– ARTICLE –

New Evidence for Variation in Colonisation, Cultural Transmission, and Subsistence from Lapita (2900 BP) to the Historic Period in Southwestern Fiji

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ABSTRACT:

Fiji was colonised approximately 3000 BP by populations with intricately decorated Lapita pottery. At nearly the same time, culturally related populations also colonised nearby Tonga and Samoa and the archaeology of each archipelago indicates continued contact, but also cultural divergence over time. Previous research in the far western islands of Fiji has also identified late Lapita colonisation deposits and subsequent cultural changes that have raised further questions about regional variation in the Fijian archaeological record. Here we present results of the first survey, excavation, and archaeological analyses from the islands of southwestern Fiji and interpret these findings relative to current research on the colonisation of Fiji-West Polynesia, changes in the spatial scale of cultural transmission in the region, and changes in foraging practices and environments. Survey and test excavations identified eleven sites and pushes back the colonisation of the far western islands to 2900 BP. Preliminary analyses of cultural materials from these sites indicate a complexly structured colonising population in Fiji-West Polynesia, variation over time in the frequency of contact between populations in Fiji, and subsistence practices likely influenced by environmental change and human competition.

Keywords: Fiji, Polynesia, Lapita, colonisation, subsistence

As Fiji was likely colonised from the west (Irwin 1992; Di Piazza *et al.* 2007), the far western Fijian islands – the Malolo, Mamanuca, and Yasawa Islands (Fig. 1) – may be the first islands encountered by Fiji's Lapita colonisers. The colonisation of the Yasawa Islands and ensuing cultural changes have been the focus of archaeological research since the mid-1990s (Hunt *et al.* 1999; Cochrane 2002; Cochrane *et al.* 2004; Cochrane and Neff 2006; Cochrane 2009). Intriguingly, this research indicates that the Yasawas were first inhabited around 2700 BP, approximately 300 years later than other areas of Fiji and that these populations were somewhat isolated from the rest of the archipelago. Additionally, the spatial scale of cultural transmission, that is the passing of information and items between individuals, across the Yasawas seems to have expanded and contracted throughout prehistory (Cochrane and Neff 2006). Also, global environmental change has had deleterious effects on local island resources (Morrison and Cochrane 2008), likely encouraging violent competition between human groups (see Field 2004). These findings raise questions about regional variation in the Fijian archaeological record and how this variation, in particular the archaeological sequence of the far western islands, fits with current research on the timing and spatial patterning of Fiji's colonisation by Lapita populations. Additionally, the cultural relatedness of Fiji's far western populations to other Lapita pottery-bearing groups in Tonga and Samoa is possibly more complex than previously thought (e.g., Burley *et al.* 2010; Cochrane and Lipo, in press). Questions also arise about changes in the spatial scale of cultural transmission in Fiji, and the effects of environmental change on Fiji's past population.

To investigate these questions we conducted the first archaeological field work in the Malolo and Mamanuca Islands to the south of the Yasawas (Cochrane *et al.* 2007). Survey and excavations identified eleven sites and a cultural sequence that pushes back the colonisation of the far western islands to 2900 BP. Preliminary analyses of artefacts from these sites indicate significant differences in the cultural sequences here relative to the Yasawa Islands, and unexpected, albeit tentative, similarities with other parts of Fiji and West Polynesia, principally the Tongan and Samoan archipelagos. The following sections describe the archaeological sites of the Malolo and Mamanuca Islands and the preliminary analyses of sediments, artefacts, and some subsistence remains. The concluding section

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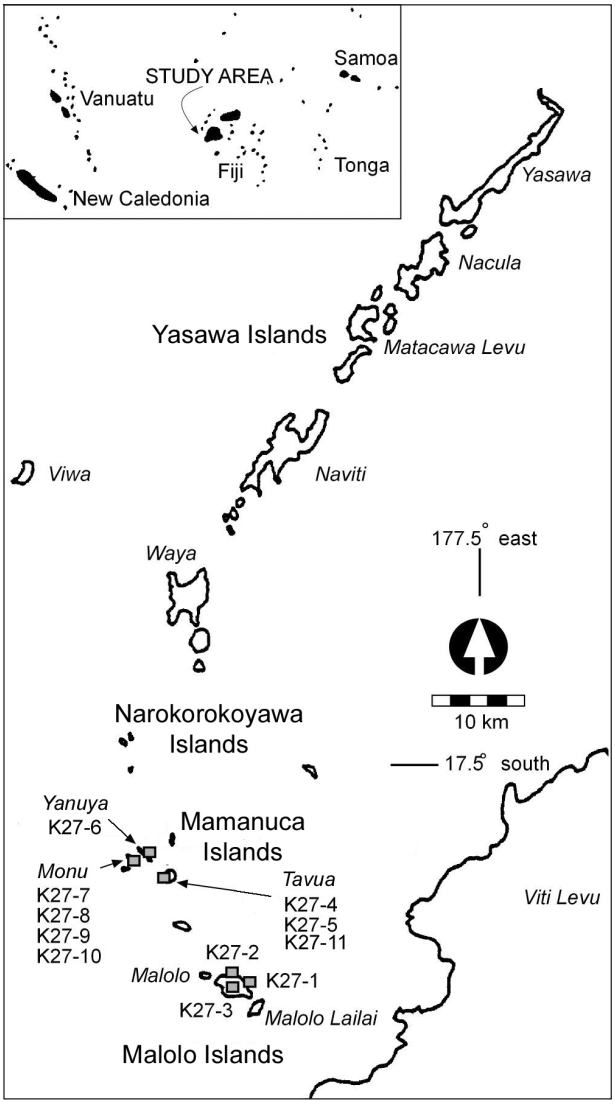

Figure 1. Map of the far western Fijian islands showing sites defined in the Malolo and Mamanuca islands.Individual islands names are italicised.

discusses the analytical results in terms of colonisation processes, cultural transmission, subsistence and environment in the Fiji Islands.

THE MALOLO ISLANDS

Malolo (9.8 km^2) and the smaller islands that surround it lie approximately 18 km to the west of Viti Levu and inside the barrier reef at Fiji's western edge. The Malolo Islands are geologically complex, related to the geological history of southwestern Viti Levu with portions possibly formed 19 million years ago (Rodda and Lum 1990). Other portions of the Malolo Islands were likely formed during geological events that created the bulk of the Mamanuca and Yasawa Islands to the north some 8–6 million years ago (Rodda 1994). Malolo itself consists of a main ridge running roughly east-west with a series of linked summits, the tallest at 220 metres above sea level, and a tongue of land extending southeast connecting Malolo to the island of Malolo Lailai at low tide. Malolo and Malolo Lailai are surrounded by shallow fringing reefs up to 600 metres wide in some places with some additional reefs beyond these. Many of Malolo's beach flats and small valleys would likely have been habitable throughout the human history of Fiji and today the beach flats are the sites of two modern villages (Solevu and Yaro), plantations, and resorts.

Prior to our archaeological work we suspected that the both the geological history of Malolo and sea-level changes may have adversely affected the preservation of buried cultural deposits on the island. No paleosea-level work has been conducted in the Malolo or Mamanuca Islands and the complex tectonic environment of Fiji creates localised emergence and subsidence (Nunn *et al.* 2002). However, general conclusions regarding sea-level change in these islands can be made. At the time of colonisation, a high-stand resulted in sea-levels 1–2 m above current levels in Fiji with sea-level subsequently falling to present levels at an average rate of 0.5 m every 1000 years (Nunn 1998; for nearby Tonga see Dickinson *et al.* 1998). Over the 3,000 years of human occupation, however, the rate and direction of sea-level change has likely not been constant. In particular, Nunn (1998; 2000; 2001) has correlated variation in sea-level with global climatic patterns, such that during the Little Climatic Optimum (LCO, *c.* 1050–690 BP), sea-level may have rose again to 0.9 m above its present position. In a transition period following the LCO (*c.* 690–575 BP), sea-level may have quickly dropped 0.5 m. At the start of the Little Ice Age (LIA, *c.* 575–150 BP), sea levels may have again risen to their present position, only to gradually fall to almost a meter below present position by *c.* 200 BP. The last two hundred years have seen sea-levels rise again to present levels. Nunn's use of non-Pacific proxy climate data to generate such reconstructions has been challenged. Allen (2006) notes that Pacific-based proxy climate data suggest climate change in the central Pacific *c.* 700 BP is the opposite of that predicted by Nunn (e.g., higher, not lower, average temperatures). Allen (2006: 527) argues, however, that even these climate changes suggested by Pacific-based proxy data might have had an adverse, and regionally-specific, effect on Pacific populations. Our own research in the northern Yasawa Islands (Morrison and Cochrane 2008) suggests climate change *c.* 700 BP affected local subsistence resources and possibly interaction between human groups. In short, it appears likely that climate change around 700 BP may have affected local environments and possibly relative sea-level in the Mamanuca and Yasawa Islands.

