The first settlement of Remote Oceania: the Philippines to the Marianas

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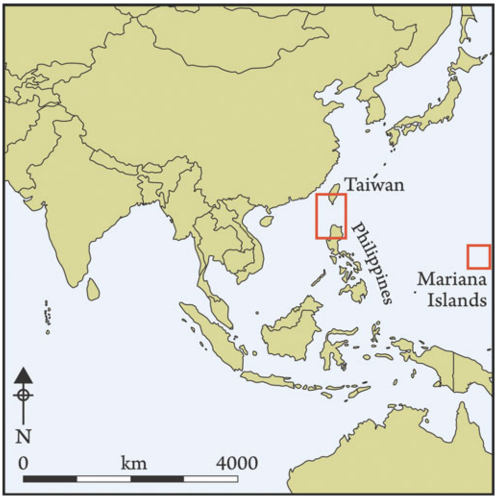
Research



The authors compare pottery assemblages in the Marianas and the Philippines to claim endorsement for a first human expansion into the open Pacific around 1500 BC. The Marianas are separated from the Philippines by 2300km of open sea, so they are proposing an epic pioneering voyage of men and women, with presumably some cultivated plants but apparently no animals. How did they manage this unprecedented journey?

Keywords: Oceania, Marianas, Neolithic Philippines, Austronesian

Supplementary information can be found online at: http://antiquity.ac.uk/projgall/hung329/.

Introduction

The human settlement of the remote islands of Oceania beyond the Solomon Islands has been a topic of enquiry since the eighteenth century. The modern mainstream view relates

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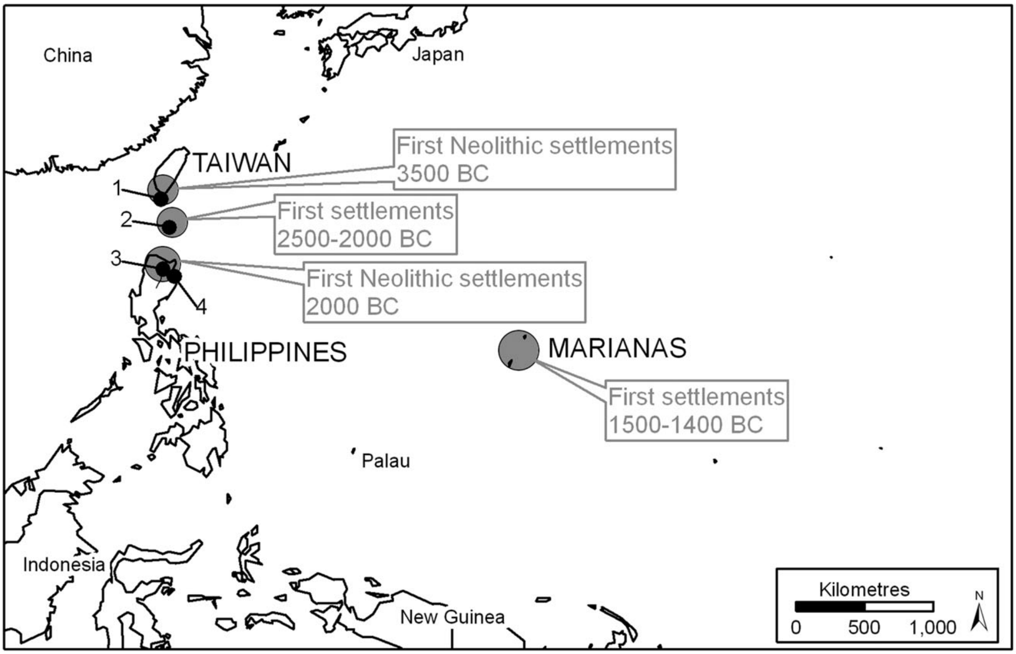

Figure 1. Taiwan, the Philippines and the Marianas: 1) Eluanbi & Kending; 2) Batanes Islands; 3) Nagsabaran (Cagayan Valley); 4) Dimolit (east coast of Luzon).

this settlement to a migration of Austronesian-speaking Neolithic populations from 1350 BC onwards sailing via equatorial latitudes in eastern Indonesia into the western Melanesian islands, and then via the Lapita cultural complex into Polynesia and central/eastern Micronesia (Kirch 2000; Summerhayes 2007). However, another corner of the western Pacific witnessed a remarkable feat of ocean crossing perhaps a century or two before the Lapita spread, and over a much greater open ocean distance than any known Lapita movement.

The Mariana Islands are the northernmost islands of Micronesia, consisting of more than a dozen islands in a north-south arc between 13 and 20° north, situated across open sea about 2300km east of Taiwan and the Philippines (Figure 1). A number of archaeologists have already suggested close cultural relations between the Marianas and the Island Southeast Asian Neolithic (eg. Spoehr 1973; Bellwood 1975: 10, 1978: 282, 1985: 253, 1997: 235–6, 2005: 137; Thiel 1987; Kirch 1995, 2000: 167–73; Shutler 1999) and, since 1975, Bellwood has regarded a Philippine connection as most likely. Sites with comparable pottery, which imply such connections, include the Batungan caves on Masbate, the Cagayan Valley shell middens in northern Luzon, Kalumpang in western Sulawesi and Sanga Sanga rockshelter in the Sulu archipelago.

Recent work in both the Marianas and the Philippines allows us now, for the first time, to report specific parallels between red-slipped and decorated pottery, dating to 1500–1400 BC (Table 1), found in the larger southern islands of Guam, Tinian and Saipan in the Marianas, with comparable pottery assemblages from sites in the northern Philippines.

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Table 1. Summary of radiocarbon dating of earliest site deposits at Ritidian and Unai Bapot, Mariana Islands.

Site and reference	Lab sample	Provenience	Sample material	Measured ^{14}C age (years BP)	δ^{13}C (‰)	Conventional ^{14}C age (years BP)	Marine reservoir correction (ΔR)*	Calibrated 2σ probability**
Ritidian, Guam (Carson 2010)	Beta-239577	Fenceline Pit 35, 0.88–1.05m; later cultural layer	Charcoal	2820±40	−25.4	2810±40	n/a	1109–1104 BC (0.4%); 1076–1065 (1%); 1056–842 (98.6%)
	Beta-253681	Fenceline Pit 35, 2.50–2.60m, earliest cultural layer, intertidal zone	*Anadara antiquata* shell	3030±40	−0.7	3430±40	−44±41	1547–1257 BC
	Beta-253682	Fenceline Pit 35, 2.55–2.60m, earliest cultural layer, intertidal zone	*Halimeda* sp. algal bioclast	2980±40	+5.3	3480±40	−44±41	1609–1323 BC
	Beta-253683	2.60–2.65m, pre-dates cultural layer	*Heliopora* sp. coral limestone	3610±50	+4.4	4100±50	−44±41	2454–2077 BC (99.7%); 2075–2069 BC (0.3%)
Unai Bapot, Saipan (Carson 2008)	Beta-214761	Layer III-A, combustion feature, post-dates earliest cultural layer	Charcoal	2850±40	−25.8	2840±40	n/a	1125–903 BC (100%)

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Table 1. Continued

Site and reference	Lab sample	Provenience	Sample material	Measured ^{14}C age (years BP)	$\delta^{13}C$ (‰)	Conventional ^{14}C age (years BP)	Marine reservoir correction (ΔR)*	Calibrated 2σ probability**
	Beta-202722	Layer IV-A, localised discard pile, earliest cultural layer	*Anadara antiquata* shell	3210±40	−.5	3590±40	−44±41	1732–1439 BC
	Beta-216616	Layer IV-A, localised discard pile, earliest cultural layer	*Anadara antiquata* shell	3320±50	−1.1	3710±50	−44±41	1914–1560 BC

* Marine reservoir correction of −44±41 was calculated for *Anadara antiquata* shells at the Ritidian site in northern Guam (Carson 2010).

