7

Site chronology and a review of radiocarbon dates from Fiji

Geoffrey Clark

Archaeology and Natural History, The Australian National University

Atholl Anderson

Archaeology and Natural History, The Australian National University

Introduction

The earliest radiocarbon dates from the Central Pacific were obtained by Edward W. Gifford, on charcoal recovered from excavations at Vunda and Navatu on Viti Levu (Gifford 1951a, b), and the results were later used to outline the first culture sequence proposed for Fiji, by Roger Green (1963). Subsequent investigations by Frost (1970, 1979) and Best (1984) substantially increased the number of ^{14}C results from the archipelago, and allowed a wider range of cultural attributes, such as settlement location, interaction pattern, subsistence economy and stone-tool types, to be age-correlated.

This chapter is divided into two sections, with the first section reporting the radiocarbon and thermoluminescence dates obtained by the Early Prehistory of Fiji project (the EPF) between 1996 and 2000. There were 68 radiocarbon determinations from 13 prehistoric sites. Most dated deposits were from coastal or near-coast locations on Viti Levu ($n=9$), two sites were from Beqa Island, and two excavations were on Mago Island in the Lau Group. Six sites contained ceramics of Lapita style (some mixed with pottery of post-Lapita age), two sites had deposits of mid-sequence antiquity, and five sites had pottery and other items common in late-prehistoric sites dating to the last millennium. Results were used to construct a chronology for each site by assessing the reliability of each determination. In several deposits, the age of the oldest cultural remains was not able to be determined with radiocarbon because of extensive reworking of Lapita remains with more recent cultural materials.

There are now more than 300 radiocarbon determinations from prehistoric sites in Fiji, and the second section of this chapter presents age results identified in a review of the archaeological literature. In listing the ^{14}C results from Fiji our purpose is to provide a comprehensive overview of archaeological determinations, and to illustrate the geographic locations and points in the Fiji culture sequence that have been the focus of chronometric research. Recent investigations with a significant dating component have greatly altered the temporal dimensions of key sections of the Fijian sequence. These include, in addition to the EPF, the work of Nunn, Kumar and colleagues at Lapita sites (2004a, 2004b), the analysis of mid-sequence ceramic change at the Sigatoka Sand Dunes (Burley 2005), and the study of fortifications (Field 2004, 2005). Our review concludes with a discussion of these parts of the sequence in light of new chronological data.

Site chronology

Radiocarbon determinations were obtained on samples from two north-coast Viti Levu sites (Natunuku, Navatu 17A), seven southwest Viti Levu sites (Karobo, Malaqereqere, Tuvu, Volivoli II, Volivoli III, Qaranioso I and Qaranioso II), Beqa Island and Ugaga Island (Kulu and Ugaga), and two sites on Mago Island in the Lau Group (Votua and Sovanibeka). There were 68 determinations, two AMS and the rest radiocarbon, and nine samples were 'modern' (Table 17). Two thermoluminescence determinations were obtained on pottery excavated from the Navatu 17A site (Table 18). At the Sigatoka Sand Dunes, an intact cultural deposit was not located, and optically stimulated luminescence (OSL) age results were obtained on the dune sediments (see Anderson et al. 2006). New radiocarbon dates from the Yanuca Lapita site excavated in the 1960s by Lawrence and Helen Birks have been reported previously (Clark and Anderson 2001b), and are listed in the review of archaeological dates (see below).

Radiocarbon samples of marine shell, terrestrial shell, bone, palm wood and charcoal were analysed at the Quaternary Dating Research Centre (QDRC) at the Australian National University ($n=45$), the Waikato Radiocarbon Dating Laboratory at the University of Waikato ($n=15$), the Beta Analytic Inc. Radiocarbon Dating Laboratory (BETA) in Florida ($n=7$), and the Australian Nuclear Sciences and Technology Organisation (ANSTO) at Lucas Heights ($n=1$). Two thermoluminescence dates were determined at the Department of Physics at the University of Adelaide. Sample pretreatment and calibration are outlined below. Radiocarbon results from the EPF are given in Table 17 and Figure 83, with the conventional radiocarbon age (CRA), ^{13}C value (estimated and measured), calendar age at 2SD (cal. BP), sample material/species, excavation context and sample weight.

Sample pretreatment

Charcoal

Clay, rootlets, shell fragments and other adhering non-charcoal materials were removed with tweezers from excavated charcoals before samples were submitted. Dating laboratories also physically removed possible contaminants before samples were washed in distilled water and crushed, or chopped to increase the surface area for subsequent pretreatment. Chemical pretreatment at the QDRC involved washing the charcoal in 10% HCl, whereas Waikato and Beta Analytic Inc. used the ABA method, in which the sample is heated with dilute HCl followed by dilute NaOH, and given a final treatment in dilute hot HCl. Identification of wood charcoals used in radiocarbon dating is routinely carried out in New Zealand, and at some contract archaeology companies working in the Pacific, such as the International Archaeological Research Institute, Inc. (IARII). Charcoal from twigs or shortlived taxa is preferred for radiocarbon dating since it is unlikely to incorporate a high 'inbuilt' age (Anderson 1991).

Table 17. Radiocarbon results from EPF archaeological investigations.

Lab. Number	Conventional Age (BP)	Calibrated Age BP (2 SD)	$\delta^{13}\text{C}$	Sample type	Species	Unit and Depth below surface (cm)	Total weight (grams)
Ugaga							
ANU-10774	1720 ± 70	1150–1390	0.0 ± 2.0E	Marine shell	<i>Tridacna maxima</i>	Sq. I5: 20–30	81.0
ANU-10776	1900 ± 60	1310–1590	0.0 ± 2.0E	Marine shell	<i>Turbo argyrostromus</i>	Sq. M8: 20–30	111.9
Beta-107951	2130 ± 50	1580–1850	2.0	Marine shell	<i>Tridacna maxima</i>	Sq. -A13: 30–40	117.8
ANU-10772	2140 ± 70	1550–1890	0.0 ± 2.0E	Marine shell	<i>Trochus niloticus</i>	Sq. I5: 30–40	443.3
ANU-10773	2490 ± 70	1970–2320	0.0 ± 2.0E	Marine shell	<i>Tridacna maxima</i>	Sq. 09: 30–40	206.6
ANU-10777	2530 ± 70	2000–2340	0.0 ± 2.0E	Marine shell	<i>Tridacna maxima</i>	Sq. J9: 40–50	137.0
ANU-10778	2600 ± 70	2090–2470	0.0 ± 2.0E	Marine shell	<i>Tridacna maxima</i>	Sq. T/U-1: 40–50	131.9
ANU-10775	2620 ± 60	2130–2470	0.0 ± 2.0E	Marine shell	<i>Tridacna maxima</i>	Sq. I9: 30–40	180.3
Beta-107952	2690 ± 60	2260–2650	2.0	Marine shell	<i>Tridacna maxima</i>	Sq. P10: 30–40	132.7
Beta-107953	3150 ± 70	2760–3140	3.2	Marine shell	<i>Trochus niloticus</i>	Sq. C12: 50–60	278.2
ANU-10734	97.7 ± 0.8%M	Modern	-24 ± 2.0E	Charcoal	–	Sq. I9: 20–30	100.0
Wk-5553	98.5 ± 0.7%M	Modern	-27.7 ± 0.2	Charcoal	–	Sq. K5: 30–40	18.2
Wk-5554	98.3 ± 0.5%M	Modern	-26.9 ± 0.2	Charcoal	–	Sq. J9: 20–30	11.0
Wk-5555	98.8 ± 0.5%M	Modern	-26.8 ± 0.2	Charcoal	–	Sq. K7: 20–30	100.0
Wk-5556	98.2 ± 0.5%M	Modern	-25.3 ± 0.2	Charcoal	–	Sq. P8: 20–30	56.1
Kulu							
Beta 107947	2590 ± 50	2120–2380	1.8	Marine shell	<i>Tridacna</i> sp.	C11: 60–70	–
Beta 107948	2590 ± 50	2120–2380	1.5	Marine shell	<i>Cerithium</i> sp.	C11: 130–140	–
Beta 107949	180 ± 40	0–280	-29.0	Charcoal	Candle nut	C11: 110–120	–
Beta 107950	220 ± 50	0–310	-24.0	Charcoal	Candle nut	C11: 140–150	–
ANU-10727	820 ± 100	560–910	-24 ± 2.0E	Charcoal	–	C9: 40–50	3.0
ANU-10743*	117.2 ± 2.7%M	Modern	-24 ± 2.0E	Charcoal	–	C11: 100–110	0.32
Karobo							
ANU-10781	300 ± 70	0–500	-24 ± 2.0E	Charcoal	–	Square Y, L3: 33	9.5
ANU-10780	1780 ± 80	1420–1830	-24 ± 2.0E	Charcoal	–	Square Ab-1, L7: 122	7.3
ANU-11067	1680 ± 70	1370–1700	-24 ± 2.0E	Charcoal	–	Square A2, L5: 100	6.2
ANU-11068	2130 ± 120	1740–2340	-24 ± 2.0E	Wood	Palm cf. <i>Cocos nucifera</i>	Square A2, L5: 137	15.9
Malaqereqere							
ANU-10453	830 ± 90	560–910	-24 ± 2.0E	Charcoal	–	Sq. A2: 60–70	5.5
ANU-10452	460 ± 60	330–420	-24 ± 2.0E	Charcoal	–	Sq. A1: 10–20	78.3
ANU-10454	670 ± 70	520–680	-24 ± 2.0E	Charcoal	–	Sq. A1: 40–50	11.0
Tuvu							
ANU-11020	1570 ± 100	1260–1700	-24 ± 2.0E	Charcoal	–	TP 1, Spit IV	3.0
Volivoli II							
ANU-10449	1120 ± 70	810–1170	-24 ± 2.0E	Charcoal	–	TR. 1: 20–30	5.6
ANU-10450	1960 ± 70	1630–2040	-24 ± 2.0E	Charcoal	–	TR. 1: 40–50	11.5
ANU-10451	1080 ± 190	580–1300	-24 ± 2.0E	Charcoal	–	TR.1: 50–60	4.6
Volivoli III							
ANU-11018	290 ± 60	0–490	-24 ± 2.0E	Charcoal	–	TP. 1, Spit 2	7.0
ANU-11016	1100 ± 90	770–1170	-24 ± 2.0E	Charcoal	–	TP. 1, Spit 5	2.2
ANU-11019	1060 ± 80	740–1070	-24 ± 2.0E	Charcoal	–	TP. 1, Spit 8	4.5
Qaranioso 1							
ANU-11015	1280 ± 120	920–1350	-24 ± 2.0E	Charcoal	–	TP. 1: 30	–

