Rice As a Prehistoric Valuable in the Mariana Islands, Micronesia

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ALTHOUGH HISTORIC and linguistic sources, reviewed below, indicate the indigenous Mariana Islanders of Micronesia, whose descendants are known as Chamorros (Chamorus), grew rice before initial Western contact in the early 1500s, it is not known when or why rice cultivation began in these islands—the only case in Remote Oceania.[1] Recent excavations in western Guam have confirmed the late prehistoric presence of domesticated rice (*Oryza sativa* L.) in rare pottery sherds, and the nature and timing of all the available evidence—from archaeology, palaeoethnobotany, linguistics, and history—suggest a solution to this puzzle. Rice may have been adopted as a "valuable" rather than as a staple, for use in ceremonial exchanges that marked the late prehistoric period. The accumulating evidence for the late prehistoric cultivation of rice in the Marianas is summarized below, and an explanation-sketch is offered for the adoption of rice as a ceremonial food.

RECENT FINDS

In a sealed primary cultural deposit at Tumon Bay, western Guam (13° 30′ N, 144° 45′ E; Figs. 1, 2), two pottery sherds, each bearing the impression of a rice spikelet identified as *Oryza sativa* L., were found during archaeological excavations undertaken prior to construction of a hotel water park (Moore et al. 1993). The rice impressions were recognized during routine laboratory analysis. Within one of the impressions are small fragments of charred husk, fragmentary silica skeletons of lemma and palea, broken trichomes (macrohairs) and small pieces of charred grain (Pls. I–III). Portions of the original surface finish on the sherds were lost due to thermal spalling, and the exfoliation exposed the spikelet impressions. One impression occurs on the (exfoliated) interior surface of a body sherd (Pl. I) and the other on a similarly exposed exterior surface of a thickened, incurving rim sherd (Pls. II, III). It is likely that the impressions were not visible when the

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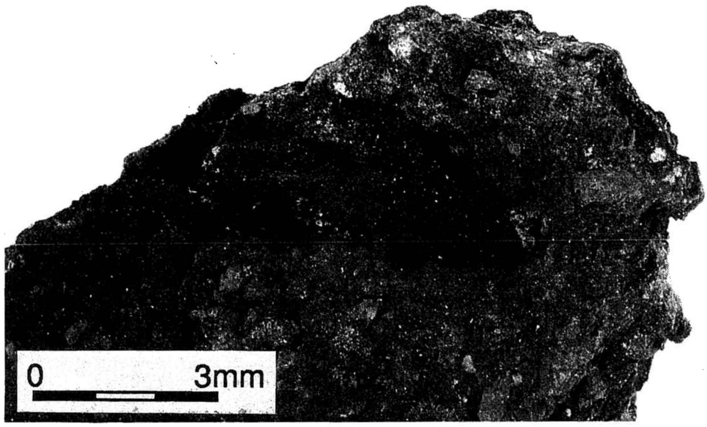
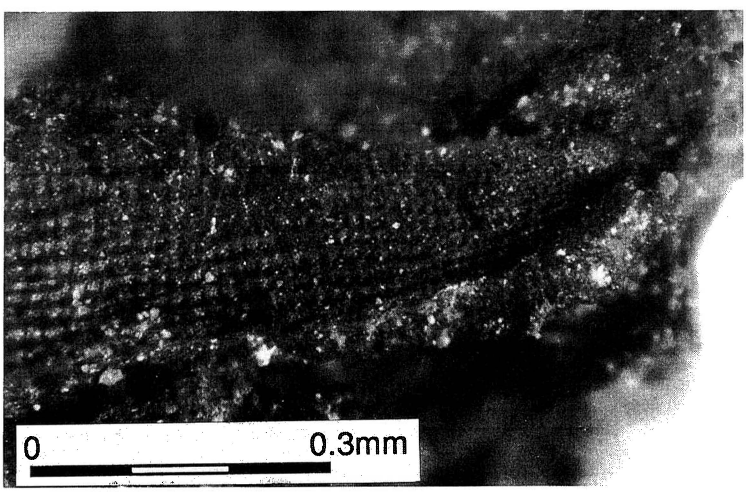


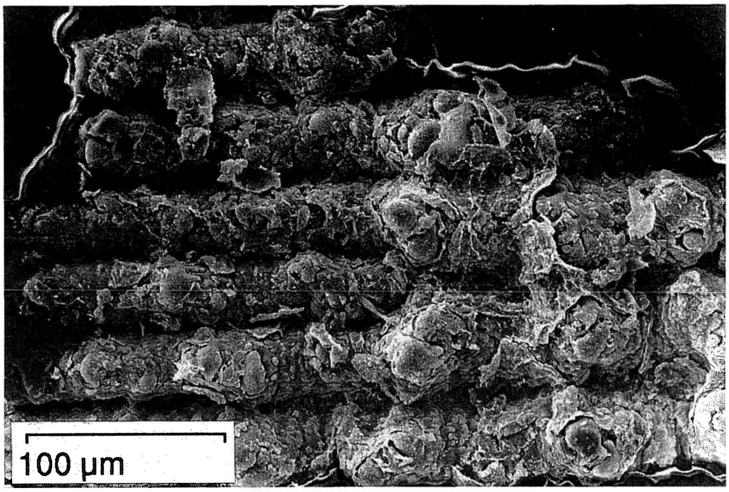
Pl. I. Impression of rice spikelet, internal surface of Latte Phase pottery body sherd from Tumon Bay, Guam.



Pl. II. Impression of rice spikelet, external surface of Latte Phase pottery rim sherd from Tumon Bay, Guam.

surface finish was intact. These are whole spikelets rather than fragmentary husks, occurring at very low frequencies in ceramic assemblages but not as temper. These facts suggest that the rice was accidentally incorporated into the clay—possibly at the clay collection site or at the pottery manufacturing site (where rice may have been growing or was being processed nearby).

The Tumon sherds are dated through association with radiocarbon-dated charcoal to 620 ± 50 B.P. (Table 1). Typologically, the sherds are of the Latte Phase (Spoehr 1957), which spans a period of some 700 years beginning about



Pl. III. Fragment of lemma or palea from *Oryza sativa* L., external surface of Latte Phase pottery rim sherd from Tumon Bay, Guam (same specimen as Pl. II).