** Calibrations are by CALIB software version 6 (Stuiver & Reimer 1993), using INTCAL09 dataset for charcoal specimens and MARINE09 dataset for marine specimens (Reimer *et al*. 2004).

The earliest Marianas sites (Figure 2)

The earliest sites on the Mariana Islands occur in shoreline-oriented settings during a period of slightly higher sea level (about 1.8m) than the present, and are associated with thin-walled, red-slipped pottery termed Marianas Red by Spoehr (1957). After 1000 BC, significantly different pottery types are evident (Moore 1983, 2002), along with a lowering of sea level (Dickinson 2000) and a substantial re-configuration of coastal ecosystems.

The Achugao site on Saipan is by far the most informative for the earliest Marianas pottery, yielding the largest volume of recovered material (Butler 1994, 1995). This large collection of 143 decorated pieces is especially important because of its size, since decorative elements are present on only one per cent or less of the sherds. Other sites are valuable for their precise and confident dating of the earliest settlement period, but have limited pottery collections (e.g. Carson 2010; Clark *et al.* 2010).

As reported by Butler (1994, 1995), the early Achugao ceramics exhibit only two major vessel forms. The dominant form, representing 85 per cent of all rims, is a small to medium-sized vessel, sometimes carinated, with a sharply everted rim and a rounded base. The other 15 per cent are simple hemispherical bowls. Other vessel forms have been reported from other sites but in very low frequencies and with extreme fragmentation (Carson 2008).

The earliest component of Marianas Red is a thin-walled, often red-slipped, calcareous sand-tempered ware. The decorated sherds show complex, predominantly rectilinear, incised patterns, although some are curvilinear, with the zones between the major elements packed with rows of tiny, delicate punctations (tiny punch-marks). Stamped circles border the decorative bands and sometimes occur within them (Figure 3, sherd group 2). Lime-filling is evident in most of the decoration. Similar decorated and red-slipped pottery is shown in Figure 4, recovered by Pellett and Spoehr (1961) from the House of Taga site on Tinian Island and now stored in the Bishop Museum in Honolulu, yet without associated radiocarbon dating.

The most instructive sites for dating the earliest Marianas settlement and its associated pottery are Ritidian on Guam (Carson 2010) and Unai Bapot on Saipan (Carson 2008), as summarised in Table 1. At Ritidian, the earliest occupation, dated to 1547–1323 BC, was associated with very fine red ware pottery, followed later by thicker and coarser pottery dated to 1056–842 BC. At Unai Bapot, the earliest red ware is dated to approximately 1732–1560 BC, followed by a later occupation associated with different pottery types dated to 1125–903 BC. Based on these findings, the earliest Marianas settlement, associated with the earliest Marianas Red pottery, can be confined to a time interval of approximately 1500–1000 BC.

Comparable pottery from the Philippines

The red-slipped, circle- and punctate-stamped pottery from several sites in the Cagayan Valley on Luzon is the most similar reported, so far, to that from the Marianas, although this similarity need not mean that the first settlers migrated specifically from the Cagayan Valley itself, which obviously has an inland location. The radiocarbon sequence from Nagsabaran suggests that red-slipped and stamped pottery dates here between 2000 and 1300 BC,

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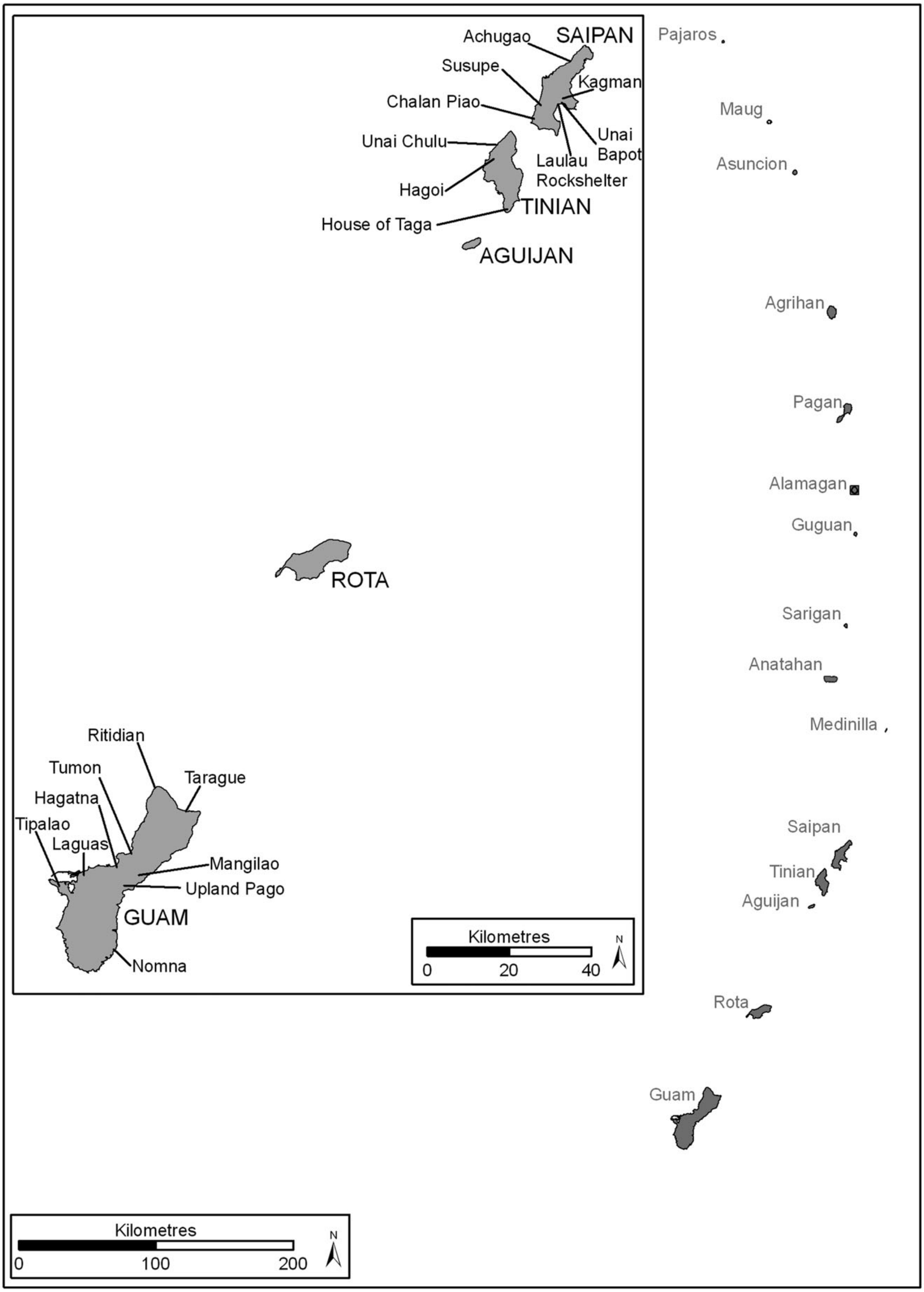