Continued on next page

Table 17 continued

Lab. Number	Conventional Age (BP)	Calibrated Age BP (2 SD)	$\Delta^{13}\text{C}$	Sample type	Species	Unit and Depth below surface (cm)	Total weight (grams)
Qaranioso II							
ANU-11014	660 ± 60	530–670	-24 ± 2.0E	Charcoal	–	TP. 1: 30	–
Natunuku							
ANU-10382	98.4 ± 1.0%M	Modern	-24 ± 2.0E	Charcoal	–	Tr.3, Sq.6: 25–40	7.0
ANU-10699	1160 ± 70	600–890	0.0 ± 2.0E	Marine shell	<i>Tridacna</i> sp.	Tr.3, Sq.A5: 30–40	65.9
ANU-10381	99.7 ± 0.8%M	Modern	-24 ± 2.0E	Charcoal	–	Tr.3, Sq.A5: 10–20	20.4
ANU-10700	380 ± 70	160–230	0.0 ± 2.0E	Marine shell	<i>Trochus</i> sp.	Tr.3, Sq.A5: 10–20	172.8
ANU-10698	2780 ± 90	2310–2720	0.0 ± 2.0E	Marine shell	<i>Tridacna</i> sp.	Tr.3, Sq.A5: 20–30	95.8
ANU-11307	2600 ± 60	2110–2440	0.0 ± 2.0E	Marine shell	Species ?	Tr. 3, no context	–
ANU-11306	1170 ± 50	630–840	0.0 ± 2.0E	Marine shell	Species ?	Tr. 3, no context	–
ANU-11305	2900 ± 50	2490–2770	0.0 ± 2.0E	Marine shell	Species ?	Tr. 3, no context	–
Navatu 17A							
ANU-10385	350 ± 70	150–500	-24 ± 2.0E	Charcoal	–	Tr. A1, L1: 100	40.7
ANU-10388	104.0 ± 1.1%M	Modern	-24 ± 2.0E	Charcoal	–	Tr. B2, L1: 20	5.0
ANU-10710	720 ± 70	250–500	0.0 ± 2.0E	Marine shell	<i>Anadara</i> sp.	Tr. B2, L1: 50	116.8
ANU-10389	330 ± 60	150–490	-24 ± 2.0E	Charcoal	–	Tr. B1, L1: 86	20.7
ANU-10709	980 ± 70	480–670	0.0 ± 2.0E	Marine shell	<i>Gafrarium</i> sp.	Tr. B1, L2: 120	51.7
ANU-10384	870 ± 70	660–910	-24 ± 2.0E	Charcoal	–	Tr. B1, L2: 140	6.0
ANU-10387	1240 ± 140	800–1350	-24 ± 2.0E	Charcoal	–	Tr. B1+2, L4: 215	2.4
ANU-10390	1010 ± 140	660–1180	-24 ± 2.0E	Charcoal	–	Tr. B1+2, L4: 220	2.1
ANU-10386	1670 ± 70	1360–1690	-24 ± 2.0E	Charcoal	–	Tr. B3+4, L4: 230	7.3
ANU-10708	1980 ± 70	1360–1710	0.0 ± 2.0E	Marine shell	<i>Tridacna</i> sp.	Tr. B3+4, L4: 230	78.8
Votua							
Wk-5366	2970 ± 50	2620–2870	-0.3 ± 0.2	Marine shell	<i>Anadara antiquata</i>	Testpit 1, 60–70	133.3
Wk-5367	2930 ± 50	2540–2830	-0.2 ± 0.2	Marine shell	<i>Anadara antiquata</i>	Testpit 1, 30–40	198.8
ANU-10706	2520 ± 120	2170–2790	-24 ± 2.0E	Charcoal	–	Testpit 1, 40–50	7.1
Wk-5368	2940 ± 50	2570–2840	-0.4 ± 0.2	Marine shell	<i>Anadara antiquata</i>	Area 1: 20–30	157.7
Wk-5369	2950 ± 50	2600–2850	-0.2 ± 0.2	Marine shell	<i>Anadara antiquata</i>	Area 1: 10–20	183.4
ANU-10707	2670 ± 70	2460–2880	-24 ± 2.0E	Charcoal	–	Area 1: 20–30	4.6
ANU-11069 A	2490 ± 60	1990–2300	0.0 ± 2.0E	Marine shell	<i>Trochus niloticus</i>	Area 1: 20–30	68.0
ANU-11069 B	2990 ± 60	2650–2930	0.0 ± 2.0E	Marine shell	<i>Trochus niloticus</i>	Area 1: 10–20	40.0
ANU-11528	2680 ± 70	2470–2920	-26.4 ± 0.2	Charcoal	–	Area 2, Sq. 4: 60	8.1
ANU-11527	2850 ± 50	2440–2730	-1.5 ± 0.1	Marine shell	<i>Anadara antiquata</i>	Area 2, Sq. 1: 60–70	43.6
Sovanibeka							
OZF882*	840 ± 40	670–770	-20.0	Bone	<i>Rattus praetor</i>	Test Pit 1: 50–60	1.7
ANU-10779	2820 ± 70	2360–2720	0.0 ± 0.2E	Marine shell	<i>Anadara antiquata</i>	Test Pit 2: 30–50	7.3
ANU-11246	4290 ± 60	4540–4960	-2.5 ± 0.2	Land snail	<i>Gonatorhaphe lavens</i>	Test Pit 2: 55–58	34.1

* = AMS determination.

'E' in the delta ^{13}C column indicates the use of an estimated ^{13}C value.

Table 18. Navatu 17A thermoluminescence results (Trench B, Square 1).

TL No.	Unit/Depth (cm)	Equivalent dose (Gy)	a-value	Total dose rate (Gy ka ⁻¹)	Age	Age range
98001	Tr. B, Sq. 1: 140	1.59±0.3	0.22±0.03	1.22 ± 0.11	1300 ± 275	1575–1025
98002	Tr. B, Sq. 1: 230	2.44±0.3	0.28±0.03	1.10 ± 0.13	2230 ± 380	2610–1850

Figure 83. EPF calibrated age determinations at 2SD.

