generally have a round or tapered shape, while many of Saipan's Type A rims have a tapered or flattened shape. Typically Guam's Type B rims have a rounded shape, while many of Saipan's Type B rims have a flattened shape. In other words, Saipan's pottery collections have more flat rims while Guam's have more round rims.

Rim embellishment, or decoration is another trait that is differentially distributed during the Latte Period. Guam's rims lack decoration, except for a few exceedingly thick Type B rims that are incised with a lattice design (Fig. 6). On the other hand, Saipan's rims, both Type A and Type B are often enhanced by the addition of simple impressions along the top of the rim. Many of the impressions appear to have been made by pressing a fingertip or other rounded object into the damp clay (Fig. 7).

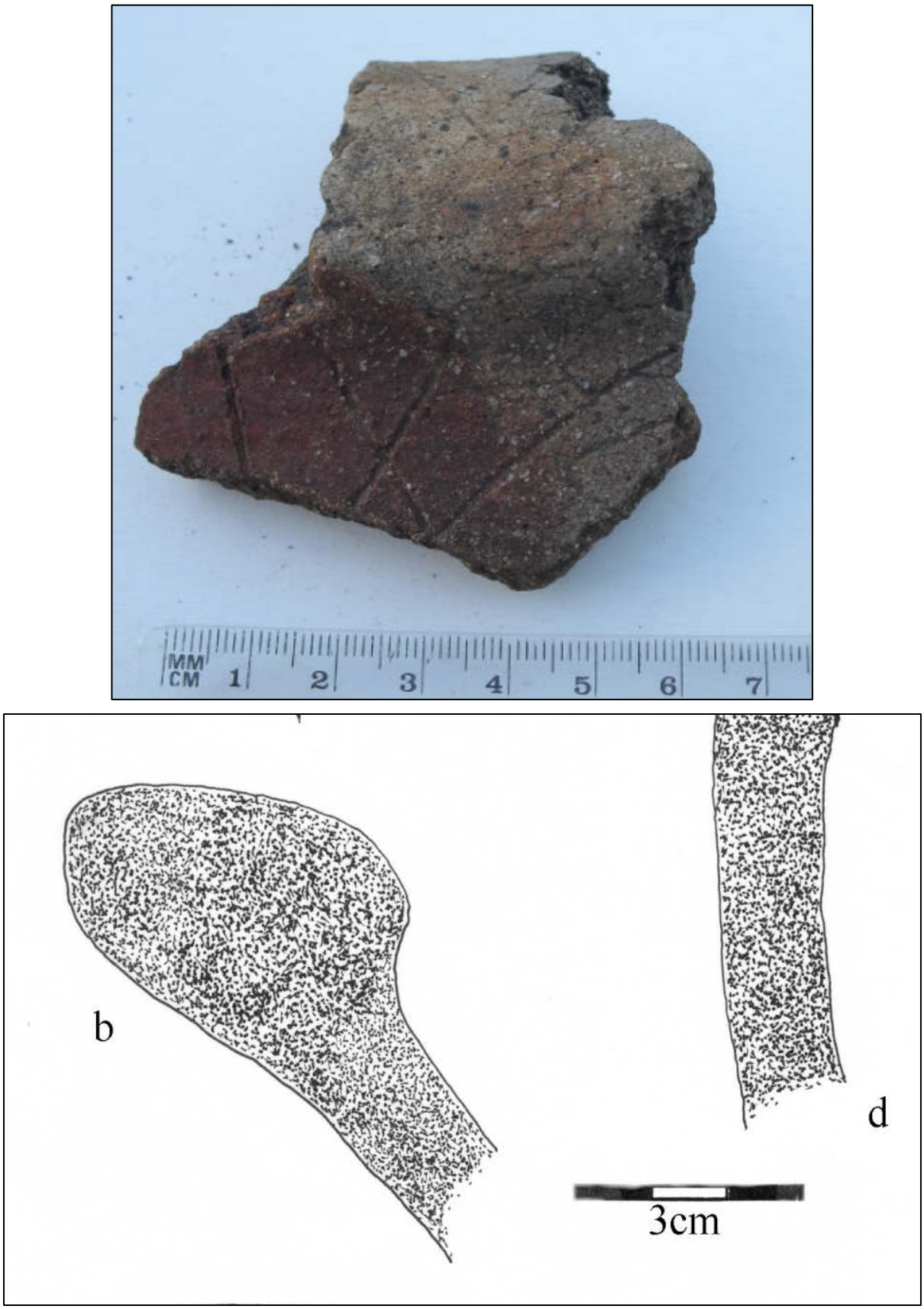

Figure 6. Late Latte Period exceedingly thick Type B rim with an incised lattice design from Guam. Vessel exterior to the right.

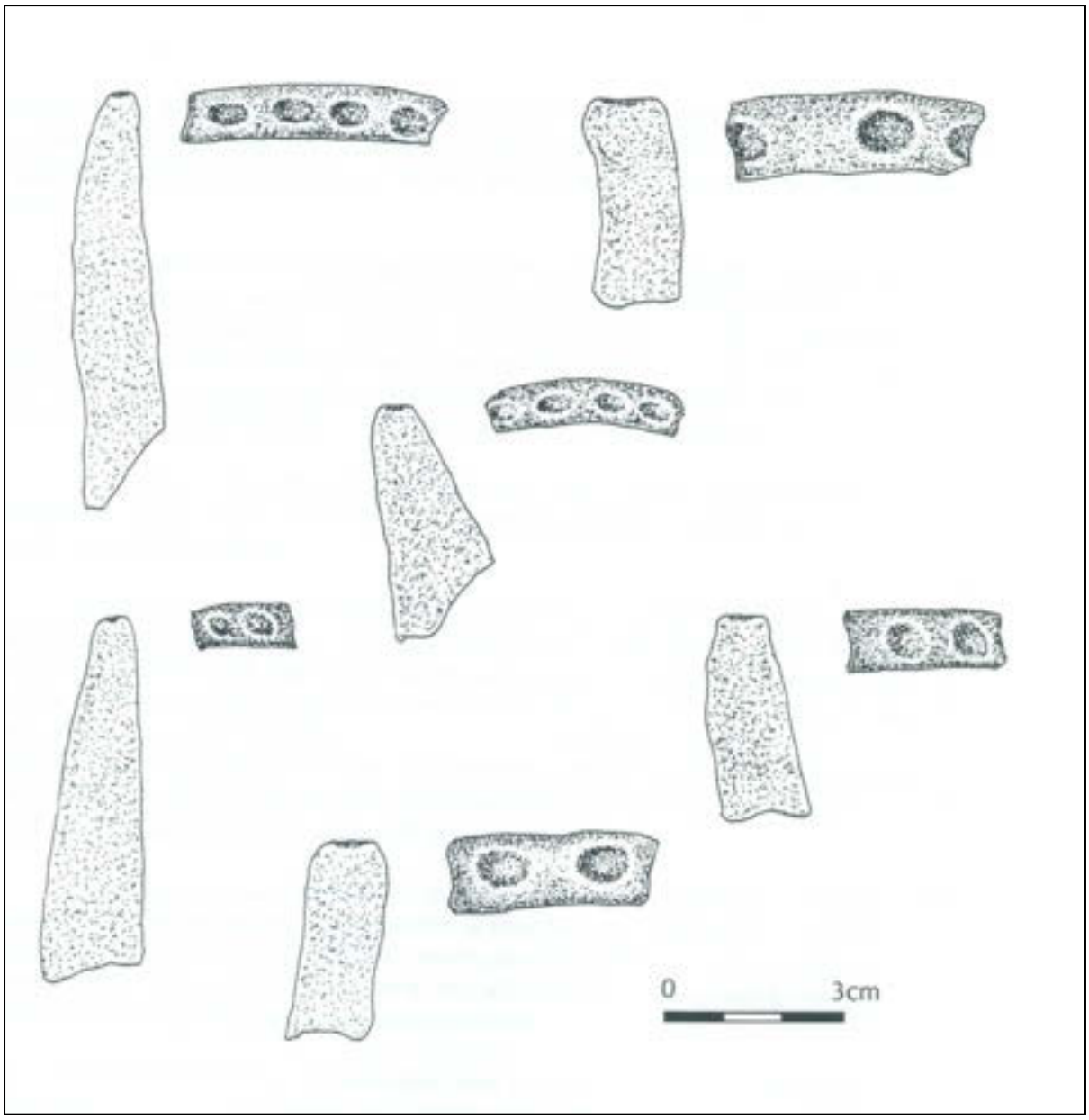

Figure 7. Illustrations of simple impressions on Type A and Type B rims from Saipan. Vessel exterior is to the right.

Surface Treatments

A variety of techniques were used to finish the exterior surfaces of the Latte Period pottery. While the numerically dominant category across the region is plain, there are a number of treatments such as combed, cord-marked, punctate, scraped, striated, trailed, and wiped/brushed which provide textured surfaces to the pots. In addition, applications such as lime-paint or lime-plaster have been noted. Few painted or drawn (incised) designs have been reported.

While most of the Latte Period pots have a plain finish, Guam's pottery collections contain more pots with textured treatments than do the Saipan collections. For example, 20 percent, or more, of the sherds in some of Guam's collections exhibit some sort of textured treatment (Table 1). The most common techniques are wiped/brushed and combed (vertical and random) (Figs. 8 and 9).

Saipan's pottery collections contain higher percentages of plain sherds than do the Guam collections. Often 10 percent, or less, of the sherds in the Saipan collections exhibit textured treatments (Amesbury and Moore 2008; Hunter-Anderson et al. 1996). The wiped/brushed and combed finishing techniques rarely occur on Saipan. When these two treatments are identified, the sherd is frequently thought to have derived from Guam (or Rota).

Table 1. Distribution of Surface Treatment Percentages.

Collection	Plain	Textured	Other	Number of Sherds
Guam				
Tumon, Naton Beach, Phase 1 Hunter-Anderson et al. 1998:113	33	66	01	88
East Agana, BlueWater Moore 2008	73	26	01	1035
Saipan				
Susupe Amesbury and Moore 2008:37	78	08	16	112
Susupe Hunter-Anderson et al. 1996:104	85	08	07	223

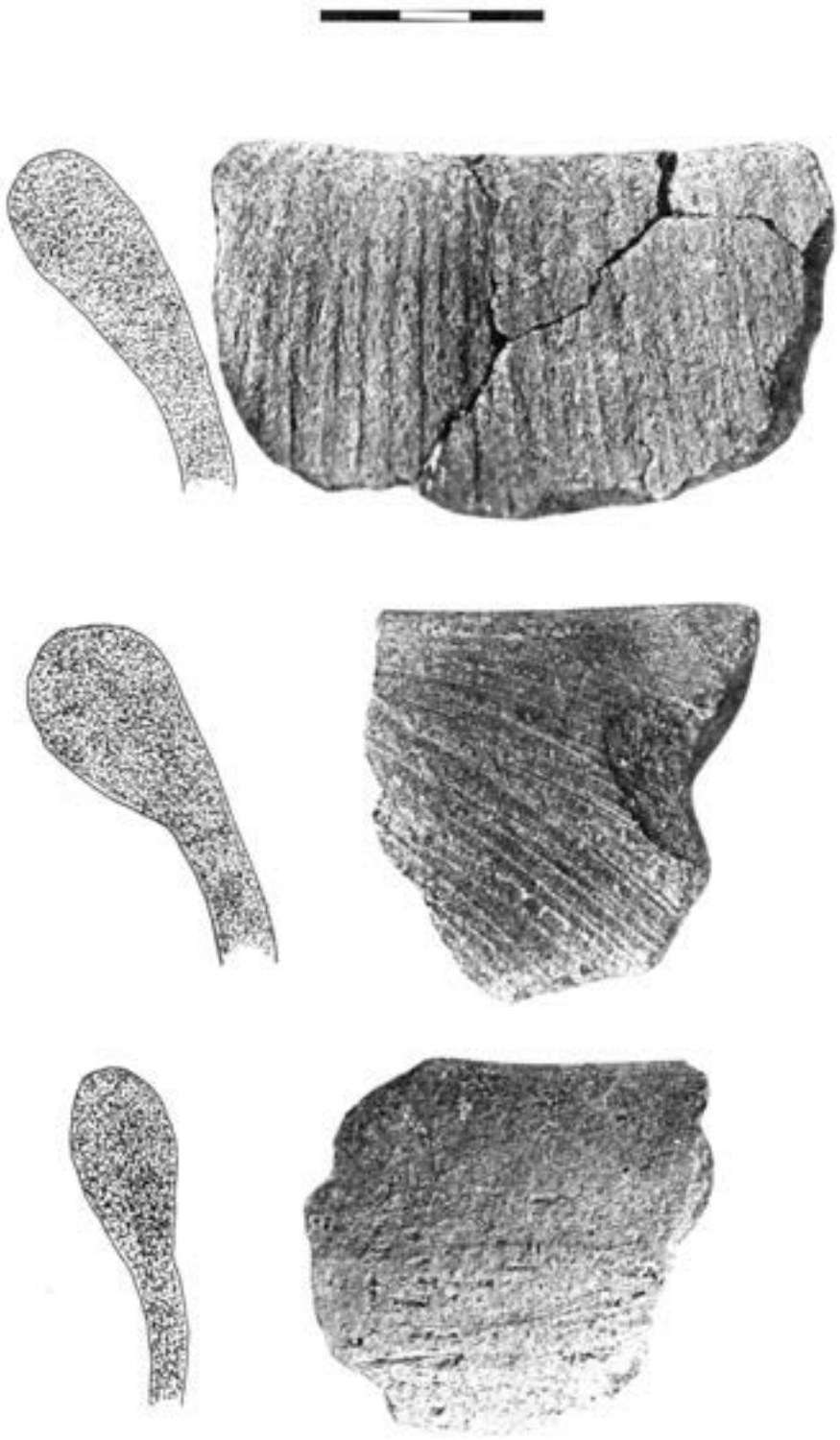

Figure 8. Typical surface treatments on Latte Period pottery from Guam. Top is combed, middle is random combing, and bottom is wiped/brushed.

Figure 9. Photo of three sherds from Guam with a combed finish and an illustration of a bowl with a combed finish.

In spite of the absence of the textured treatments, many of Saipan's plain sherds have a rough rather than a carefully smoothed exterior surface. The rough finish could mean that no additional treatment was necessary to provide a surface that could be easily gripped. Likewise, the quartz inclusions that are partially exposed on the surface of many of Saipan's pots help to provide a rough surface.

It has been suggested that the roughened surfaces on the large Latte Period pots enhanced their function in some way, perhaps by making it possible to regulate the surface moisture or to better handle the large containers (Hunter-Anderson and Butler 1995:55).

It is my impression, based on the charred remains on the interior surfaces of some sherds with a plain finish, that some of the cooking pots had a plain finish. Analyses of the charred remains on some plain Latte Period sherds have identified plant starch and/or plant remnants from taro and yams (Moore 2012; 2005), which indicate that these tubers had been prepared in the pots.

Wall Thickness

Reinman (1977:156) observed that the pottery vessels from Saipan seem larger and thicker-walled than Guam. A comparison of the mean thicknesses of a few assemblages from Guam and Saipan indicates that some of Guam's collections are thinner than Saipan's (Table 2). The mean thickness of some Guam collections is less than 10 mm. For example, the mean thickness of 88 sherds from Tumon Bay is 8.7 mm (Hunter-Anderson et al. 1998:113), and the mean thickness of 858 sherds from Ugum, in southern Guam, is 8.4 mm (Moore et al. 1992).

On the other hand, the mean thickness of some Saipan collections is greater than 10 mm. For example, the mean thickness of 223 sherds from Susupe is 13.5 mm (Hunter-Anderson et al. 1996); the mean thickness of 2799 volcanic tempered sherds from Spit 2 at Afetna is 12.3 mm (McGovern-Wilson 1989:171); the mean thickness of 60 sherds from the surface of an archaeological survey on Kagman is 11.8 mm (Hunter-Anderson 1993:46), and the mean thickness of 95 sherds from the 0-10 cm level of Chalan Galaide is 10.5 mm (Graves and Moore 1986). While these figures have not been subjected to a statistical test to determine if the differences are statistically significant, they seem to lend support to Reinman's observation that some of Saipan's pots have thicker walls and bases than Guam.