Figure 2. The locations of early settlements in the Marianas, c. *1500–1000 BC.*

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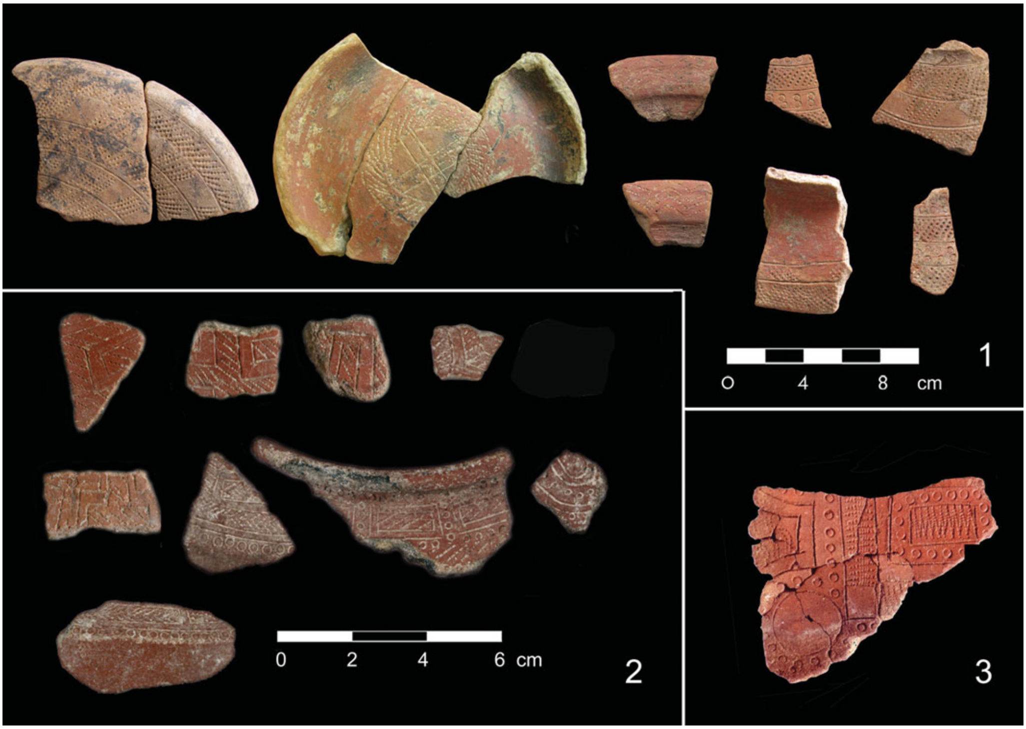

Figure 3. Similar pottery decoration involving punctate/dentate and circle-stamping, in combination with incision, from: 1) Nagsabaran, northern Philippines; 2) Achugao, Saipan, Mariana Islands; 3) Site 13 at Lapita, New Caledonia (2, courtesy of Brian Butler, see Butler 1994; 3, courtesy of Christophe Sand, see Sand 1999: 46).

thus commencing before but overlapping with the earliest Marianas dates (Table 2 and see supplementary information online).

Of the Cagayan Valley sites, Nagsabaran has been the most productive for defining the pottery and other material culture of this period (Hung 2005, 2008; Tsang 2007; Piper *et al.* 2009a). It lies on the south bank of Zabaran Creek, which joins the Cagayan River from the west, about 22km above its mouth on the north coast of Luzon. Excavations at this 4.2ha site between 2000 and 2009 have revealed a lower alluvial silt deposit that contains red-slipped pottery, trapezoidal-sectioned stone adzes (some stepped), baked clay penannular earrings and two Taiwan jade bracelet fragments. The late Neolithic and Iron Age layers above the silts are contained within a large riverine shell midden. The radiocarbon dates for the lower alluvial layer at Nagsabaran are rather mixed, since much of the alluvium was clearly re-deposited from elsewhere in the site or its vicinity, and the layer was disturbed by the digging of some very large postholes from the base of the covering shell midden. However, in Table 2 it can be seen that the dates in trenches P1 and P7 maintain a reasonable degree of stratigraphic order. The dating results support an overall range for the Cagayan red-slipped, stamped and incised pottery between 2000 and 1000 BC.

Basically, the early period Marianas pottery resembles a sub-set of the more diverse Nagsabaran pottery. Decoration is also quite rare in Nagsabaran, on about one per cent of sherds or less, and consists of punctate, circle-stamped and incised motifs, often with

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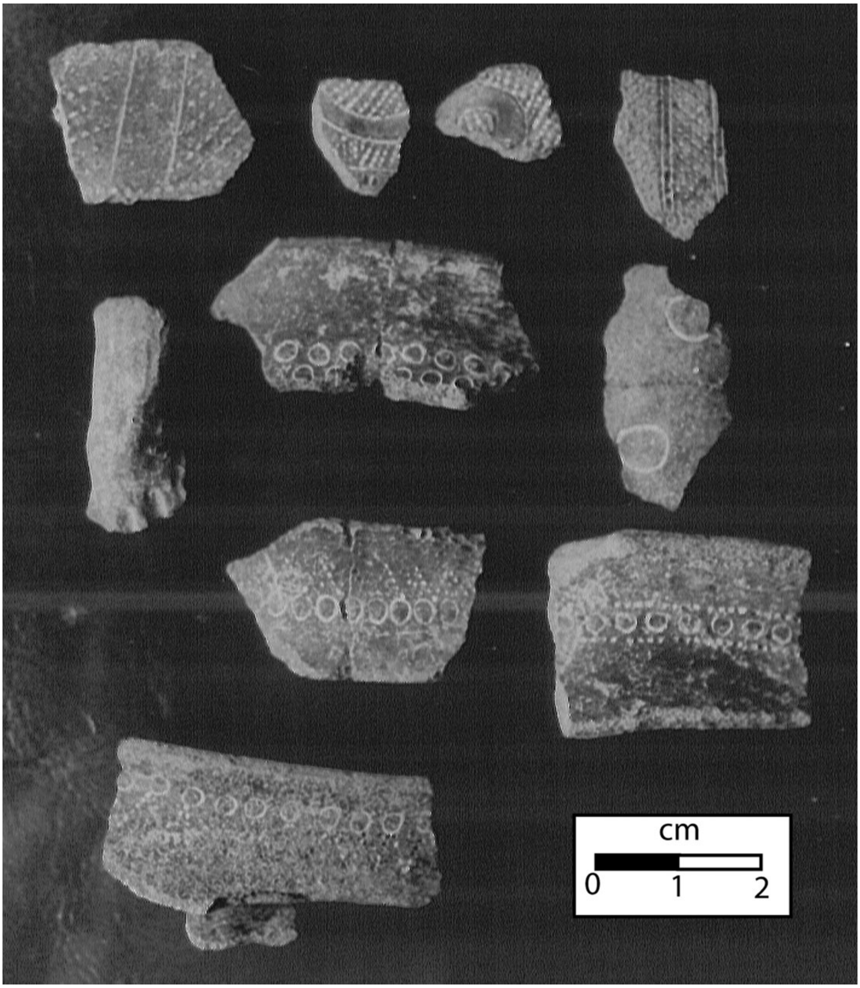

Figure 4. Decorated pottery from the earliest layer at the House of Taga site in Tinian, excavated by Pellett and Spoehr 1961 (photograph courtesy of the Micronesian Area Research Center, University of Guam).

lime-infill. The Nagsabaran motifs, in which one or more rows of stamped circles lie parallel to incised bands filled with comb-like punctate or dentate stamping (Figure 3, group 1), are all extremely similar to those of the earliest Marianas Red, as well as to the zonal decoration on some Lapita pottery from the Santa Cruz Islands (Figure 5, and see Spriggs 1990: 86) and New Caledonia (Figure 3, group 3). The Nagsabaran pottery includes a greater variety of vessel forms than occur in the Marianas: for instance, a vertical-walled bowl with a ring foot, and the large sherds found at this site indicate that decoration sometimes covered most of the exterior of the vessel.