Radiocarbon laboratories do not currently identify archaeological charcoals from the tropical Pacific. Consequently, ages on charcoal from Fiji and from elsewhere in the West and Central Pacific may be older than the cultural activity associated with the sample.

Palm wood

The surfaces of a palm-wood sample dated at the QDRC were scraped clean and the wood was chopped into small splinters and milled. The sample was washed in hot 10% HCl, rinsed and dried. The sample was Soxhlet extracted with ethanol, ethanol/chloroform (2:1) and water, bleached with sodium perchlorate, rinsed and dried.

Marine and terrestrial shell

Marine-shell samples were identified using a reference collection at the ANU, and cleaned with a dental drill (QDRC) or acid etched (Beta Analytic Inc., Waikato). The Waikato laboratory tests marine shells for recrystallisation before dating, but this procedure was not standard for marine shell dated at the QDRC and Beta Analytic Inc. Marine shells from the Votua site were examined for recrystallisation with X-ray diffraction, which identified the samples as 100% aragonite, indicating that the prehistoric shell samples were not affected by the transformation of biogenic aragonite to calcite. Land snails were identified by Winston Ponder (Australian Museum), with samples of a single species sorted and pretreated by gently crushing the shell and repeatedly washing the residue in an ultrasonic bath filled with distilled water until adhering cave sediments had been removed from the surface shell.

Bone

Macroscopic contaminants attached to the bone sample were removed with tweezers at ANSTO, the dry bone was crushed in a mortar and pestle, and the fragments were washed in an ultrasonic bath filled with Milli-RO water until clean. The fragments were placed in a freeze dryer for one to two days, then ground to powder with a particle size of less than 200 μm . Chemical pretreatment involved removal of the inorganic bone component with an acid-alkali wash and gelatin extraction in heated 0.01M HCl, followed by separation of the collagen in solution with a centrifuge, and two to three days of freeze drying to dry the gelatin.

CRA and calibration

Isotopic fractionation refers to the difference in the proportion of ^{14}C to ^{12}C in a living organism or sample, and the proportion of ^{14}C to ^{12}C in the carbon reservoir. The conventional radiocarbon age (CRA) is corrected for fractionation by measuring the $\delta^{13}\text{C}$ of a sample with a mass spectrometer, or by using an estimated value for marine and terrestrial carbon reservoirs. Some CRA ages from the QDRC had measured $\delta^{13}\text{C}$ values, but most incorporated estimated values of $-24 \pm 2.0\text{‰}$ for charcoal and $0 \pm 2.0\text{‰}$ for marine shell relative to VDPB. For Fijian charcoal samples the measured $\delta^{13}\text{C}$ varied from -29.0‰ to -24.0‰ ($\delta^{13}\text{C}$ range = 5.0‰). The majority of marine shells had a similar range of 5.7‰ (3.2‰ to -2.5‰), suggesting that in most cases the use of estimated $\delta^{13}\text{C}$ values would not have made a significant change to the CRA. However, a *Trachycardium* shell from the Yanuca site on Viti Levu was measured at -12.3‰ (Clark and Anderson 2001b), indicating that some marine shellfish from locations adjacent to freshwater sources can have $\delta^{13}\text{C}$ values significantly different from the estimated marine reservoir value. CRAs and standard errors (1SD) were rounded to the nearest decade.

Calibrations were by CALIB 5.0 (Stuiver and Reimer 1993), with terrestrial samples calculated with the Southern Hemisphere curve (McCormac et al. 2004), marine samples

with the Marine curve of Hughen et al. (2004), and mixed terrestrial-marine samples with the Southern Hemisphere combined curves of Hughen et al. (2004) and McCormac et al. (2004). DeltaR was set at 0 for marine samples. DeltaR values of +25 years (Petchey 1995) and $+45 \pm 30$ years (Stuiver and Braziunas 1993) have been used to calibrate radiocarbon determinations from Fiji, and a marine reservoir value of 38 ± 16 years has been calculated for Viti Levu on coral rings (Toggweiler et al. 1991). In the absence of marine-reservoir values for specific locations, we prefer to use the 0 value, given the diversity of marine and coastal environments in Fiji. Marine-shell-charcoal pairs from archaeological sites in Viti Levu and the Lau Group (Clark 2000; Thomas et al. 2004) also suggest that the value of DeltaR is relatively small. Samples of human bone (Table 19) were calibrated with the terrestrial-marine Southern Hemisphere calibration curve, with DeltaR set at 50% because of the likelihood of marine carbon in the diet (Leach et al. 2001). Calibrated results are reported at two standard deviations and rounded to the nearest decade.

Ugaga Island

Four charcoal samples were sent to the Waikato Radiocarbon Dating Laboratory and one to the QDRC. Modern results were obtained, necessitating a new sample submission strategy (Wk-5553, Wk-5554, Wk-5555, Wk-5556, ANU-10734). Graphing the weight of charcoal recovered from each square and spit at the site revealed that the samples came from squares with abundant charcoal that was probably introduced by recent ovens dug into the site. Because of the difficulty of identifying prehistoric charcoal samples in the mixed stratigraphy at Ugaga, marine shells were selected for radiocarbon dating instead of charcoal.

Two factors supported the use of marine shell for dating the site. First, large and heavy shells are less susceptible to profile migration through the digging activities of crabs, people and other agents. Second, local informants said shellfish were not plentiful on the island's small reef, and had not been collected from Ugaga in recent times. This suggested much of the marine shell on Ugaga could have been deposited in prehistoric times. Ten marine-shell samples were dated, three at Beta Analytic, Inc. and seven at the QDRC.

In contrast to the charcoal results, all of the marine-shell samples gave prehistoric ages, with CRA results ranging from 1720–3150 BP. Five of the calibrated dates lay between 1970 and 2650 cal. BP (ANU-10773, ANU-10777, ANU-10778, ANU-10775, Beta-107952), and four between 1150 and 1890 cal. BP (ANU-10774, ANU-10766, Beta-107951, ANU-10772). A large unbroken *Trochus niloticus* shell from Square D12 had an age of 2760–3140 cal. BP (Beta-107953). The sample was collected from a grey sand at 60 cm depth that contained a few plain sherds and several large fragments of coral.

Considering the amount of disturbance at Ugaga (Chapter 5), there is a reasonable age-depth relationship over the site, with the most recent shell determinations from the 20–30 cm spit, and the oldest ^{14}C dates from lower spits. Square I5 had stratigraphically consistent dates from upper and lower spits (ANU-10774, ANU-10772). Modern determinations (ANU-10734, Wk-5554) on charcoal from squares I9 (20–30 cm) and J9 (20–30 cm) were contradicted by much older ages on shell from the same squares (ANU-10775, ANU-10775), emphasising the capacity for earth ovens (*lovo*) to introduce large amounts of modern charcoal into prehistoric levels.

Radiocarbon dates from Ugaga show the small island was used in the Lapita era and for the following two millennia, with only limited evidence in the ceramics and radiocarbon results for human use in the past 1000 years.

Table 19. An inventory of radiocarbon results from archaeological sites in Fiji.