Given Malolo's geological age, there has been opportunity for more erosion compared to the nearby Mamanucas and Yasawas where intact subsurface cultural deposits are found on many beach flats (see below, and Cochrane 2009). Malolo's potentially longer erosional history may

have decreased the coastline-interior gradient and thus increased the potential area of coastline inundated by postulated sea-level rise around 700 BP. Additionally, cultural deposits on the paleobeaches and beach flats of Malolo may have been more adversely effected by typical wave action and storms during a high sea-stand than on islands with steeper coastline-to-inland gradients. These possibilities help us interpret the archaeological core data presented below.

The initial archaeological survey of Malolo defined three sites by the presence of surface features and portable artefacts, or buried cultural deposits (Table 1). While the concept site is necessary for some recording purposes, sites can be problematic grouping devices for analyses of artefact distributions across the landscape (Lewarch and O'Brien 1981; Dunnell 1992). Indeed, the sites on Malolo are defined in relation to a background artefact distribution of pottery sherds on almost every beach flat and many of the ridgelines of Malolo. Additional archaeological surveys of the island will doubtless define more sites. Our survey techniques consisted of four or five individuals walking abreast with several metres between each person when possible and with each person scanning the ground for portable artefacts, surface architecture, and landscape features. If visibility was poor, surveyors would stop every few metres to clear the ground surface. All the beachflats and major ridgelines on the island were surveyed in this way.

Malolo Coring Programme

Using a hand-driven auger fifteen archaeological cores (7 cm diameter) were placed on three beach flats where survey, topography and sea-level changes suggested the possibility of buried paleobeach deposits and other cultural strata representing Fiji's 3000 year human history. Cores 1 through 12 were placed on the only extensive beach flat on the island's eastern coast and occupied by Solevu Village. These cores were generally located along transects perpendicular to the beach to identify the inland distance and depths to be explored with controlled excavations. A series of cores at the southern end of the beach flat in the village gardens revealed paleobeach deposits with sherds (including one with a paddle-impressed [parallel ribs] surface) at depths greater than 2 meters and very near or under the water table. The paleobeach deposits were overlain by two to three layers described by various texture classes and a soil horizon suggesting largely colluvial and wave deposition.

Cores 13 and 14 were placed approximately 160–170 m from the beach at the back of a beach flat on the southwest side of Malolo and revealed the currently forming soil horizon and two layers (a sandy clay loam, and a clay) before encountering the water table at approximately 160 cmbs. No subsurface cultural deposits were noted, despite the presence of surface sherds nearer the beach brought up from the subsurface by crabs. Any intact subsurface

Table 1. *Archaeological sites of the Malolo and Mamanuca Islands identified in 2006.*

Site No.	Island	Name	Estimated Cultural Chronology	Morphology and Primary Use Category
K27-1	Malolo	Solevu Village	2000–0 BP	surface and subsurface ceramic deposit, low intensity human activity
K27-2	Malolo	Navasua	500–100 BP	annular ditch and bank defensive habitation, platforms, surface ceramics
K27-3	Malolo	Uluisolo	500–100 BP	terraced hilltop with United States military structures (WW II), surface ceramics (prehistoric), possible prehistoric defensive habitation
K27-4	Tavua	Tavua Village	2900–0 BP	beach flat habitation with subsurface ceramics (including Lapita), midden, and other artefacts
K27-5	Tavua	Tavua Ridge	500–100 BP	modified ridgetop with terraces (possible *yavu*), surface ceramic, possible defensive habitation
K27-6	Yanuya	Yanuya Village	200–0 BP	beach flat habitation with subsurface ceramics and midden
K27-7	Monu	Qwaqwa	?	rockshelter with surface and subsurface ceramics, midden and other artefacts, possible habitation
K27-8	Monu	Kasa	200–50 BP	beach flat habitation with 3 terraces(*yavu*)
K27-9	Monu	Onedare	200–50 BP	beach flat habitation with 4 house mounds (*yavu*), platform with stone upright and surface ceramics
K27-10	Monu	–	500–100 BP	upland defensive habitation with approximately 7 house mounds (*yavu*), surface ceramics
K27-11	Tavua	–	at least 2700 BP	surface ceramics
K27-10		–	500–100 BP	upland defensive habitation with approximately 7 house mounds (*yavu*), surface ceramics

deposits in the area are likely fairly recent.

Core 15 was located approximately 190 m back from the beach and south of site K27-2, a ring-ditch fortification (see below), in gardens used by Yaro village on the northeastern corner of the island. This core uncovered two layers of increasing clay content with depth and an active upper soil horizon, suggesting that sediments here are largely a product of colluvial deposition and weathering. No cultural deposits were encountered before the water table was reached at approximately 3 metres below the surface.

Sediments recovered from the cores in these three locations indicate that undisturbed buried cultural deposits of significant age, greater than a few hundred years, may be difficult to locate on Malolo. The Solevu village beach flat is the largest on the island and, after fairly extensive coring of its southern end, only a single location contained cultural deposits above the water-table and suitable for controlled excavation.

Solevu Village, Site K27-1

The recovery of a decorated sherd and paleobeach sediments from a single core in the Solevu Village gardens suggested this as an area for controlled excavation. Approximately 193 metres inland we excavated a 1 x 1 m test unit to 2.53 m below the ground surface. Four layers were defined in excavation (Fig. 2) with small amounts of ceramics and charcoal found throughout as well as a single a lithic artefact. Excavation was conducted using 10-cm arbitrary levels (spits) within layers.

Field and laboratory analyses of recovered sediments suggest a single depositional regime in a wetland environment followed by increased terrestrial deposition and soil formation (Table 2). Layers III and IV were likely deposited in an enclosed, vegetated wetland or tidal flat with periodic inputs of medium-to-coarse- sized reef sands from storm waves. These very poorly sorted (IV) to poorly sorted (III) layers also contain high levels of silts and clays suggestive of a low-energy environment such as shallow, trapped water. If this was an enclosed wetland, storm waves that brought in coarse particles might not be able to remove the silts and clays. The poorly sorted Layer II may signify a drier environment given its brown sediment colour and perhaps more oxidising conditions compared to Layers III and IV. Layer I is a well-sorted silty clay loam with a relatively small proportion of calcareous grains and a soil horizon extending from the ground surface. The lenses encountered in the test unit testify to additional depositional processes including high energy storms capable of dramatically altering the existing ground surface as in the case of Lens IIIa. Sediments from disturbed areas, likely crab and root holes, were screened separately with associated artefacts kept separate from the layer sediment.

Although low in abundance compared to sites in the Mamanucas and Yasawas, pottery sherds were the

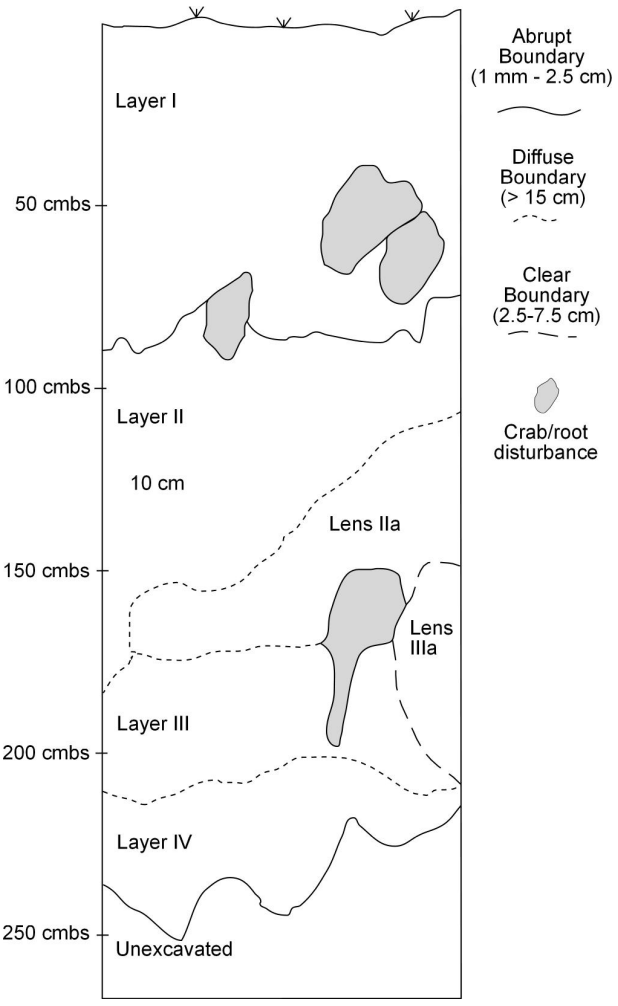

Figure 2. South profile of Test Unit 1 at site K27-1, Solevu Village.