Similar decorated red-slipped pottery occurs in other Cagayan Valley sites of the second millennium BC, such as Magapit (Hung 2005, 2008). Circle-stamped pottery was also very common between about 1300 BC and AD 1 in the Batanes Islands, between Luzon and Taiwan, although punctate-stamping and the use of incision to define decorative zones do

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Table 2. ^{14}C dates from Nagsabaran, Cagayan Valley, northern Philippines. The upper shell midden is represented by dates from Pit 1 (P1) excavated in 2000, and Pit 14 (P 14), excavated in 2009. All dates from all pits that relate to the alluvial silt layers below the shell midden are listed in this table. See supplementary information online for discussion. The Gakashuin and National Taiwan University dates listed in this table are from Tsang 2007: 94 and we do not have measured δ^{13}C values.

Sample #	Dated material	Pit number and depth below ground surface	δ^{13}C	Conventional age (years BP)	Calibration) (IntCal 09)
GX-26797	Charcoal	P1, 0.8m, shell midden		1470±50	AD 436–659
GX-26798	Charcoal	P1, 1.1m, shell midden		1670±60	AD 244–535
GX-26705	Charcoal	P1, 1.2m, shell midden		2120±220	735 BC–AD 335
GX-26698	Charcoal	P1, 1.4m, shell midden		1830±70	AD 50-381
GX-26806	Charcoal	P4, 1.5m, shell midden		2150±150	731 BC–AD 175
GX-26699	Charcoal	P1, 1.8m, shell midden		1920±80	111 BC–AD 320
GX-26800	Charcoal	P1, 1.8m, shell midden		1760±110	AD 50–538
GX-26799	Charcoal	P1, 1.5m, shell midden		1960±90	194 BC–AD 245
GX-26801	Charcoal	P1, 2.3m, shell midden		2260±270	933 BC–AD 336
GX-26802	Charcoal	P1, 2.4m, shell midden		2240±270	918 BC–AD 346
GX-26702-AMS	Charcoal	P1, 2.5m, shell midden		1820±40	AD 85–322
ANU-13020	*Batissa childreni*	P14, 0.8m, shell midden	−12.5	2620±30	831–771 BC
ANU-13019	*Batissa childreni*	P14, 1.2m, shell midden	−8.9	2560±30	805–553 BC
ANU-13018	*Batissa childreni*	P14, 1.4m, shell middem	−26.4	7380±40	6380–6099 BC
ANU-13017	*Batissa childreni*	P14, 1.8m, shell midden	−10.4	3420±30	1873–1632 BC
ANU-13024	*Batissa childreni*	P14, 2.1m, shell midden	−12.6	2680±30	897–801 BC
NTU-3799	*Batissa childreni**	P1, 3.1m, lower silts		3450±40	1886–1666 BC
GX-26704- AMS	Charcoal	P2, 1.4m, lower silts		2620±40	895–669 BC
GX-26705	Charcoal	P2, 1.5m, lower silts		6610±290	6065–4900 BC
GX-26711-AMS	Charcoal	P4, 2.1m, lower silts		2520±50	799–417 BC
NTU-3798	Charcoal	P7, 1.6m, lower silts		2670±40	902–794 BC
GX-28379	Charcoal	P7, 1.6m, lower silts		3050±70	1454–1112 BC
GX-28381	Charcoal	P7, 1.9m, lower silts		3390±130	2023–1417 BC
WK-23397	Pig premolar**	P9, 1.4m, lower silts		3940±40	2567–2299 BC

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Table 2. Continued

Sample #	Dated material	Pit number and depth below ground surface	δ13C	Conventional age (years BP)	Calibration) (IntCal 09)
WK-19713	Charcoal	P9, 1.5m, lower silts	−23.7	4450±39	3337–2933 BC
WK-19712	Animal bone	P9, 1.5m, lower silts	−22.7	2504±35	791–510 BC
WK-18059	Charcoal	P9, 1.6m, lower silts	−27.8	1946±30	21 BC–AD 127
WK-17756	Charcoal	P9, 1.8m, lower silts	−25.6	2528±31	795–541 BC
ANU-13016	Charcoal	P11, 1.7m, lower silts	−26.5	3510±30	1915–1749 BC
ANU-13014	Charcoal	P14, 2.4m lower silts	−27.4	2660±30	895–793 BC
ANU-13013	Charcoal	P14, 2.4m, lower silts	−31.6	2540±30	797–546 BC
ANU-13021	*Batissa childreni*	Modern shell, Cagayan River	−12.7	98.47% modern	
ANU-13023	*Batissa childreni*	Modern shell, Zabaran Creek	−15.1	103.14% modern	
ANU-15410	*Batissa childreni*	Modern shell, Zabaran Creek	−13	104.83% modern	
ANU-15411	*Batissa childreni*	Modern shell, Zabaran Creek	−17	105.03% modern	
ANU-15412	*Batissa childreni*	Modern shell, Zabaran Creek	−14	103.02% modern	

* Sample originally published as charcoal.

** Piper *et al.* 2009a.

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Figure 5. A Lapita sherd from Nenumbo, Gawa, Santa Cruz Islands (Melanesia), showing both the combination of circle- and dentate-stamped zones, and also the cross-in-circle motif that occurs on one of the Nagsabaran sherds shown in Figure 4 (from Bellwood 1978: fig. 9.12, courtesy of the late Roger Green).

not occur here (Bellwood & Dizon 2005). In Taiwan, fairly rare impressed pottery occurs by about 1500 BC, including circle-stamping in the late Neolithic site of Yingpu in central Taiwan (Tsang 2000: 70) and punctate-stamping in the Yuanshan assemblage at Dabenkeng near Taipei (Chang 1969: pls. 82D & 84D). Taiwan, however, has no Neolithic pottery with both circle- and punctate-stamping, even though it does have the oldest red-slipped pottery in Island Southeast Asia, this being present in small quantities with incised and cord-marked pottery in the oldest Neolithic sites (*c.* 3000 BC), becoming dominant after 2200 BC in eastern and southern Taiwan (Hung 2005, 2008). Elsewhere in the Philippines, the geographic range of the circle- and punctate-stamping represented in the Cagayan Valley extended at least as far south as Masbate Island in the central Philippines, where similar punctate-stamped pottery was reported by Solheim (1968).

Elsewhere in Island Southeast Asia, very small amounts of punctuate-stamped pottery occur in parts of East Malaysia (Sabah) and eastern Indonesia, again in association with red-slipped surfaces (Chia 2003; Chazine & Ferrie 2008; Peter Lape, Daud Tanudirjo, Truman Simanjuntak and Anggraeni, *pers. comms*). But the available illustrated motifs are very small and difficult to relate precisely to any on Luzon or the Marianas. Because of the importance

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of this pottery style in the Cagayan Valley, it is possible that substantial innovation in pottery decoration might have taken place on Luzon itself.