Island	Site	Lab Code	CRA	CRA SE	C13	Cal. BP	Sample Type	Identification	Context	Reference
Aiwa Lailai	DR:1	Beta-172192	1510	40	—	1290–1410	Bone	<i>Pteropus</i> sp.	IIIb/4	O'Day et al. (2007)
Aiwa Lailai	DR:2	Beta-172191	2300	50	—	2140–2350	Bone	<i>Gallus gallus</i>	IV/5	O'Day et al. (2007)
Aiwa Levu	AC2:1	Beta-165465	2380	40	—	2160–2490	Bone	<i>Gallus gallus</i>	II/2	O'Day et al. (2007)
Aiwa Levu	AC2:2	Beta-165466	960	40	—	750–920	Bone	<i>Pteropus</i> sp.	I/1	O'Day et al. (2007)
Aiwa Levu	AC2:3	Beta-165467	1630	40	—	1370–1550	Bone	<i>Pteropus</i> sp.	II/2	O'Day et al. (2007)
Aiwa Levu	AR1:2	Beta-164251	280	40	—	150–450	Bone	<i>Pteropus</i> sp.	I/1	O'Day et al. (2007)
Aiwa Levu	AR1:2	Beta-164252	2310	40	—	1970–2290	Bone	Human	III/13	O'Day et al. (2007)
Aiwa Levu	AR1:2	Beta-164260	200	40	—	0–300	Charcoal	—	II/5	O'Day et al. (2007)
Aiwa Levu	AR1:2	Beta-164261	570	40	—	500–630	Charcoal	—	III/10	O'Day et al. (2007)
Aiwa Levu	AR1:4	Beta-164258	360	40	—	310–490	Bone	<i>Pteropus</i> sp.	II/3	O'Day et al. (2007)
Aiwa Levu	GR1	Beta-165469	370	40	—	310–490	Bone	<i>Ducula</i> sp.	II/5	O'Day et al. (2007)
Beqa	Kulu	ANU-10727	820	100	-24 ± 2.0E	560–910	Marine shell	—	C9: 40–50 cmbs	ANU-EPF
Beqa	Kulu	Beta 107947	2590	50	1.8	2120–2380	Marine shell	<i>Tridacna</i> sp.	C11, 60–70 cmbs	ANU-EPF
Beqa	Kulu	Beta 107948	2590	50	1.5	2120–2380	Marine shell	<i>Cerithium</i> sp.	C11, 130–140 cmbs	ANU-EPF
Beqa	Kulu	Beta 107949	180	40	-29.0	0–280	Charcoal	Candle nut	C11, 110–120 cmbs	ANU-EPF
Beqa	Kulu	Beta 107950	220	50	-24.0	0–310	Charcoal	Candle nut	C11, 140–150 cmbs	ANU-EPF
Beqa	Nacuromoce	?	626	60	—	104–430	Marine shell	<i>Trochus niloticus</i>	Layer 1	Crosby (1988: Appendix)
Beqa	Rukua	?	1670	60	—	1370–1690	Charcoal	—	Layer 3	Crosby (1988: Appendix)
Beqa	Rukua	?	1676	60	—	1090–1340	Marine shell	<i>Atactodea striata</i>	Layer 3	Crosby (1988: Appendix)
Beqa	Kulu	ANU-10743*	117.2 ± 2.7%M	—	-24 ± 2.0E	—	Charcoal	—	C11: 100–110	ANU-EPF
Beqa	Natunuku	ANU-10382	98.4 ± 1.0%M	—	-24 ± 2.0E	—	Charcoal	—	Tr.3, Sq.6: 25–40	ANU-EPF
Lakeba	Kedeke	NZ-4042	690	50	—	550–670	Charcoal	—	Sq A, Layer J7	Best (1984: 146)
Lakeba	Kedeke	NZ-4043	110	60	—	0–280	Charcoal	—	Sq D, Layer 2	Best (1984: 146)
Lakeba	Laselase	NZ-4039	80	70	—	—	Charcoal	—	B.E	Best (1984: 87)
Lakeba	Laselase	NZ-4040	2000	100	—	1620–2150	Charcoal	—	L,M	Best (1984: 87)
Lakeba	Laselase	NZ-4041	2280	100	—	1950–2490	Charcoal	—	S-U	Best (1984: 87)
Lakeba	Laselase	NZ-4903	1515	60	—	1280–1520	Charcoal	—	J2	Best (1984: 87)
Lakeba	Laselase	NZ-5182	1200	40	—	660–850	Marine shell	<i>Turbo chrysostomus</i>	J1	Best (1984: 87)
Lakeba	Qaranipuqa	NZ-4588	1790	40	—	1260–1430	Marine shell	<i>Tridacna maxima</i>	Layer F3	Best (1984: 75)
Lakeba	Qaranipuqa	NZ-4589	2600	50	—	2130–2400	Marine shell	<i>Lambis lambis</i>	Layer T	Best (1984: 75)
Lakeba	Qaranipuqa	NZ-4590	2830	60	—	2390–2730	Marine shell	<i>Conus leopardus</i>	Layer W	Best (1984: 75)
Lakeba	Qaranipuqa	NZ-4591	2230	50	—	1700–1960	Marine shell	<i>Turbo bruneus</i>	Layer K4	Best (1984: 75)
Lakeba	Qaranipuqa	NZ-4592	1770	90	—	1410–1860	Charcoal	—	Layer F3	Best (1984: 75)
Lakeba	Qaranipuqa	NZ-4593	2110	90	—	1820–2310	Charcoal	—	Layer K1	Best (1984: 75)
Lakeba	Qaranipuqa	NZ-4594	2960	70	—	2860–3320	Charcoal	—	Layer N	Best (1984: 75)
Lakeba	Qaranipuqa	NZ-4595	1120	90	—	780–1230	Charcoal	Coconut	Layer W	Best (1984: 75)
Lakeba	Qaranipuqa	NZ-4596	2620	100	—	2360–2850	Charcoal	—	Layer T	Best (1984: 75)

Continued on next page

Table 19 *continued*

Island	Site	Lab Code	CRA	CRA SE	C13	Cal. BP	Sample Type	Identification	Context	Reference
Lakeba	Qaranipuqa	NZ-4808	2260	80	—	2000–2350	Charcoal	—	Layer N	Best (1984: 75)
Lakeba	Qaranipuqa	NZ-4810	4010	620	—	2530–5580	Bone	Turtle	Layer W	Best (1984: 75)
Lakeba	Qaranipuqa	NZ-4904	394	84	—	160–540	Charcoal	—	Layer A2	Best (1984: 75)
Lakeba	Qaranipuqa	NZ-4905	892	60	—	670–910	Charcoal	—	Layer E2	Best (1984: 75)
Lakeba	Qaranipuqa	NZ-4906	2960	160	—	2330–3130	Bone	Turtle	Layer W	Best (1984: 75)
Lakeba	Ulunikoro	NZ-4044	1020	90	—	690–1060	Charcoal	—	Sq 3, Layer B	Best (1984: 129)
Lakeba	Ulunikoro	NZ-4581	930	40	—	480–620	Marine shell	<i>Turbo chrysostomus</i>	Sq 15, Layer B2	Best (1984: 129)
Lakeba	Ulunikoro	NZ-4582	970	40	—	500–640	Marine shell	<i>Turbo chrysostomus</i>	Sq 17, Layer B3	Best (1984: 129)
Lakeba	Ulunikoro	NZ-4583	980	40	—	510–640	Marine shell	<i>Turbo chrysostomus</i>	Sq 12, Layer B1	Best (1984: 129)
Lakeba	Ulunikoro	NZ-4584	340	50	—	290–490	Charcoal	—	Sq 8, Layer B5	Best (1984: 129)
Lakeba	Ulunikoro	NZ-4585	900	90	—	650–950	Charcoal	—	Sq 15, Layer B3	Best (1984: 129)
Lakeba	Ulunikoro	NZ-4586	1010	90	—	690–1060	Charcoal	—	Sq 12/13, Layer B1	Best (1984: 129)
Lakeba	Ulunikoro	NZ-4587	1030	90	—	690–1070	Bone	Turtle	Sq 12, Layer B1	Best (1984: 129)
Lakeba	Ulunikoro	NZ-5179	984	50	—	500–650	Marine shell	<i>Turbo crassus</i>	Sq 12, Layer A	Best (1984: 129)
Lakeba	Ulunikoro	NZ-5180	1315	40	—	760–940	Marine shell	<i>Turbo chrysostomus</i>	Sq 8, Layer B5	Best (1984: 129)
Lakeba	Ulunikoro	NZ-5181	411	40	—	0–130	Marine shell	<i>Turbo chrysostomus</i>	Sq 10, Layer B	Best (1984: 129)
Lakeba	Wakea	NZ-4807	2701	120	—	2360–3060	Charcoal	—	Sq 25, Layer B18, approx: 225 cmbs	Best (1984)
Lakeba	Wakea	NZ-4809	2604	80	—	1050–2520	Marine shell	<i>Trochus niloticus</i>	Sq 19, Layer B20a, approx: 225 cmbs	Best (1984)
Mago	Sovanibeka	ANU-10779	2820	70	0.0 ± 2.0E	2360–2720	Marine shell	<i>Anadara antiquata</i>	Test Pit 2, 30–50 cmbs	ANU-EPF
Mago	Sovanibeka	ANU-11246	4290	60	-2.5 ± 0.2	4540–4960	Land snail	<i>Gonatorhaphe lavens</i>	Test Pit 2, 55–58 cmbs	ANU-EPF
Mago	Sovanibeka	OZF882	840	40	-20.0	670–770	Bone	<i>Rattus praetor</i>	Test Pit 1: 50–60 cmbs	ANU-EPF
Mago	Votua	ANU-10706	2520	120	-24 ± 2.0E	2170–2790	Charcoal	—	Testpit 1, 40–50 cmbs	ANU-EPF
Mago	Votua	ANU-10707	2670	70	-24 ± 2.0E	2460–2880	Charcoal	—	Area 1, 20–30 cmbs	ANU-EPF
Mago	Votua	ANU-11069 A	2490	60	0.0 ± 2.0E	1990–2300	Marine shell	<i>Trochus niloticus</i>	Area 1, 20–30 cmbs	ANU-EPF
Mago	Votua	ANU-11069 B	2990	60	0.0 ± 2.0E	2650–2930	Marine shell	<i>Trochus niloticus</i>	Area 1, 10–20 cmbs.	ANU-EPF
Mago	Votua	ANU-11527	2850	50	-1.5 ± 0.1	2440–2730	Marine shell	<i>Anadara antiquata</i>	Area 2, Sq. 1, 60–70 cmbs	ANU-EPF
Mago	Votua	ANU-11528	2680	70	-26.4 ± 0.2	2470–2920	Charcoal	—	Area 2, Sq. 4, 60 cmbs	ANU-EPF
Mago	Votua	Wk-5366	2970	50	-0.3 ± 0.2	2620–2870	Marine shell	<i>Anadara antiquata</i>	Testpit 1, 60–70 cmbs	ANU-EPF
Mago	Votua	Wk-5367	2930	50	-0.2 ± 0.2	2540–2830	Marine shell	<i>Anadara antiquata</i>	Testpit 1, 30–40 cmbs	ANU-EPF
Mago	Votua	Wk-5368	2940	50	-0.4 ± 0.2	2570–2840	Marine shell	<i>Anadara antiquata</i>	Area 1, 20–30 cmbs	ANU-EPF
Mago	Votua	Wk-5369	2950	50	-0.2 ± 0.2	2600–2850	Marine shell	<i>Anadara antiquata</i>	Area 1, 10–20 cmbs	ANU-EPF
Moturiki	Naitabale	NUTA2-5198a	2492	70	-15.4	2110–2650	Bone	Human	T1: 150 cmbs	P. Nunn, pers. comm., USP
Moturiki	Naitabale	NUTA2-5198b	2547	90	-15.4	2160–2690	Bone	Human	T1: 150 cmbs	P. Nunn, pers. comm., USP
Moturiki	Naitabale	NUTA2-5198c	2550	80	-15.4	2630–2690	Bone	Human	T1: 150 cmbs	P. Nunn, pers. comm., USP
Moturiki	Naitabale	NUTA2-5200a	2664	70	-15.1	2360–2720	Bone	Human	T1: 150 cmbs	P. Nunn, pers. comm., USP
Moturiki	Naitabale	NUTA2-5200b	2637	70	-15.1	2345–2710	Bone	Human	T1: 150 cmbs	P. Nunn, pers. comm., USP