Do the thicker wall and base measurements mean that Saipan's vessels were larger than Guam's? Few whole pots have been recovered and there is scant information about orifice diameter and vessel height for comparison. In addition, it is clear that Latte Period pots were made in a variety of shapes and sizes. No extremely large or unusual measurements were found in the archaeological reports that were reviewed. The orifice diameters of Guam's vessels with Type B rims range from 8 to 50 cm (Reinman 1977:77). The orifice diameter of Saipan's pots with Type A and Type B rims range from about 15 to 46 cm (Thompson 1979:94-95; Graves and Moore 1986; Hunter-Anderson 1993; Amesbury and Moore 2010). While this comparison suggests that some of Guam's pots were larger, it is likely that data from more sites on Saipan would indicate that its pots were equally as large and some of the thick-walled pots may have been larger.

Table 2. Distribution of mean body thickness for eight pottery collections from Guam and Saipan.

Guam		
Collection	**Number of Sherds**	**Mean Thickness**
Ugum	858	8.4 mm
Tumon Bay	88	8.7 mm
BlueWater	1625	9.2 mm
Northern Plateau	248	9.9 mm
Saipan		
Chalan Galaide	95	10.5 mm
Kagman	60	11.8 mm
Afetna	2799	12.3 mm
Susupe	223	13.5 mm

Thick walls do not make good cooking pots. On the other hand, thick walls make durable storage jars and serving vessels. If Saipan's Latte Period assemblages truly have greater numbers of thick sherds than Guam's, it could be inferred that there were more serving vessels or storage jars in the Saipan collections. Since Saipan's annual rainfall is less than Guam's, and Saipan has fewer rivers than Guam, possibly the people living on Saipan needed more jars for storing water. Therefore, the apparent greater mean thickness of the Saipan assemblages may reflect a bias toward storage jars. Likewise, the greater mean thickness for the collection from Guam's northern plateau, where there is no surface water, could suggest that the people utilizing this area also needed more storage jars. This is an intriguing idea that needs further testing.

Summary

While there is considerable similarity in the distribution of specific pottery traits across Guam and Saipan during the Latte Period, some unique differences are apparent. A typical Guam pot has volcanic sand temper, a globular shape with a rounded or slightly conical base, an incurving Type B rim with a rounded shape, and a plain or textured surface. A typical Saipan pot has volcanic sand temper with quartz grains, a globular shape with a rounded or slightly conical base, a plain or

unsmoothed surface, and a slightly incurving Type A or Type B rim with a flattened shape which is often embellished by the addition of simple impressions along the lip.

In the future, archaeologists may recognize that some of the differences noted here apply to a vessel with a specific form and function, such as a presentation or serving bowl, while cooking pots and/or storage jars are more similar in shape or size. In order to gain more information about the variety of vessel forms made, their characteristics, and their possible functions, it is recommended that future pottery analysts continue to record information about the various pottery attributes including wall thickness, temper inclusions, surface treatment, and rim type, rim shape, rim width, and rim decoration.

Timing

On Guam it appears that the transition to thickened Type B rims, textured surface treatments and volcanic temper inclusions was gradual and did not necessarily take place at the same pace at every site. An early occurrence of Type B rims and sherds with wiped/brushed surface finishes is associated with a charcoal date having a calibrated (2 sigma) range of A.D. 980-1290 (Hunter-Anderson et al. 2001:134, 140). This range begins just after the date of A.D. 800 which Spoehr (1957) proposed as the beginning of the Latte Period.

At the Afetna site on Saipan, McGovern-Wilson (1989:70, 192) tracked changes in pottery traits to around A.D. 650 (the reported 2 sigma calibrated range for his date is A.D. 650-810). The transformations that occur around that time at Afetna include a marked increase in the number of sherds, the appearance of Type B rims, an increase in wall thickness, an increase in volcanic temper, and the beginning of impressions applied to both Type A and Type B rims. The dated material at Afetna was a small *Tridacna* shell (McGovern-Wilson 1989:70). When processed for radiocarbon dates, charcoal and shell yield different results so a shell date requires an adjustment to make the dates comparable. A marine reservoir correction of 450+/- 35 years, after Bonhomme and Craib (1987:99) was applied and the date was calibrated according to Stuiver and Pearson (1986). Later, the date was re-calibrated according to a revised formula in Stuiver and Reimer (1993) which changed the range by several hundred years to A.D. 901-1307 (Amesbury et al. 1996:56, 59).

The revised range for the Afetna date is very similar to the range from the Guam site. While there may be some issues regarding the radiocarbon dates, and these two sites may not be the earliest sites associated with the new and diverse pottery traits, it would be safe to conclude that the pottery transformations took place around the beginning of the Latte Period, and that is when the regional variation in the pottery began as well.

Discussion and Conclusion

This paper describes some differences in the Latte Period pottery from Guam and Saipan and suggests that these differences first developed around the beginning of the Latte Period. While pottery sherds from Saipan have been found on Guam and pottery sherds from Guam have been found on Saipan, it appears that Saipan's distinctive vessels with large quartz inclusions in the clay, and simple impressions on the flattened Type A and Type B rims were not regularly transported to Guam. Likewise, Guam's volcanic sand tempered vessels with rounded, incurving Type B rims and combed or wiped/brushed finishes were not regularly transported to Saipan.

These distinctions suggest that by the beginning of the Latte Period it was socially important for the people to recognize where at least some of the pots had been made. On the other hand, the exceedingly thick rims which appear in the pottery sequences of both islands late in time, suggest that inter-island interaction and shared cultural practices continued throughout the Latte Period.

Archaeologists routinely use information about diversity and similarity in the cultural materials produced by a group to make inferences about social organization and the behavior of the people who made and used the artifacts (Longacre 1970). It has been argued that pottery diversity during the Latte Period is the result of increased competition for resources and reduced interaction between inter-island populations (Graves et al. 1990). The marked increase in the number of pottery sherds recovered from some archaeological deposits dating to the early Latte Period argues for an increase in the number of people who then made and used larger pots to cook the taro and yams which the results of several residue analyses have indicated were among the foods prepared in the pots (Moore 2012; 2002).

The settlement patterns across the islands near the beginning of the Latte Period indicate that by then people had expanded into the interior where they were presumably growing and harvesting root crops and other plants (Dixon et al. 2011;

Hunter-Anderson 2005; Moore 2005). Since farming requires residential space as well as land for active and fallow fields, it seems likely that once farming began there would have been an increase in the competition for land. As the population increased, there would have been competition for other resources too. The distinctive pottery produced near the beginning of the Latte Period may have been a way to signify clan or group affiliation associated with land use rights.

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Current Understandings of Ancient Marianas Pictographs

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Abstract: *Building upon earlier studies of Mariana pictographs (painted images) present on several limestone cave walls on Guam, Rota, and Saipan, I review commonalities and contrasts in the images depicted: the forms selected, image size, paints used, image placement, and other site aspects such as darkness and accessibility. I then discuss current understandings of these images, from three popular perspectives: science, art, and cultural heritage/identity. The paper concludes with an urgent plea for a comprehensive program to document these enigmatic and potentially highly informative sites before they become further endangered from modern developments and other threats to their integrity.*

Introduction

Until quite recently, only a lucky few were aware of the rich array of prehistoric images painted or incised on the limestone walls and ceilings of caves and on limestone and basalt outcrops in the Mariana Islands of Guam, Rota, Tinian and Saipan. Now, public awareness and appreciation of this intriguing phenomenon, generally termed "rock art" or "cave art," have increased, thanks to the rise of the internet, cultural tourism, local media coverage, YouTube videos, personal and government websites, and digital publishing. For instance, at the educational website Guampedia one can view several images as well as read scholarly discussions of them. These examples are among the many at Guampedia:

Photo 1. Black image, a billfish or a squid? Chugai Cave, Rota

Photo 2. Red-brown and black abstract forms, Chugai Cave, Rota

Photo 3. Red left handprint, Litekyan/Ritidian Pictograph Cave, Guam

In addition to viewing opportunities at government and personal websites, academic work on Marianas rock art is available online, mainly concerned with pictographs (painted images), as is my paper here. It is apparent that pictograph sites outnumber sites with incised or pecked images, whose technical term is petroglyphs (marks on rocks), although more are likely to be found in future. One of the early treatments of pictographs is Paul Henrickson's pioneering study, initially published in *Micronesica* in 1968, in which the author compares images at As-Quiroga Cave (Gadao's Cave) in Inalahan, Guam with the cave paintings at the Tabberakle site in Palau. In 2006, two other scholarly articles became available online at the *Micronesian Journal of the Humanities and Social Sciences*. These works review and summarize the earliest discoveries of Marianas rock art beginning in the Spanish and German colonial eras and bring readers up to date with new observations using modern documentary techniques. One is a descriptive study of the Talagi Pictograph Cave in northern Guam by Victoriano (Vic) April, and the other comprises a comprehensive review and interpretations of rock art in the Northern Marianas, especially images from Kalabera Cave in Saipan, by Genevieve Cabrera and Herman Tudela.

Attesting to the continuing scholarly interest in Marianas rock art are the two papers devoted to the subject presented at the First Marianas History Conference, one by Genevieve Cabrera and one by me. In my paper, revised here for e-publication, I suggested three frames of reference or viewpoints are evident in modern treatments of Marianas pictographs: art, science, and cultural heritage/identity. My purpose in partitioning these different approaches to Marianas rock art is to show how different interpretive frameworks shape each researcher's mode of assigning meaning to the images. The structure of the revised paper is as follows.

First, in order to establish what we are talking about, I briefly review the major attributes of Marianas pictographs and salient aspects of their archaeological contests, i.e., I point out some of the variability in forms, pigments, locations, and associations as they have been observed so far (surely we have not seen it all!). Next I consider recent popular and scholarly treatments as manifestations of differing frames of reference. The paper concludes with the hope that current threats to the integrity of this precious heritage, whether from vandalism, neglect, or natural causes, can be averted or at least mitigated through community action and involvement.

Variability

Although a comprehensive inventory of rock art sites in the Marianas archipelago has not been completed (but certainly could, given the will and the means), the known pictograph sites are dark limestone caves and narrow recesses within limestone outcrops. The consistent selection of dark locales implies that these images were created and made visible only under artificial light. Marianas pictographs occur singly, in clusters, and in panels where they overlap each other. Many are located near or on the ceiling and upper cave walls, implying some extra effort was involved in their creation. Here are some examples of the locales where pictographs occur as well as some of their associated site features.

Photo 4. As Quiroga/Gadao's Cave, facing the sea, southeastern Guam
(Online photo from Schaefnaa1)

Photo 5. Mahlac Pictograph Cave, Guam, in Guam's southern uplands
(Hunter-Anderson photo)

Photo. 6. White painted images on surface of limestone outcrop crevice, Mangilao, Guam
(Starmer photo)

Photo 7. Bedrock Mortars outside of Litekyan/Ritidian Pictograph Cave, northern Guam

Photo 8. Hornbostel photo of skulls at entrance to Liyan Kalabera Cave, Saipan
(From Cabrera and Tudela [2006:Fig. 5])

The skulls shown in Photo 8 are no longer present, and it is not clear if they were so placed prehistorically; the photo was taken by Hans Hornbostel in the 1920s. Burials have been thought or assumed to accompany some pictograph sites, however, many pictograph sites are caves lacking soil. To date no burial has been documented in direct association with pictographs. At Ritidian, a burial area outside the pictograph cave complex has been recognized and apparently excavations were conducted there, but no report on this work is available (W. Hernandez and J. Garrido pers. com. 2011).

The variation in shapes of the pictographs is considerable, with some more easily recognized than others. For instance, there are human hand prints (adult and child), and a few realistically depict animals. The majority of pictographs consists of simple line drawings or outlines suggestive of human figures, birds, and fish. Still others are purely geometric or form enigmatic shapes.

The painted images tend to be rather small, mostly ten to fifteen centimeters tall or wide, although the billfish-like form at Chugai Cave (Photo 1) extends over a meter, as do groups of bold vertical lines beneath two small turtle images, also at Chugai Cave (Photo 9 below).

Photo 9. Vertical lines extending below images of sea turtles, Chugai Cave, Rota (Internet photo, source unknown)

The pigments are either black, white, or red-brown, and, rarely, bright red. Henrickson (1968:41) reported that the "grayish-yellow" paint at Gadao's Cave (As-Quiroga Pictograph Cave) was composed of "calcium carbonate and siliceous matter with traces of free carbon or carbonaceous matter, a form of clay or marl." He surmised that the paint was quite thick when applied and this was done with fingers rather than a brush or other implement. This technique was also inferred by Cabrera and Tudela (2006) for many of the white-to-yellowish images they encountered. To further pursue the subject of pigment composition, six tiny paint samples were obtained from images at Mahlac Pictograph Cave, and analysis is currently underway (Hunter-Anderson in prep.). Preliminary results indicate that the white paint is mainly calcium carbonate (perhaps made from *afok* or slaked lime, as suggested by Cabrera and Tudela); the black paint contains organic carbon, most likely charcoal; and the red-brown paint contains iron, perhaps from local

volcanic soils. The elemental composition of the bright red pigment seen at Litekyan/Ritidian (Photo 3) is not known but such analysis is certainly possible despite the presence of microscopic algae on the images (Hunter-Anderson in prep.).

The bright red pigment may derive from an organic source, such as the *Eritem* nut oil mixed with slaked lime used for paint in Palau as suggested by Henrickson 1968:49). This tree, *Parinari laurina*, does not occur in the Marianas (Falanruw et al. 1990) so perhaps the red color was achieved from combining betel nut (*Areca catechu*), slaked lime and pepper leaf (*Piper mystheticum*), the chewing of which is a Chamorro custom. To my knowledge, no experimentation to simulate prehistoric pigments has been conducted but this could be a promising avenue of research in future.

Scholarly Works

The earliest descriptions of Marianas rock art were brief mentions in colonial government reports and letters (see reviews in Cabrera and Tudela 2006, Spenneman 2006), and scholarly treatments of the subject began with Henrickson's mid-20th century work. The original publication in 1968 showed black and white photos of portions of the extensive array of pictographs at Gadao's Cave; now a color photo of the entire panel (Photo 10 here) can be viewed online here, as well as color photos of the Palauan paintings.

Photo 10. White abstract figures, As-Quiroga Pictograph Cave (Gadao's Cave), Guam

The paired human-like figures on the lower right of the panel is a popular icon in Marianas tourist art and has been associated with a legend about two rival chiefs Malaguana and Gadao. Another version of this story, collected by ethnologist Laura Thompson (1932) involves a man from Talofofo named Kiroga. This name is similar to the late 17th century Spanish military governor Jose de Quiroga, who history says defeated Mata'pang, a chief from Tumon. This rather garbled story, possibly the source of the site's other name, is quoted in Henrickson (1968:43).

In the ensuing decades after Henrickson's study, archaeologists have located other sites with painted images but reports on these findings are widely read due to their technical nature. In 2006 two studies that focus on Marianas rock art were published online: Vic April's documentation of Talagi Pictograph Cave, Guam and the interpretive review by Genevieve Cabrera and Herman Tudelo (both are in Vol. 5 of *Micronesian Journal of the Humanities and Social Sciences*. Here are some of the images from these investigations; all are rendered in white paint:

Photo 11. Small figures all located near ceiling, Talagi Pictograph Cave, northern Guam (From April 2006:Fig. 5)

Figure 7. Female image, Kalabera Cave, Saipan.[12]

Photo 12. Headless human-like figure said to be female, Liyan Kalabera, Saipan
(From Cabrera and Tudela [2006:Fig. 7])

Figure 6. Male image, Kalabera Cave, Saipan.[11]

Photo 13. Human-like figure, said to be male, Liyan Kalabera, Saipan
(From Cabrera and Tudela [2006:Fig. 6])

Popular Interpretations

Popular as well as scholarly use of the internet has risen dramatically over the last two decades. In addition to government and travel and tourist oriented websites, personal treatments of Marianas rock art with vivid color imagery are available for viewing (see, for example, Pacific Words Guam and Guam Web Page. One of the most discussed pictographs in this emerging communication venue is the so-called Star Cave, a small alcove within the complex limestone escarpment with several caves and crevices on the Guam National Wildlife Refuge at Ritidian (Photo 14).