A.D. 1000.[2] Typically, Latte Phase sherds derive from large bowls and jars with rounded bases and restricted openings with thickened, incurving rims. Their exterior surfaces have been smoothed to achieve a plain finish or have been embellished by combing, wiping, or brushing to achieve a rough finish. When present, inclusions in the sherd matrix generally consist of volcanic sands or a mixture of calcareous and volcanic sands. Occasionally sherd temper (grog) is added to the clay (Moore 1983; Simons 1994).

Shortly after the Tumon sherds were found and the rice spikelet impressions in them verified, four more rice spikelet-impressed pottery sherds, all typologically Latte Phase, were retrieved from sites in Guam's interior (Moore 1994). J. Craib (personal communication 1993) reports a similar find from a Latte Phase coastal site at Rota, 50 km north of Guam (Fig. 1). Three of the Guam sherds are from sites in the central hills of Yona (a limestone rock shelter and two open sites in the savanna, Fig. 2). Two of these are thickened, incurving rim sherds and one is a body sherd. The impressions occur on the intact exterior surface of the sherds. Another rice spikelet-impressed sherd has been found at an open site within the limestone forest of Yigo, in northeastern Guam (Fig. 2). This is a body sherd with the impression on the intact interior surface. Most recently a Latte Phase sherd with one spikelet impression has been recovered from a coastal site at Susupe, Saipan (Moore et al. 1994) (Fig. 1).

The sherd from the Guam rock shelter has been dated by associated charcoal to 500 $\pm$ 60 B.P. (Table 1). No dates have been obtained for the surface finds. The Rota sherd reported by Craib is from the west side of the island and is currently undated. The Saipan sherd came from the backdirt of a backhoe trench and so was out of context; the sherd probably derived from an intact deposit dating to the early contact period (Moore et al. 1994).

The rice-impressed pottery from Tumon and from the rockshelter in Yona are

Table 1. Radiocarbon Dates from the Mariana Islands Associated with Rice

LAB/SAMPLE NO.	PROVENIENCE	MATERIAL	RADIOCARBON YEARS B.P.[a]	CALIBRATED DATE RANGE[b], 2σ	REFERENCE
Beta 44104	M.H. M210, Feat. A, Guam	Charcoal	1660 ± 60	A.D. 255–542	Moore & H-A 1994*a*
Beta 63157	M.H. M240, Feat. C, Guam	Charcoal	500 ± 60	A.D. 1325–1491	Moore & H-A 1994*a*
Beta 60869	P.I.C., Biofilter Trench, Guam	Charcoal	640 ± 50	A.D. 1284–1425	Moore et al. 1993
Beta 33391	Chalan Piao, Layer II Lower, Saipan	Charcoal	3210 ± 100	1733–1263 B.C.	Moore et al. 1992
PRI[c] M-1 Ca. No. 1	Mochom, Unit C-3, Layer II, Rota	Charcoal	615 ± 100[d]		Takayama & Egami 1971
PRI[c] M-1 Ca. No. 4	Mochom, Unit C-3, Layer I, Rota	*Tridacna*	170 ± 80[e]		Takayama & Egami 1971

[a] ^{13}C—corrected except *d*, *e*.
[b] Calibration by CALIB 3.0, Stuiver and Reimer (1993).
[c] Physical Research Institute, Tokyo.
[d] ^{13}C—correction not provided.
[e] Not corrected for marine reservoir effect.

the first well-dated direct archaeological indications of prehistoric rice cultivation on Guam. Their discovery in diverse locations at Latte Phase sites is consistent with the growing body of archaeological, palaeoenvironmental, historic, ethnographic, and linguistic evidence that rice began to be grown in the Mariana archipelago no earlier than the Latte Phase. While the tentativeness of "negative evidence" is acknowledged, the apparent absence of rice from sites occupied prior to about A.D. 1000 provokes the following questions: Why was rice grown no earlier than the Latte Phase? What was its role as a cultigen? And why did no other tropical Pacific island society grow rice—for example, Yap and Palau, which are closer to insular Southeast Asia—the likely source area for planting stock and techniques? Our tentative answers come from a consideration of the following facts.

ARCHAEOLOGICAL, ARCHAEOBOTANICAL, AND PALAEOBOTANICAL EVIDENCE

In addition to the rice-impressed sherds discussed above, Takayama and Egami (1971) report rice impressions in three pottery sherds from the Mochong (Mochom) site on Rota's northeast coast. Two radiocarbon dates of the layer in which the sherds were found range from 615 ± 100 B.P. to modern (170 ± 80 B.P.) (Table 1). The earlier date was obtained from a charcoal sample from the same excavation unit and level as one of the sherds. Also found at the site were pieces of metal, usually taken to indicate post-Spanish contact (i.e., after Magellan's landing in A.D. 1521 and the Spanish galleon trade beginning in A.D. 1565).