Continued on next page

Table 19 *continued*

Island	Site	Lab Code	CRA	CRA SE	C13	Cal. BP	Sample Type	Identification	Context	Reference
Moturiki	Naitabale	NUTA2-5200c	2576	80	-15.1	2190–2710	Bone	Human	T1: 150 cmbs	P. Nunn, pers. comm., USP
Moturiki	Naitabale	Wk-11474	339	40	-27.2	300–470	Charcoal	–	T1: 75 cmbs	P. Nunn, pers. comm., USP
Moturiki	Naitabale	Wk-11475	2438	50	-27.4	2330–2700	Charcoal	–	T1: 75 cmbs	P. Nunn, pers. comm., USP
Moturiki	Naitabale	Wk-11476	2650	40	-26.8	2500–2790	Charcoal	–	T1: 145 cmbs	P. Nunn, pers. comm., USP
Moturiki	Naitabale	Wk-11477	2519	40	-25.6	2360–2710	Charcoal	–	P3: 85 cmbs	P. Nunn, pers. comm., USP
Moturiki	Naitabale	Wk-11478	2644	40	-26.3	2500–2780	Charcoal	–	P3: 115 cmbs	P. Nunn, pers. comm., USP
Moturiki	Naitabale	Wk-11479	295	40	-27.4	2890–3210	Charcoal	–	R2: 55 cmbs	P. Nunn, pers. comm., USP
Moturiki	Naitabale	Wk-11480	2576	40	-24.4	2370–2750	Charcoal	–	R2: 105 cmbs	P. Nunn, pers. comm., USP
Moturiki	Naitabale	Wk-11481	2854	50	-28.0	2780–3060	Charcoal	–	R2: 115 cmbs	P. Nunn, pers. comm., USP
Moturiki	Naitabale	Wk-11482	2456	40	-28.4	2340–2700	Charcoal	–	R2: 125 cmbs	P. Nunn, pers. comm., USP
Moturiki	Naitabale	Wk-13402	2974	40	2.1 ± 0.2	2680–2840	Marine shell	<i>Anadara</i> sp.	T1: 150 cmbs	P. Nunn, pers. comm., USP
Moturiki	Naitabale	Wk-13403	2951	40	3.0 ± 0.2	2650–2840	Marine shell	<i>Tectus pyramis</i>	T1: 150 cmbs	P. Nunn, pers. comm., USP
Moturiki	Naitabale	Wk-13404	2931	40	3.0 ± 0.2	2600–2840	Marine shell	<i>Trochus niloticus</i>	T1: 150 cmbs	P. Nunn, pers. comm., USP
Moturiki	Naitabale	Wk-13405	2483	50	-27.1	2350–2710	Charcoal	–	P3: 135 cmbs	P. Nunn, pers. comm., USP
Naigani	Naigani	NZ-5615	3142	50	–	2780–3080	Marine shell	<i>Tridacna maxima</i>	Sq 7, extension, 2.92 m below datum	Best (1981)
Naigani	Naigani	NZ-5616	3152	50	–	2790–3100	Marine shell	<i>Tridacna maxima</i>	Sq 13, 2.6 m below datum	Best (1981)
Naigani	Naigani	NZ-5617	3052	50	–	2730–2950	Marine shell	<i>Saccostrea cucullata</i>	Sq 7, extension, 2.37 m below datum	Best (1981)
Naigani	Naigani	NZ-5618	3082	70	–	2720–3050	Marine shell	<i>Trochus niloticus</i>	Sq 4, extension, 1.72 m below datum	Best (1981)
Viti Levu	Natunuku	ANU-10381	99.7 ± 0.8%M	–	-24 ± 2.0E	–	Charcoal	–	Tr.3, Sq.A5: 10–20	ANU-EPF
Viti Levu	Navatu	ANU-10388	104.0 ± 1.1%M	–	–	–	Charcoal	–	Tr. B2, L1: 20	ANU-EPF
Qoqo	Qoqo	Wk-16208	2925	40	3.2 ± 0.2	2570–2790	Marine shell	<i>Trochus niloticus</i>	F1: 188	Nunn et al. (2006)
Qoqo	Qoqo	Wk-16209	2990	40	0.0	2700–2850	Marine shell	<i>Anadara</i> sp., <i>Codakia punctata</i> , <i>Gafrarium tumidum</i>	R2: 87	Nunn et al. (2006)
Qoqo	Qoqo	Wk-16218	2790	40	-24.5	2760–2940	Charcoal	–	R2: 118	Nunn et al. (2006)
Qoqo	Qoqo	Wk-16219	402	40	-24.0	330–500	Charcoal	–	P1: 185	Nunn et al. (2006)
Qoqo	Qoqo	Wk-16220	393	40	-24.0	320–500	Charcoal	–	P1: 205	Nunn et al. (2006)
Taveuni	Navolivoli	GaK-2411	710	80	–	530–730	Charcoal	–	Structure #11	Frost (1970: 132)
Taveuni	Navolivoli	GaK-2412	2050	150	–	1620–2330	Charcoal	–	Trench #14, 30 cm below Layer A	Frost (1970: 137,141)
Taveuni	Nawa	GaK-2414	710	80	–	530–730	Charcoal	–	Component E	Frost (1970: 113–114)
Taveuni	Nayalayala	GaK-2507	340	80	–	0–510	Charcoal	–	Structure #8, 40 cmbs	Frost (1970: 97)
Taveuni	Qalau	GaK-2510	280	90	–	0–490	Charcoal	–	Structure #5	Frost (1970: 119)
Taveuni	Taveuni	GaK-2413	740	70	–	550–740	Charcoal	–	Trench #6, 40–70 cmbs	Frost (1970: 99,102)
Taveuni	Taveuni	GaK-2508	Modern	–	–	–	Charcoal	–	Trench #2	Frost (1970: 68)
Taveuni	Taveuni	GaK-2509	620	90	–	470–720	Charcoal	–	Trench #2, Layer A	Frost (1970: 76)
Totoya	Lawaki Levu	Beta-67623	2480	60	–	1980–2300	Marine shell	<i>Tridacna</i> sp.	TP-3, Layer III, 40cm cmbs	Clark and Cole (1997)