From a purely geographical perspective, the north-east coast of Luzon rather than the inland Cagayan Valley might have been the most likely source for Marianas settlement, but so far the single known Neolithic site here is Dimolit (Peterson 1974a & b), on Palanan Bay. This site contains plain red-slipped pottery similar to that reported from the Cagayan Valley sites, but without any impressed decoration. The closest parallels for the earliest decorated Marianas Red pottery so far are thus in the Cagayan Valley.

Coastal and maritime economies

All of the known early Marianas sites, dated to 1500–1000 BC, may be described as *shoreline-oriented*, founded on sand spits, narrow beach fringes, in seaside rockshelters or in other marginal settings at or very near sea level. This distinction sets these sites apart from a generic coastal setting expected of almost any island society. Most definitively, the Ritidian site in northern Guam provided evidence of earliest occupation dated to 1547–1323 BC within a shallow inter-tidal lagoon setting directly overlaying coral reef dated to 2454–2077 BC (Table 1). Taking into account a sea level high-stand, between 3400 and 1050 BC, of about 1.8m higher than present (Dickinson 2000), early period Marianas site settings must have been substantially different from the modern broad sandy beaches (Carson 2011).

A close relationship with the sea is unquestionable from this perspective, and early period Marianas sites often contain abundant marine shell midden, mostly of *Anadara antiquata* shells. Vertebrate faunal materials are extremely few in number, perhaps due to discard patterns, depositional contexts or preservation qualities. The limited vertebrate fauna includes fish and bird bones, and possibly native fruit bat, at the earliest sites. The earliest rat bones appear around AD 900–1000 (Wickler 2004; Pregill & Steadman 2009). Pig, dog, deer and cattle were introduced to the Marianas only after Spanish contact.

The limited scope of faunal remains in the Marianas is rather curious, given the existence of pig, dog, chicken and rat in variable abundance at most other sites in the larger Asia-Pacific region. For example, at Nagsabaran, imported domesticated pig appears as early as 2000 BC (Piper *et al.* 2009a & b), and dog bones date at least to 500 BC. Both pig and dog were present by 2800 BC in Taiwan (Tsang *et al.* 2006). Rat bones usually coincide with the earliest human settlements in oceanic islands, so their apparently late arrival in the Marianas is deserving of explanation, perhaps related to the remote location and the difficulties of transporting live animals over such a vast distance, given the likelihood of crew hunger — even starvation — while afloat.

A marine-oriented subsistence pattern may therefore be expected for the early seafaring Malayo-Polynesians who crossed 2300km of ocean in order to settle the Marianas. Terms for sails and outriggers were among the shared vocabulary of Proto-Malayo-Polynesian communities (Pawley & Pawley 1994), suggesting skilled open sea navigation and possibly the ability to capture large and powerful marine prey. Judith Amesbury (2008a) reviews all the recorded data on bones of large pelagic fish species, such as marlin (Istiophoridae) and dolphinfish (*Coryphaena hippurus* — Coryphaenidae), from Marianas archaeological sites, evident as early as 500 BC. Unfortunately, only a miniscule fish bone sample has been

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recovered from the initial settlement period (Leach & Davidson 2006; Amesbury 2008b), and most of the occurrences of marlin and dolphinfish lack precise commencement dates. So it is still unclear to what extent prehistoric Marianas fishermen caught these species between 1500 and 1000 BC.

The Eluanbi site in southern Taiwan, *c.* 2000 BC, has provided good evidence of a contemporary specialised offshore fishing technology (Li 2002a), and a recent analysis (Campos & Piper 2009) throws surprising light on Neolithic seagoing capabilities in this region. In total, Pit 4 in Eluanbi II produced 3581 fragments of bone, of which 2573 were marine fish (71.85 per cent), 516 mammal (14.41 per cent), 303 marine turtle (8.46 per cent), and the rest unidentified. As in the Marianas sites, the fish bones suggest the dominance of specialised offshore fishing for very large groupers (Serranidae), dolphinfish, and other large pelagic carnivores such as marlin or sailfish. Dolphinfish bones, but so far not marlin, also occur in two separate occupation layers at Savidug in the Batanes Islands, dated to 1200 BC–AD 1, and then after AD 1000 (Campos 2009).

Fishing gear is rare in Marianas archaeological sites in the earliest period, 1500–1000 BC, but the few known pieces include fragments of simple one-piece rotating hooks made of *Isognomon* or rarely *Turbo* shell. Later contexts, mostly post-dating AD 1000, include the same simple rotating hooks plus a range of V-shaped or L-shaped gorges, and compound two-piece hooks and trolling lures (Thompson 1932; Spoehr 1957; Reinman 1970; Ray 1981). At one site in Guam, several bone and shell points of trolling hooks were found in layers post-dating AD 900–1000, but one possible nacreous shell lure shank was in a layer pre-dating 500 BC (Dilli *et al.* 1998: 215). Simple shell one-piece rotating hooks and possible trolling lures with rod-shaped and end-grooved stone shanks and bone points also occur at Kending (Li 2002b: 69) and Eluanbi II in southern Taiwan, *c.* 2000 BC (Li 1983), together with gorges and net-sinkers (Li 1997, 2002a, 2002b: 58, 63; Tsang *et al.* 2006). The trolling hook points found in both the Marianas and southern Taiwan are similar in shape, even though the dates for the Marianas specimens are currently younger.

Archaeological fishing gear from the Cagayan Valley sites is limited in quantity, but two fish gorges, straight rather than L-shaped, have been found in the upper shell midden (*c.* 500 BC) at Nagsabaran, made respectively of a pig lower canine and a dog upper canine (Piper *et al.* 2009b). Both were split longitudinally and provided with a notch to secure the line. A similar specimen dating to *c.* 500 BC made from a pig canine was recovered from Anaro in the Batanes Islands.

In summary, it is clear that offshore trolling for large pelagic fish was carried out by at least 2000 BC in southern Taiwan, by 1200 BC in the Batanes Islands and perhaps by 500 BC in the Marianas. We are not yet entitled to assume that this technology was carried by the first settlers of the Marianas but, given the restricted occurrence in the western Pacific of this type of fishing for large pelagic prey, and the associated equipment, even a secondary introduction from the Taiwan-Luzon region to the Marianas would still be highly significant.

Linguistic and genetic associations

The indigenous Chamorro language of the Marianas belongs to the widespread Western Malayo-Polynesian (WMP) grouping, which currently lacks any overall subgrouping