dominant artefacts (n = 786) encountered in the test unit on Malolo (Table 3). Sherds were recovered down to the deepest excavated level where the water-table forced excavation to cease (culturally sterile sediment not reached). Approximately 12% of the ceramic assemblage consists of decorated forms (Fig. 3), mostly various types of carved-paddle impressing common in Fiji. A single base sherd from level 8 has an attached foot, a rare feature of Fijian sherds (e.g., Best 1984: Table A.5), while single sherds from levels 10 and 17 exhibit the collared-rims found in late Lapita assemblages in Fiji (e.g., Birks 1973; Burley and Dickinson 2004) with the level 17 sherd also notched. The sherds designated Paddle-Impressed Other (PI Other) in Table 3 from excavation levels 13–16 and 19 are forms of spot relief that are present, but not particularly common in other areas of Fiji (Best 1984; Clark 1999). This type of paddle-impressing is absent, however, from the Mamanuca Islands and the Yasawa Islands to the north despite over 27,000 sherds having been recovered from those islands (Cochrane 2009). Finally, the Lapita-era collared-rims in levels 10 and 17, and the vertical distribution of other ce-

Table 2. *Sediment characteristics for Test Unit 1, Solevu Village, Site K27-1*

Layer	Colour	Texture	Inclusions	Sorting
I	7.5YR 3/4 (dark brown)	silty clay loam; moderate, medium granular structure; slightly hard dry consistence	very few, fine roots; very few gravels	well sorted
II	7.5YR 4/4 (brown)	sandy clay loam; weak, very fine granular structure; friable dry consistence	very few charcoal specks; few fine roots	poorly sorted
Lens IIa	10YR 4/4 (dark yellowish brown)	clay loam; weak, very fine, granular; slightly hard dry consistence	very few charcoal specks	poorly sorted
III	2.5Y 4/4 (olive brown)	sandy clay loam; moderate, fine, granular structure; friable dry consistence	very few, fine roots	poorly sorted
Lens IIIa	7.5YR 6/6 (reddish yellow)	sand; structureless	–	well sorted
IV	10YR 5/3	sandy clay; moderate, fine granular structure; very friable dry consistence	common gravels	very poorly sorted

Table 3. *Ceramic counts for Test Unit 1, Site K27-1, Solevu Village.*

Excavation Level	No. of Sherds	Appliqué	Pl Parallel Ribs	Pl Cross Hatch	Pl Other	Rectilinear Incision	Punctate	Notched
1	124						1	
2	102		1				1	
3	43							
4	36							
5	28							
6	28							
7	53		3	1	1		1	
8	44		2	2			2	
9	34		3	3				
10	15		3					
11	21		2	1				
12	5			1	1			
13	16		4		1			
14	24		1	3	2			
15	23		1		1			
16	29			1	1			
17	33					1		1
18	10			1				
19	25		2	1	1			
20	23		1					
21	5							
22	18	1		1	1			
23	10		1					
24	6							
25	28		1	3				
26	3							
TOTALS	**786**	**1**	**25**	**18**	**9**	**1**	**5**	**1**

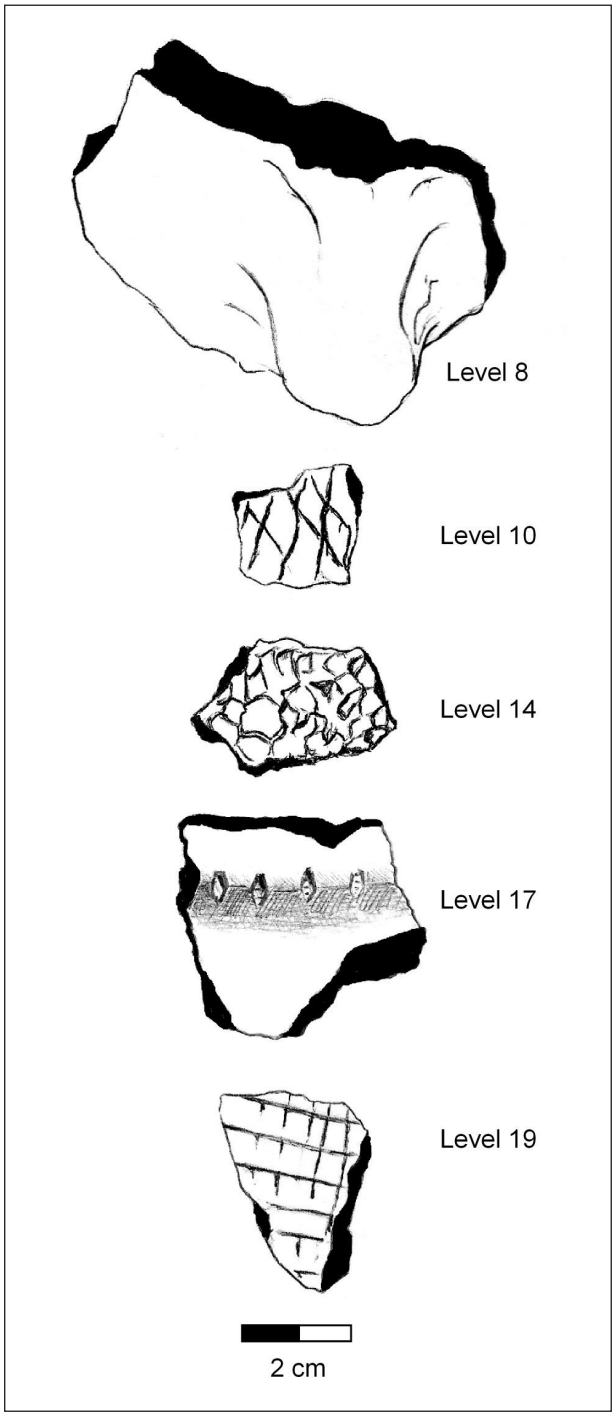

Figure 3. A sample of sherds from Test Unit 1 at site K27-1, Solevu Village, with excavation level indicated.

ramic decorations in the Solevu Village test unit, suggest that the cultural materials are mixed and not in original depositional context resulting from *in situ* human activity, but have been transported to this location through colluvial mechanisms and mixed by subsequent crab action (sherds are not excessively rounded). No dentate-decorated sherds were found.

Navasua, Site K27-2

On the northern coastline of Malolo Island, approximately 50 m inland, there is a ring-ditch fortified settlement next to Yaro village (Fig. 4). The site, Navasua (*Tridacna* sp., in Fijian), consists of an annular ditch and bank surrounding a flat interior, all totalling approximately 800 m^2 in area. The ditch is up to two meters deep and 15 m wide in places with four causeways crossing it. There are no flattened mounds or *yavu* (housemound in Fijian) typically found on late prehistoric Fijian habitation sites and in modern villages, but ground visibility is poor as the site is covered in palm forest and other vegetation. Several stone-faced earth platforms, likely post-occupation burials, are located at the northern end of the site. Surface collection of artefacts in the ring-ditch interior was conducted by a four person crew walking abreast at approximately two meter intervals. Vegetation and surface leaf litter was removed with machetes and hands to expose the ground surface, but ground visibility was extremely poor and the collected artefacts are likely not a representative sample. Ceramics (n = 412) were the only artefact type encountered with only a few of these decorated, four sherds with rectilinear incisions and two with punctates. No excavation was conducted.

Uluisolo, Site K27-3

Uluisolo (named peak on Fijian Government topographic map K27, Edition 2, 1998) is a hilltop modified by modern World War II era earth-moving machinery with an old and eroded bulldozed road leading to the top. There are multiple (at least two) concrete pads and a small (5 x 3 m) concrete structure on top of the hill. There is also a set of concrete pylons with rebar protruding from their tops, likely a foundation for a wooden superstructure. Uliusolo appears to be a World War II era look-out station, but the presence of a single plain potsherd recovered *in situ* from a sediment profile exposed by a bulldozer cut suggests that the site was also used in prehistory; this prehistoric use was likely defensive given the site's location and inaccessibility.