Continued on next page

Table 19 *continued*

Island	Site	Lab Code	CRA	CRA SE	C13	Cal. BP	Sample Type	Identification	Context	Reference
Totoya	Lawaki Levu	Beta-67624	2370	60	—	1840–2150	Marine shell	<i>Tectus</i> sp.	TP-1, Layer II, 40cm cmbs	Clark and Cole (1997)
Ugaga	Ugaga	ANU-10772	2140	70	0.0 ± 2.0E	1550–1890	Marine shell	<i>Trochus niloticus</i>	I5: 30–40 cmbs	ANU-EPF
Ugaga	Ugaga	ANU-10773	2490	70	0.0 ± 2.0E	1970–2320	Marine shell	<i>Tridacna maxima</i>	O9: 30–40 cmbs	ANU-EPF
Ugaga	Ugaga	ANU-10774	1720	70	0.0 ± 2.0E	1150–1390	Marine shell	<i>Tridacna maxima</i>	I5: 20–30 cmbs	ANU-EPF
Ugaga	Ugaga	ANU-10775	2620	60	0.0 ± 2.0E	2130–2470	Marine shell	<i>Tridacna maxima</i>	I9: 30–40 cmbs	ANU-EPF
Ugaga	Ugaga	ANU-10776	1900	60	0.0 ± 2.0E	1310–1590	Marine shell	<i>Turbo argyrostromus</i>	M8: 20–30 cmbs	ANU-EPF
Ugaga	Ugaga	ANU-10777	2530	70	0.0 ± 2.0E	2000–2340	Marine shell	<i>Tridacna maxima</i>	J9: 40–50 cmbs	ANU-EPF
Ugaga	Ugaga	ANU-10778	2600	70	0.0 ± 2.0E	2090–2470	Marine shell	<i>Tridacna maxima</i>	T/U-1: 40–50 cmbs	ANU-EPF
Ugaga	Ugaga	Beta-107951	2130	50	2.0	1580–1850	Marine shell	<i>Tridacna maxima</i>	minus A13: 30–40 cmbs	ANU-EPF
Ugaga	Ugaga	Beta-107952	2690	60	2.0	2260–2650	Marine shell	<i>Tridacna maxima</i>	P10: 30–40 cmbs	ANU-EPF
Ugaga	Ugaga	Beta-107953	3150	70	3.2	2760–3140	Marine shell	<i>Trochus niloticus</i>	C12: 50–60 cmbs	ANU-EPF
Ugaga	Ugaga	Wk-5554	98.3 ± 0.5%M	—	-24 ± 2.0E	—	Charcoal	—	Sq. K7: 20–30	ANU-EPF
Ugaga	Ugaga	Wk-5555	98.8 ± 0.5%M	—	-24 ± 2.0E	—	Charcoal	—	Sq. K7: 20–30	ANU-EPF
Ugaga	Ugaga	Wk-5556	98.2 ± 0.5%M	—	-24 ± 2.0E	—	Charcoal	—	Sq. P8: 20–30	ANU-EPF
Vanuabalavu	Qaranilaca	ANU-11536H	980	80	0.0 ± 2.0	460–690	Marine shell	<i>Anadara</i> sp.	Layer III: 80 cmbs	Nunn et al. (2004a)
Vanuabalavu	Qaranilaca	ANU-11537H	1140	80	0.0 ± 2.0	550–870	Marine shell	<i>Anadara</i> sp.	Layer IV: 105 cmbs	Nunn et al. (2004a)
Vanuabalavu	Qaranilaca	ANU-11538H	1060	60	-24 ± 2.0E	790–1060	Charcoal	—	Layer III: 75–85 cmbs	Nunn et al. (2004a)
Vanuabalavu	Qaranilaca	ANU-11539H	1180	60	-24 ± 2.0E	930–1220	Charcoal	—	Layer IV: 104–109 cmbs	Nunn et al. (2004a)
Viti Levu	Bourewa	Wk-14235	2896	40	-27.4	2810–3140	Charcoal	—	Pit 3: 123 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-14236	2867	40	-25.0	2790–3060	Charcoal	—	Pit 3: 109 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-14237	3259	40	-12.8	2950–3220	Marine shell	<i>Tellinidae</i>	Pit 4: 53 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-14238	2740	40	2.5 ± 0.2	2330–2640	Marine shell	<i>Fimbria fimbriata</i> , <i>Codakia punctata</i>	Pit 2: 55 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-14239	3027	40	3.5 ± 0.2	2720–2900	Marine shell	<i>Trochus niloticus</i>	Pit 1: 71 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-14594	2944	40	2.9 ± 0.2	2610–2830	Marine shell	<i>Codakia punctata</i>	Pit 3: 105 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-14595	2915	40	-23.5	2860–3140	Charcoal	—	Pit 4: 54 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-14597	2717	40	-23.6	2730–2860	Charcoal	—	Pit 2: 57 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-14598	2612	40	-23.1	2490–2760	Charcoal	—	Pit 1: 54 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-14599	2894	40	-24.7	2800–3140	Charcoal	—	Pit 1: 85 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-16206	1590	40	3.6 ± 0.2	1050–1250	Marine shell	<i>Strombus gibberulus</i> , <i>Strombus labiatus</i> , <i>Fimbria fimbriata</i> , <i>Vasum turbinellus</i>	Pit L4: 82 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-16207	2940	40	2.9 ± 0.2	2610–2730	Marine shell	<i>Anadara</i> sp., <i>Codakia</i> sp.	Pit B3: 90 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-16216	164	40	-24.4	0–280	Charcoal	—	Pit B4: 134 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-17539	383	30	-25.1	320–490	Charcoal	—	Pit X8: 95 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-17540	133	30	-26.7	0–260	Charcoal	—	Pit X2: 196 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-17541	2506	30	-26.1	2360–2710	Charcoal	—	Pit X1: 105 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-17542	2920	30	-24.4	2870–3140	Charcoal	—	Pit X3: 135 cmbs	P. Nunn, pers. comm., USP