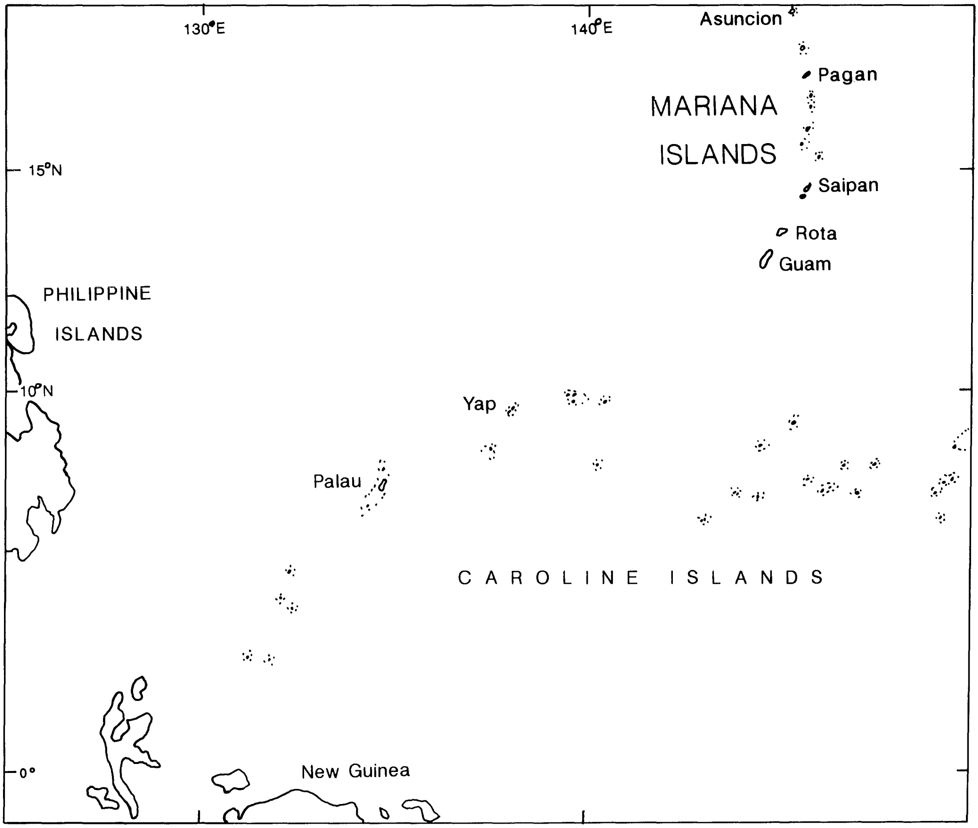


Fig. 1. Map of western Micronesia in the western Pacific.

Although the authors claim no vertical disturbance in the deposits, the metal pieces and several burial pits had been dug into the same layer as the rice-impressed sherds, hence the primary depositional context of these materials is open to question.

Other physical evidence for Latte Phase rice in Guam includes a fragment of charred caryopsis of *Oryza sativa* retrieved from a soil flotation sample from an undated cultural layer exposed in a backhoe trench near the sea at Merizo in southern Guam (Henry et al. 1991) (Fig. 2). The same layer contained Latte Phase pottery, but the top was truncated and overlain by modern coral fill. Dating this specimen by cultural association in the absence of a firm radiocarbon date is problematic due to the location of the site. Storm waves could have disturbed the stratigraphy and the rice could have been deposited during historic times when this crop was grown in the vicinity. Other evidence for rice from southern Guam includes a phytolith fragment from a husk of *Oryza sativa* found 132 cm below surface in a sediment core. The core was taken at an inland, high-elevation freshwater marsh in Agat (Hunter-Anderson 1994*a*) (Fig. 2). No direct date is available for the phytolith. From its position in the core it appears to be no older than 300 B.P. Analysis of the core for $^{13}c/^{12}c$ indicates considerable mixing of the sediments, and this specimen could be older or younger than the estimated

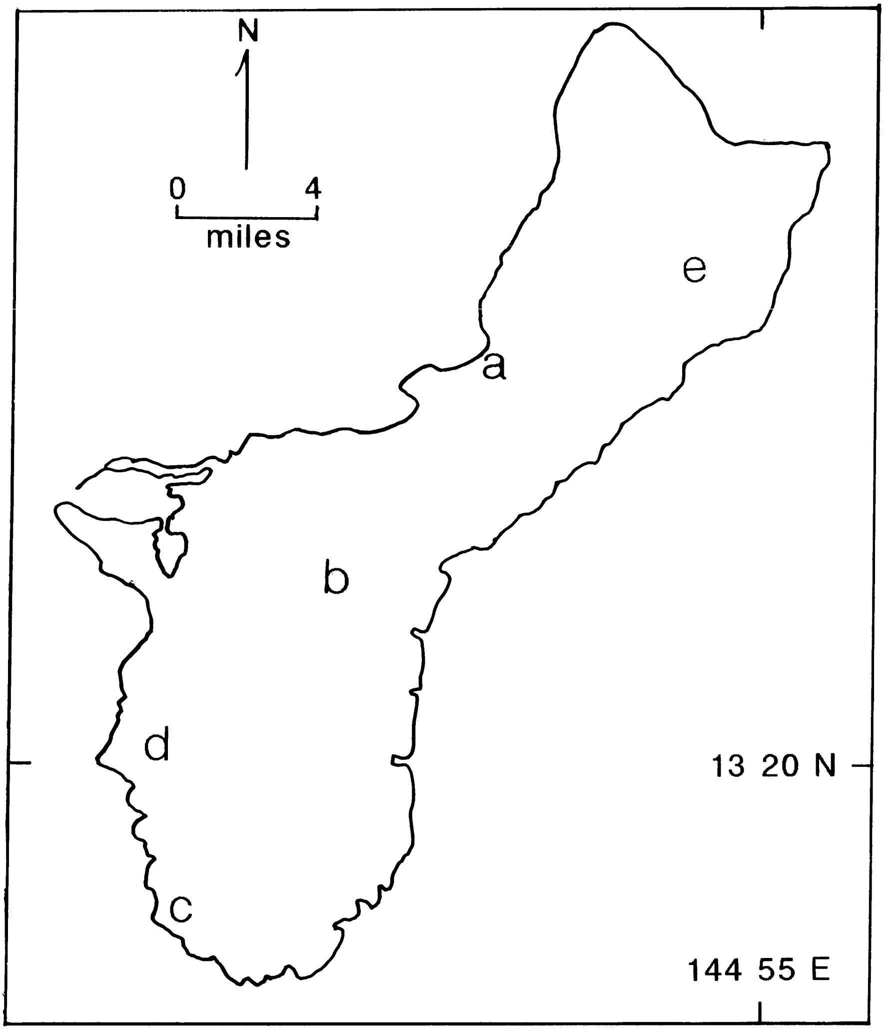


Fig. 2. Sites that have yielded evidence for prehistoric rice in Guam: (a) Tumon Bay, (b) Yona, (c) Merizo, (d) Agat, (e) Yigo.

age. A ten-stone latte set located on the slope that faces the coring site and another latte set farther up the slope indicate occupation of the area during the Latte Phase.

In a cave at the island of Asuncion (Fig. 1), Yawata (1963) found "a quantity of burnt rice husks" spread over two burials associated with Latte Phase artifacts. Unfortunately, the rice husks he collected from this site had turned to powder before they could be examined in the laboratory, and the site has not been directly dated.