Photo 14. Lines of red-brown dots on low ceiling of small alcove, Litekyan/Ritidian Pictograph Cave, northern Guam (Carson photo)

This site contains numerous pictographs in other parts of the cave known officially as Litekyan/Ritidian Pictograph Cave. This site has recently been nominated to the Guam and National Registers of Historic Places, along with the Mahalac Pictograph Cave on Naval Base Guam, on the basis of their historically significant pictographs. Here are two of the images at Litekyan/Ritidian Pictograph Cave:

Photo 15. Black abstract form, Litekyan/Ritidian Pictograph Cave, northern Guam (Hernandez photo)

Photo 16. Red-brown geometric form, a series of six box-like forms with a central vertical line. Litekyan/Ritidian Pictograph Cave, northern Guam (Hernandez photo)

Some of the Litekyan/Ritidian images have received detailed interpretive treatment online by Rudy Villaverde Guam's Starcave who links them to astronomical events and constellations related to ancient Chamorro ocean navigation. The "Star Cave" portion of the cave (where the lines of dots configuration is located) has been the focus of a digital mapping experiment conducted by Mark Willis, assisted by Mike Carson; the project is the subject of a YouTube video Photogrammetry Work at Star Cave, Guam.The dots pictograph has even been listed among world archaeological sites relating to prophecies of a certain Ezra Small.

Archaeological surveys have located several sites with pictographs in the Northern Marianas and on Guam; they occur in both inland and coastal settings where limestone outcrops are common. Here is a sketch of the large panel of pictographs at Mahlac Pictograph Cave (Figure 1), located in south-central Guam by Dixon et al. (2004). Archaeological testing at the site found prehistoric cultural deposits under the south overhang-entrance to the cave, radiocarbon dated to the late Latte Period, c. 1450 C.E. (Henry et al. 1998). The Mahlac pictographs, accessible from the north end of the tubular cave, were rendered in white, black, and red-brown pigments and are located near and on the ceiling.

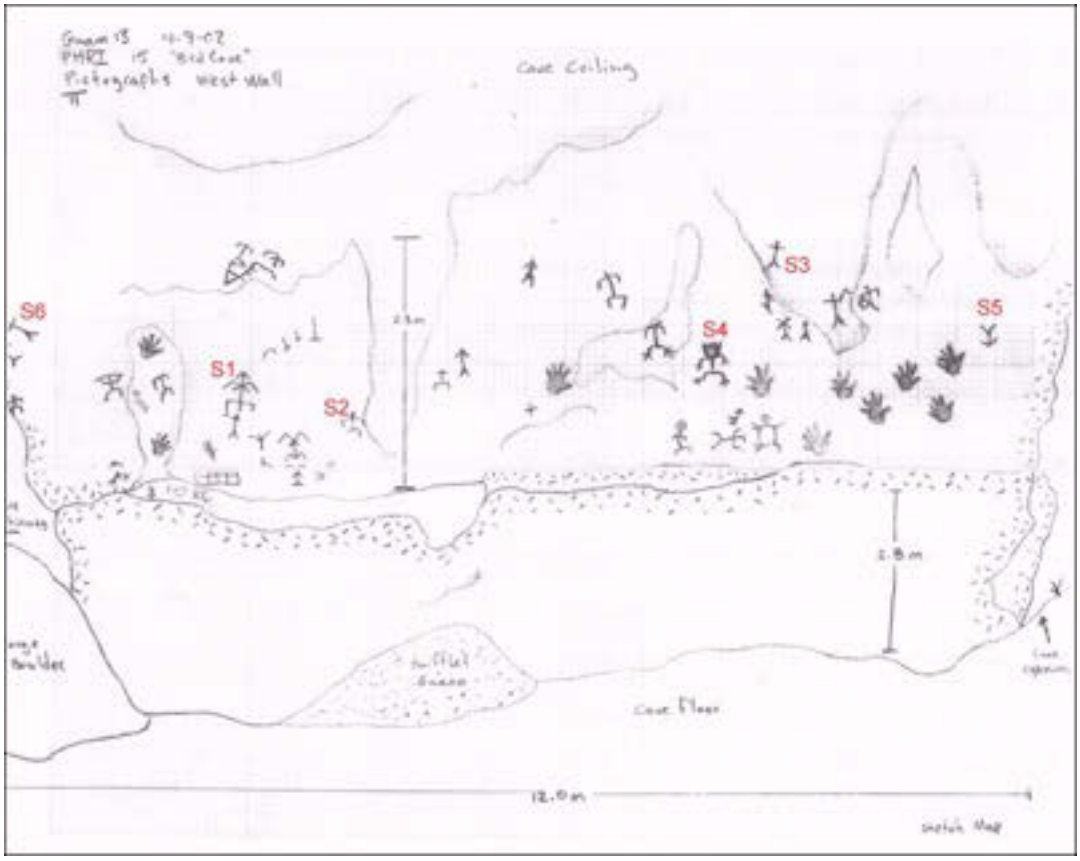

Figure 1. Sketch of pictograph panel, Mahlac Pictograph Cave, in Guam's southern uplands (courtesy of Boyd Dixon)

The red numbers in Figure 1 signify which images paint samples were taken from as part of my research project funded by the Guam Preservation Trust. Six samples were retrieved, two from each of the colored pigments, white, red-brown, and black. I am working with chemist and rock art pigment analyst Prof. Marvin Rowe to determine the elemental composition of these samples. In addition, we have submitted one of the black paint samples, which apparently contains charcoal, for radiocarbon assay. The dating analysis can indicate whether the black image was made at the time of the prehistoric occupation at the site but will not determine whether all the images are contemporary; for this, more dating samples would need to be obtained. In the field, some of the images look fresher than others, possibly due to repeated use of the cave for creating pictographs over a long time period.

Photo 17. Red-brown figure with round head, Mahlac Pictograph Cave, Guam (Hunter-Anderson photo)

The image in Photo 17 combines a linear body and limbs with five digits and an in-filled, naturalistically drawn head with what appear to be tiny ears. The human-like figure in Photo 18 appears to have four arms. Unusual forms like these are fairly rare in my experience.

Photo 18. Black figure, Mahlac Pictograph Cave, Guam
(Hunter-Anderson photo)

Photo 19. White bird or fish-like figure, Mahlac Pictograph Cave, Guam
(Hunter-Anderson photo)

Many more examples from this site and from others could be shown here, but the similarities among pictographs throughout the archipelago should be evident from those given here. Similarities include the prevalence of two-dimensional forms, both the more easily recognizable as well as the geometric and abstract forms; the use of three main colored pigments (white, black, red-brown); the superposition of images; the grouping of abstract and realistic images in the same panel; and occasionally unique forms such as in Photo 16. There are intriguing differences as well, including my non-quantitative impression that Guam's pictographs exhibit more variety in form than those from sites in the Northern Marianas. What this may imply about past social interactions within the archipelago is another unanswered question we might ask and future researchers may someday be able to answer.

Frames of Reference

The lack of ethnographic information about the cultural contexts in which the Marianas pictographs were created is frustrating to researchers today. This absence has led to numerous speculations and interpretations, each according to the researcher's frame of reference.

According to Dictionary.com , a frame of reference is:

> "a structure of concepts, values, customs, views, etc., by means of which an individual or group perceives or evaluates data, communicates ideas, and regulates behavior"

In studies of prehistoric cave paintings generally, two frames of reference are evident: art and science. An art frame of reference is seldom applied to Marianas rock art, the artistic merit of the ancient images has been noted in the essay "Ancient Chamorro Cave Art" by Dominica Tolentino in Guampedia.com. More common are science frames of reference, at least those that invoke phenomena related to scientific investigation. Perhaps uniquely in the Marianas, a third approach has emerged, what I call the cultural heritage/identity frame of reference. These ways of understanding overlap at times but each is driven by distinctive assumptions and motivations. I will discuss each in turn, with most of the discussion devoted to the various science frames of reference that have been utilized.

Art

In the art frame of reference, it is artistic ability, a form of human intelligence, that is assumed along with the artist's intention to communicate ideas through various media. The evident humanness of the creators of the spectacular animal cave paintings discovered in deep caves in southern France in 1933 was initially confounding to scholars of "primitive art": given the artistic merit of these paintings, it was asked, were these people, who lived some 20,000-30,000 years ago, so very human after all, just like us? As evidence accrued for the authenticity and antiquity of the paintings, there was no denying their human origin. What these images "mean" now and what they once "meant" have been the subjects of much speculation, even as more of these ancient archaeological sites continue to be found.

Photo 20. Large gallery, Lascaux Cave, France
(National Geographic online photo)

Upon having viewed the just-discovered Lascaux images, an awestruck Pablo Picasso is alleged to have said, "We have invented nothing!" I believe he meant that despite the fact that those responsible for creating these paintings lived a long time ago, in much more primitive conditions than we do today, they nonetheless were far from primitive in their technical skills and were equally inventive, even superior to modern artists.

The multiple legs on this Ice Age image from Chauvet Cave in France have been judged as a clever two-dimensional technique to depict motion (Bower 2012), a comment derived from an art frame of reference.

Photo 21. Running bison, Chauvet Cave, France
(From M. Azema, J. Clottes, Chauvet Cave scientific team)

From an art frame of reference, the Marianas painted images are intriguing, and many are pleasing to look at; some seem to be arranged artistically and have been rendered fairly accurately, such as the animal images at Chugai Cave in Rota. However, as Henrickson (1968:46), an artist and an art critic himself, has argued, the term "style" is inappropriate for the painted images he studied in Guam and Palau. He defined style as a "community of aesthetic response embracing not only the reason why it comes into being but also the manner of its coming."

Translated into plain English, Henrickson's definition suggests that "style" should be reserved for self-aware Western painting traditions and artistic movements, such as impressionism, expressionism, fauvism, and the like, whereas in so-called primitive art, we have a different situation despite apparent similarities in the image forms and techniques. Henrickson (1968:46) proposed that these similarities

are more technical ("morphological") than due to a shared "style:" "The technical matter of *how* a work of art is shaped need not be related to the psychological explanation of *why* a work was created."

Science

A science frame of reference is motivated by a desire to understand the material world and assumes it is directly knowable. In formulating an interpretation, a scientist calls upon what he/she thinks is a relevant body of knowledge that can help place the new observations in an appropriate interpretive context. In an anthropological archaeology frame of reference specifically, one assumes that human behavior is regular, not idiosyncratic or random, and thus over time the cultural processes in which people participate leave patterned material traces. This assumption about processes producing the archaeological record is the opposite of the popular notion that archaeologists study the material evidence of single events and individual human thoughts and motivations (see Binford's [1981] exploration of the "Pompeii Premise" in modern archaeology).

With appropriate methods and imagination, patterns of interest can be discovered and testable explanations offered for them. Vic April's detailed documentation at the Talagi Pictograph Cave site reflects an anthropological archaeology frame of reference in which evidence for behavioral regularities in the creation and use of pictographs is sought. Importantly, this approach anticipates variation in the subject under study. Without defining the range of variability in a subject, one can miss important clues as to its nature and significance.

Unlike stone tools that could be described as part of the technological component of a cultural system, pictographs have no apparent practical function, and thus they are usually assigned to the vague domain of ritual practices. April is careful not to propose specific 'emic' or indigenous meanings for the Talagi images. Rather he views them as material evidence for human cognitive expression generated within a particular cultural adaptive context, namely, prehistoric Chamorro culture. April's study of the Talagi site is descriptive, following the expectation that as much data as possible must be assembled before explanations are attempted.

A hallmark of April's science frame of reference is the use of descriptive methods that are independent of the observer and can be independently verified by others using the same tools, such as camera, measuring tape, and compass. First he documents the size and configuration of the images and their site surroundings

and associations. This includes noting the bedrock mortars at the mouth of the cave and the images' positions vis à vis each other and their location near the ceiling, as well as the materials used. Once basic descriptions have been made, April offers highly constrained inferences pertaining to aspects of what has been described: for example, how many people were engaged in painting the images at one time, what was the paint made of, how was it applied, etc. This kind of systematic observation and limited inference is standard archaeological practice, and many reports on Marianas sites with pictographs are similar in scope and format although perhaps not as thorough. In inductive inquiries like April's, asking and answering broader interpretive questions are often left for later, presumably when more data are available that can provide additional insight. To show he is aware of this ultimate scientific goal, April invokes general anthropological concepts regarding what the images might represent within their systemic context (p. 66):

> "We can only speculate that [they] represent cultural relationships and patterns of communication and commerce among people. Change of styles sometimes may reflect new ideologies and other cultural practices, for example, religion."

No such circumspection in interpretive statements characterizes the work of astronomer Rosina Iping, who also worked within a science frame of reference, what could be called "ethnographic analogy." She boldly proposed that the lines of reddish brown dots at the Ritidian Pictograph Cave represents an astronomical calendar. The abstract of her 1999 conference paper, "The Astronomical Significance of Ancient Chamorro Cave Paintings" states that:

> "…around 2000 B.C. the Chamorro's (*sic*) used the Moon as their calender (*sic*). Vertical and horizontal rows of 12 dots indicate that they used the year and the 12 months with in as their measure of time. This fact, the more recent folklore of tales of stars, and their ability to navigate on the ocean with the aid of their star maps, is evidence of their great knowledge of Astronomy now and in the far past…"

Photo 22. Red-brown dots configuration on ceiling,
Litekyan/Ritidian Pictograph Cave, Guam
(Carson photo)

Confusingly, a BBC online report about her 1999 conference presentation says that she had proposed that the ancient Chamorros had used a 16 month calendar, involving sixteen different constellations, as indicated by the sixteen dots on the cave ceiling. The BBC reporter quotes Iping during a telephone interview:

> "The 16 dots, I am pretty sure, are a calendar. It's supposed to be the 16 months they are still using on the nearby island of Puluwat. An old navigator who lives on Puluwat told me how they use the months, and how they navigate by the stars."

Whether Iping meant 12 months as in her abstract, or 16 months as in the BBC interview, neither seems to correspond to the number of dots in the lines on the ceiling at the "Star Cave," which are actually extremely difficult accurately to count. The paint is uneven and occasionally faint and some of the dots look like natural coloration of the cave ceiling. Nor does the notion of a 12 or 16 month calendar correspond to the lunar calendar used throughout indigenous Micronesia, which has 13 months.

To warrant the star calendar interpretation, Iping cites contemporary ethnographic information obtained from an interview with a navigator from Pulowat Atoll. Her proposal is weakened, however, by an apparent confusion between oceanic way-

finding based on local constellations and a lunar calendar that is consulted for planting purposes and other important cycles. Had she conducted more thorough research into Micronesian maritime cultures she would have found that practical navigational knowledge, particularly the basics of way-finding, was and is taught using a circular configuration of rocks or shells to stand for the sailing destination constellations.

Photo 23. The late Pius "Mau" Piailug teaching from star compass.
(From Univ. of Hawaii Digital Library)

The circular form of this instructive device is simplified here; usually it contains more small shells or stones to signify specific constellations. The edge of the circle shows where the inverted "bowl" of the sky meets the horizon as viewed from a canoe (see the tiny model canoe inside the circle). The constellations and seasonal positions in the sky-dome are particular to each island group. For example, a navigator from Ulithi might use a set of constellations that are slightly different than those used by a navigator from Satawal. Master navigators (as opposed to the majority of navigators who confine their voyages to local destinations such as fishing grounds) are aware of these local differences and have learned all the necessary information needed to sail in the entire Micronesian region and beyond.

There can be little doubt that the ancient Chamorros had, as do contemporary navigators in the Carolines, intimate knowledge of local and regional ocean way-finding and that they carefully passed on this information to each succeeding generation. In fact, separate navigation "schools" once prevailed throughout

Micronesia, each with its own set of secret beliefs, practices, and ritual objects, as well as shared practical knowledge of sailing and canoe making (Metzgar 1991). Common to these island cultures, and to the ancient Chamorro as well, is a lunar calendar that not only relates to agricultural cycles by tracking the seasons, it helps navigators to interpret and predict wind and current patterns and to anticipate sailing conditions for any specific voyage. This is the body of relevant information that, had Iping checked her calendar idea against it, would have caused her to re-evaluate its appropriateness.