THE MAMANUCA ISLANDS

The Mamanuca Islands lie between Malolo and the Yasawa Islands to the north and are also know as the Mamanuca-i-cake islands (the upper Mamanucas). The Mamanucas consist of seven islands, three of which were investigated: Tavua, Yanuya, and Monu. Compared to Malolo, the Mamanucas have simpler geological origins. They appear to have been formed roughly 8–6 million years ago and may be a product of the same volcanism that formed the Yasawas Islands (Rodda 1994). The fringing reefs surrounding parts of Tavua, Yanuya and Monu are not as shallow as those in the Malolo Islands and trap less sedi-

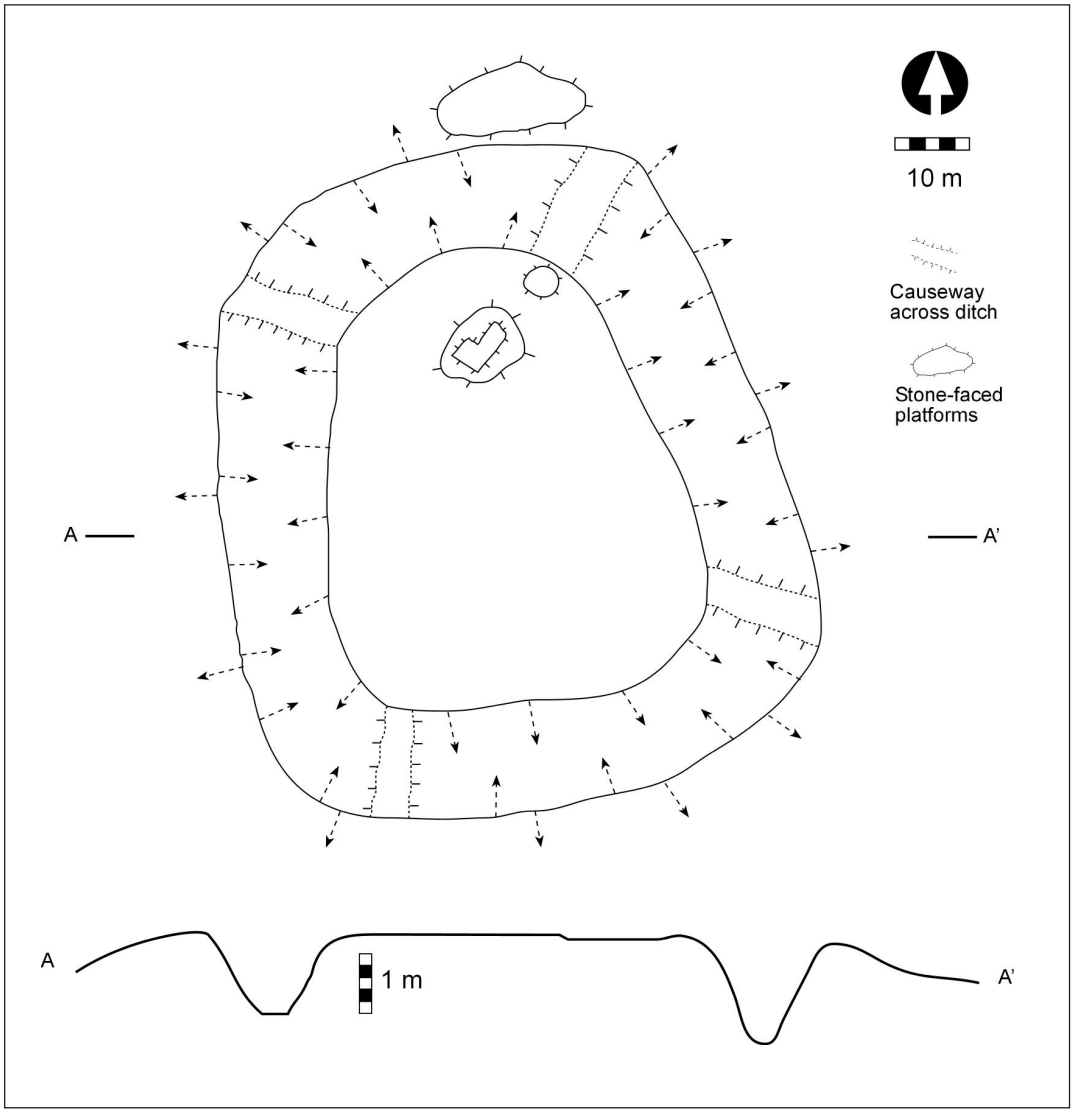

Figure 4. Tape and compass map of site K27-2, Navasua. Arrows indicate down direction of slope, see cross-section for steepness. Note that vertical scale is exaggerated relative to plan-view scale. Short lines emanating from causeways and platforms indicate area behind line is raised.

ment with no mangroves and with more live reef exposed at low tide. Like the Malolo Islands, the Mamanucas contain habitable beach flats, although with no large valleys as on Malolo and in general there is greater topographical relief in the Mamanucas.

Mamanuca Coring

Pedestrian survey (following procedures similar to those used on Malolo) and coring defined six sites in the Mamanucas Islands (Table 1, Fig. 5). Only three cores were placed in these islands, each to investigate specific possible archaeological sites and not with the primary goal of describing the subsurface characteristics of larger areas, as on Malolo Island. Core 16 in site K27-7 (cores were numbered sequentially during the 2006 field season), a shallow rockshelter and associated features on Monu Island (see below), reached a depth of 80 cmbs in organically enriched silty sediment. Pottery sherds, lithic debitage, and marine shell were found throughout the core. The core was abandoned as additional sediment past 80 cmbs could not be withdrawn. Core 17 was placed near the primary school on Yanuya Island in an area that was subsequently excavated (site K27-6). This core revealed three layers of sandy loam, loamy sand, and silty clay with sherds sporadically encountered to the base of the core at 205 cmbs where the auger bucket could no longer retain sediment. Core 18 was placed in the western gardens of Yanuya village and uncovered two layers of silt and silty clay with shell and a few sherds encountered up to 150 cmbs. The

core was stopped at 190 cmbs as additional sediment could not be retained in the auger bucket past this depth.

Monu Island Sites, K27-7 through K27-10

Survey along the eastern coast of Monu, an uninhabited island, defined four sites. The western coast and interior uplands were not extensively surveyed. Site K27-7 (Qwaqwa [all Monu names come from Yanuya village residents]) is a rockshelter and associated stone paving. The rockshelter is approximately 7 m above sea level (asl), 15 m inland from the high-tide mark and is approximately 12 x 4 m in area. The floor of the rockshelter is covered in pottery sherds and fine silt. Approximately 30 m south of the rockshelter there is a paving of light green basalt boulders 10 cm below the ground surface and visible in a wave-cut stratigraphic section at the top of the beach. Pottery sherds are visible in the exposed section 80 cm below the paving.

Site K27-8 (Kasa) is also located along the beach, south of the rockshelter. The site is a small beachflat habitation approximately 50 x 20 m in area at the top of the current beach. The beachflat is very narrow and angled toward the beach so that the three terraces present are faced with basalt cobbles and boulders on their downhill sides.

Site K27-9 (Onedara) is located near the southern tip of Monu just inland from the beach. This beachflat habitation is approximately 75 x 40 m in area with four flattened mounds (*yavu*) visible. One of these is quite large (10 x 25 m), with a standing stone at one end, and is identified as an abandoned church by local residents of Yanuya Island. Pottery is scattered across the site.

Site K27-10 is an upland defensive habitation. The site is located directly above (100 m asl) the rockshelter K27-7 and consists of at least seven *yavu* and at least three linear rock features along with two circular (3 x 3 m) rock features, possibly graves. Pottery is scattered across the site. The site is considered defensive due to its location on a cliff top and the single access route up a narrow creek that ends between the rockshelter and the associated paving of site K27-7. Additionally, this single access route is easily viewed from areas within site K27-10. None of the pottery on the surface of the Monu sites was collected.

The sites along the east coat of Monu Island are likely relatively recent habitations given the visible *yavu* found at the sites and local traditions of their former use. Site K27-10 is an exception as there was no local knowledge of this site. It's defensive characteristics suggest it may have been constructed approximately 500 BP, a time when defensive sites in the Yasawa Islands to the north were inhabited (Cochrane 2009).