Continued on next page

Table 19 *continued*

Island	Site	Lab Code	CRA	CRA SE	C13	Cal. BP	Sample Type	Identification	Context	Reference
Viti Levu	Bourewa	Wk-17543	3006	40	4.1 ± 0.2	2710–2870	Marine shell	<i>Trochus niloticus</i>	Pit X24E: 52 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-17544	3474	40	3.2 ± 0.2	3250–3450	Marine shell	<i>Conus</i> sp.	Pit X25: 140 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-17545	2851	40	2.9 ± 0.2	2470–2720	Marine shell	<i>Codakia punctata</i>	Pit X23: 98 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-17546	2951	40	2.4 ± 0.2	2650–2840	Marine shell	<i>Codakia punctata</i> , <i>Gafrarium tumidum</i> , <i>Turbo</i> sp.	Pit X3: 124 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-17547	3006	40	4.5 ± 0.2	2710–2870	Marine shell	<i>Trochus niloticus</i>	Pit X6: 94 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-17548	2938	40	1.6 ± 0.2	2610–2820	Marine shell	<i>Anadara</i> sp.	Pit X2: 120 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-17549	3046	40	4.4 ± 0.2	2730–2920	Marine shell	<i>Trochus niloticus</i>	Pit X3: 104 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-17967	198	30	-19.4	0–130	Bone	<i>Sus scrofa</i>	Pit X8: 55 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-17968	3107	40	2.4 ± 0.2	2760–3000	Marine shell	<i>Atactodea striata</i>	Pit X6: 68 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-17969	1740	30	2.9 ± 0.2	1230–1360	Marine shell	<i>Strombus gibberulus</i>	Pit X8: 68 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-17970	2866	30	2.3 ± 0.2	2610–2730	Marine shell	<i>Tridacna squamosa</i>	Pit X10: 78 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-17971	2831	40	3.8 ± 0.2	2450–2710	Marine shell	<i>Turbo chrysostomus</i>	Pit X20: 60 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-17972	2824	40	3.0 ± 0.2	2430–2710	Marine shell	<i>Turbo</i> sp.	Pit X20: 69 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-17973	2870	30	-25.8	2800–3060	Charcoal	—	Pit X3: 121 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-17974	891	30	-25.2	680–900	Charcoal	—	Pit X21E: 45 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-20281	3038	40	3.6 ± 0.2	2730–2910	Marine shell	<i>Trochus niloticus</i>	Pit X2: 90 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-20282	3014	40	3.6 ± 0.2	2710–2880	Marine shell	<i>Trochus niloticus</i>	Pit X2: 20 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-20283	2976	40	4.3 ± 0.2	2690–2850	Marine shell	<i>Trochus niloticus</i>	Pit X3: 70 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bourewa	Wk-20284	3044	40	3.6 ± 0.2	2730–2920	Marine shell	<i>Trochus niloticus</i>	Pit X3: 30 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Bukusia	AA-50303	189	50	-28.3	0–300	Charcoal	—	TU 1, 30–40 cmbs	Field (2004: 90)
Viti Levu	Bukusia	AA-50304	259	40	-24.3	0–440	Charcoal	—	TU 2, 40–50 cmbs	Field (2004: 90)
Viti Levu	Bukusia	Wk-11135	202	60	-29.6	0–300	Charcoal	—	TU 2, 80–90 cmbs	Field (2004: 90)
Viti Levu	Korohewa	AA-50305	210	40	-27.9	0–300	Charcoal	—	TU 1, 60–70 cmbs	Field (2004: 90)
Viti Levu	Korovatuma	AA-50300	527	50	-27.2	460–630	Charcoal	—	TU 1, 60–70 cmbs	Field (2004: 90)
Viti Levu	Korovatuma	AA-50301	188	40	-27.2	0–290	Charcoal	—	TU 1, 20–30 cmbs	Field (2004: 90)
Viti Levu	Korovatuma	AA-50310	338	50	-26.0	160–490	Charcoal	—	TU 2, 60 cmbs	Field (2004: 90)
Viti Levu	Madraya	AA-50296	398	40	-28.7	320–500	Charcoal	—	TU1, 20–30 cmbs	Field (2004: 90)
Viti Levu	Malaqerqere	ANU-10452	460	60	-24 ± 2.0E	320–540	Charcoal	—	Sq. A1: 10–20 cmbs	ANU-EPF
Viti Levu	Malaqerqere	ANU-10453	830	90	-24 ± 2.0E	560–910	Charcoal	—	Sq. A2: 60–70 cmbs	ANU-EPF
Viti Levu	Malaqerqere	ANU-10454	670	70	-24 ± 2.0E	520–680	Charcoal	—	Sq. A1: 40–50 cmbs	ANU-EPF
Viti Levu	Malua	AA-50290	159	30	-26.5	0–280	Charcoal	—	TU1, 50–60 cmbs	Field (2004: 90)
Viti Levu	Malua	AA-50295	624	30	-26.3	530–640	Charcoal	—	TU2, 10–20 cmbs	Field (2004: 90)
Viti Levu	Nadroga	AA-50297	224	50	-24.6	0–320	Charcoal	—	TU1, 50–60 cmbs	Field (2004: 90)
Viti Levu	Nasilai	Beta-22096	Modern	—	—	—	Wood	Post	Level IV	Rosenthal (1995: 97)
Viti Levu	Nasilai	Beta-22097	330	70	—	150–230	Wood	Canoe mast	?	Rosenthal (1995: 97)
Viti Levu	Natunuku	ANU-10698	2780	90	0.0 ± 2.0E	2310–2720	Marine shell	<i>Tridacna</i> sp.	Tr.3, Sq.A5: 30–40 cmbs	ANU-EPF

Continued on next page

Table 19 continued

Island	Site	Lab Code	CRA	CRA SE	C13	Cal. BP	Sample Type	Identification	Context	Reference
Viti Levu	Natunuku	ANU-10699	1160	70	0.0 ± 2.0E	600–890	Marine shell	<i>Tridacna</i> sp.	Tr.3, Sq.A5: 30–40 cmbs	ANU-EPF
Viti Levu	Natunuku	ANU-10700	380	70	0.0 ± 2.0E	0–230	Marine shell	<i>Trochus</i> sp.	Tr.3, Sq.A5: 20–30 cmbs	ANU-EPF
Viti Levu	Natunuku	ANU-11305	2900	50	0.0 ± 2.0E	2490–2770	Marine shell	? Species	Trench 3	ANU-EPF
Viti Levu	Natunuku	ANU-11306	1170	50	0.0 ± 2.0E	630–840	Marine shell	? Species	Trench 3	ANU-EPF
Viti Levu	Natunuku	ANU-11307	2600	60	0.0 ± 2.0E	2110–2440	Marine shell	? Species	Trench 3	ANU-EPF
Viti Levu	Natunuku	GaK-1218	3240	100	—	3080–3680	Charcoal	—	Layer 6, Rectangle E, Location C	Davidson et al. (1990: 131)
Viti Levu	Natunuku	NZ-7863	2640	30	0.7	2210–2440	Marine shell	<i>Tridacna maxima</i>	Layer 5, Rectangle D, Location C	Petchey (1995: 94)
Viti Levu	Natunuku	NZ-7864	2750	30	0.3	2340–2610	Marine shell	<i>Tridacna maxima</i>	Layer 5b, Rectangle D, Location C	Petchey (1995: 94)
Viti Levu	Natunuku	NZ-7865	2622	30	-0.3	2180–2390	Marine shell	<i>Gafarium tumidum</i>	Layer 5b, Rectangle D, Location C	Petchey (1995: 94)
Viti Levu	Natunuku	NZA-2117	2676	60	1.8	2200–2600	Marine shell	<i>Gafarium tumidum</i>	Layer 5, Rectangle D, Location C	Petchey (1995: 94)
Viti Levu	Natunuku	NZA-2512	1896	90	-14.8	1400–1820	Bone	Human	Rectangle C, Layer above 5, Location C	Davidson et al. (1990: 131)
Viti Levu	Navatu	M-5810	950	300	—	320–1390	Charcoal	—	24–30 inches bs	Gifford (1951b)
Viti Levu	Navatu	M-5879	1200	500	—	150–2150	Charcoal	—	90 inches bs	Gifford (1951b)
Viti Levu	Navatu	M-6342	1300	500	—	310–2310	Charcoal	—	96–104 inches bs	Gifford (1951b)
Viti Levu	Navatu	M-351	2000	500	-24 ± 2.0E	850–3140	Charcoal	—	104–110 inches bs	Gifford (1951b)
Viti Levu	Navatu 17A	ANU-10384	870	70	-24 ± 2.0E	660–910	Charcoal	—	Tr. B1: L2, 140 cmbs	ANU-EPF
Viti Levu	Navatu 17A	ANU-10385	350	70	-24 ± 2.0E	150–500	Charcoal	—	Tr. A1: L1, 100 cmbs	ANU-EPF
Viti Levu	Navatu 17A	ANU-10386	1670	70	-24 ± 2.0E	1350–1690	Charcoal	—	Tr. B3+4: L4, 230 cmbs	ANU-EPF
Viti Levu	Navatu 17A	ANU-10387	1240	140	-24 ± 2.0E	800–1350	Charcoal	—	Tr. B1+2: L4, 215 cmbs	ANU-EPF
Viti Levu	Navatu 17A	ANU-10389	330	60	-24 ± 2.0E	150–490	Charcoal	—	Tr. B1: L1, 86 cmbs	ANU-EPF
Viti Levu	Navatu 17A	ANU-10390	1010	140	-24 ± 2.0E	660–1180	Charcoal	—	Tr. B1+2: L4, 220 cmbs	ANU-EPF
Viti Levu	Navatu 17A	ANU-10708	1980	70	0.0 ± 2.0E	1360–1710	Marine shell	<i>Tridacna</i> sp.	Tr. B3+4: L4, 230 cmbs	ANU-EPF
Viti Levu	Navatu 17A	ANU-10709	980	70	0.0 ± 2.0E	480–670	Marine shell	<i>Gafarium</i> sp.	Tr. B1: L2, 120 cmbs	ANU-EPF
Viti Levu	Navatu 17A	ANU-10710	720	70	0.0 ± 2.0E	250–500	Marine shell	<i>Anadara</i> sp.	Tr. B2: L1, 50 cmbs	ANU-EPF
Viti Levu	Nokonoko	AA-50283	1311	40	-25.0	1080–1280	Charcoal	—	TU 1, 95–105 cmbs	Field (2004: 90)
Viti Levu	Nokonoko	AA-50284	674	40	-8.7	440–550	Riparian shell	? Species	TU 3, 10–20 cmbs	Field (2004: 90)
Viti Levu	Nokonoko	AA-50287	1492	40	-26.7	1290–1400	Charcoal	—	TU 5, 20–30 cmbs	Field (2004: 90)
Viti Levu	Nokonoko	AA-50288	212	40	-24.5	0–310	Charcoal	—	TU 6, 30–40 cmbs	Field (2004: 90)
Viti Levu	Nokonoko	AA-50289	135	30	-24.9	0–260	Charcoal	—	TU 10, 10–20 cmbs	Field (2004: 90)
Viti Levu	Nokonoko	AA-50299	185	60	-27.4	0–290	Charcoal	—	TU 7, 30–40 cmbs	Field (2004: 90)
Viti levu	Qara-I-Oso I	ANU-11015	1280	120	-24 ± 2.0E	920–1350	Charcoal	—	TP. 1: 30 cmbs	ANU-EPF
Viti Levu	Qara-I-Oso II	ANU-11014	660	60	-24 ± 2.0E	530–670	Charcoal	—	TP.1, Layer 2: 30 cmbs	ANU-EPF
Viti Levu	Qaramatatolu	Wk-16214	297	40	—	150–450	Charcoal	—	Pit M4: 160 cmbs	Nunn et al. (2005)
Viti Levu	Qaramatatolu	Wk-16213	970	40	—	750–920	Charcoal	—	Pit M4: 145 cmbs	Nunn et al. (2005)