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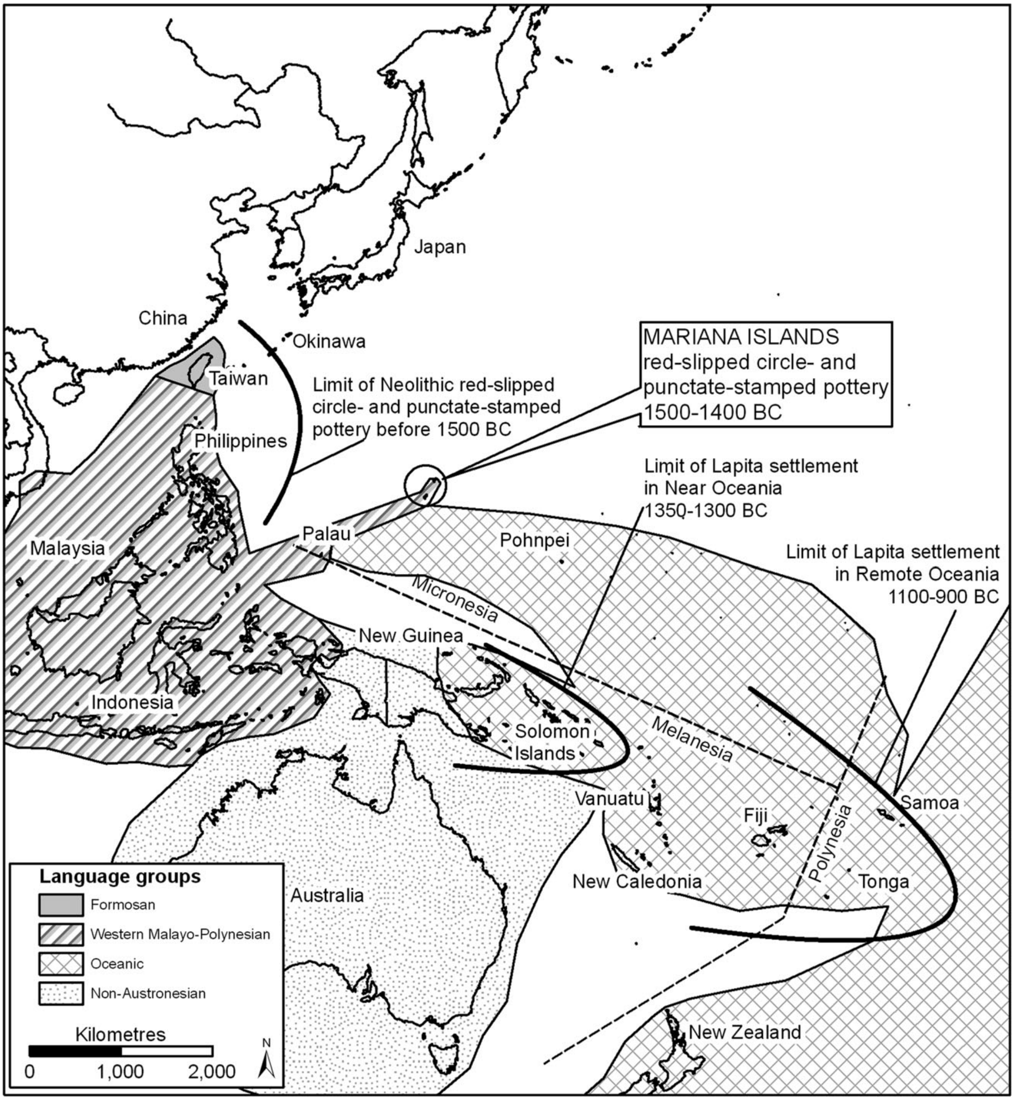

Figure 6. The major Austronesian linguistic subgroups and the early distributions of red-slipped and stamped pottery in the Taiwan/Philippine region and the Marianas. Also shown is the spread of Lapita pottery in Island Melanesia and western Polynesia, so far without any definite antecedent in Island Southeast Asia, south of the Philippines.

structure, within the larger Austronesian language family (Blust 2009) (Figure 6). WMP languages are spoken in the Mariana and Palau Islands in western Micronesia, the Philippines, Malaysia, much of Indonesia, coastal southern Vietnam, and as far west as Madagascar. Their origins, together with those of all other extra-Formosan Austronesian languages, can be sourced to a linguistic reconstruction, termed Proto-Malayo-Polynesian, that underwent its initial period of differentiation somewhere in northern Island Southeast Asia. The Formosan languages of Taiwan are not Malayo-Polynesian, and trace back to deeper separations in the overall Austronesian family tree. The major Malayo-Polynesian language subgroup known as Oceanic, associated at its proto-language stage with Lapita settlement in

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the Bismarck Archipelago, was also a fairly early separation from Proto-Malayo-Polynesian (Ross *et al.* 1998; Pawley 2002).

The WMP classification for Chamorro reflects a linguistic origin separate in geographical terms from that of the Lapita-associated Oceanic grouping, and Chamorro and Proto-Oceanic share no unique subgrouping innovations. Chamorro reflects an origin directly within Island Southeast Asia, not western Oceania. As a result, most linguists currently favour the Philippines as the most likely source for Chamorro and the inhabitants of the Marianas. Both Blust (2000) and Reid (2002) suggested the central or northern Philippines, with Chamorro as a primary or at least very early split from Proto-Malayo-Polynesian.

Current research on Chamorro mtDNA indicates a rarity of the widespread Oceanic mtDNA haplogroup B4, which is also differentiated in the Marianas from other Malayo-Polynesian populations by a unique mutation at base 16114. Instead, most Chamorro belong to haplogroup E lineages that occur widely in the Philippines and Indonesia (Vilar *et al.* 2008; Tabbada *et al.* 2010).

Conclusion

The earliest Marianas Red pottery records the first human settlement in Remote Oceania, between 1500 and 1400 BC, slightly pre-dating the earliest Lapita pottery in Near Oceania at 1350–1300 BC (Summerhayes 2007, in press; Kirch 2010). Over 20 years ago, Spriggs (1990: 20) emphasised Marianas Red as the *smoking gun* that required an insular Southeast Asian origin for the first colonists of the remote Pacific Islands (see also Spriggs 2007: 113–14). Given the uncertain internal classification of WMP languages, we propose that the first settlers in the Mariana Islands, around 1500–1400 BC, shared an ease of communication with other WMP communities in Island Southeast Asia, facilitating co-mingling of groups and possible shifting of residence over long distances. According to this view, multiple related groups potentially could have moved quickly in several directions at the same time.

A drift voyage at the mercy of dominant winds and currents would have been extremely unlikely to reach the Marianas from any source area (Scott Fitzpatrick, *pers. comm.*; see also Callaghan & Fitzpatrick 2008), so an intentional voyage of exploration is more probable. Actual settlement required sufficient numbers of males and females, plus at least some imported subsistence plants, even perhaps animals eaten en route, so it is likely that a degree of planning was involved. While the first explorers to discover the Mariana Islands may have possessed many cultural traits and skills shared commonly throughout a broad region, the subsequent successful colonisation indicates strong similarities of pottery type and language with the northern Philippines. As Rainbird (2003: 85) has also observed, such a settlement of the Marianas from the Philippines *'would constitute the longest sea-crossing undertaken by that time in human history.'* Therefore, the study of Chamorro origins is not only an issue of Austronesian migration, but also a significant episode in the evolution of human voyaging technology.

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References

AMESBURY, J.R. 2008a. Prehistoric period, in J. Amesbury & R. Hunter-Anderson (ed.) An analysis of archaeological and historical data on fisheries for pelagic species in Guam and the Northern Mariana Islands. Report prepared for Micronesian Archaeological Research Services, Guam.

- 2008b. Pelagic fishing in prehistoric Guam, Mariana Islands. *PFRP (Pelagic Fisheries Research Program) Newsletter* 13(2): 4–7.

BELLWOOD, P. 1975. The prehistory of Oceania. *Current Anthropology* 16(1): 9–28.

- 1978. *Man's conquest of the Pacific: the prehistory of Southeast Asia and Oceania*. Auckland: Collins.

- 1985. *Prehistory of the Indo-Malaysian Archipelago*. Sydney: Academic Press.

- 1997. *Prehistory of the Indo-Malaysian Archipelago*. Honolulu (HI): University of Hawai'i Press.

- 2005. *First farmers: the origins of agricultural societies*. Oxford: Blackwell.

BELLWOOD, P. & E. DIZON. 2005. The Batanes archaeological project and the Out of Taiwan hypothesis for Austronesian dispersal. *Journal of Austronesian Studies* 1(1): 1–33.