Yanuya Island, Site K27-6

The single village on Yanuya Island has been inhabited for an archaeologically unknown length of time, but Cores 17 and 18 (see above) suggest the presence of prehistoric habitation. Additionally, when examined by eye, the elevation profile across the primary school on the southwest-facing bay suggests that the school's athletic field may be the remnant of a back-dune with ample space for habitation deposits between this and a small ridge in the centre of the island. A single 1 x 1 m test unit was excavated in this area to 2.08 m below the surface.

Field analysis of recovered sediments defined two layers: Layer I, an upper stratum of loamy sand, and Layer II, a lower stratum of culturally sterile coarse sand beginning approximately 50 cmbs. Layer II is penetrated by crab and root holes that contain sherds and shell from the upper stratum. Pottery (n = 1970) was recovered from the test unit, with 97% of the assemblages found in the first 50 cm of excavation. Less than 1% of the assemblage is decorated with two carved-paddle impressed sherds, four sherds with rectilinear incisions and one sherd with appliqué. The specific decorative techniques used at K27-6 suggest that its cultural deposits likely date to the last 100–200 years.

Tavua Island Sites, K27-4, K27-5, and K27-11

Pedestrian survey on Tavua along the central ridge of the island, and the beach flats to the west and northeast of this ridge defined three sites. Site K27-5, on the ridge, consists of two artificially flattened terraces with possible ditches placed along their perimeters. The site is approximately 150 x 30 m in size and was likely used for defensive purposes as access is extremely difficult and the site has an unrestricted view in all directions. A single sherd with circular punctates on the rim was recovered. Tall grasses on the site made ground visibility negligible.

Site K27-11 is a surface ceramic deposit on Tavua Island's northeastern beach flat. During a several-hour visit in 2009, surface ceramics were observed in fallow and currently cultivated plots on the beach flat (Tavua Village inhabitants garden here), with a higher density of surface sherds at the northern end of the beach flat. Sherds were mostly plain, but two 'collared' rim sherds, one also notched, were observed and are typical of late Lapita deposits in Fiji (see Fig. 3, level 17 sherd; and Birks 1973: Fig. 15; Cochrane 2009: Fig 4.7). No artefacts were collected.

Site K27-4 is located directly behind the single inhabited village on Tavua Island (Fig 5). The site, called simply Tavua Village, is on a large beach flat (550 x 300 m) surrounded by steep hillsides on the north, east and south sides, although colluvial deposition on the beach flat does not seem to include mass wasting or other catastrophic depositional events. The site was located after noting the presence of subsurface burned sediment, prehistoric pottery, and shell midden eroding from the sidewall of a sand-mining pit dug by the contemporary inhabitants of Tavua Village. In 2006, a test unit was placed approximately 2 m from this sand pit, and in 2009 four more test pits were placed in a rough line stretching approximately 20 m south from the original excavation. Cultural mate-

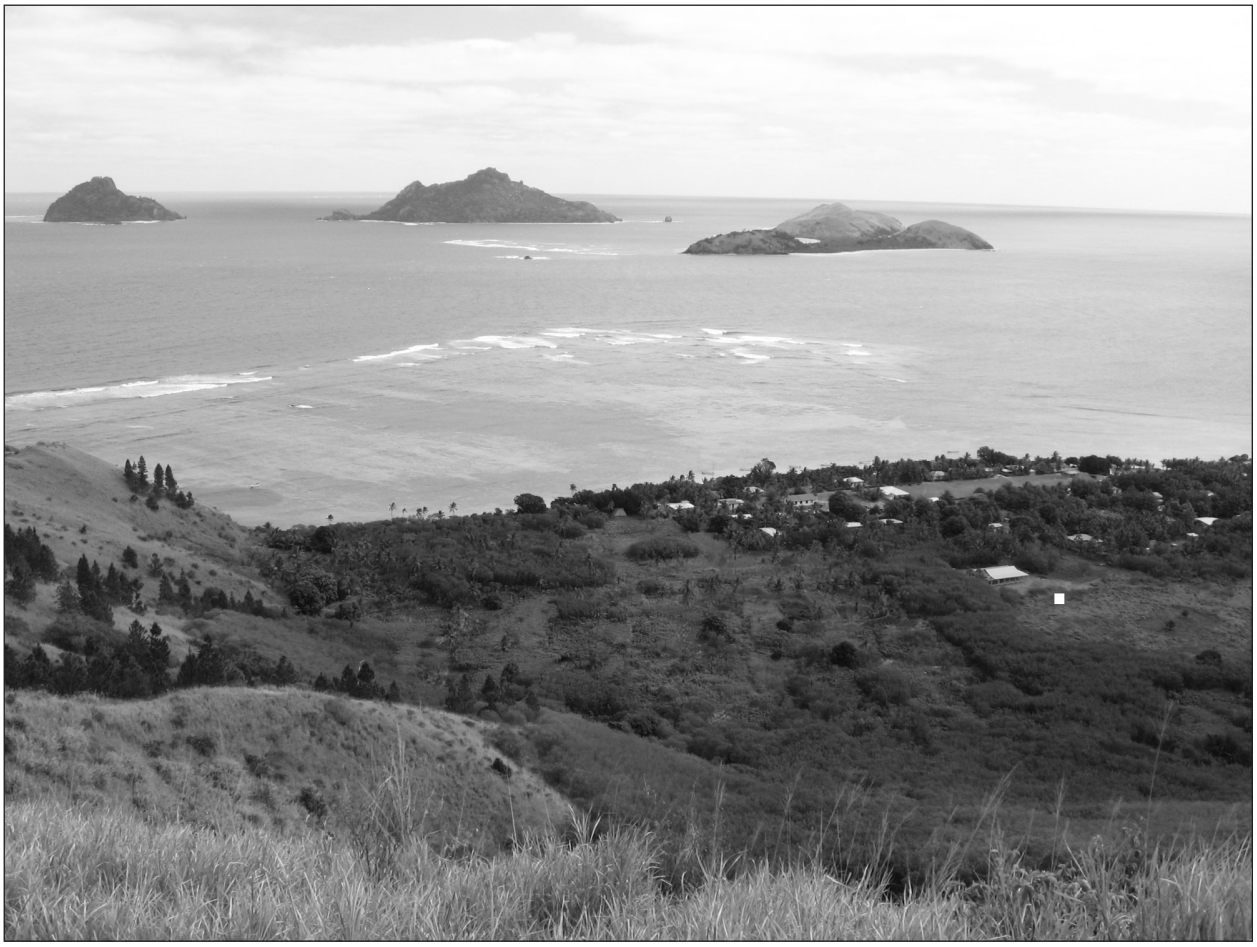

Figure 5. Site K27-4, Tavua Village and location of Test Units (white square) in foreground. Islands in the background are, from right to left, Yanuya (site K27-6), Monu (sites K27-7 through K27-10) and Monu Riki (not surveyed). View to NW. Photo by E. Cochrane.

rials, including lithics, shell midden and ceramics were recovered from all test pits, from the surface up to a maximum depth of 175 cmbs. Approximately the top 35 cm of Test Unit 1 contains spoil from the village sand-mining pit and consequently has older archaeological materials. Ceramics with Lapita dentate designs were recovered as deep as 154 cmbs. The deposits are stratified and represent the initial colonisation of the island and also likely the earliest colonisation of the far western islands of Fiji (see below).

Field and laboratory analysis of the Tavua Village sediments indicate a sequence of anthropogenic and colluvial deposition with soil formation atop basal beach sand sediments (Fig. 6 and Table 4). Layer V is a well sorted coarse yellow sand deposited by high-energy waves with practically no fine fraction and very little cultural material consisting of shell and bone only in the top 10 cm. Post-hole features were excavated into Layer V (see profiles of TUs 1 and 5, Fig. 6). Layers I-IV were identified in the field as different depositional units based on colour, density, and artefact content. Layer III is not present in all test units. Besides textural and colour differences, layer II also differs from Layer I by an absence of pebbles and cobbles and an increase in shell content. Preliminary microartefact (–2 to 2 phi size range) analyses identified the presence of ceramic microartefacts in Layers I and II suggesting increased trampling of ceramics in the deposition of these layers.