A science frame of reference, perhaps what could be called "ancient astronomy," can be inferred from the interpretive work of Rudy Villaverde, also here. A methodological problem with these interpretations is a lack of objectivity in characterizing the images themselves. Villaverde's claims of astronomical connections to the Ritidian images are hard to follow visually because the original shapes of the images are unclear. The paint is often faint or obscured by algal growth, making outlines hard to discern and subject to less objective descriptions than is desirable in science. Because there can be no agreement among objective observers about the attributes of the observations, their alleged links with specific constellations and astronomical events are dubious at best. Importantly from a science frame of reference, the relevant body of knowledge that would make Villaverde's ideas acceptable as hypotheses is absent.

There can be no doubt that the ancient Chamorros were highly familiar with the apparent movement of the constellations in the night sky and with the seasonal changes marked by them and in other ways, such as wind and current variations. Yet within a science frame of reference, one can ask of Villaverde's astronomical interpretations, why should the ancients have recorded this kind of information in dark cave locales, where teaching and learning conditions are far from optimal? Even preservation conditions are not good, at least for the pictographs in sites near the sea, such as the Litekyan/Ritidian escarpment. Also, the parts of the Litekyan/Ritidian Pictograph Cave, especially the "Star Cave" section of it, are difficult to find and enter, small in volume, have slippery, uneven floors, and there is no light whatsoever. To use such settings to teach younger generations about important astronomical events and constellations seems less than good pedagogy to me.

Villaverde's astronomical interpretations would be more plausible had ethnographic information existed in which dark and difficult settings were used for teaching and learning among other sea-faring fishing and farming island groups in

the region. In fact, they are not; important ritual and practical knowledge is taught in large open spaces such as men's/canoe houses and women's houses, where students and their mentors can be accommodated comfortably, the light is good, and food is close to hand (always a plus). Thus, an important requirement for a science frame of reference is missing from this work, namely, the relevant body of knowledge by which explanations are warranted as at least plausible.

Yet another, different, science frame of reference is reflected in the research on Marianas rock art by Genevieve Cabrera and Herman Tudela. Their approach might be called "archaeological analogy." Given the lack of ethnographic information regarding the making and use of pictographs at the time of Spanish intrusion into the Marianas, the authors warrant this proposals by citing the apparent continuity in cultural practices associated with ancestor veneration among Chamorros today. These and other cultural facts are assembled in favor of a certain interpretation of the pictographs but this is not the same as citing a body of knowledge as a warrant, even in combination with archaeological burial features seen as evidence for "ancestor worship." Specifically, a visual correspondence is claimed between archaeological drawings of secondary burials and certain selected pictographs of that appear human-like in positions that could be construed as having been modified after death.

According to Cabrera and Tudela, the visual similarities between the image and a secondary burial from the Latte Period are apparent, and "harken not only to ancestor worship, but are a direct commentary on burials themselves and on "how" bodies were interred."

Figure 16. Flex burial image, Saipan.[26]

Photo 24. Human-like figure, likened to a Latte Period secondary burial, Liyan Kalabera, Saipan.
(after Cabrera and Tudela [2006:Fig. 16])

Here is an archaeological drawing of a secondary burial from a site in Saipan. By analogy between this interment and the image in Photo 24, the human-like pictograph is an illustration that purportedly shows how at least some ancestors were interred during the Latte Period.

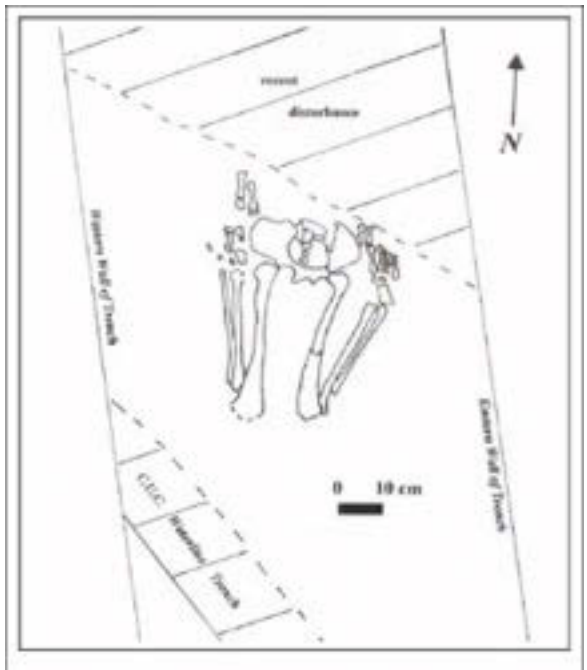

Figure 17. Drawing of actual of flex burial, Saipan.[27]

Figure 2. A secondary burial, upper body missing, Saipan.
(From Cabrera and Tudela [2006:Fig. 17])

The authors cite the presence of skulls at Liyan Kalabera as further evidence of ancestral worship (although there are no ethno-historic records that indicates skulls were placed at cave entrances), as well as the current name of the site, derived from Spanish, meaning skulls. Whether a similar name in Chamorro was ever used is not established, nor are there arguments for why this particular burial custom should have been illustrated in a dark cave, or illustrated at all. It may be of interest to note that archaeological research has established that the range of variation in Latte Period burial features is quite large, and many burials have been found intact.

We do know through historical documents that during the early European contact era, Chamorro ancestors were very important to their descendants. For example, according to an account by Juan Pobre, a lay religious who lived for several months on Rota in 1602 (Driver 1983), ancestral skulls were kept in the dwelling houses, to be consulted and prayed to for help in daily affairs and on special occasions, such as during severe drought. Also during the pre-colonial era, the long bones, not necessarily of relatives, were removed from burials and made into tools (Coomans 2000). But, as Cabrera and Tudela recognized, there is nothing in the few historical accounts to suggest why the local people made pictographs at all. Apparently this behavior was frowned upon by the Spanish and was harshly suppressed, likely because of its association with indigenous religious beliefs and practices.

The methodological problems with the Iping calendar proposal and the archaeological analogy of Cabrera and Tudela, and, for that matter, many other current attempts to assign specific meanings to Marianas rock art images, include a narrow focus that ignores variability in the subject matter thought relevant, in these cases, celestial navigation and ancestor worship. Because of this specificity, "cherry picked" images of interest are discussed while others are ignored. Science prefers comprehensive explanations, those that account for as many as possible different aspects of a phenomenon under scrutiny and interpretation.

Villaverde's interpretations are especially vulnerable from a scientific viewpoint. In their excessive complexity they defy the principle called Occam's Razor or Simplicity of the Hypothesis. Science prefers simplest solution to a given problem because it is less likely to be incorrect than a complex solution. The preference for simple explanations ones has to do with the number of supporting statements that

are necessarily invoked in complex explanations; as the number of such statements increases, so does the probability of error in one or more of them.

More importantly, these proposals cannot be tested as presented; it is not enough to cite portions of another empirical domain that seem relevant but which are not warranted to be so through logical argument linking data to propositions. What about other Latte Period mortuary practices; why are they not "commented upon" in cave imagery, or are they? The specificity of this particular proposal precludes its ability to enlighten us about other pictographs at Kalabera and elsewhere. Similarly, the incomplete and confused use of ethnographic information by Iping precludes a wider understanding of the subject of pictographs and their societal roles. What other images can be interpreted in this way, if any? In addition to being overly complex, Villaverde's proposals also fail to answer questions that arise from the awareness of the variations in pictograph forms and locales: why was astronomical subject matter was selected for illustration at Ritidian/Litekyan Pictograph Cave but not at Mahlac Cave, or As-Qiroga, or Talagi?

The lack of comprehensiveness in these proposals blinds us to many intriguing aspects of Marianas rock art. For example, why are pictographs more prevalent than petroglyphs? Why are there so many differences in the forms used? And what about those little hand prints (they are quite small, perhaps those of children)? What about the fact that the painted images are located in parts of the cave that are not only totally dark, many are very high up on the walls or even on the ceiling? What about the superposition of images; does this imply repeat visits to these sites? Multiple image creators? Over how long a time period were the panels created? How about the use of color; is there patterning in the color used to depict certain forms? There are also geographic questions, such as do certain images occur in only some geographic settings while others are more universally distributed? Which sites have burials directly associated with the imagery, and which sites have mortars? Were the mortars used to prepare the paints? The answers to these and many other questions are potential clues to the cultural contexts in which they were created and certainly beg to be investigated.

While comprehensive documentation of Marianas rock art sites is clearly necessary, it is still not sufficient from a scientific point of view. Data cannot by themselves yield explanation; using our scientific frames of reference we also require theories that locate the data along analytical dimensions; this is accomplished through imagination and logic. For example, perhaps the images

relate to the societal roles of their creators and users. We can ask, what were the culturally determined occasions when these images were created and/or viewed? To pursue these speculations productively, and all science starts with speculations, those of us who work within an anthropological archaeology frame of reference are challenged to characterize the cultural adaptive system and specifically the ideological and sociological organizations or components that existed when the images were being made and used. Micronesian ethnography and ethnology can help, especially in the pre-Christian ideological domain such as communicating with ancestral spirits as Metzgar (1991) has documented for Lamotrek and other Trukic speakers in the Carolines. He found (p. 391) that:

> "Lineage members, when they die, are believed to have the potential of acquiring new knowledge and skills as a result of their association with deities in the world. The anthropological is replete with to islanders attempting to make contact with the spirit world in the hope that a god, goddess, or ancestral spirit will communicate a prophecy, diagnose the answer to a problem, or give an inspired remedy to cure a malady. Those who were successful in this regard became recognized mediums and were viewed as oracles of patron spirits. Theoretically and ontologically these spirit mediums may be viewed as one "channel" by which *rong* knowledge originally entered the world."

If we think the human-like stick figures have to do with communicating with ancestors and seeking advice and help for certain problems, perhaps we can consider that image-making involved what anthropologists call "sympathetic or imitative magic." This is a common practice in many indigenous cultures in the Pacific and elsewhere, based on the idea that "like produces like" what happens to an image of someone happens to that person in life. With this concept, part of a body of knowledge from comparative anthropology, we have another way to view the "flexed burial" box-like image that is found not only at Liyan Kalabera but also in other caves.

Figure 16. Flex burial image, Saipan.[26]

Photo 25. Human-like figure, Saipan.
(From Cabrera and Tudela [2006:Fig. 16])

Suppose that this image is not just an illustration of how burials were done during the Latte Period (assuming the image was made during this time), but instead is a material manifestation of the practice of sympathetic magic, in which the desire to become pregnant and to bear a child is expressed graphically. Through the sympathetic magical act of drawing the desired situation on the cave wall, the creator of the drawing attempted to cause the desired effect to come to pass in reality. To see how sympathetic magic could have been involved in this case, consider the following.

In every culture some women are unable to conceive or bear children successfully. Especially where high fertility rates are crucial for population survival, sympathetic magic, along with other more practical measures, may be utilized to help alleviate this problem. In contrast to the proposals of Iping and Cabrera and Tudela, my childbirth/sympathetic magic proposal is not derived from the narrow notion of a woman (or someone else, say her husband) just wanting the woman to bear a child. Rather, my proposal situates this pictograph and others that resemble childbirth, within a larger cultural adaptive context, namely, under conditions of high infant mortality and frequent demographic fluctuations.

We know from archaeology and ethnography world-wide that infant mortality was and is high in non-industrial cultural systems lacking modern medical facilities. During the Latte Period, archaeologists have found burials of young women who likely died in childbirth; some were buried with an infant, suggesting not only high infant mortality but also young adult female mortality during childbirth (Hunter-Anderson et al. 1998). Cultural adaptive conditions favoring high fertility include demographic fluctuations from typhoons and severe droughts, in addition to demographic instability due to small group size. Under such sometimes adverse circumstances, people do what they can with the resources at hand. Low fertility or inability to bear children successfully among some women living during the Latte Period very likely did exist in the Marianas, and it is also likely that various measures, magical and pragmatic, were taken to improve their chances of conceiving and carrying children to term. The cherishing of children, high adoption rates, and the importance of strong extended family ties among the Chamorros and other Islanders known ethnographically could relate in part to this demographic history and experience.

The point of this alternative suggestion for interpreting the image in Photo 25 is not to prove the sympathetic magic idea is correct. It is only offered to contrast with Cabrera and Tudela's archaeological analogy and Iping's calendar proposal, which lack relevant cultural contexts that can point to ways to verify their claims. In short, to the scientific skeptic, which each scientist is by nature, these appear as arbitrarily contrived interpretations based on a specific belief about the past rather than deduced from a body of knowledge that comprises the frame of reference needed.

In addition to the rich ethnographic record of the Micronesian region, which has yet to be mined for clues about island adaptations that could be relevant to characterizing ancient Chamorro culture (in addition to late contact-era information such as that recorded by Freycinet and others in the 19th century), archaeological research in the Marianas is lifting the veil, a little at a time, about the character of the prehistoric cultural systems that supported so many for so long. Still, we scientists must admit our ignorance in order to start learning. Simply confirming what we think we know by claiming a match between our subject of interest and a favorite belief about a subject, that is, from citing apparent analogies from archaeology or ethnology but without placing these analogies within the relevant contexts, ensures we will miss the forest for the trees. Consider the blind men and the elephant:

Figure 3. The blind men and the elephant.

As in interpretive narratives that have no grounding in a solid scientific frame of reference, once the part of the elephant that is focused upon is named, a story can be created that accounts for it, for example, the trunk is a snake that eats people, or the leg is a pillar that holds up the earth. Stories that are very specific to a limited set of observations can be convincing, satisfying, even entertaining. But is this a reliable learning strategy? No, because it does not question what one thinks is the case. And one so easily can be wrong, as the history of science attests.

One technique that scientists use to cope with this problem is to review all the variability that seems to be co-related and then to tame it by classifying it. This is the direction that Vic April's and Cabrera and Tudela's work could take, for example. All the pictograph sites within the archipelago could be inventoried, and a classification designed to capture the entire range of variation in images' shapes. Then an analysis could be performed with regard to site features or other associations, in turn producing more hints about the reasons for the variability observed. The difficulty is to make a useful classification, one that illuminates and helps in analysis that leads to new understanding or at least leads to new questions.

Here is a classification devised by archaeologists Genevieve von Petzinger and April Nowell who studied the geometric images from over 200 Paleolithic (Ice Age) pictograph caves and shelters in Europe.

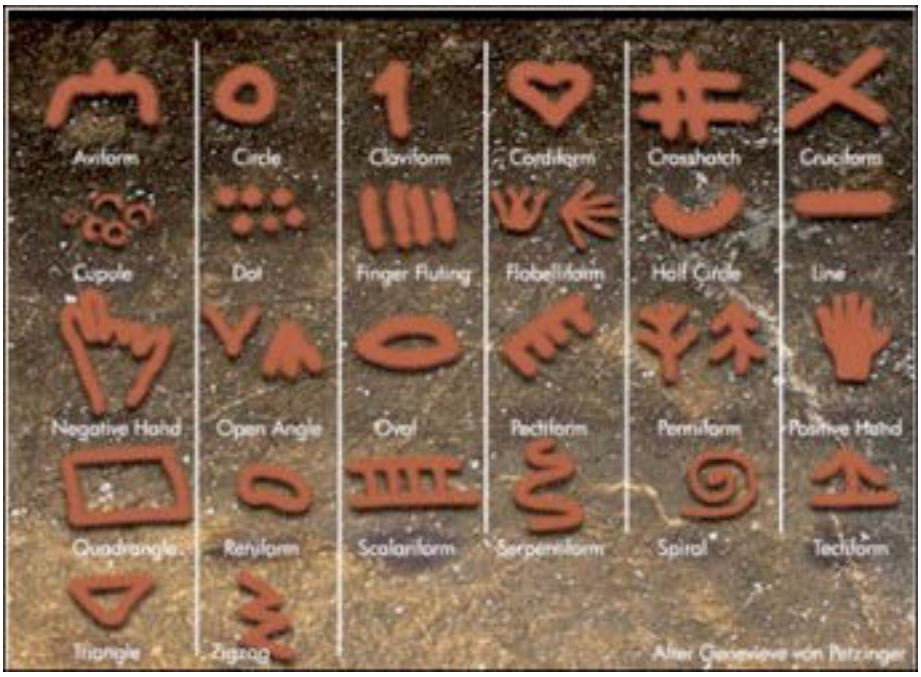

Figure 4. Von Petzinger's classification of European Ice Age symbols.

According to von Petzinger, she undertook her study after realizing that the well-drawn Ice Age animals had received most of the scholarly and popular attention while the smaller, simple images had been ignored.