BLUST, R. 2000. Chamorro historical phonology. *Oceanic Linguistics* 39: 83–122.

- 2009. *The Austronesian languages* (Pacific Linguistics 602). Canberra: Department of Linguistics, Research School of Pacific and Asian Studies, The Australian National University.

BUTLER, M. 1994. Early prehistoric settlement in the Mariana Islands: new evidence from Saipan. *Man and Culture in Oceania* 10: 15–38.

- 1995. *Archaeological investigations in the Achugao and Matansa areas of Saipan, Mariana Islands* (Micronesian Archaeological Survey Report 30). Saipan: The Micronesian Archaeological Survey, Division of Historic Preservation, Department of Community and Cultural Affairs.

CALLAGHAN, R. & S.M. FITZPATRICK. 2008. Examining prehistoric migration patterns in the Palauan archipelago: a computer simulated analysis of drift voyaging. *Asian Perspectives* 47(1): 28–44.

CAMPOS, F.Z. 2009. The ichthyoarchaeology of Batanes Islands, northern Philippines. Unpublished MA dissertation, University of the Philippines.

CAMPOS, F.Z. & P.J. PIPER. 2009. A preliminary analysis of the animal bones recorded from the OLP II site 2006, southern Taiwan, in C.W. Cheng, Cultural change and regional relationships of prehistoric Taiwan: a case study of Oluanpi II site: Appendix B. Unpublished PhD dissertation, National Taiwan University.

CARSON, M.T. 2008. Refining earliest settlements in Remote Oceania: renewed archaeological investigations at Unai Bapot, Saipan. *Journal of Island and Coastal Archaeology* 3: 115–39.

- 2010. Radiocarbon chronology with marine reservoir correction for the Ritidian archaeological site, northern Guam. *Radiocarbon* 52: 1627–38.

- 2011. Palaeohabitat of first settlement sites 1500–1000 BC in Guam, Mariana Islands, western Pacific. *Journal of Archaeological Science* 38: 2207–21.

CHANG, K.C. 1969. *Fengpitou, Tapenken, and the prehistory of Taiwan*. New Haven (CT): Yale University Press.

CHAZINE, J.M. & J.G. FERRIE. 2008. Recent archaeological discoveries in East Kalimantan, Indonesia. *Bulletin of the Indo-Pacific Prehistory Association* 28: 16–22.

CHIA, S.M.S. 2003. *The prehistory of Bukit Tengkorak as a major pottery making site in Southeast Asia* (Sabah Museum monograph 8). Kota Kinabalu: Department of Sabah Museum.

CLARK, G., F. PETCHEY, O. WINTER, M.T. CARSON & P. O'DAY. 2010. New radiocarbon dates from the Bapot-1 site in Saipan and Neolithic dispersal by stratified diffusion. *Journal of Pacific Archaeology* 1(1): 21–35.

DICKINSON, W.R. 2000. Hydro-isostatic and tectonic influences on emergent Holocene paleoshorelines in the Mariana Islands, western Pacific Ocean. *Journal of Coastal Research* 16: 735–46.

DILLI, B.J., A.E. HAUN & S.T. GOODFELLOW. 1998. Archaeological mitigation program: Mangilao golf course project area. Volume 2: data analyses. Report prepared by Paul H. Rosendahl PhD Inc., Hilo, Hawai'i.

HUNG, H-C. 2005. Neolithic interaction between Taiwan and northern Luzon: the pottery and jade evidences from the Cagayan Valley. *Journal of Austronesian Studies* 1: 109–134.

https://doi.org/10.1017/S0003598X00068393 Published online by Cambridge University Press

- 2008. Migration and cultural interaction in southern coastal China, Taiwan and the northern Philippines, 3000 BC to AD 1. Unpublished PhD dissertation, The Australian National University.

KIRCH, P.V. 1995. The Lapita culture of western Melanesia in the context of Austronesian origins and dispersals, in P.J–K. Li, C.H. Tsang, Y.K. Huang, D.A. Ho & C.Y. Tseng (ed.) *Austronesian studies relating to Taiwan* (Symposium series of the Institute of History and Philology, Academia Sinica 3): 255–94. Taipei: Academia Sinica.

- 2000. *On the road of the winds: an archaeological history of the Pacific islands before European contact*. Berkeley (CA): University of California Press.

- 2010. Peopling of the Pacific: a holistic anthropological perspective. *Annual Review of Anthropology* 39: 131–48.

LEACH, B.F. & J.M. DAVIDSON. 2006. *Analysis of faunal material from an archaeological site complex at Mangilao, Guam* (Technical report 38). Wellington: Museum of New Zealand, Te Papa Tongarewa.

LI, K-C. 1983. *Report of archaeological investigations in the O-luan-pi Park at the southern tip of Taiwan.* Taipei: Kending Scenic Area Administration, Ministry of Communications; Department of Anthropology, National Taiwan University; Council for Cultural Planning and Development, Executive Yuan (in Chinese).

LI, K-T. 1997. Change and stability in the dietary system of a prehistoric coastal population in southern Taiwan. Unpublished PhD dissertation, Arizona State University.

- 2002a. Prehistoric marine fishing adaptation in southern Taiwan. *Journal of East Asian Archaeology* 3(1–2): 47–74.

- 2002b. *Historical remains in Hengchun Peninsula*. Kending: Kending National Park (in Chinese).

MOORE, D.R. 1983. Measuring change in Marianas pottery: the sequence of pottery production at Tarague, Guam. Unpublished MA dissertation, University of Guam.

- 2002. Guam's prehistoric pottery and its chronological sequence. Report prepared for the International Archaeological Research Institute, Inc., Honolulu, and the Department of the Navy, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, HI, by Micronesian Archaeological Research Services, Guam.

PAWLEY, A. 2002. The Austronesian dispersal: languages, technologies and people, in P. Bellwood & C. Renfrew (ed.) *Examining the farming/language dispersal hypothesis* (McDonald Institute monographs): 251–73. Cambridge: McDonald Institute for Archaeological Research.

PAWLEY, A. & M. PAWLEY. 1994. Early Austronesian terms for canoe parts and seafaring, in A. Pawley & M. Ross (ed.) *Austronesian terminologies: continuity and change* (Pacific Linguistics Series C 127): 329–61. Canberra: Department of Linguistics, Research School of Pacific and Asian Studies, The Australian National University.

PELLETT, M. & A. SPOEHR. 1961. Marianas archaeology: report on an excavation on Tinian. *Journal of the Polynesia Society* 70: 321–5.

PETERSON, W.E. 1974a. Summary report of two archaeological sites from northeastern Luzon. *Archaeology and Physical Anthropology in Oceania* 9: 26–35.

- 1974b. Anomalous archaeology sites of northern Luzon and models of Southeast Asian prehistory. Unpublished PhD dissertation, University of Hawai'i.

PIPER, P.J., H-C. HUNG, F.Z. CAMPOS, P. BELLWOOD & R. SANTIAGO. 2009a. A 4000 year-old introduction of domestic pigs into the Philippine Archipelago: implications for understanding routes of human migration through Island Southeast Asia and Wallacea. *Antiquity* 83: 687–95.

PIPER, P.J., F.Z. CAMPOS & H-C. HUNG. 2009b. A study of the animal bones recovered from pits 9 and 10 at the site of Nagsabaran in northern Luzon, Philippines. *Hukay* 14: 47–90.