Dating. Three AMS analyses on unidentified charcoal and one on shell, all from Test Unit 1, date the site occupation (Table 5). Charcoal recovered from Layer V, 106–116 cmbs, and associated with archaeological bone and shell, returned a date of 2850 ± 36 (AA-73316) in uncalibrated radiocarbon years. This was calibrated to 3080–2860 calBP at 2σ with Calib 5.0.1 (also used for subsequent calibrations). Charcoal from the same excavation level as the deepest Lapita decorated sherds , 86–96 cmbs, returned a date of 2693 ± 39 (AA-73315) uncalibrated radiocarbon years, giving a calibrated date of 2861–2748 calBP at 2σ. Carbonised residue on a sherd from the same excavation level as the shallowest Lapita decorated sherds, approximately 67–77 cmbs, was dated to 2536 ± 35 BP (AA-73317) uncalibrated radiocarbon years, resulting in a calibrated date range of 2748–2671 (36%) and 2643–2489 (63%) calBP at 2σ. A *Tridacna* sp. shell from level 4 (27–37 cmbs) produced a

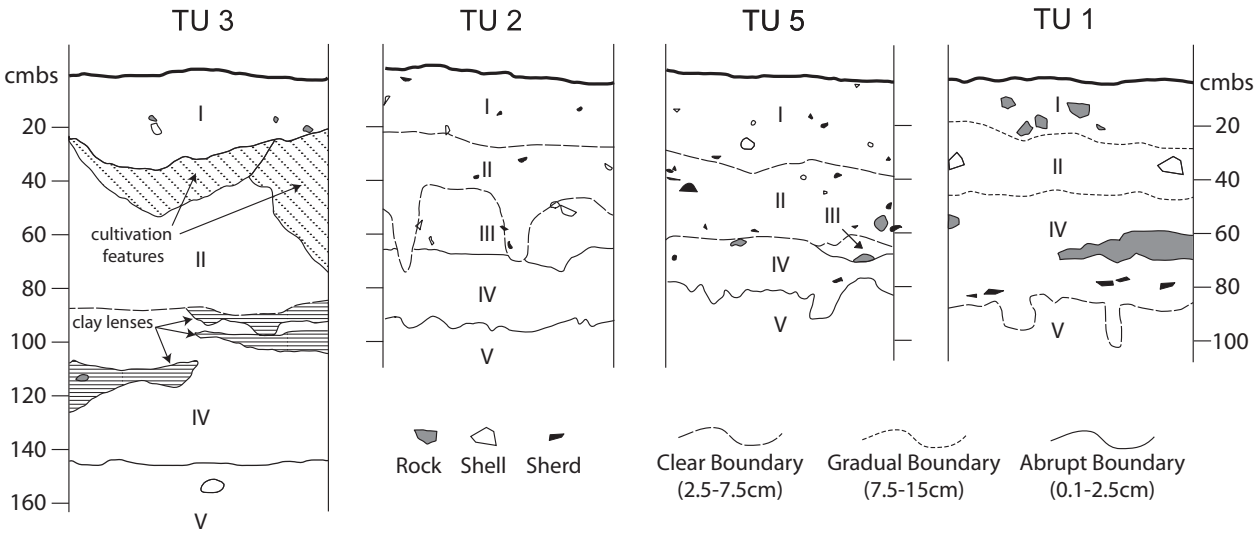

Figure 6. West wall profiles of selected test units at Tavua Village, site K27-4. Profiles are arranged south to north, from left (TU 3) to right (TU 1). Roman numerals designating layers indicate same strata in each test unit. Layer III defined only in Test Units 2 and 5. Test Unit 4 profile is similar to 3, but was inadequately recorded.

date 2832 ± 30 (Wk-20392) uncalibrated radiocarbon years, calibrated to 2675–2387 calBP at 2σ. This *Tridacna* shell is likely spoil from near the bottom of the sand mining pit deposited on the modern surface and subsequently buried. The dating of charcoal from undisturbed sediments indicates that the Tavua Village site was first occupied approximately 2900 BP. This date of initial occupation is supported by the Lapita decorative classes and vessel types found in the Tavua Village ceramic assemblage. This is the oldest date in the Yasawa and Mamanuca islands.

Ceramics. A moderately large ceramic assemblage was recovered from the test units. (n = 11,358, Table 6). The presence of typically older sherd types and decorative classes in excavation levels 1–3 of Test Unit 1 has resulted from the deepest sediments of the nearby sand mine pit being placed on the modern surface. The test unit was excavated through these older sediments, and their cultural materials, now near the surface in this area. In particular, two ceramic strap-handles were recovered from levels 1 and 2 and a spout was recovered from level 3 (all Layer I). These sherds were parts of narrow-spouted, handled jugs typically found in Lapita-era (*c.* 3000–2700 BP) assemblages in the Fiji-West Polynesia region (Kirch 1997: 158–159). Notched collared-rim sherds that also appear in Lapita assemblages in the region were recovered from levels 1–3 as well.. Since these and all other sherds from excavation levels 1–3 in Test Unit 1 cannot be securely assigned to

Table 4. *Sediment characteristics for Test Units, Tavua Village, Site K27-4*

Layer	Colour	Texture	Inclusions	Sorting
I	7.5YR 2.5/1 (black)	sandy clay loam; weak, very fine, subangular blocky structure; firm moist consistence	very few gravels and pebbles; few fine roots, charcoal flecks and chunks	well-sorted
II	7.5YR 4/2 (brown)	sandy clay loam; weak, very fine, granular structure; loose moist consistence	very few pebbles and cobbles; very few, very fine roots; charcoal flecks and chunks	well-sorted
III	10YR 6/4 (light yellowish brown)	loamy sand; weak, very fine, granular structure; loose moist consistence	very few pebbles and cobbles	poorly sorted
IV	10YR 5/2 (grayish brown)	loamy sand; weak, very fine, granular structure; friable moist consistence	very few pebbles; charcoal flecks and chunks	poorly sorted
V	2.5Y 8/4 (pale yellow)	coarse sand; structureless, fine, granular; firm moist consistence	–	well-sorted

Table 5. *Radiocarbon data from Test Unit 1 samples, Tavua Village, Site K27-4*

Lab No.	Location	Material	^{14}C Age BP	δ^{13}C	Calibrated Age Range BP (2 σ probabilities)*
AA-73315	K27-4, TU 1, level 11, 92–106 cmbs	unidentified wood charcoal	2693 ± 39	–24.8	2861–2748
AA-73316	K27-4, TU 1, level 13, 116–126 cmbs	unidentified wood charcoal	2850 ± 36	–27.8	3073–2865
AA-73317	K27-4, TU1, level 8, 77–87 cmbs	unidentified charcoal residue adhering to ceramic	2536 ± 35	–24.3	2748–2671 (36%) 2643–2489 (63%)
Wk-20392	K27-4, TU1, level 4, 37–47 cmbs	*Trochus* sp. (hinge)	2832 ± 30	2.4	2675–2387

* Calibrations performed using Calib 5.0.1 (Stuiver and Reimer 1993) and associated calibration data set. Marine calibration dataset from Hughen *et al*. (2009) and ΔR correction factor from Toggweiler *et al*. (1991)

their original stratigraphic context they are not counted in Table 6. Table 6 groups the Tavua Village ceramic assemblage into layers, and not excavation levels, as layers are easily correlated across test units. Sherds recovered from the boundary between layers and not confidently assigned to either layer are placed into two-layer groups (e.g., IV/V).

The dentate-stamp-decorated Lapita ceramics found in Layers II–IV/V (Fig. 7) number only 19 sherds representing motifs 1, 15, 16, 18, 76, and design element 1 as defined by Mead *et al*. (1973). Although this assemblage is too small for any quantitative analysis and conclusions, motifs 1, 15, 16, 76 and design element 1 are found in relatively high frequencies at Lapita sites across Fiji and in Tonga (Best 1984; Clark and Murray 2006; Poulsen 1987). This supports previous conclusions that the colonisers of Tavua and the Mamanucas, along with other areas of Fiji and Tonga may be considered a single cultural population (e.g., Green 1995), that is, a population within which cultural transmission led to material culture similarities, including the distribution of Lapita motifs (Cochrane and Lipo, in press). The other decorated ceramics associated with the dentate stamped sherds include notched collared rims (listed as punctate, the method of application, in Table 6), a rim sherd with incised Xs near the lip and other incised sherds, paddle-impressed sherds, and slipped and wiped sherds. Slipping and wiping sherds may impart functional characteristics to vessels and therefore the presence of these traits may be explained by different processes compared to other types of decoration. All of these surface modifications, however, are found in other Lapita era assemblages across Fiji and Tonga (Best 1984; Poulsen 1987).