> "Scientists had noticed these symbols before, but until we made our database we could not analyse them properly. Today, I can ask my database any question I like. For example, how many hectiforms are found at each cave that were painted, say, between 15,000 and 20,000 years ago? That slowly pulls out the patterns" (2012 interview of von Petzinger by Robin McKie in *The Observer*).

An intriguing result of this search for image patterning is that the same five marks occur at several sites in the study region, and, in addition, they have been found incised on a necklace made of the teeth of red deer found in a burial of a young woman. The researchers suggest the consistent use of these same marks may be a kind of code or symbol system. Just what information was conveyed by this code, if it is a code, is unknown, as are the conditions giving rise to its development and use. This is where anthropological theory that can account for this kind of behavior in this cultural context needs to be built.

Could, should, a classification like this and a search for patterning among the images be done in the Marianas? Cabrera and Tudela and Rudy Villaverde have suggested, in addition to specific interpretations of specific images, that the entire repertory comprise a form of writing or visual "narratives" of ancient Chamorro history. This proposition has implications that can be explored. For example, true writing has syntax that reflects grammar. In writing, syntax is indicated by patterned repetitions of marks. Some of the Marianas images seem to be quite widespread among sites but are these systematically patterned? We don't know yet. Or was it something else that was being communicated through symbols? If so, to whom was the communication directed, and why was this form of communication used? To answer these kinds of questions we need to imagine and propose the conditions that gave rise to the use of pictorial communication. Was it to communicate sanctified or other information only among specialists who had privileged access to these sites, or did everyone share in the iconography? Was it to communicate with ancestors? What needs did this kind of communication serve within the cultural system? Clearly more careful analysis and more thinking about these questions are needed if progress is to be made toward deciphering the significance of Marianas rock art in the past, as well as in the present.

Cultural Heritage/Identity

Unlike the art and science frames of reference discussed and critiqued above, the cultural heritage/identity frame of reference is a new phenomenon and possibly unique to the Marianas. In this approach to (and use of) rock art, the pictograph images are presented as examples of valuable parts of Chamorro culture, which are enhanced through interpretive narratives. The valorization of Chamorro culture using pictograph images follows a pattern seen during the cultural essentialization process that has been noted for indigenous groups who have experienced severe cultural losses and ongoing cultural changes including language (Hunter-Anderson 2011). In the essentializing Chamorro culture nowadays, as noted by Robert Underwood in his keynote address to the conference, certain appealing elements of the ancient culture are selected over more recent but still authentic, elements, to represent the whole. In Underwood's term, "leap-frogging," the experiences and values of the ancestors whose names are still known to their descendants, are "leap-frogged "over in favor of the remote, more "authentic," past that remains unsullied by modern influences. These essential elements, often expressed through the arts, valorize the ancient Chamorro culture, sometimes exaggeratedly so (as in the overly muscular warriors depicted on t-shirts and paintings). The

essentialization process includes elevating local foods to a higher status by reserving them for special occasions, recreating ancient dances and chants, forming voyaging canoe building clubs to learn ancient navigation skills, wearing iconic ornaments, and in the case of pictographs, interpreting them through an imagined past.

Other venues in which the cultural heritage/identity frame is reflected through pictographs include websites, posters, and souvenirs. For instance, here is a poster produced by the Guam Historic Resources Division that celebrates Chamorro heritage on display at Gadao's Cave.

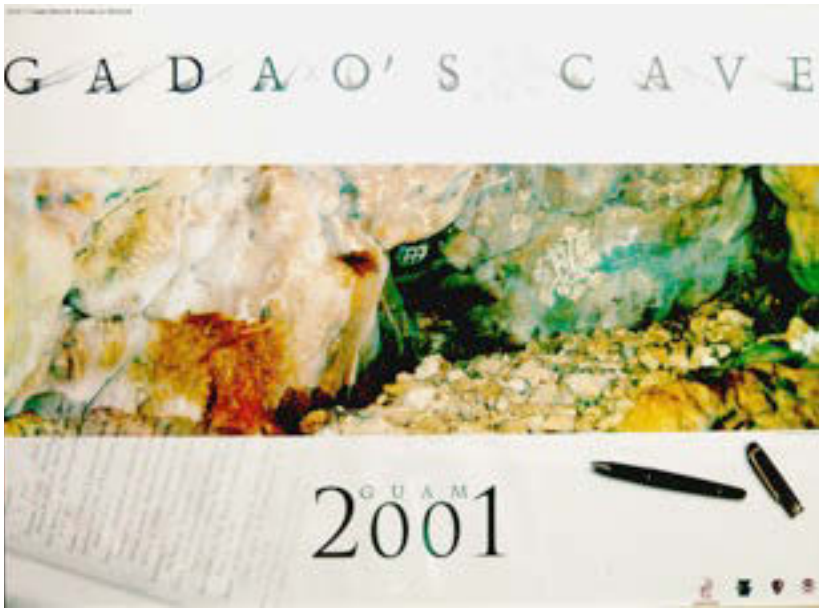

Figure 5. Poster produced by the Guam Historic Resources Division.

I believe the main message of this poster is a celebration of ancient Chamorro heritage, which is accomplished by the attractive format showing a popular pictograph site. While specific interpretation of the images is left unsaid, they speak for themselves and to us, of a proud heritage worthy of being identified with.

On websites such as Guampedia, visitors wishing to do some "homework" before they arrive in the Marianas can consult the information and images of the better known rock art sites as cultural attractions. Nowadays, some travelers to the islands have posted photos of the rock art sites they have visited. Jewelry using iconic pictographs, especially figures from Gadao's Cave, is available in shops catering to tourists.

Figure 6. Silver pendant at Micronesian Goldsmiths

Figure 7. Lime inlaid Pendant by Nathalie Pereda

Villaverde's web videos, texts, drawings and photos and the article by Cabrera and Tudela, while involving science in subject matter, are a better fit within the cultural heritage/identity frame of reference. Even Iping's proposal has been often cited as confirmation of ancient Chamorro wisdom and knowledge and thus fits here too. These works draw favorable attention to the ancient images as symbols of a proud past and serve to encourage Chamorro youth to claim this identity through appreciation of the alleged meanings of the images.

In imaginative and colorful ways that appeal to a modern web-savvy audience, Villaverde's websites present a large body of information on ancient Chamorro culture and heritage, including pictographs. One, The Guam Website, is specifically aimed at the youth of the Marianas. He introduces the site as follows:

> "This website is uniquely infused with culture not found in the published canons of history books to include Chamoru oral historiography and spirituality. No government funds were used to create this culture website but is offered to the youth of the Marianas, coming of age and seeking their identity, rite of passage in their journey of cultural transformation as Chamorus."

Villaverde engages his audience while providing information about many aspects of Chamorro culture and natural history of the Marianas including his original ideas that propose astronomical connections or meanings to many of the pictographs at Litekyan/Ritidian Pictograph Cave. Validation is achieved by citing other ancient cultures' use of symbols in rock art as well as other practices related to astronomy. These connections with other cultures and astronomy serve to elevate Chamorro heritage and emphasize its rich past and present worth. This image is supposed to depict the constellation known to us as Orion, although to me it looks like a dancer (for a clearer depiction of the pictograph, see Photo 15).

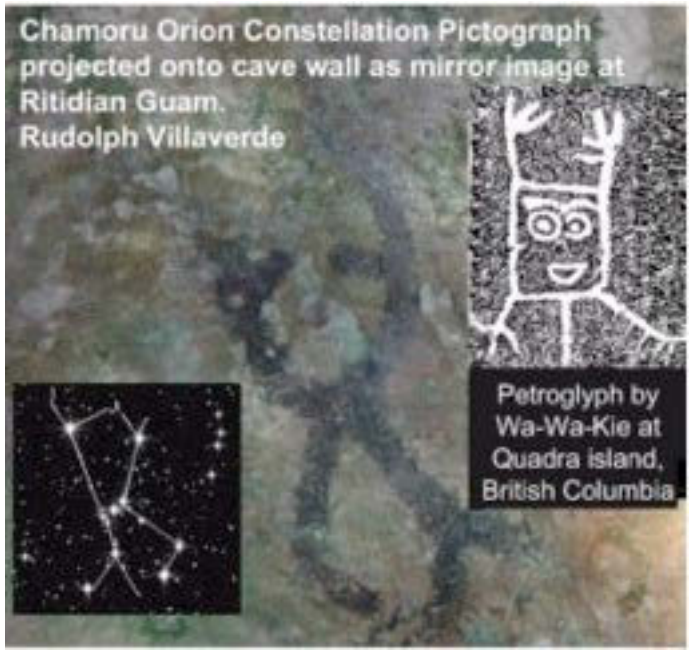

Figure 8. Stick figure image at Litekyan/Ritidian Pictograph Cave, other information added.

Here is another image interpreted by Villaverde as a record of an astronomical event that was seen and recorded elsewhere in the world, as well as in Guam.

Figure 9. Faint red image at Litekyan/Ritidian Pictograph Cave, other information added

The precise outlines of this small pictograph are difficult to discern in the field. Villaverde uses an artist's rendering which conforms to the idea of a starburst, a cosmic explosion, the Crab Supernova M1 of 1024 C.E. (to me this image looks more like a human figure than an exploding star). A quotation from a Chinese observer of this astronomical event is printed below the red pictograph, seemingly to add legitimacy to the interpretation. In this way it elevates ancient Chamorro culture by showing that, like the civilized Chinese, the Chamorros also observed the skies and recorded unusual events.

Scientific skeptics would question the appropriateness of this rendering of the pictograph that extends some of the "rays' to make the image appear more starburst-like, but that is not the point. The point of these fanciful interpretations of certain pictographs is that ancient Chamorros behaved like other knowledgeable people at the time; they observed and recorded celestial observations in a cave in Guam.

In addition to his websites, Villaverde has appeared on TV regarding current threats to Guam pictographs. For example, in a KUAM News report on the pictographs at As-Quiroga Cave, Rudy Villaverde comments on these ancient images that manifest Chamorro cultural heritage and its value for Chamorro youth of today. The images are under threat from natural and man-made causes including vandalism. His comments, which emphasize the culture loss already experienced and the need to preserve these important remnants of the past, can be heard here.

Sounding a more hopeful note regarding the present role of Marianas rock art, the conclusion of the article by Cabrera and Tudela (2006:51), for those who would identify with this ancient heritage:

> "After 500 years of silence, the rock art of the Mariana Islands slowly begins to reclaim the Chamorro people's rightful ancestral voice and by doing so, hopes to rejuvenate the inherent cultural wisdom lodged in the hearts of its modern-day descendants"

Conclusion

It is clear that researchers have only begun to document and interpret the rich tradition of Marianas rock art, whether from an art, a science, or a cultural heritage/identity frame of reference. All would agree that current understandings of Marianas rock art will benefit from comprehensive documentation and effective protection. The similarities and differences in many aspects of these images and their archaeological locales are provocative and worthy of study and appreciation on many levels and through many different approaches. I hope my presentation clarifies how these different approaches are driving current investigations of ancient Marianas pictographs and that it will motivate those with the ability to make further documentation and protection of Marianas rock art a reality for the sake of everyone with a stake in the outcome.

Acknowledgements

I wish to acknowledge the hard work of the organizers of the First Marianas History Conference and a pleasure to them for the opportunity to present my thoughts as an archaeologist, while in the best of company in Saipan. *Dangkulu Na Si Yu'us Ma'ase!*

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Rosalind Hunter-Anderson came to Micronesia in 1980 to study Yapese settlement patterns from an ethno-archaeological perspective. This field experience led to her enduring interest in the prehistory and ethnology of the region. At the University of Guam, Hunter-Anderson pursued field studies on fresh water customs and organized the first Micronesian Archaeology Conference in 1987. Under a National Science Foundation fellowship at University of California at Irvine in 1989 she completed an archival study of traditional Micronesian farming systems. Returning to Guam, she joined archaeologists Darlene Moore, Judith Amesbury, and Eleanor Wells to form Micronesian Archaeological Research Services, undertaking numerous anthropological projects during the 1990s and early 2000s. Hunter-Anderson also produced a weekly public radio show, "Island Archaeology," and continues to present her work at professional meetings and in scholarly journals and documentary videos. Hunter-Anderson and husband, Yigal Zan, moved to New Mexico in 2006, where she remains active in research and writing on the anthropology faculty at the University of New Mexico.

I Tinigi' I Man-Aniti (The Writings of the Ancestors): Initial Interpretation of the Discoveries of Rock Art in the NMI

By Genevieve S. Cabrera
Cultural Historian
putut6837@gmail.com

Abstract: *For centuries, the Western world categorized the ancient Chamorro inhabitants of the Marianas Archipelago as a "prehistoric" people; one without a written history. This paper emphasizes that the ancient Chamorro, not unlike other ancient cultural groups the world over, did have a recorded history; a history documented in pictorial format. This pictorial approach, perhaps argued by some as not being cumulative in nature, is nonetheless a written account of key aspects of the ancient Chamorro life-way, most especially as it pertains to ancestor worship, which continues to be the fulcrum of the Chamorro identity. This discussion of the rock art also takes into account issues of site placement, media utilized, and stylistic differences by which we can begin to understand the iconography of these conveyances.*

Introduction

In-depth field research of the rock art of the NMI (Northern Mariana Islands) began in 2005 for this author who had long since refused to believe that the inherent documentation of the ancient history of the Marianas Archipelago was nonexistent while other contemporaneous cultures the world over had their ancient history recorded with actual writing or writing symbolized through the depiction of images. Additionally, that the segments of ancient Chamorro history were considered, for the most part, inconsequential to the arrival of the first Europeans and categorized as *prehistory* centuries later, only added to the zeal with which the research was undertaken.

Seven years of field surveys reinforce this author's position that the images that were inscribed by ancient Chamorro hands on the walls of caves and rock shelters throughout the islands of Saipan, Tinian, and Rota, constitute a written record. Arguably, it is not a cumulative record, but it is a record nonetheless and one that expounds upon the dominant contentions of ancestor worship by which the ancient culture was governed. Moreover, these ancestral espousals once held by the Chamorro of old, still hold true in the cultural practices of the Chamorro today. It

is with this link between *i man-aniti* (ancestors) and their progeny that we embark on an initial interpretation of the rock art of the NMI.

Figure 1
Approximately 98% of the rock art documented to date is comprised of headless anthropomorphic images. It is known that the ancient Chamorro interred their dead, but that after decomposition of muscles and tissue, the skull was exhumed, cleaned, placed in a specialized reliquary, if you will, and brought inside the home. This provided the family of the deceased physical proximity to their departed loved one as well as a line of direct communication with him/her.

Communication with the dearly departed also was assumed through the *kakana* or shamaness/shaman who kept a number of skulls in her/his home for this purpose. The *kakana* was the medium through which the powers of the *aniti* were channeled. The physical and spiritual presence of the *aniti* and their intercession (when needed) assisted the living with personal or communal conflict. Equally importantly, great reliance was placed on the *aniti*'s powers in assuring successes in fishing, farming, hunting, battle, and craftsmanship.

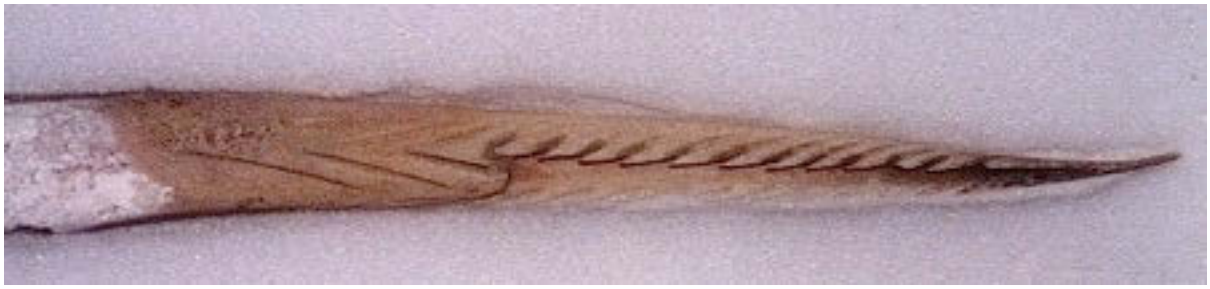

Figure 2

Figure 3

The long bones or the arm and leg bones were also disinterred and fashioned into tools. For example, the femur (thigh bone) was made into a barbed spearhead and the clavicle (collar bone) was carved into one component of the compound fishhook. [**Figures 2 and 3**]. Awls or needles for making fishing nets were also made from human bone. Throughout the last 40 years of archaeological field excavations within the NMI, it was not an uncommon occurrence to come across a burial with the human skeletal remains missing the skull and/or the long bones.