HISTORICAL AND ETHNOGRAPHIC EVIDENCE

Beginning in A.D. 1526, Western eye-witnesses to encounters between the Chamorros and the Europeans state that rice was grown in the Marianas and was offered in trade (see originals and translations of these accounts in Lévesque 1992). The early documents indicate that some of the islands (which ones are not specified) produced more rice than others, and that rice was transported among them via sailing canoes. In A.D. 1565, "fields, sown with rice" were seen at Guam, and bales of rice wrapped in mats were traded for iron nails from the Legazpi Expedition that year (Abella 1965). In the following decades Marianas-grown rice was traded to European ships, including the putatively annual Manila Acapulco galleon (Schurz 1939). A Spanish Franciscan lay brother, Juan Pobre de Zamora, lived in Rota for seven months in 1602 and reported that rice there was consumed at funerals and special meals and was used to pay compensation for social offenses (Driver 1989). According to the Pobre account, rice was exchanged for fish between the people who lived in the island interior and those living on the coast. During the Spanish-Chamorro wars of 1670–1695, the Europeans found household rice stores (no quantities given) in abandoned native villages on Guam, whose occupants had fled ahead of the soldiers (Garcia 1985).

Two centuries later, Spanish governor de la Corte (1970) relates the traditional belief among the Chamorros that rice flour and the bones of the daughter of the chief Taga of Tinian (who lived during the Spanish conquest and had converted to Christianity) were placed, by her father, in a capstone at the House of Taga latte set. Upon hearing this, de la Corte visited the site and found fragments of a human jaw and two finger bones in a cavity in a capstone there, but reported no rice flour.

Throughout the Spanish colonial period, ending in 1898, and during the first American occupation (1898–1941), rice was a minor commercial crop in Guam (Carano and Sanchez 1964). Water buffalo and laborers from the Philippines and Japan worked in rice paddies on the southwest coast at Piti and Agat. During the Japanese occupation of Guam (1941–1944), the areas under rice cultivation were expanded and rice was in great demand by the soldiers and civilians as food became scarce toward the end of the war (Carano and Sanchez 1964).

Just before the close of the German administration of the Marianas north of Guam (1898–1914), two traditional rice-growing areas and the folklore explaining their origins during prehistoric times were documented by Corbinian (Mueller 1913). In one of these stories a chief forced his people to make rice gardens in a very inhospitable limestone area at the northern end of Rota. In fact, from what we understand of Marianas growing conditions, this place was the least optimal of any that could have been imagined. The area was said to have been leveled by hand, and soil had to be brought in from elsewhere to provide a growing medium. In one version of the story, people were so angry at this chief for making them work on this arduous project that they threw him into the sea, giving the place the name, Matmos ("drowned"). In another version, the chief himself despaired of winning the competition with another chief who had built a better rice-growing area on the other side of the island so he jumped into the sea and drowned himself.

In 1937, Yawata (1963) visited one of these areas, Talacaia (Talakhaya), on the east side of Rota, where he observed terraced fields on gentle slopes fed by a large natural spring. Some of the fields were under cultivation by the Rotanese. Yawata collected samples of the rice and reports them as "*boeloe* varieties of Java stock," which he notes are found throughout Java, Bali, south-central Celebes, the Philippines, and Taiwan. Yawata (1963) points to similar distributions of *boeloe* varieties of rice and of the peoples of "Proto-Malayan stock," suggesting links between the ancient Mariana Islanders and the "Paleo-Indonesians." Rice is no longer produced commercially in the Marianas, but until recently it was sometimes grown for family use. The neo-Chamorros purchase large quantities of imported rice, regard specially prepared rice dishes as essential at religious and secular feasts, and most households consume steamed rice every day.

LINGUISTIC EVIDENCE

Although contemporary Chamorro contains many words of Spanish origin, this Oceanic language includes many Austronesian-linked terms that pertain to rice, such as *fa'i* (rice when growing), *fama ayan* (rice field), *timulo* (pile of rice stalks after harvesting, for drying crop before threshing), *chaguan agaga* (jungle rice), *tinitu* (dehusked rice), *potu* (rice cake), *bibenka* (rice pudding), *pugas* (uncooked rice), *hineksa* (cooked, boiled rice), *alaguan* (rice soup, drink), *suman* (sweet rice tamale) (Topping et al. 1975). If rice had been adopted only after Spanish contact and subsequent colonization with the import of rice along with water buffalo and Filipino labor, the Chamorro terms for rice and its associated activities should reflect the dialects of these immigrants and/or Spanish terminology. The only clearly Spanish-derived word pertaining to rice is the varietal name, *balencia.* Detailed linguistic studies that would test this hypothesis have not been conducted, but the available information appears not to support the idea of initial Spanish importation (Wylie n.d.).

It is possible that these terms came into the Chamorro language via the Filipinos, some of whom intermarried with islanders. More research needs to be conducted to determine whether replacement by Filipino terms has occurred within the rice-related vocabulary of Chamorro. Wylie's study shows that some Proto-Austronesian forms such as *lusong* assume a broader semantic scope in Chamorro (proto-form, 'rice mortar'; Chamorro, 'mortar'). Some lexical restructuring toward a more narrow semantic scope was also evident. For example, in twelve Austronesian languages the cognate term used in a general way for rice plant has become restricted in Chamorro to mean uncooked rice. Limited relexification and later borrowing were also indicated. According to Wylie, "[t]hough the possibility both of coincidence and of borrowing cannot be entirely eliminated, there is a fair amount of support for claiming that at least across sets of cognates, reflexes are consistent with the notion of a common protolanguage as evidenced by the regularity of sound change.... The evidence of lexical reconstruction, especially the collapsing and broadening of meaning, would indicate that for an extended period in prehistoric Chamorro society, terms related to rice cultivation were important and thus were routinely used. Whether rice cultivation stopped abruptly or gradually is unknown, but even having lapsed, the patois of rice culture was by this time imbued in the language" (Wylie n.d.: 6–7).