PREGILL, G.K. & D.W. STEADMAN. 2009. The prehistory and biogeography of terrestrial vertebrates on Guam, Mariana Islands. *Diversity and Distributions* 15: 983–96.

RAINBIRD, P. 2003. *The archaeology of Micronesia*. Cambridge: Cambridge University Press.

RAY, E.R. 1981. The material culture of prehistoric Tarague Beach, Guam. Unpublished MA dissertation, Arizona State University.

REID, L.A. 2002. Morphosyntactic evidence for the position of Chamorro in the Austronesian language family, in R.S. Bauer (ed.) *Collected papers on Southeast Asian and Pacific languages* (Pacific Linguistics 530): 63–94. Canberra: Department of Linguistics, Research School of Pacific and Asian Studies, The Australian National University.

REIMER, P.J., M.G.L. BAILLIE, E. BARD, A. BAYLISS, J.W. BECK,C.J.H. BERTRAND, P.G. BLACKWELL, C.E. BUCK, G.S. BURR, K.B. CUTLER, P.E. DAMON, R.L. EDWARDS, R.G. FAIRBANKS, M. FRIEDRICH, T.P. GUILDERNSON, A.G. HOGG, K.A. HUGHEN, B. KROMER, G. MCCORMAC, S. MANNING, C. BRONK RAMSEY, R.W. REIMER, S. REMMELLE, J.R. SOUTHON, M. STUIVER, S. TALAMO, F.W. TAYLOR, J. VAN DER PLICHT, C.E. WEYHENMEYER. 2004. IntCal04 terrestrial radiocarbon age calibration, 0-26 cal kyr BP. *Radiocarbon* 46: 1029–1058.

https://doi.org/10.1017/S0003598X00068393 Published online by Cambridge University Press

REINMAN, F.M. 1970. Fishhook variability: implications for the history and distribution of fishing gear in Oceania, in R.C. Green & M. Kelly (ed.) *Studies in Oceanic culture history: papers presented at Wenner-Gen Symposium on Oceanic Culture History, Sigatoka, Fiji, August 1969, Volume 1* (Pacific Anthropological Records 11): 47–60. Honolulu (HI): Bernice P. Bishop Museum.

ROSS, M., A. PAWLEY & M. OSMOND. 1998. *The lexicon of proto Oceanic: the culture and environment of ancestral Oceanic society. Volume 1: material culture* (Pacific Linguistics series C 152). Canberra: Pacific Linguistics, Research School of Pacific and Asian Studies, The Australian National University.

SAND, C. 1999. *Archéologie des origines: le lapita calédonien* (Cahiers de l'archeologie en Nouvelle-Calédonia 10). Nouméa: Service des Musées et du Patrimoine de Nouvelle-Calédonie.

SHUTLER, R.J.R. 1999. The relationship of red-slipped and lime-impressed pottery of the southern Philippines to that of Micronesia and the Lapita of Oceania, in J. C. Galipaud & I. Lilley (ed.) *Le Pacifique de 5000 à 2000 avant le présent: suppléments à l'histoire d'une colonization: actes du colloque Vanuatu, 31 juillet-6 août*: 521–9. Paris: IRD.

SOLHEIM II, W.G. 1968. The Batungan cave sites, Masbate, Philippines, in W.G. Solheim II (ed.) *Anthropology at the Eighth Pacific Science Congress of the Pacific Science Association and the Fourth Far-Eastern Prehistory Congress, Quezon City, Philippines, 1953* (Asian and Pacific Archaeology series 2). Honolulu (HI): Social Science Research Institute, University of Hawai'i.

SPOEHR, A. 1957. *Marianas prehistory: archaeological survey and excavations on Saipan, Tinian and Rota* (Fieldiana: anthropology 48). Chicago (IL): Chicago Natural History Museum.

- 1973. *Zamboanga and Sulu: an archaeological approach to ethnic diversity* (Ethnology Monographs 1). Pittsburgh (PA): Department of Anthropology, University of Pittsburgh.

SPRIGGS, M. 1990. The changing face of Lapita: transformation of a design, in M. Spriggs (ed.) *Lapita design, form and composition: proceedings of the Lapita Design Workshop, Canberra, Australia, December 1988* (Occasional papers in prehistory 19): 83–122. Canberra: Department of Prehistory, Research School of Pacific Studies, The Australian National University.

- 2007. The Neolithic and Austronesian expansion within Island Southeast Asia and into the Pacific, in S. Chiu & C. Sand (ed.) *From Southeast Asia to the Pacific: archaeological perspectives on the Austronesian expansion and the Lapita cultural complex*: 104–140. Taipei: Academia Sinica.

STUIVER, M. & P.J. REIMER. 1993. Extended ^{14}C data base and revised CALIB 3.0 ^{14}C age calibration program. *Radiocarbon* 35: 215–30.

SUMMERHAYES, G.R. 2007. The rise and transformations of Lapita in the Bismarck Archipelago, in S. Chiu & C. Sand (ed.) *From Southeast Asia to the Pacific: archaeological perspectives on the Austronesian expansion and the Lapita cultural complex*: 129–72. Taipei: Academia Sinica.

- In press. Lapita interaction: an update, in M.Z. Gadu & H.M. Lin (ed.) *2009 International Symposium of Austronesian Studies*. Taidong: National Museum of Prehistory.

TABBADA, K.A., J. TREJAUT, J.H. LOO, Y.M. CHEN, M. LIN, M. MIRAZÓN-LAHR, T. KIVISILD & M.C.A. DE UNGRIA. 2010. Philippine mitochondrial DNA diversity: a populated viaduct between Taiwan and Indonesia? *Molecular Biology and Evolution* 27(1): 21–31.

THIEL, B. 1987. Excavations at the Lal-Lo shell middens, northeast Luzon, Philippines. *Asian Perspectives* 27(1): 71–94.

THOMPSON, L.M. 1932. *Archaeology of the Marianas Islands* (Bernice P. Bishop Museum. Bulletin 100). Honolulu (HI): Bishop Museum.

TSANG, C-H. 2000. *The archaeology of Taiwan*. Taipei: Council for Cultural Affairs, Executive Yuan.

- 2007 Recent archaeological discoveries in Taiwan and northern Luzon: implications for Austronesian expansion, in S. Chiu & C. Sand (ed.) *From Southeast Asia to the Pacific: archaeological perspectives on the Austronesian expansion and the Lapita cultural complex*: 75–103. Taipei: Academia Sinica.

TSANG, C-H., K.T. LI, & C.Y. CHU. 2006. *Xian Min Lv Ji [Footprints of the ancestors: archaeological discoveries in Tainan science-based industrial park]*. Tainan: Tainan County Government (in Chinese).

VILAR, M., D. LYNCH, C. CHAN, D. REIFF, R.M. GARRUTO & J.K. LUM. 2008. Peopling of the Marianas: an mtDNA perspective. Abstract from the 33rd Annual Meeting of the Human Biology Association held in Columbus, Ohio, April 9–10, 2008. *American Journal of Human Biology* 20: 237.

WICKLER, S. 2004. Modelling colonisation and migration in Micronesia from a zooarchaeological perspective, in M. Mondini, S. Munoz & S. Wickler (ed.) *Colonisation, migration and marginal areas: a zooarchaeological approach* (Proceedings of the 9th Conference of the International Council of Zooarchaeology, Durham, August 2002): 28–40. Oxford: Oxbow.

https://doi.org/10.1017/S0003598X00068393 Published online by Cambridge University Press