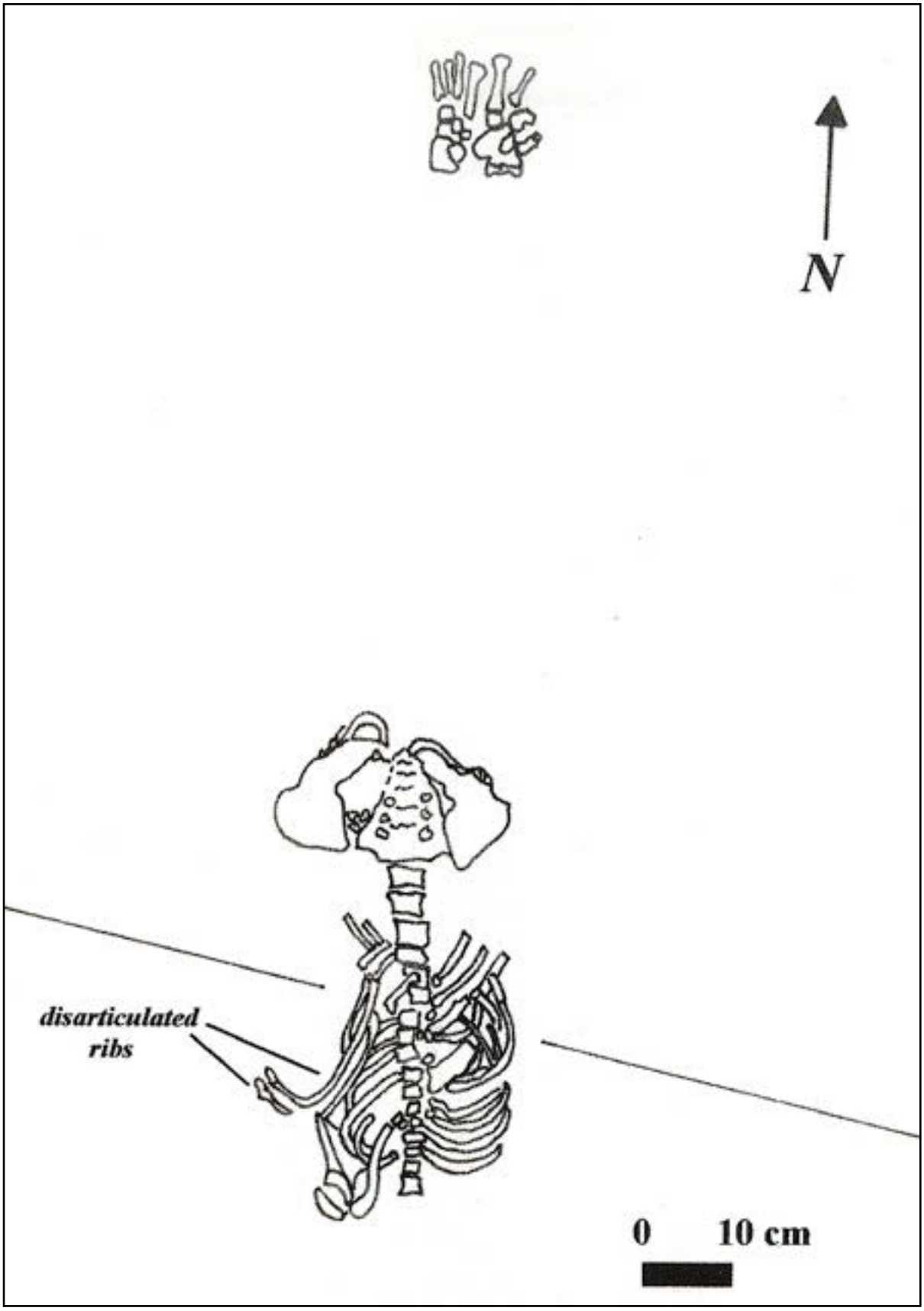

Figure 4

Figure 5

It is not surprising that what archaeologists encountered at burial sites is also depicted in the rock art repertoire. Figure 4 shows a set of skeletal remains absent the skull and long bones. Looking at this from a linear perspective, one can clearly see that the sparse remains show a "T" configuration with the pelvis comprising the top horizontal bar of the "T" and the spinal column the vertical bottom portion. Figure 5 is a pictograph of an inverted "T" with no other imagery within its immediate proximity and as such, is not dissimilar to the burial in Figure 4. Perhaps the exception might be that the Figure 4 burial has the associative pair of foot bones. Another example is the pictograph of the fish and the fishhook rendered next to it.

Figure 6
There is a flattened portion of the fishhook to which another element, such as a shaft, would have been hafted. One might deduce that perhaps what we see here is the "hook" part of a compound fishhook. Furthermore, that there is the hint of a notched end opposite the curved tip of the hook likens it to the fractured compound fishhook fashioned from a human clavicle in Figure 3.

The emphasis here is again the physical and spiritual proximity between the living and their *aniti*. The barbed spearhead carved from the femur and the compound fishhook from the clavicle meant that the deceased may be dead, but she/he continues to function alongside her/his family and clan. There is protection in battle in the form of weaponry (literally fighting against an enemy). There is the provision of food in the use of implements of fishing and/or hunting (hooking the fish or netting the fruit bat that will feed the family/clan).

Early accounts reference that the dead were buried in caves and more especially during the Latte Period, within the family/clan lot/compound. It follows that a preponderance of pictographs and petroglyph were placed within caves or cave-like settings inclusive of shallow rock shelters. It does not yet appear in the literature that the actual painting of the pictographs or incising of the petroglyphs was part and parcel to the burial ceremony. Dating to determine the age of the rock art discovered to date has yet to be undertaken. Be that as it may, another commentary put forth by the ancient Chamorro and evidenced in the rock art is the manner in which the dead were interred.

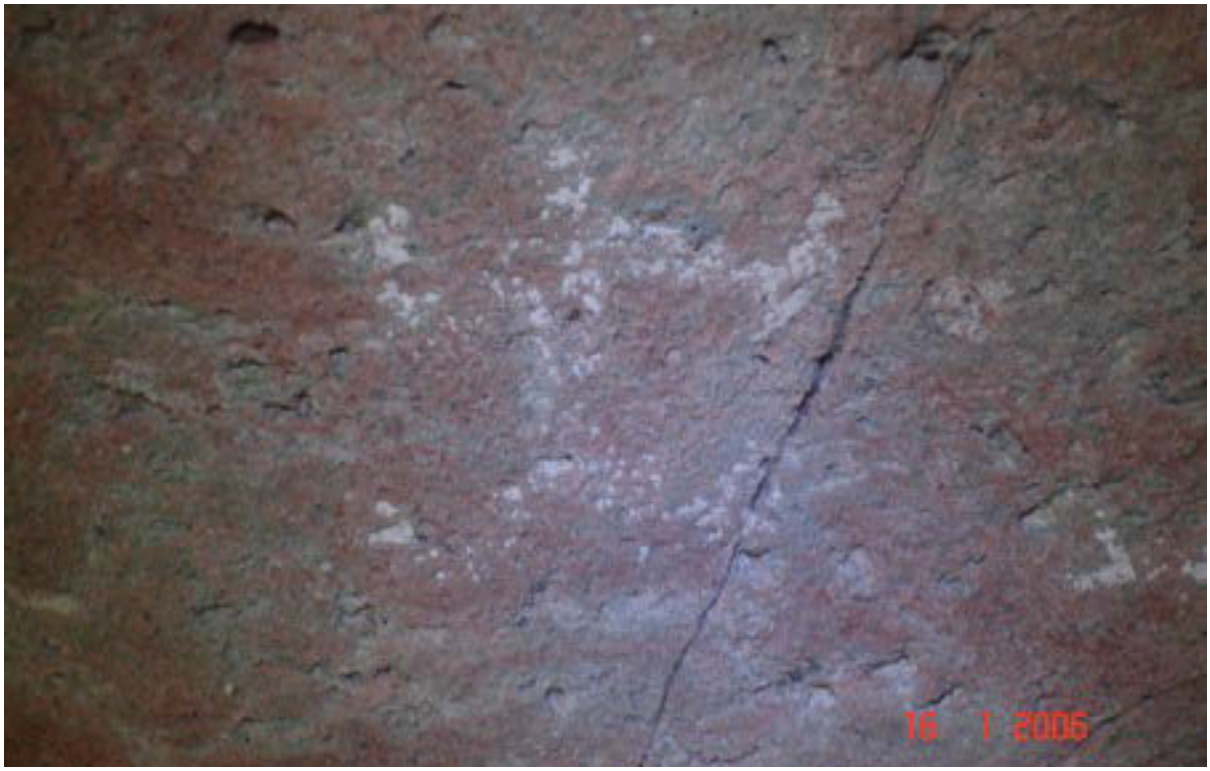

Figure 7

Figure 8

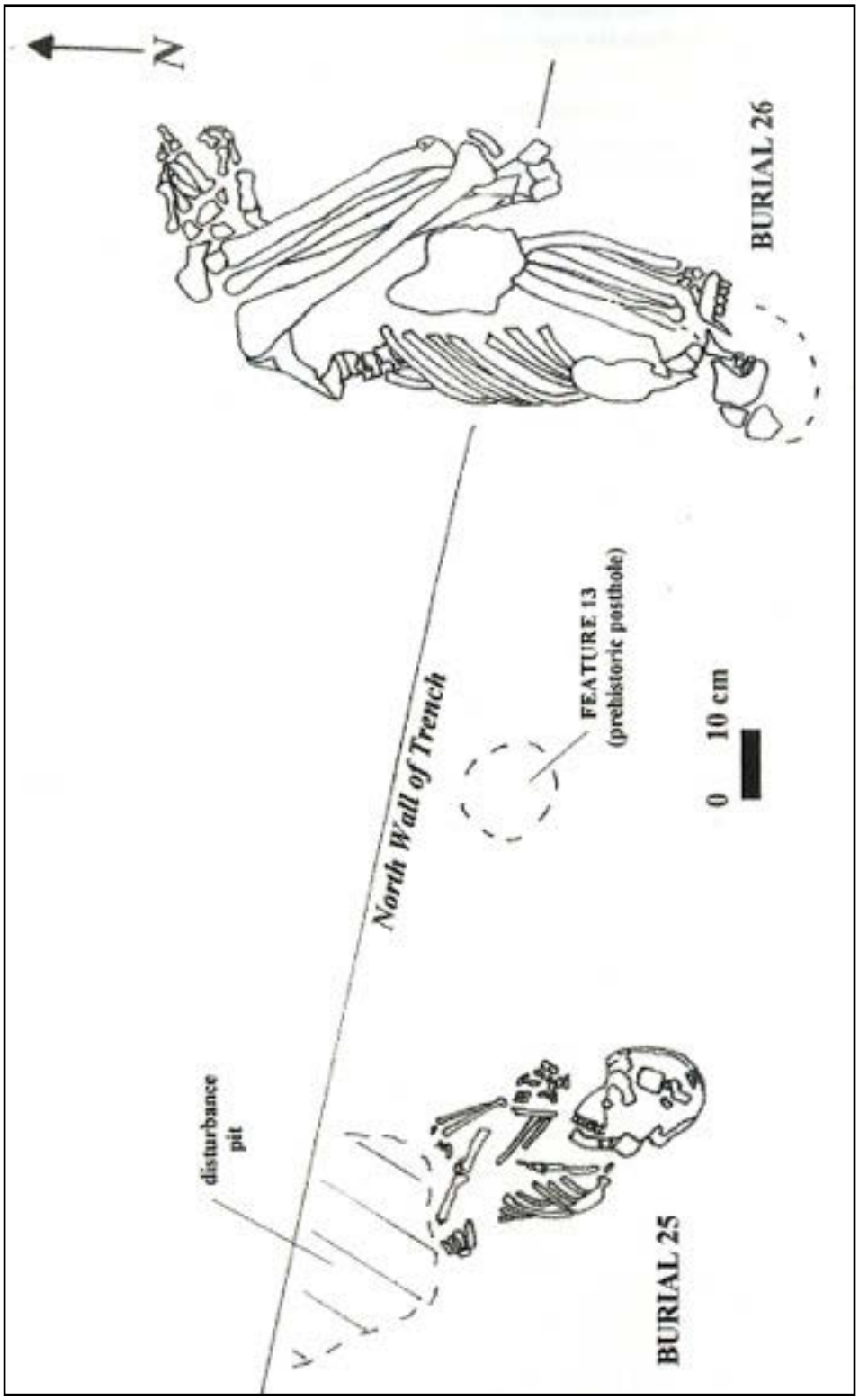

Figure 9

A number of the anthropomorphic images show the human figure in very contorted positions. [**Figures 7, 8, and 9**]. In Figure 6, the lower legs are bent upward and outward at the knees. In Figure 7, the thighs are at a right angle with the vertebral column and the lower legs are at right angles with the thighs. The upper arms are each at a right angle with the torso and the forearms are bent

downward at right angles from the elbows. This gives the human body a boxlike configuration. It could very well be that the intended positioning is that seen in the burial in Figure 8 wherein the lower legs are flexed at the knees, the arms are bent at the elbows and the former and the latter tucked against the body.

The question here is obviously the technical prowess of the artist (or lack thereof), but the important observation is that the ancient Chamorro were documenting aspects of interment. It is noted in Spanish accounts that the ancient Chamorro tied a noose around the long bones to more efficiently extract them from the burial site. It is more practical to have the long bones placed in a flexed position so that when it came time for their removal from the grave, they disarticulate much more readily.

The connection that the ancient Chamorro had with the *aniti* is as alive today as it was millennia ago. While the Chamorro of today do not exhume skulls and bring them inside the home nor do they fashion from the long bones and other skeletal remains tools for fishing, battle, or hunting, they do make every effort to keep their ancestral connections viable. Quite ironically, this is done through the guise of Catholicism, the very product of manipulative yet fatalistic efforts by the Spanish missionaries to eradicate animism and the ancestral bonds integral to ancient Chamorro culture.

By today's standards, deceased relatives are remembered each year during the anniversary of their death. Generally, a nightly rosary is said during the nine days leading up to and including the anniversary date itself. Oftentimes, the nightly rosary is accompanied by offering a mass of intention, which is attended by not only immediate and extended relatives, but by friends and neighbors as well. Additionally, it does not matter whether the relative died a year ago or 75 years ago, the death anniversary is remembered and celebrated by this gathering of the family. Ordinarily this celebration of the deceased's life and achievements occurs during the first, fifth, tenth, and twentieth anniversary of her/his death. During these events, the family will also include and collectively celebrate the anniversaries of other members of the family.

The telling and retelling of stories about the deceased relatives keeps not only the family or clan history alive, but equally importantly, it reinforces the traditional island oral culture, which is the bond that ties us to our Chamorro *aniti*.

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Genevieve S. Cabrera started her field surveys of ancient Chamorro rock art in 2005 and to date continues to build upon this established database. Her deep-seated interest in ancient Chamorro history began as a little girl when island stories of old were told and retold by family and community elders. While varied, Cabrera's interests and efforts are culturally based and are particularly focused on the study of the archaeology of the ancient Chamorro people and the preservation of the unique cultural heritage of the Northern Mariana Islands (NMI) as a whole. Cabrera holds a BA in Art History. As a cultural historian, she has authored articles and field survey reports on the history and archaeology of the NMI. While working as the staff historian for the Division of Historic Preservation, she published *The Historic and Cultural Sites of the CNMI: The National Register Sites.*

Marianas History Conference

Ancient Marianas History Posters

Now and Then: Community Engagements at Pago Bay, Guam

Abstract
Archaeological investigations on a privately owned project area located along the northern shoreline in Pago Bay recovered material from a prehistoric Latte Village as well as historic material from the old Spanish Village of Pago. The project provides information about the history of the people who lived there in the past and includes information about the responsibilities of the people who live there now with respect to government regulations regarding the treatment of historic properties.

Darlene Moore, MA, an archaeologist, has been president of Micronesian Archaeological Research Services (MARS) since its inception in 1992.