In layers I and I/II, post-dating the Lapita assemblage, a set of decorative classes typical for the Fijian islands are found including paddle-impressed designs created from parallel ribbed and cross-hatched paddles as well as a more rare diamond-patterned paddle (not found in the Yasawas). Wiped sherds, typically necks that are striated by wiping the wet clay with palm husk, are also found in these layers and occur throughout Fiji. The slipped sherds (all red slip) are from small inverted rim bowls, again found throughout Fiji.

The number of rim sherds found in the test units is

Table 6. *Ceramic counts for Test Units 1–5, Site K27-4, Tavua Village. Excavation levels 1–3 from Test Unit 1 not included.*

Layer	No. of Sherds	Dentate	PI Parallel	PI Cross	PI Other	Curvilinear Incision	Rectilinear Incision	Molding	Punctate	Slip	Wiped
I	3847		38	13	8		3	1	7		
I/II	920		11	1	1	1	1			4	8
II	3821	3	8	1			3		5	31	6
II/III	232	4								1	2
III	276	4							1	1	
IV	1819	7	2				3		8	13	3
IV/V	155	1								11	
V	288									54	2
Totals	**11358**	**19**	**59**	**15**	**9**	**1**	**10**	**1**	**21**	**115**	**21**

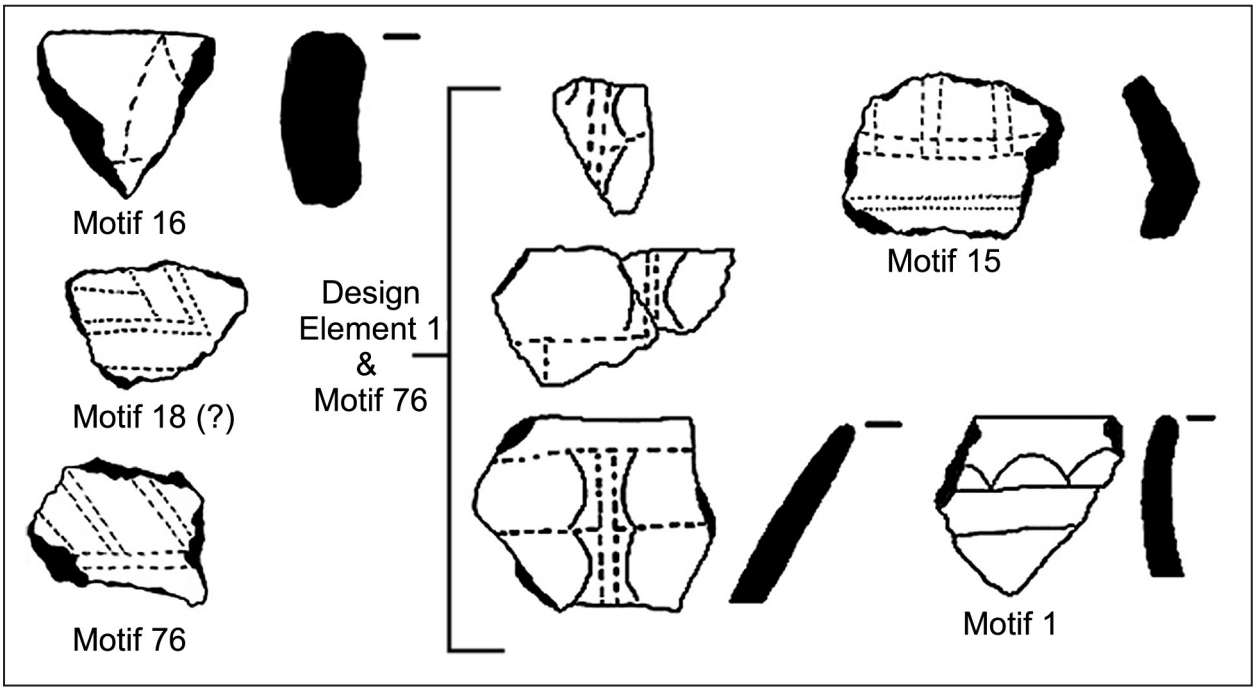

Figure 7. A sample of Lapita dentate-stamped and incised sherds recovered from Tavua Village, site K27-4 with Mead *et al*. (1973) motifs categories and design elements indicated.

small (n = 494) and these are highly fragmented making it difficult to estimate the kinds of vessel present. The Lapita layers include carinated sherds likely from globular everted rim pots as such vessels with carinations are found in almost all Lapita assemblages in the region. Collared rims recovered from the Lapita layers are also found on globular everted or direct rim pots in similarly dated deposits in Fiji. Layer IV contained a strap handle found on spouted jars during the Lapita era. Various jar rims are also found in Layer II including an everted cooking pot rim known as *kuro* in Fijian. In summary, the vessel types and decorations present in the Tavua Village assemblage are present in all currently known Fijian assemblages, except for the Yasawa islands to the north of Tavua. However, the variation described here for Tavua Village is likely a product of the small sample size and not indicative of the larger ceramic population at the site.

Shellfish. Like archaeological sites throughout the Yasawa islands (Morrison and Cochrane 2008; Cochrane 2009), the Tavua Village shellfish remains are the most abundant kind of subsistence item recovered, outnumbering other fauna including terrestrial mammals, birds, and fish by a large margin. It is unclear whether this bias towards shellfish accurately records prehistoric subsistence behaviours, or reflects poor preservation of skeletal material.

The shellfish from Test Unit 1 have been analysed, except for the spoil in excavation levels 1–3, and the assemblage consists of 1866 specimens, all but 26 identifiable to family. While trends in family abundances may not display the precision necessary for robust analyses of foraging behaviour and environmental change, the preliminary analysis of the Test Unit 1 assemblage does suggest several hypotheses to be quantitatively investigated with further analysis of the other test units. Figures 8 and 9 show the number of identified specimens (NISP) for the five most abundant bivalve and gastropod families recovered from Test Unit 1. The excavation levels as depicted here are roughly equal in volume with levels nine and ten collapsed into a single level. Taxa in level 14 are considered to be naturally deposited and not the result of human foraging behavior.

Bivalves (Fig. 8) decrease in abundance over time with individual bivalve families following similar trends of decreasing NISP. There are also potentially significant trends in the presence-absence of individual bivalve families over time. The presence and absence of *Aricdae* and *Veneridae* may indicate changes to the local environment and the availability of these taxa to ancient foragers. The *Arcidae* identified here is almost certainly *Anadara antiquata*, a species that inhabits the coral sand of the intertidal zone, while the *Veneridae* are likely *Gafrarium* sp., a suspension feeder whose abundance declines when fine-sediment content of water is greater than 20% (Baron and Clavier 1992). Both these species are relatively common at other archaeological sites in western Fiji (see e.g., Morrison and Cochrane 2008; Szabó 2000), and they are not found in contemporaneous excavation levels at Tavua Village. *Veneridae* are found only in V/11 and above IV/7 suggesting a possible change in the water sediment content and the composition of the intertidal substrate during these times, that is around 2800 BP and after approximately 2500 BP

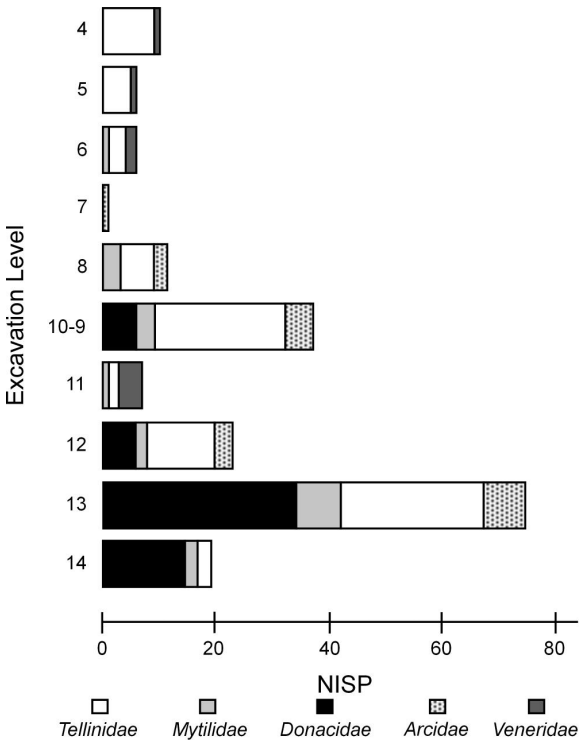

Figure 8. NISP of the five most abundant bivalve families per excavation level from the Tavua Village site, K27-4, Test Unit 1.