TIMING AND ORIGINS

The earliest known sites in the Marianas are Tarague, Guam (Kurashina and Clayshulte 1983; Moore 1983); Huchanao, Guam (Haun et al. [in prep.]); Chalan

Piao, Saipan (Moore et al. 1992; Spoehr 1957); Achugao, Saipan (Butler 1994); and Unai Chulu, Tinian (Craib in press). These sites represent the early Pre-Latte Phase and date from about 3500 B.P. Their locations indicate a preference for coastal settings among the earliest Marianas islanders. Despite numerous archaeological surveys and excavations over the last thirty years, no inland sites have been found to date earlier than 1660 $\pm$ 60 B.P. (Table 1) (Moore and Hunter-Anderson 1994*a*).[3] Pre-Latte artifacts include sherds from vessels of red-slipped pottery—a small percentage decorated with incised or impressed geometric designs; *Conus* shell ornaments—beads, pendants, bracelets, and shell-working implements such as sea-urchin-spine drills and coral files; marine shell fishhooks and adzes, stone pounders and scrapers, and rare flakes, cores, and debitage of basalt and chert. Basalt and sandstone adzes are absent. Characteristic items, such as the *Conus* beads and red-slipped pottery, gradually disappear from the archaeological record about 2500 B.P. (Butler 1994; Moore et al. 1992).

Similarities have been noted between the Pre-Latte pottery of the Marianas and the Melanesian pottery called Lapita, whose beginning dates to about the same time (for example, Bellwood 1979, 1985). The manufacturing techniques and decorative motifs suggest an origin for Pre-Latte ceramics in Indonesia or the Philippines. However, the sites with supposedly ancestral pottery have been dated to a few hundred years later than the early Pre-Latte ceramics, as Butler (1994: 34) reminds us.

Although rice was being grown in Southeast Asia at the time (Bellwood et al. 1992),[4] it may not have been among the cultigens brought into (or retained by immigrants to) the tropical western Pacific during the early settlement period, and no evidence for rice has been found in Pre-Latte or Lapita sites. At a number of Lapita occupation sites, anaerobic sediments have preserved the remains of several Old World tropical tree and root crops, so preservation is not a factor contributing to rice's absence (Gosden et al. 1989; Hather 1992; Hayes 1992; Kirch 1989). The Lapita and Pre-Latte migrations into the south and north tropical Pacific, respectively, took place during the mid-Holocene Climatic Optimum, a period of global warming that peaked ca. 5000–3000 B.P. and after which modern climates were established globally, including the El Niño/Southern Oscillation phenomenon (Lamb 1977; McGlone et al. 1992; Roberts 1989). That eastward migrations into the Pacific occurred both south and north of the equator toward the end of this period suggests climatic conditions may have fostered them, perhaps creating high population-growth rates in donor areas, and eventually a strong impetus for out-migration.[5]

The Marianas archaeological record reflects a significant human population increase from A.D. 1000, when the number and kind of sites rose dramatically (Hunter-Anderson and Butler 1991). The mid-Latte Phase (A.D. 1200–1400) is marked by very high site densities. In Guam, the largest and best-studied island in the archipelago, mid-Latte Phase sites are found in a wide variety of coastal and interior habitats (Reinman 1977). Characteristic artifacts include ceramic sherds from large storage vessels, chipped stone scrapers, cores and debitage, ground basalt tools (adzes and pounders), coral and shell adzes, basalt, sandstone, coral and clay slingstones, composite fish hooks and gorges of *Tridacna* and *Isognomon*, and spear/harpoon points made from human bone. Ornaments include *Spondylus* beads and *Tridacna* pendants. The bones of pelagic fish are common at coastal sites, and the shellfish in the middens indicate that over the centuries since the early Pre-Latte, some inshore habitats have shifted from soft and silty to hard, shallow sand substrates (Paulay 1992). Inland sites (e.g., Beardsley 1992; Hunter-Anderson, 1994*b*) include ceramic and lithic scatters and chert quarry-workshops in the open savannas and more substantial occupations on forested ridge tops. Other site locations include rock shelters, river terraces, and slopes near wetlands.

Many Latte Phase sites have large basalt and limestone mortars associated with stone pillar and capstone features, called "latte stones." The latte stones, for which the period is named, are thought to have supported dwellings (Craib 1986; Plaza 1973; Thompson 1940) but may also have signified lineage land-rights claims (Hunter-Anderson 1989, 1992; Moore and Hunter-Anderson 1994*b*) or ranked corporate groups (Graves 1986). The mortars, which first appear at archaeological sites during the Latte Phase, closely resemble the large stone mortars used by the Indonesian Batak to husk rice using long wooden poles (Sherman 1990). In fact, stone (and wood) mortars are parts of a rice-processing technology employed widely throughout South and Southeast Asia. Stone mortars (*lusong*) and wooden pounders were used by the Chamorro during historic times (Thompson 1945). The advent of the large mortars during the Latte Phase suggests the beginning of rice cultivation at this time. A large stone mortar occurred at one of the inland Guam sites (M214) with a rice-impressed pottery sherd found on the surface (Moore and Hunter-Anderson 1994*a*).

The following paragraphs form an explanation-sketch to account for the observations summarized above. It is admittedly only a suggestion based more on theories and hypotheses than facts. Yet it is our conviction that such tentative explanatory efforts are necessary to guide additional fact gathering in a productive way.

THE LACK OF RICE IN THE PRE-LATTE PHASE

The lack of evidence for rice during the Pre-Latte Phase suggests that physical and/or social conditions did not favor rice cultivation at this time. Studies indicating what late Holocene coastal and interior environments in the Marianas were like when people first arrived are just beginning (e.g., Athens and Ward 1993; Butler 1994; Cordy and Allen 1986; Hunter-Anderson 1994*a*; Randall 1992; Ward 1994); they indicate complex, dynamic environmental histories at various locales, but some general observations and inferences can be made. A c. 2 m higher sea stand prevailed during the mid-Holocene, in Guam and Rota until c. 4200 B.P. (Kayanne et al. 1993), and did not reach present levels until c. 1000 years ago, probably largely due to seismic uplift (Easton et al. 1978; Tayama 1952). Higher sea levels in conjunction with mainly steep coastlines would have limited the spatial extent of shoreline settlement and reliance upon strand and valley-bottom farming, which are features of the late prehistoric. Due to steep gradients, terrestrial sediments eroded into the sea rather than onto land, and seaward beach progradation had not yet progressed to produce the wide leeward beaches seen today.