She participated in field projects located in Utah and Nevada and completed a Master's degree from the University of Guam in 1983. MARS, an archaeological consulting firm, is based on Guam. Moore has completed archaeological projects located on Guam, Rota, Tinian, Saipan, and Yap.

She analyzes the pottery recovered from the various sites that MARS has worked on in the Mariana Islands, focusing on how the pottery industry changed over time. She is also interested in understanding the role pots played in the past.

Now and Then

Community Engagements at Pago Bay, Guam

Darlene R. Moore, Micronesian Archaeological Research Services, Guam

At Old Pago, Latte Period and Spanish Period Archaeology

involves multiple examples of community **engagement** beginning in the 17th century when the Spanish **engaged** the indigenous people living in this traditional Chamorro village located on Guam's eastern shoreline. Archaeological research in the 21st century gathered information about the Chamorro latte village (A.D. 1000-1600) and the subsequent Spanish town which was established in 1680 and abandoned in 1856 after a smallpox epidemic reduced the population and a typhoon destroyed the Catholic Church and other structures. The stone structures were not rebuilt and information about the exact location of Pago was lost.

The archaeological investigations took place on private land situated northeast of the Pago River mouth with access to the Pago Bay shoreline. When the land owner wanted to build, he **engaged** the government's laws and regulations regarding the treatment of historic properties. Since his land was located in an area considered to be culturally sensitive, the Guam Historic Preservation Office (HPO) required him to **engage** an archaeological firm. When human skeletal remains were encountered during construction excavations, the land owner, in negotiations with the HPO agreed to preserve them in place and **engaged** a local group to hold a reburial/blessing ceremony. After the archaeological field work was complete, the land owner **engaged** the Guam Preservation Trust to help fund the analysis of recovered material.

As a result of these recent community engagements, the house was completed, the burials were preserved, new historical and archaeological information about Old Pago was gained, the Guam Museum acquired an artifact collection, the technical report of the archaeological findings was completed and copies were donated to the public schools and libraries thereby ensuring that the history and archaeological information was available to young and old alike.

The artifacts and information from the project area provide tangible representations of some of the transformations that took place as a result of the Spanish **engagement** with the Chamorro culture.

Changes in Construction: Latte Period to Spanish Period

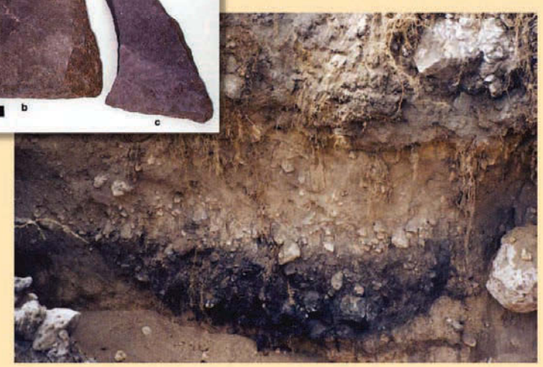
During the Latte Period construction material for structures included pillars or posts made from limestone. The stone posts were set into the ground and formed a foundation for the pole and thatch super structure. When the Spanish arrived, clay tiles and/or bricks were among the materials used to build their structures which included outdoor ovens, churches, schools, and houses for the clergy and soldiers. This house, called the Governor's Palace, was located in Pago.

Adapted from Louis Claude de Freycinet's *An Account of the Corvette L'Uraine's Sojourn at the Mariana Islands, 1819*, translated and prefaced by Glynn Barratt 2003, Occasional Historical Papers No. 13, CNMI Division of Historic Preservation, Saipan.

Changes in Cooking: Latte Period to Spanish Period

Earth-ovens, similar to this basin-shaped dark area *(pictured below)*, were called *chahan* in Chamorro and were (and still are) used to cook taro, yams and fish. Charred coconut shell from this oven yielded a radiocarbon date with a calibrated range (2 Sigma) of A.D. 870-1020, near the beginning of the Latte Period.

When the Spanish arrived they brought corn, the *metate* and the *mano* to grind the corn, and the *comal* (*kommat* in Chamorro), a flat griddle used to cook the tortillas (*titiyas* in Chamorro). Stone *kommat* fragments are pictured.



Changes in Ceramics: Latte Period to Spanish Period

The Chamorros made bowls and jars from local clay which they used for cooking, serving, and storage. When the Spanish arrived they brought in large earthenware jars, porcelain bowls and plates, and glass bottles, and the Chamorros stopped making their traditional wares.

Changes in Valuables: Latte Period to Spanish Period

During the Latte Period the Chamorros made shell beads like this one from the project area.The beads were strung together in long strands that were worn as ornaments for special ceremonies and that made up the valuables of the ancients.

When the Spanish arrived they brought silver coins to pay the salaries of the soldiers. The coins could be used to purchase goods from the governor's store in Hagåtña. This coin, worth two *reales*, was minted in Mexico in 1779. It was recovered from ground surface near the project area.

For more information or a copy of the report, *Latte Period and Spanish Period Archaeology at Old Pago, Guam*, contact Micronesian Archaeological Research Services, Guam.

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Possible Cases of Molar Incisor Hypomineralization (MIH) in Subadults from Guam in the Mariana Islands

Abstract

In this poster, molar incisor hypomineralization (MIH) is considered as a possible diagnosis for discolored dentition found in subadults from archaeological sites on Guam in Micronesia. The affliction had been recognized and described by dentists previously, but it was not given a common name until 2001. MIH is a systemic condition that impacts children and consists of enamel hypomineralization in first molars and, commonly, in associated incisors as well. The condition is characterized by at least one molar having demarcated opacities of a yellow-brown or white-yellow color. Causes include poor general health and environmental stressors in the first three years of life. Individuals with the condition often experience pain and sensitivity in the affected region of the mouth. While the archaeological cases from Guam generally fit descriptions provided in the literature, a key difference is that the yellow-brown defects are not exclusively on first molars and incisors. In this study, each individual is analyzed for indicators of health and compared to known modern cases of children with MIH. Differential diagnoses include fluorosis, erythroblastosis fetalis, amelogenesis imperfecta, neonatal hepatitis, hemorrhage or necrosis of pulp, and betel chewing. The aims of this study include contributing to our understanding of prehistoric Chamorro health and providing a comprehensive review of an indicator of subadult health that can be applied to paleopathological studies around the world.

Julie K. Euber earned her Masters from Arizona State University where she is currently working towards her PhD in bioarchaeology. Her interests include paleopathology and biological relationships between ancient populations.

Joanne Eakin received a BA in Anthropology from the University of Maryland and an MA in Anthropology with a concentration in Bioarchaeology from the University of New Mexico, and has worked as an archeologist in the American Southwest and Micronesia. Her first encounter with Marianas archaeology was as an osteologist for the Manenggon Hills excavations in the interior of Guam in the early 1990s, and she later served as the staff archeologist for the CNMI Historic Preservation Office. She has participated in recovery and analysis of human skeletal remains from numerous archaeological excavations on Guam and the CNMI.

Possible Cases of Molar Incisor Hypomineralization (MIH) in Subadults from Guam in the Mariana Islands

Julie K. Euber, Arizona State University, School of Human Evolution and Social Change
Joanne Eakin, Southeastern Archaeological Research, Inc.

Introduction

The aims of this study include contributing to our understanding of prehistoric Chamorro health and providing a comprehensive review of an indicator of subadult health that can be applied to paleopathological studies around the world. Molar incisor hypomineralization (MIH) is considered as a possible diagnosis for discolored permanent dentition found in subadults from at least two archaeological sites on Guam. MIH is a systemic condition that impacts children and consists of enamel hypomineralization in first molars and commonly in associated incisors as well. The condition is characterized by at least one molar having demarcated opacities of a white, yellow, or brown color. Individuals with the condition often experience pain, sensitivity, and higher rates of caries in the affected region of the mouth.

Molar-Incisor Hypomineralization

MIH is a systemic condition that impacts children and consists of enamel hypomineralization in first molars and commonly in associated incisors (**Figure 1**). Individuals with the condition often experience pain, sensitivity, and higher rates of caries in the affected region of the mouth. Similar to contemporaneous clinical studies, systematic studies of hypomineralized developmental enamel defects in past populations often include all opacities without attempts at parsing out particular conditions (Ex. 1-5). Although the exact cause of MIH is still unknown, recent developments in the definition and diagnosis of the condition may allow for more differentiation between cases of hypomineralization in our own work. Possible factors in the cause of MIH include environmental conditions, respiratory tract problems, perinatal complications, dioxins in the breast milk, oxygen starvation combined with low birth weight, calcium and phosphate metabolic disorders, and frequent childhood diseases.[6] To explore the feasibility of examining frequencies and possible causes of MIH in past populations, this poster examines two cases of possible MIH and compares their dental characteristics to those found in the clinical literature.

Clinical Characterizations and Criteria for MIH

- Demarcated white, yellow, or brown opacities need to be present on at least one permanent first molar to be considered MIH, and associated permanent incisors are also often affected.
- The opacities are most common on occlusal and buccal surfaces and the top third of tooth.
- MIH can occur on teeth other than first molars and incisors as well, but this is not often recorded in clinical studies.
- Opacities can appear before or after eruption.
- Similar opacities in deciduous dentition are called Deciduous Molar Hypomineralization (DMH). There is a strong relationship between DMH and MIH suggesting a shared cause.[7]
- Individuals who survive the insult of MIH (or, more precisely, the insult spurring MIH symptoms) would eventually either lose the softened region to caries or lose the tooth entirely.

Fig. 1: MIH from Clinical Studies

Region and Archaeological Sites

The individuals we examined are from two different excavation projects on Guam, but the sites are contiguous (**Figure 2**). Monitoring and data recovery were conducted at Villa Kanton Tasi in 2000-2001 by Micronesian Archaeological Research Services. The Villa Kanton Tasi project area was a 1.09 acre parcel in Tumon, Tamuning Municipality, Guam, located seaward of the coastal road on Tumon Bay. Five Latte Period mortuary areas were identified and 34 primary burial features were hand excavated. Monitoring and data recovering were conducted at the Suehiro Hotel in Tumon in 1989 by Paul H. Rosendahl, Ph.D., Inc. At least six individuals were identified during the project.


Figure 2: Location of the archaeological sites in Tumon, Guam

Individuals and Afflicted Dentition

Villa Kanton Tasi, Burial 7, Age 7 +/- 24 months

Burial 7 was aged based on dental development and epiphyseal fusion.


Photo from Villa Kanton Tasi site report

Discoloration was not present on molars. The defects were limited to the incisors. The individual expressed indications of physiological stress, including active infections on multiple locations of the cranium.
The permanent maxillary central incisor pictured on the left expressed three hypoplastic enamel lines and loss of one half of the labial surface. Six carious lesions located on upper canines, lower right canine, and lower right first deciduous molar (Note similarity to first picture in clinical examples).

Suehiro, Burial 4, Age 4-5

Burial 4 was aged based on dental eruption and fused neural arches separate from the centrum.


Permanent Molars-an example of typical development


Deciduous maxillary incisors from labial (left) and lingual (right) view

Note the yellow-brown color of the deciduous mandibular central incisors, brown opacities on the deciduous molars, and the wear pattern on the deciduous maxillary incisors. The developing permanent molars are brown, but during development this coloring will fade.

Differential Diagnoses

Soil stains are not a strong possibility. In the current examples, staining appears on the developing permanent dentition, but not all of the exposed deciduous dentition.

Betel nut staining is the result of chewing betel nut and cosmetic application. In Latte burials, staining does not typically occur until the age of 14 or 15. (**Figure 3**).


Figure 3: Hyatt B122-Betel Stains

Dental Fluorosis is characterized by mottled yellow to brown opacity. Dental health in the island ecosystem is strongly influenced by the relatively high levels of dietary fluoride. Marine resources are generally rich in fluoride, and fluoride concentrations in food and water on several islands in Polynesia and Micronesia are high enough to produce clinical signs of dental fluorosis in the permanent teeth of children. High fluoride levels in maternal diets may have been partly responsible for the poor enamel mineralization.[11] (**Figure 4**)


Figure 4: Fluorosis[12]

Other Possible differential diagnoses:
Typical development, erythroblastosis fetalis, amelogenesis imperfecta, neonatal hepatitis, and hemorrhage or necrosis of pulp

Conclusions and Implications

- While studies of enamel defects in past populations are fairly common, focusing on MIH specifically may allow for a better understanding of the condition's etiology and frequencies in the past.
- The opacities are not restricted to the top third of the tooth though, which is the most common pattern in MIH today. Only the Suehiro burial is known to have the demarcated opacities on the M1s as required by MIH diagnostic criteria.
- DMH appears to be present in the Suehiro burial.
- Dental fluorosis is the most convincing differential diagnosis in both cases.

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Uncredited photographs were taken by the first author.

This project was partially funded by a research grant from the School of Human Evolution and Social Change, Arizona State University.

An Archaeological Perspective on Gender and the Division of Labor in Traditional Chamorro Households

Abstract

Students and faculty from the University of Guam and the University of Hawai'i conducted a three year field school at the Guam National Wildlife Refuge (GNWR). Our study compared ethnohistoric accounts of household organization with archaeological patterns at the 17th century village of Ritidian. We investigated archaeological assemblages from two *latte* buildings to document their respective economic activities. Unexpected differences in their artifact assemblages reveal the following:

1) Economic activities varied between the two *latte* buildings
2) They were domiciles of a single economically integrated household
3) Their disparate functions signaled a gendered division of labor

In brief, one *latte* building was used by women to make and use pottery for the preparation and storage of food. In contrast, the other *latte* building was used by men to make canoes and fishing gear. This archaeological study reveals aspects of traditional Chamorro practices that documentary accounts do not fully describe.

James M. Bayman, PhD, is Professor of Anthropology at the University of Hawai'i-Mānoa. He received his PhD at Arizona State University. Dr. Bayman's archaeological research for the past several years has focused on studying the technologies and political economies of contact-period societies in the Mariana Islands and the Hawai'ian Islands. He has also conducted research on traditional craft economies, obsidian artifact geochemistry, property rights, social identity, and macro-economy in Arizona and northern Mexico.

Bayman is a former president and vice-president of the Society for Hawai'ian Archaeology. His research has been published in various journals, books, and monographs. Over the past 35 years he has conducted archaeological fieldwork in Oceania (Marianas, Hawai'i), Southeast Asia (Cambodia), and North America (U.S. Southwest, Midwest).

An Archaeological Perspective on Gender and the Division of Labor in Traditional Chamorro Households

Jim Bayman,[1] Hiro Kurashina,[2] Mike Carson,[3] & John Peterson[2]

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[2]Micronesian Area Research Center, University of Guam, Mangilao

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The Archaeological Field School

Students and faculty from the University of Guam and the University of Hawai'i conducted a three year (2008-2010) field school at the Ritidian Unit of the Guam National Wildlife Refuge (GNWR). The field school was designed to assist the US Fish & Wildlife Service with its mandate to manage cultural resources at GNWR, provide university students and volunteers with training in archaeological field techniques, engage the local community in its efforts to preserve and celebrate Guam's rich history and heritage, and to conduct scholarly research.

Europeans inspecting a latte ruin on Rota in 1819

Location of the field school at GNWR

Early Historic Period at Ritidian

A Spanish map by Alonso Lopez in 1671 indicates the location of a Chamorro village ("Ritidian") with a Christian church in what is now the Guam National Wildlife Refuge; a later observer witnessed a mass that was attended by 400 individuals. Finally, a priest was killed at Ritidian in 1681, shortly before the village was abandoned by its residents who were forcibly relocated through the Spanish reducción policy of 1682. Because the village of Ritidian was abandoned so rapidly the archaeological record of its latte buildings is relatively well-preserved.

Leonard Iriarte and Guma' Pâlu Li'e – I Fanlanai'an conduct protocol at the field school

Field school students and members of Guma' Pâlu Li'e – I Fanlanai'an

Archaeological Excavations

The field school excavations were undertaken to recover artifacts and other cultural materials from two adjacent latte buildings in order to document the daily lives of Chamorro who lived in Ritidian shortly before it was abandoned during the reducción. The excavations were conducted as follows:

- Sixteen 1m x 1m units were excavated below and adjacent to each latte building foundation until non-cultural deposits were encountered.
- Sediments from the excavations were sieved with 1/8 mesh wire screens to enhance the recovery of cultural materials. Smaller samples of sediments were processed with water.
- Excavation of one unit was undertaken a few meters below the cultural deposits to confirm the lack of a buried ("pre-latte") archaeological horizon.