(see Dating, above). The absence of *Donacidae*, or *Donax* sp., a small clam, shortly after the deposition of Layer IV begins (ca. 2600 BP) also suggests a change in local environment, foraging behaviors, or both after this time. Further analysis of the total assemblage and paleoenvironmental studies will help narrow these possibilities.

Gastropods (Fig. 9) decrease, then increase in abundance in the more recently deposited sediments. Among gastropods, *Patellidae*, likely including several genera of limpets, decline in abundance over time, disappearing near the end of Layer IV deposition when the overall abundance of gastropods begins to increase. This may suggest a new shellfish foraging strategy focused on taxa with more edible flesh than the small limpets.

The Tavua Village site is the earliest dated site in the far western Fijian islands. The artefact assemblage consists of decorated Lapita ceramics and more recent ceramic forms in a relatively undisturbed stratigraphic sequence. A few other artefact types including a drilled shark-tooth pendant, a shell ornament, three hammerstones, and a coral abrader or shaft straightener from Layers IV and V, two adzes from Layer I and a handful of lithics from all layers, three shell beads from Layers I and II, and abundant shell as food remains indicate a likely domestic use of the site. The post-holes originating in Layer IV appear to date to the Lapita era of the site and may have formed the support for a wooden structure.

DISCUSSION AND CONCLUSION

The first survey and excavation of archaeological sites in the Malolo and Mamanuca islands of southwest Fiji identified eleven sites, with test excavations conducted at three sites. Preliminary analyses of the recovered cultural materials indicate populations on the Mamanuca and Malolo islands were part of a larger Fijian and West-Polynesian population, at least during the first few hundred years after colonisation of the region as Lapita motifs found in the Tavua excavations also appear in, for example, Samoa (Petchey 1995: Table 6.1) Tonga (Poulsen 1987), and Niutoputapu (Kirch 1988: Table 29). However, the order in which Fiji, Tonga, and Samoa were colonised, and the intensity of post-colonisation interaction have been the subject of modest debate since the 1960s (Anderson and Clark 1999; Best 1984). Burley and his colleagues (Burley and Connaughton 2007; Burley and Dickinson 2001, 2010; Burley, *et al.* 2002), for example, have analysed ceramic pastes, as well as radiocarbon dates on cultural strata, ceramic tempers, and Lapita motifs to argue that Nukuleka, Tonga, was colonised without any prior 'stop-over' in Fiji and that Samoa was colonised directly from Tonga. Clark and Murray (2006) have argued that rank orders of Lapita motifs in assemblages suggest east Fiji (Lau Islands) was colonised by both populations from west Fiji and Tonga. Further, excavations by Nunn and colleagues have pro-

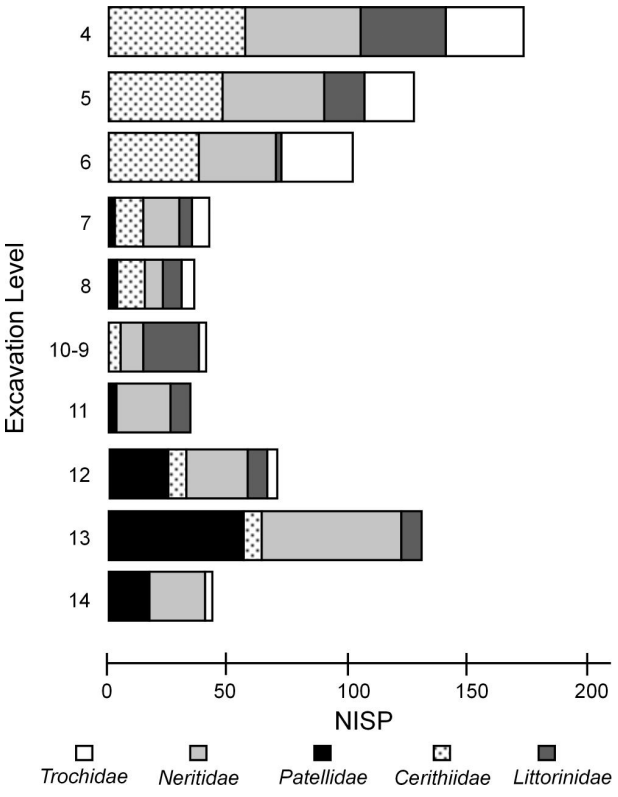

Figure 9. NISP of five most abundant gastropod families per excavation level from the Tavua Village site, K27-4, Test Unit 1.

duced some of the earliest archaeological dates in the region at the site of Bourewa, southwest Fiji. Here, bulk charcoal in layers with early (intricately decorated) Lapita ceramics dates to *c.* 3100–3000 BP. These archaeologists and others are concerned with questions such as: did the colonists of Fiji-West Polynesia settle the area in stepping-stone or branching pattern? And what is the cultural relationship between West Fiji, East Fiji, Tonga, and Samoa?

Complex colonisation processes are also likely indicated by the Lapita motifs present at the Tavua Village site, although the small sample prevents any definitive conclusions at this time. Clark and Murray (2006) argue that the Lapita design system underwent a process of temporal decay, so that the least used motifs dropped out of the decorative system over time. For example, the most abundant motifs in a 'home-land' population should also be present in a later 'daughter' population. As successive daughter-populations are produced the least abundant motifs in each daughter-population will continue to drop out of the decorative system.

If we use this logic to examine the Tavua Village Lapita motifs, these motifs are also among the ten most abundant motifs of Tongan and east Fijian sites (data from Clark and Murray 2006). On the face of it, this might suggest that Tonga and east Fiji comprise the 'home-land' for Tavua, but such conclusion is certainly unwarranted and instead points to the notion that the population structure of colonising groups in the region is likely more complex than decay-models suggest (see also Burley *et al*. 2002: 222). One possibility is that the pattern of colonisation in the region can be described by an Ideal Free Distribution (Kennett *et al*. 2006) where the ecologically best habitats for a given subsistence regime are colonised first then less favorable habitats are colonised as the best locations fill up or as subsistence activities in these locations are disrupted or changed due to habitat degradation (cf. Clark and Anderson 2001: 85). Future research using large well-dated ceramic samples and ecological surveys of early and late Lapita sites are necessary to explain the complex colonisation patterns coming to light in Fiji-West Polynesia, particularly Tonga and Fiji.

Post-Lapita ceramic variation in the Mamanuca and Malolo islands suggests cultural transmission between the far-western Fijian Islands and a pan-Fijian population continued, at least at low frequency. For example, the spot-relief paddle impressed sherds recovered from Solevu Village on Malolo Island and the diamond-relief paddle impressed sherds from Tavua Village are found throughout Fiji, but are fairly rare. The absence of these decorative types in the Yasawa islands, despite thousands of sherds analysed, indicates that the Yasawa islands population may have been relatively isolated from the rest of Fiji.

Although more research is also needed to explain post-Lapita cultural variation in Fiji (Burley and Clark 2003), the initial analyses presented here, and other recent research, suggest changes to local environments and human competition helped shape the course of prehistory. Four of the eleven sites identified in the Malolo and Mamanuca Islands seemed to serve a defensive purpose and these likely date to late in the prehistoric period, perhaps 500 BP as suggested by defensive sites in the Yasawa Islands (Cochrane 2009) and other evidence of human competition such as butchering of adolescents (Cochrane *et al*. 2004; Pietrusewsky *et al*. 2007). Moreover, Morrison and Cochrane (2008) and Cochrane and Neff (2006) have recently suggested that an increase in competition between groups in the Yasawa islands may have been related to local environmental changes with detrimental effects on subsistence resources (see also Field and Lape 2010). Although the analysis of shellfish fauna at Tavua Village is preliminary, variation in the use of shellfish may also indicate local environmental changes, subsistence adaptation (Field *et al*. 2009), and competition for resources.

The initial survey and excavation of sites in the Malolo and Mamanuca Islands demonstrates a human presence in the islands for approximately 2900 years. These Lapita colonisers were part of a larger population that first settled Fiji and West Polynesia. Post-Lapita cultural change, primarily variation in ceramic decoration, subsistence, and settlement types, suggests continuing contact with the larger regional population and adaptation to changing natural and social environments.

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