Deep marine embayments in western Guam and Saipan (now the Agana marsh and the Susupe marsh system, respectively), as well as small protected coastal locales at Ypao, Tarague, and Huchanao bays in Guam (Cloud et al. 1956; Haun et al. in prep.; Leidemann 1980; Randall 1987; Tracey et al. 1964) and at Achugao Point and Laulau Bay in Saipan (Butler 1994; Spoehr 1957), evidently supported small encampments. On steep hillsides and terraces near these settlements, taro, yams, bananas, and tree crops such as breadfruit could have been grown and wild foods could have been collected throughout the island, but the cultivation of rice would have required extraordinary effort beyond that which was feasible given what are believed to have been very low population levels. Although the frequency of severe tropical storms and short-phase droughts is not known for this part of the Pacific, the general pattern of a summer monsoon and winter tradewinds was established (McGlone et al. 1993). Paleoclimatic proxy indicators suggest that temperatures were slightly higher and storminess less pronounced than during the previous millennium, conditions that were to last for several centuries and may have been partially responsible for this successful initial human penetration into the northwestern Pacific at this latitude (Bridgman 1983; Finney 1985; Wilson and Hendy 1971).

We suggest that the chief advantage of rice, its storability, was irrelevant when population density was low, and it could not offset the main disadvantage, relatively high labor requirements. Rice production involves coordinated labor for soil preparation, planting, weeding, transplanting, harvesting, drying, winnowing, transporting the crop from the fields, and storing and protecting the harvest against moisture and predators. The Pre-Latte populations were too small to warrant the incorporation of, or to sustain, such a labor-intensive and technologically specialized cultigen. In addition to wild foods such as arrowroot (*Tacca leontopetaloides*), *Pandanus* spp., and cycads (*Cycas circinalis*), the usual Indo-Malaysian tropical cultigens, yam, taro, breadfruit, coconut, and other fruits and nuts were probably sufficient to support a small population. Long-term storable food such as rice was unnecessary, as temporal and spatial fluctuations in the productivity and availability of crop plants and other resources (resulting from occasional typhoon or drought damage) could be overcome by intra-island and inter-island residential shifts within the archipelago.

THE CULTURAL ROLE OF RICE IN THE LATTE PHASE

The distinctive features of the Latte Phase, such as the latte stones, large stone mortars, the variety of groundstone adzes, large storage vessels, and more complex land use and settlement systems, began to appear about A.D. 1000, which generally coincides with the onset of the Little Climatic Optimum (LCO), a period beginning 1000–800 B.P. and lasting until c. 500 B.P. (Lamb 1977; Roberts 1989; Wilson 1981). Like the beginning of the Pre-Latte era, this period also involved favorable conditions for Oceanic voyaging and settlement. The major difference between the two periods from a Marianas cultural-adaptive standpoint was in the physical environment—relative sea level was lower, shorelines had prograded several hundred meters in some cases, large marine embayments had filled in and become marshes, and upland sediments were accumulating in river valleys and along shorelines.

The archaeological changes that point to higher human density in this period may indicate greater carrying capacity due to these physical changes. For example, areas of strand-gardening and hillside agro-forestry could be increased in and near settlements where the coastal lowlands had widened. Seeps and wells tapping the freshwater lens in sandy lowlands could provide water for larger settlements and water-loving crops. The interior savannas would be more productive as the size and reliability of small wetlands increased, as stream gradients were less severe. River terraces built up from mild flooding events would become attractive for farming and nearby ridges would be available for settlement. Although the few wide lagoon systems were reduced or entirely closed off from the sea, lowland flood plains would have provided additional agricultural land. In Guam, the Agana swamp had formed by this time, providing a large wetland whose edges could be planted (Cordy and Allen 1986; Hunter-Anderson et al. 1989). Similarly, in Saipan, the Susupe embayment had become closed off and freshwater marshes characterized the southwestern coast. As the Latte Phase settlement system expanded along these large islands' coasts and into the interior, both cultivated and wild forms could be exploited more economically—for example, wild yams, *Pandanus* fruit, arrowroot, cycads, and other useful products from native forests—and on Guam numerous riparian settings could be planted with betel nut, coconut, breadfruit, bananas, and taro.

Rice could have been grown in such interior wetlands, in naturally moist areas near seeps (as at Talakhaya on Rota), and at the inland edges of lowland marshes if groundwater was not too saline. In the *Miscanthus* savanna people could have used techniques similar to those in the *Imperata* grasslands of northern Sumatra (Sherman 1990). These include planting rice in moist swales and in low mounds of overturned sod. Nonetheless, just because the physical conditions for growing rice may have existed, this does not necessarily account for the adoption of rice cultivation and its incorporation into an already established cultural system. After all, rice is not commonly cultivated in the Marianas now, although there are numerous locales where it could be. Similarly, the "development" literature is full of cases in which adoption of a particular agricultural crop is encouraged by an outside agency yet the local people fail to adopt it or do something completely unexpected with it. Anthropologists explain these cases in terms of the cultural-adaptive system and its articulation with the local environment, including social and demographic factors (Dove 1988).

Higher human population in the Marianas, prompted by the favorable conditions of the LCO and expanded areas for settlement and cultivation, may have come from intrinsic growth together with immigration from Southeast Asia.[6] Following the proposals of Athens (1977) regarding cultural evolutionary constraints on tropical horticulturalists, higher human densities would have led to intergroup competition for territory and hence to the rise of unstable, shifting defensive–offensive alliances as each group sought to maintain or increase its territory rather than intensify further on the same amount of land (see Meggitt 1977 for compelling examples). Under pressure to produce more food, people appear reluctant to intensify agriculturally because such efforts are subject to the law of diminishing returns: for each increment of effort at intensification, a smaller and smaller increment of increased production is gained (Boserup 1965; Ruthenberg 1980). Athens argues that in this selective context sociocultural rather than technological solutions are favored, namely, organizational strategies which enable competing groups to defend or increase their land holdings.