Pin flags marking cultural materials

Excavation in progress

Plan of latte excavation

Students screening

Completed excavation at latte building #1

Archaeological Materials at the Latte Buildings

Cultural artifacts from the foundations and nearby areas of the two latte buildings indicate that a variety of activities were undertaken at Ritidian, including the use of pottery vessels for cooking and storing food and water. Shell adzes and bone needles would have been used for making canoes and sails for deep-sea fishing and inter-island travel. Ground and chipped stone artifacts were used for various activities such as food processing, mat-making, and pottery production.

Tridacna shell adzes for wood-working

Marine shell fishhooks

Bone tools for making fishing nets

Ground stone and chipped stone for making pottery, preparing food, and processing plant-fibers..

Marine shell beads

Dating the Latte Buildings

The recovery of iron nails and fragments, a European glass bead, an iron fishhook, and an East Asian porcelain (that dates to the mid to late 17th century) corroborate documentary accounts of the abandonment of the latte village during the reducción in 1682. Chamorro communities acquired forged iron via trade with the Spanish (Quimby 2011).

Chamorro trading with Europeans

European bead

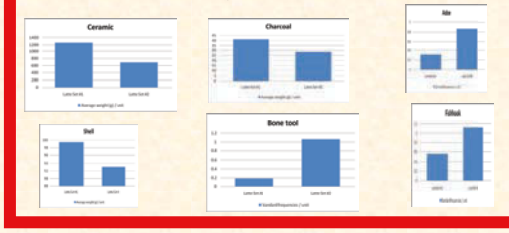
Iron fishhook

Iron nails and fragments

East Asian porcelain

Comparison of Cultural Materials at the Two Latte Buildings

The relative abundance of certain cultural materials varied at the two latte buildings. Materials related to cooking, storage, and consumption of food, such as pottery, charcoal, and marine shell, were concentrated at Latte building #1. In contrast, fishhooks, adzes, and bone tools related to fishing and canoe construction, were concentrated at Latte building #2.



Traditional Division of Labor: Historic Representations

Russell's (1998) review of Spanish records, ethnographic accounts, and post-contact illustrations reveals that labor was gendered in traditional Chamorro households. Female labor was often devoted to the preparation of food and the fabrication of plant-fiber mats and other materials. Although females and males worked together on near-shore fishing, deep-sea fishing was undertaken by males. Males also made fishhooks and constructed canoes. Both females and males engaged in agriculture.

Females and males engage in near-shore fishing with nets

View of woman cooking beside a latte building

Males undertake off-shore fishing

Females prepare plant-fiber materials for house construction

Females prepare plant-fiber goods

Archaeological Findings of Study

The two latte buildings were probably used by members of a single traditional household and the activities of women and men were spatially separated. This pattern is common elsewhere in the Pacific. One latte building (#1) was used by women to process, cook, and store food. The other latte building (#2) was used by men to make equipment for fishing such as nets, hooks, canoes, and sails. The spatial division of labor according to gender was not strict and some activities were at times practiced by both men and women, as well as children.

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Acknowledgements

This research was supported by the Guam Preservation Trust; Guam National Wildlife Refuge, US Fish & Wildlife Service; Micronesian Area Research Center, University of Guam; and Department of Anthropology, University of Hawai'i.

- Rosanna Barcinas led the field school on visits to various cultural sites on Guam
- Encouragement for this research was provided by members of Guma' Pâlu Li'e– I Fanlanai'an
- The historic photos and historic images are from Guampedia
- The recent field and artifact photos are by Dr. Hiro Kurashina, Dr. Mike Carson, and Dr. Stephen Acabado
- The Northern Mariana Islands Council for the Humanities sponsored a guest lecture on the field school in 2010

An Assessment of Health and Lifestyle Among Chamorros Saipan, Commonwealth of the Northern Mariana Islands

Abstract

Earlier investigations of health and disease in the Mariana Islands suggested that the prehistoric inhabitants of Saipan and the small islands experienced more stress than the prehistoric inhabitants of larger islands such as Guam. This study examined the health and lifestyle in skeletons from two archaeological sites on Saipan, the Chalan Monsignor Guerreo Road Project (CGM) and the Beach Road Sewer System (BRSS) sites. Context is provided by comparison with skeletons from earlier excavations on Saipan and other islands in the Marianas archipelago.

The indicators of stress investigated include cribra orbitalia (CO), linear enamel hypoplasia (LEH), stature, trauma, infection, and dental diseases (e.g., antemortem tooth loss (AMTL), caries, dental abscess, etc.). With the exception of significantly lower dental caries frequency in the skeletons from the CGM and BRSS sites, the prevalence of stress is similar in the skeletal series from Saipan. When compared to the skeletons from Guam, significantly higher frequencies of CO, AMTL, and dental attrition and lower frequencies of dental caries were observed in the Saipan skeletons. Slightly higher, but not significant, frequencies of treponemal infection and limb bone fractures were observed in the Saipan series.

The results of this study support, in part, earlier assessments that the prehistoric Chamorro living on Saipan experienced more stress than those living on Guam. The cultural practice of chewing Areca (betel) nut and other environmental and cultural differences are examined to explain these results.

This research was funded, in part, by Capital Improvement Funds, Saipan, CNMI.

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[2]Swift and Harper Archaeological Resource Consulting, Saipan

Excavations discussed in this poster were performed by Swift and Harper Archaeological Resource Consulting (SHARC), a Saipan-based partnership composed of a three-person team of archaeologists, Michael A. Fleming, Marilyn Swift, and Randy Harper. Many of SHARC's projects have required the scientific study of human skeletal remains. On Saipan, these projects have included the Southern Sewer System and Chalan Monsignor Guerrero Phase III Roadway

Improvement. Results of analyses from these projects comprise this poster presentation. Analysis of the human remains was conducted by Michael Pietrusewsky, Ph.D. and his associate and former student Michelle Toomay Douglas, M.A.

Michael Pietrusewsky completed his doctoral dissertation at the University of Toronto in 1969. He is a member of the American Association of Physical Anthropologists, a Fellow of the American Academy of Forensic Sciences, and on the Editorial Board of the Anthropological Science Association. His primary employment is as a professor at the University of Hawai'i, Manoa where he teaches courses in Physical Anthropology, Human Origins, Skeletal Biology, Human Biology of the Pacific, and Forensic, Physical, and Biological Anthropology. His research involves the study of archaeological human skeletons from the Pacific Islands, Australia, Southeast Asia, and East Asia and focuses on biological distance, population history, health, and lifestyle in the Pacific-Asian region. He is also a board certified forensic anthropologist. His interest is also in Bioarchaeology which is an emerging discipline emphasizing the human biological component of the archaeological record. Among the topics explored are musclo-skeletal indicators, paleodemography, paleopathology, dental anthropology, indicators of biological stress, trauma and violence, infectious diseases, bio-distance studies, and isotopic analysis of diet and nutrition.

Michael A. Fleming, M.A., is the Principal Investigator. Fleming, received his Masters Degree in 1986 from the University of Otaga, New Zealand and later served the CNMI as Chief Historic Preservation Officer. His career with the Historic Preservation Office spanned a twenty-year period. As CNMI HPO Director, he administered the Federal Grants program, oversaw the production of technical and professional reports, and completed inventory surveys on the islands of Saipan, Rota, Tinian, Anatahan, Sariguan, Guguan, Alamagan, and Pagan. Additionally, he supervised testing and excavation programs throughout CNMI. Fleming provided a public interface between the Historic Preservation Office and Public School System and directed HPO participation in public events including the WWII 50 year memorial, Historic Preservation week, and Cultural Heritage week. During his tenure, the Micronesian Archaeological Survey Series was published by the Historic Preservation Office. His qualifications satisfy the professional standards for archaeologists as outlined in 36 CFR Part 61 of the Secretary of the Interior's Standards.

Randy A. Harper, B.A. and Marilyn K. Swift, B.A. are Project Directors. For larger projects, the work force is comprised of local hires with an interest in their cultural heritage. Before working in the CNMI, Swift and Harper each completed more than 15 years of cultural resource management in the states of Arizona, California, Colorado, Hawaii, Nevada, and New Mexico. Prior to forming SHARC, Randy Harper and Marilyn Swift worked for other private companies completing over eight major-citing projects on the islands of Saipan, Tinian, Rota, and Guam. Their experience in the CNMI spans over twenty years.

An Assessment of Health and Lifestyle among Chamorro from Saipan, Commonwealth of the Northern Mariana Islands

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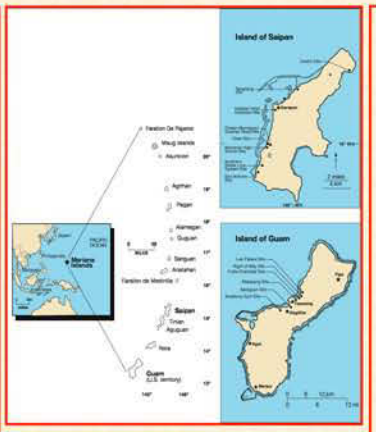
Mariana Islands and the Chamorro

The Mariana Islands form an archipelago of fifteen islands stretching north-south between 13° and 21° latitudes in the western Pacific Ocean. Guam, Rota, Tinian, and Saipan, located in the southern group, are the largest islands in the archipelago. When the first Europeans arrived in 1521, they found the islands inhabited by a single group of people who spoke Chamorro, an Austronesian language. The earliest human settlement of the Mariana Islands may date to 3500 B.P.



Map: Locations of the skeletal series

Background

A previous investigation of health and disease in the Mariana Islands suggested that the prehistoric Chamorro from Saipan experienced higher levels of specific as well as non-specific indicators of health, including dental enamel hypoplasia, cribra orbitalia, and treponemal infection, than the prehistoric Chamorro living on Guam (Pietrusewsky et al., 1997). Saipan's smaller land mass (121 km^2), lower rainfall, slightly cooler temperatures, and superficial ground water make this island more susceptible to environmental perturbations (e.g., drought, typhoon, etc.) than Guam (549 km^2).

Research Questions

Utilizing general and specific indicators of stress, this paper examines the health and lifestyle of Chamorro:

- During prehistoric (Latte Period) and contact periods (post-1521) on Saipan
- Between Saipan and Guam

We hypothesize that physiological stress will be higher in:

- Contact period skeletons than prehistoric skeletons from Saipan
- Skeletons from Saipan than skeletons from Guam

Materials and Methods

This study examines skeletons from the Latte and the Spanish Mission Periods from two sites on Saipan and compares them to previously examined skeletons from Saipan and Guam.

- Chalan Monsignor Guerreo Road Project (CMG) Site (A.D. 1050 – 1450)
- Southern Sewer Line System (SSLS) Site (A.D. 1420 – 1670)
- 349 skeletons from 12 sites located on Saipan and Guam (Pietrusewsky et al., 1997)

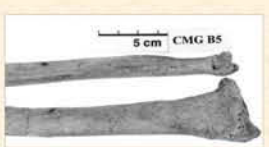
Non-specific indicators of systemic stress:

- cribra orbitalia (CO)
- linear enamel hypoplasia (LEH)
- stature

Specific indicators of stress examined:

- limb bone fractures
- spondylolysis
- infection (treponemal disease)
- AMTL, caries, alveolar resorption, alveolar defect, calculus, attrition

Statistical tests: Fisher's exact test and Student's t-test



Comparisons: SSLS versus CMG

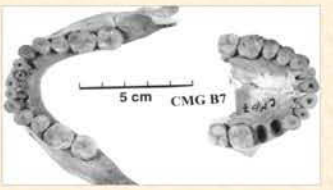
Average Stature (cm)	SSLS	CMG	P value
Males	173.8	171.4	0.6147
Females	160.1	159.1	0.7790

Average Stature (cm)	Saipan	Guam	P value
Males	175.0	172.4	0.2498
Females	160.0	162.8	0.1092

Indicator/Trait	SSLS (%)	CMG (%)	P value
LEH	**38.9**	**11.8**	**0.0421**
Cribra orbitalia	66.7	50.0	1.0000
Limb bone fracture	0.0	5.9	1.000
Spondylolysis	14.3	0.0	1.0000
AMTL	4.8	8.1	0.3265
Caries	2.0	2.6	1.0000
Alveolar resorption	**68.7**	**0.0**	**0.0001**
Alveolar defect	4.2	7.3	0.4270
Calculus	17.1	11.1	0.3161
Attrition	48.3	42.7	0.4328
Infection	0.0	33.3	0.1250
Betel staining	**81.7**	**69.0**	**0.0265**

The only significant differences **(highlighted)** in the prevalence of skeletal and dental indicators recorded in the SSLS and CMG series were those for **LEH, alveolar resorption**, and **betel stained teeth**, all higher in the prehistoric/historic SSLS series. Although not significantly different, higher frequencies of CO, spondylolysis, calculus, and attrition were also observed in the SSLS series. Evidence of treponemal infection was observed only in the CMG skeletons.

Given the later dates for several of the SSLS skeletons, these differences may reflect greater stress during the time when the Chamorro on Saipan were engaged in a strong resistance to Spanish rule. Some of the differences may be the result of small samples, preservation issues, and betel staining.

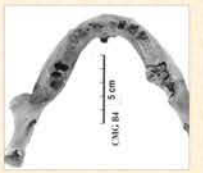


Areca Nut Chewing and Dental Pathology

Areca nut (*Areca catechu*) chewing, with or without, the use of pepper leaf (*Piper betle*) and/or slaked lime, is common throughout South/Southeast Asia and the western Pacific. The light to dark brown/reddish brown stain observed in adult dentitions for many archaeological skeletal series from the Mariana Islands, including those examined in this study, has been associated with this cultural behavior. There is now a substantial epidemiological literature demonstrating a link between betel chewing, cariostasis, periodontal disease, calculus, and increased dental attrition.

Comparisons: Saipan versus Guam

Indicator/Trait	Saipan	Guam	P value
LEH %	34.0	31.0	0.5624
Cribra orbitalia %	20.0	7.1	0.0876
Male stature (cm)	173.9	172.4	0.2498
Female stature (cm)	160.0	162.8	0.1092
Limb bone fracture %	1.1	0.8	0.1027
Spondylolysis %	1.3	6.7	0.1027
Infection %	12.7	8.1	0.2941
Alveolar defect %	4.2	7.3	0.4270
AMTL %	**7.1**	**5.3**	**0.0130**
Caries %	**7.1**	**10.1**	**0.0448**
Alveolar resorption %	**6.0**	**4.6**	**0.2346**
Calculus %	**10.5**	**15.6**	**0.0017**
Attrition %	**48.7**	**26.3**	**0.0001**
Betel staining %	**75.3**	**53.3**	**0.0001**



Comparisons between Saipan and Guam indicate:

- No significant differences are observed for CO, LEH, and adult stature
- Limb bone fractures are similar
- Spondylolysis is slightly more common in the Guam series
- Treponemal infection rates are similar on the two islands
- No significant differences in alveolar defects
- AMTL, alveolar resorption, and attrition significantly higher in the Saipan series
- Caries rate is significantly lower in Saipan teeth
- Calculus is significantly higher in Guam teeth

The significantly higher frequency of betel-stained teeth in the Saipan series may explain the higher frequencies of AMTL, alveolar resorption, and attrition observed in the Saipan series as well as the lower caries rate in the Saipan teeth. The unexpected lower frequency of advanced calculus in the Saipan series may be explained by several confounding variables (e.g., the level of oral hygiene, diet, general health, and dental status) influencing periodontal status, and hence calculus build-up (IARC, 2004), and cultural differences in the use of slaked lime in the betel-quid preparation on the two islands.

Discussion/Conclusions

Although preservation and sample size issues require these results be interpreted with caution, there is evidence for increasing physiological stress over time on Saipan consistent with archaeological evidence for increasing population size, changes in marine resource utilization, and contact with Europeans. The previously noted inter-island differences between Guam and Saipan are strengthened with the addition of these new skeletal series. Quite likely some of the differences between these two islands may be attributed to temporal differences in the skeletal series, differences in diet, as well as the cultural practice of chewing areca nut with or without the use of slaked lime.

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