In small tropical islands, and especially in typhoon- and drought-prone ones like the Marianas, another factor militates against agricultural intensification: such efforts can come to naught in a few hours, from a single typhoon. Typhoons bring damaging high winds, flooding, and salt-spray damage. If the typhoon strikes after a drought or at the end of the dry season, the damage is compounded and recovery very slow. El Niño droughts, which now occur every 2–7 years (van der Brug 1986) and appear to have been a regular part of the climate system of the Pacific throughout the late Holocene (McGlone et al. 1992), destroy or severely damage crops no matter how densely planted, well weeded, terraced, shaded, and so on they may be. Under these conditions the "intensification ceiling" probably was reached rather quickly in the Marianas. It would be more energy-efficient to exert minimal effort in agriculture and instead try to increase land holdings. Land holdings of a given group can be increased by incorporating additional members and their lands, and by subtle encroachments as well as overt appropriations of land. As incorporation is not always possible and encroachments and takings will be resisted, these pressures give rise to the endemic feuding and shifting defensive–offensive alliance systems that have been described throughout Oceania.

Under conditions of constant competition for land, territorial groups must have allies to assist them in land taking and land defense, and it is in this context that being a member of a strong alliance becomes essential and of continuing concern. Because the real strength of an alliance is constantly changing with small shifts in demography and other factors, alliances are not stable. Shifting alliance systems are marked by frequent exchanges of valuables, including rare items and prestige foods, which are tokens of "alliance-worthiness." As they have been produced by considerable labor and demonstrate a group's ability to obtain rare materials and convert them into desirable objects, such valuables represent numerical and organizational strength—the qualities desirable in an ally. Exchanges occur within and between social groups, ranging from small gifts among families, lineages, and clans commemorating the birth of a child or other interkin group event, to payments for minor offenses within a village, to major village or district presentations at feasts that involve hundreds of people and several months—even years—of planning to amass large quantities of prestigious foodstuffs and other wealth.

Although no archaeological data directly support this, we suggest that rice growing was incorporated into Latte Phase agriculture as a prestige food useful in social-ceremonial contexts and that these uses continued at least until European contact, at which point there are reliable accounts of rice being grown and exchanged among the islanders and with Europeans for iron and other imports. The high value placed on rice in the aboriginal social system would have resulted from the relative difficulty in growing, harvesting, and processing the crop for storage and consumption.[7] In this context, rice's strengths—its storability and fungibilty—now became relevant. From family or lineage stores this easily measured and manipulated, high-value item was ever-ready and convenient for small and frequent demands for a valuable to compensate an offended party or to present when marking a lineage ceremonial event. Rice's weak point—requiring more labor than the other tropical cultigens and hence representing more risk as a cultivation option—was no longer a drawback but in fact gave rice its high value. Rice's well-known yield response to increased labor inputs (Grist 1959, cited in Spencer 1963; Hanks 1972) may have enabled relatively large amounts to be accumulated for use in regional exchanges even while the overall subsistence system was not labor intensive.

THE UNIQUENESS OF MARIANAS RICE CULTURE IN THE TROPICAL PACIFIC

The evident lack of rice in other tropical Pacific islands of the "taro-yam agricultural realm" (to which should be added breadfruit in Micronesia, especially in the higher rainfall zone of central and eastern Carolines; see Taylor 1973) and its uniqueness to the Mariana Islands can be explained by geography—latitude and relative isolation from large land masses—and by history. Rice cultivation is thought to have originated in temperate Asia and to have expanded southward, replacing or complementing the earlier taro- and yam-based subsistence strategies as cultivators successfully developed and acclimatized different varieties. Regardless of varieties and growing techniques, rice yields (except the recent "green revolution" hybrid varieties) decrease significantly in areas within 10 degrees of the equator (Grist 1959, cited in Spencer 1963). The Mariana Islands are the only group lying outside this latitudinal constraint in the North Pacific tropics. If cultural connections via long-distance canoe voyages were in fact maintained between the Mariana Islands and Southeast Asia during the Latte Phase (with the Philippines, for example, as they were during early historic times),[8] then rice-planting stock could have been obtained when the need arose.

Growing rice as a prestige food may have been a solution to the need for a consistently available (and when scarce, all the more valuable) commodity for social exchanges at a time when there were few other ways of creating wealth or obtaining exotic goods. Rice was of intrinsic value, as it was not only edible but also represented a significant investment of labor. The relatively great distance from the large land masses to the west and southwest precluded these areas from serving as a regular, reliable source for exotic inputs. Alternative exotics such as pearl shell, golden cowries, and backstrap-loomed textiles from the coral islands of the Carolines to the south are possibilities. However, during the period of interest, the coral islanders may already have begun to participate in the *sawei* exchanges with Yap and thus would have been limited in their ability also to supply reliable quantities of exotic goods to the Marianas (Alkire 1965; Lessa 1950).[9]

As for the nonuse of rice in the southern hemisphere islands of Melanesia and Polynesia, beside the latitudinal constraints, one can note the availability of reliable alternatives, especially pigs (the prestige food of choice in these islands and source of worked tusks that were exchanged as valuables).[10] In these areas, inter-island exchanges involved people living on large land masses such as New Guinea, capable of supporting many pigs as well as people. Although small islands participated, the larger islands supplied many exotics for the system, for example, in the *kula* of the Trobrianders and the *lakatoi* expeditions of the Motu (Malinowski 1961; Seligmann 1910). Exotic valuables could move among the smaller, closely spaced islands via canoes. Although the prehistoric Marianas exchange systems are virtually unknown, they appear to have been confined to the islands of the archipelago without significant external inputs.

CONCLUDING REMARKS

We have reviewed the present evidence for prehistoric rice cultivation in the Marianas and have offered a tentative explanation for this apparently anomalous agricultural practice in Remote Oceania. While highly speculative and built upon scarce direct archaeological evidence, our model has testable implications in a variety of domains. Most devastating for the proposal that rice was used principally for ceremonial exchanges in the context of density-dependent competition for land would be geographically widespread evidence for rice cultivation during the Pre-Latte era, when it is generally supposed that population density was low. Such evidence could come from rice inclusions in locally made Pre-Latte ceramics; from rice-starch residues on Pre-Latte ceramic vessels; from Pre-Latte era archaeobotanical remains of rice (grains, husks, stems, and their phytoliths); from palaeobotanical remains such as have been found in the freshwater marsh sediment core at Agat, Guam; or from other sources. Practical difficulties in conducting such tests include the facts that few Pre-Latte sites are known, that these sites tend to be buried under later Holocene coastal sands and are not easily studied, that Pre-Latte remains are not always in primary depositional context but have been redeposited by wave action, meaning that the preservation of delicate or organic materials is poor. Nonetheless, increased archaeological attention to sites from the early end of the Marianas prehistoric sequence, bearing such questions in mind, is essential if progress is to be made in understanding adaptive processes in the small islands of the tropical Pacific.

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NOTES

1. Until recently, it was accepted that the Marianas were the easternmost rice-growing area in the Pacific, but doubts were raised by Craib and Farrell (1981; compare Pollock 1983). They noted that the earliest record of European contact, Pigafetta's narrative of Magellan's 1521 landing at Guam, did not in fact include rice in the list of foodstuffs provided the Europeans by the islanders, and that centuries later rice was erroneously added to the list of foods in widely cited secondary accounts of Magellan in the Marianas—for example, Burney (1803).
2. Moore (1983) and Graves (1986) have shown that the transition from the Pre-Latte to the Latte Phase was gradual and that not all distinguishing traits of the Latte Phase arose at the same time. The Latte Phase derives its name from the unique groupings of large stones (latte sets) found in coastal and inland areas, in small clusters and singly or in pairs. A latte set consists of stone posts or shafts set upright into the ground and mounted by a capstone. Opposing pairs of shafts in two parallel rows form a rectangular space. The number of paired shafts in a set can vary from three to seven; most common are sets with four, five, or six pairs (see Thompson 1932 for illustrations). From the domestic debris often found with latte sets they have been interpreted as house posts that supported wooden houses. Human interments, hearths, and pits are commonly associated with latte sets at coastal sites (for a discussion of latte sets at inland sites, see Moore and Hunter-Anderson 1994*b*).
3. The archaeological record of Guam's interior is best known of all the large Mariana Islands (see Butler 1992 for nearly 100 percent coverage of the small island of Aguiguan), and more surveys to document early occupations of inland areas in the rest of the archipelago are badly needed.
4. See Snow et al. (1986) for a discussion of the earliest archaeological evidence for rice cultivation in the Philippines, c. 3400 years B.P.

5. Bridgman (1983), Finney (1985), and Irwin (1992) have all proposed that more frequent westerlies and a lack of storminess during the period of Lapita migrations facilitated relatively safe exploratory sailing eastward, but none linked the relative climatic stability of the Climatic Optimum with adaptational success in the sense of higher growth rates once the immigrants reached the islands, nor as a factor impelling the migrations from overpopulated donor areas. The older idea of the migrations being caused by "population pressure," though not completely abandoned (for example, see Spriggs and Anderson 1993), seems to have been supplanted by a kind of "environmental possibilism" (see especially Irwin 1992) based upon the results of modern simulations. Embedded in such studies is the notion that cultural evolution proceeds along the lines of human infant development: first there is a learning period in which cultural adaptations such as sailing technology improve with practice over time; hence the "voyaging corridor" north, west, and east of New Guinea is characterized as a "broad nursery" where navigation skills were honed for generations, ultimately to be used for the exploratory trips into Remote Oceania (Irwin 1992 : 32–33). Granted, once the child learns to walk, he can run. But the inappropriatness of the analogy for explaining why culture evolves or changes is clear; it implies that a cultural system is first less capable and later becomes more capable, and ignores the effects of the continuous operation of natural selection and other evolutionary forces.
6. It may be no coincidence that the greatest cultural elaboration and differentiation within Micronesia occurred during this period or that the farthest Polynesian settlement was achieved. Population influx from Polynesia into Micronesia seems to have been limited to the eastern part of the region, judging from linguistic and social patterns (Alkire 1977; Hunter-Anderson (ed.) 1990; Irwin 1992; Kirch 1984).
7. According to de la Corte (1970), growing wet rice in the mid-nineteenth century on Guam was difficult due to uncertain rainfall, strong winds during seeding, and competition from better adapted grasses. His experiments with dryland rice brought from the Philippines produced healthy plants, but the flowers and hence the crop were destroyed by "a plague of insects" that fed upon the rice plants flowering at the edges of marshes.
8. There are several accounts of drift voyages from the Marianas to the Philippines in the sixteenth century; for examples see Lévesque (1992).
9. The beginning of the *sawei* system is unknown, but a hint is contained in the fact that the few archaeological occurrences of Yapese pottery, one of the items exchanged in the *sawei*, excavated at three sites at Lamotrek in the central Carolines, have been dated to the interval A.D. 1200–1500 (Fujimura and Alkire 1984).
10. There is no unequivocal archaeological evidence for the prehistoric presence of pigs in the Marianas (Intoh 1986, 1994). Prior to European contact, the only mammals known to have been present are three species of bat (*Pteropus mariannus*, *P. tokudae*, and *Emballonura semicaudata*) (G. Wiles, Guam Aquatic and Wildlife Resources, personal communication 1993), and the Pacific rat (*Rattus exulans*) is believed to have accompanied the first island settlers (Roberts 1991; Storer 1962).

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ABSTRACT

Although historic and linguistic sources indicate that the indigenous Mariana Islanders of Micronesia cultivated rice before initial Western contact in the early 1500s, it is not known when or why rice cultivation was adopted in these islands—the only case in Remote Oceania. Recent excavations in Guam have confirmed the late prehistoric presence of *Oryza sativa* L. in rare pottery sherds, and the nature and timing of all the available evidence—from archaeology, palaeoethnobotany, linguistics, and history—suggest a solution to this puzzle. The adaptive significance of rice, a labor-intensive cultigen in comparison with the common Old World tropical staples of Micronesia (yams, taro, bananas, and breadfruit), may have been as a "valuable" in ceremonial exchanges and events that marked the late prehistoric period. The accumulating evidence for late prehistoric rice cultivation in the Marianas is summarized, and an explanation-sketch is offered for the adoption and use of rice as a high-prestige item. KEYWORDS: rice cultivation, Mariana Islands, high prestige.