Continued on next page

Table 19 *continued*

Island	Site	Lab Code	CRA	CRA SE	C13	Cal. BP	Sample Type	Identification	Context	Reference
Viti Levu	Qoroqoro	AA-50307	974	40	-29.4	750–930	Charcoal	–	TU1, 90–100 cmbs	Field (2004: 90)
Viti Levu	Qoroqoro	AA-50308	182	40	-29.1	0–290	Charcoal	–	TU3, 20–30 cmbs	Field (2004: 90)
Viti Levu	Qoroqoro	Wk-11134	259	100	-28.2	0–460	Charcoal	–	TU4, 50–70 cmbs	Field (2004)
Viti Levu	Rove	Wk-14240	155	30	-25.2	0–280	Charcoal	–	Pit 1: 65 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Rove	Wk-14241	187	60	-24.9	0–290	Charcoal	–	Pit 1: 95 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Rove	Wk-14242	95	40	-24.6	–	Charcoal	–	Pit 1: 75 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Rukuruku	Beta 64460	210	60	–	–	Marine shell	<i>Trochus niloticus</i>	Surface	Kuhlken and Crosby (1999)
Viti Levu	Rukuruku	Beta 64461	160	70	–	0–290	Charcoal	–	Trench 3/4, Layer 3: 60 cmbs	Kuhlken and Crosby (1999)
Viti Levu	Sigatoka	CAMS 32251	230	40	-27.8	0–310	Charcoal	–	West Dunes	Dickinson et al. (1998)
Viti Levu	Sigatoka	CAMS 32252	510	60	-25.9	330–630	Charcoal	–	Open field	Dickinson et al. (1998)
Viti Levu	Sigatoka	CAMS 48565	2470	50	-23.7	2350–2700	Charcoal	–	Level 1	Burley (2003, 2005)
Viti Levu	Sigatoka	CAMS 48566	2490	50	-21.4	2350–2710	Charcoal	–	Level 1	Burley (2003, 2005)
Viti Levu	Sigatoka	CAMS 68191	1550	40	-27.4	1300–1520	Charcoal	–	Level 2	Burley (2003, 2005)
Viti Levu	Sigatoka	CAMS 68192	1540	40	-26	1300–1520	Charcoal	–	Level 2	Burley (2003, 2005)
Viti Levu	Sigatoka	CAMS 68194	1620	40	-25.5	1360–1540	Charcoal	–	Level 2	Burley (2003, 2005)
Viti Levu	Sigatoka	CAMS 68195	1310	40	24.5	1080–1280	Charcoal	–	Level 2	Burley (2003, 2005)
Viti Levu	Sigatoka	CAMS 68196	2510	40	-24.3	2360–2710	Charcoal	–	Level 1	Burley (2003, 2005)
Viti Levu	Sigatoka	CAMS 70090	1400	40	-28.3	1180–1330	Charcoal	–	Level 2	Burley (2003, 2005)
Viti Levu	Sigatoka	CAMS 70091	1430	40	-27.4	1180–1360	Charcoal	–	Level 2	Burley (2003, 2005)
Viti Levu	Sigatoka	CAMS 70920	1480	40	-25.5	1280–1390	Charcoal	–	Level 2	Burley (2003, 2005)
Viti Levu	Sigatoka	CAMS 70921	1410	40	-24.6	1180–1340	Charcoal	–	Level 2	Burley (2003, 2005)
Viti Levu	Sigatoka	GaK-1206	1720	80	–	1380–1810	Charcoal	–	Level 2, Sq. 52C, 12–15 inches	Birks (1973:57)
Viti Levu	Sigatoka	GaK-946	2460	90	–	2190–2740	Charcoal	–	Level 1, Sq. 45A, bottom 6 inches	Birks (1973:57)
Viti Levu	Sigatoka	NZ-7599	1680	60	–	1380–1690	Charcoal	–	Level 2	Best (1988)
Viti Levu	Sigatoka	NZA-4789	2627	80	-25.8	2360–2840	Charcoal	–	Level 1', 53 cm below datum	Petchey (1995)
Viti Levu	Sigatoka	Wk 8239	2740	80	–	2500–3000	Charcoal	–	Level 1	De Biran (2001)
Viti Levu	Sigatoka	Wk 8328	1410	150	–	960–1550	Charcoal	–	Level 2	De Biran (2001)
Viti Levu	Sigatoka	Wk 8900	690	50	–	550–670	Charcoal	–	Level 3	De Biran (2001)
Viti Levu	Sigatoka	Wk 9030	1400	40	–	1180–1330	Charcoal	–	Level 2	De Biran (2001)
Viti Levu	Sigatoka	WK 996a	Modern	–	-7.6	–	Bone	Human	Mound south of Sq. B4	Best (1988: 6,14)
Viti Levu	Sigatoka	WK 996b	1870	70	-15.9	1390–1770	Bone	Human	Mound south of Sq. B4	Best (1988: 6,14)
Viti Levu	Sigatoka	Wk-5333	590	60	-26.3	500–650	Charcoal	–	West Dune Field: Level 3?	Dickinson et al. (1998)
Viti Levu	Tatuba Cave	AA-50291	207	30	-28.1	0–300	Charcoal	–	TU1, 190–200 cmbs	Field (2004: 90)
Viti Levu	Tatuba Cave	AA-50292	1802	30	-25.5	1550–1770	Charcoal	–	TU1, 140–150 cmbs	Field (2004: 90)
Viti Levu	Tatuba Cave	AA-50293	339	40	-20.6	0–260	Bone	Human	TU 1, 130–140 cmbs	Field (2004: 90)
Viti Levu	Tatuba Cave	AA-50294	1993	40	-26.0	1740–1990	Charcoal	–	TU1, 80–90 cmbs	Field (2004: 90)
Viti Levu	Tatuba Cave	AA-50298	1294	40	-25.6	1070–1270	Charcoal	–	TU1, 50–60 cmbsr	Field (2004: 90)

Continued on next page

Table 19 *continued*

Island	Site	Lab Code	CRA	CRA SE	C13	Cal. BP	Sample Type	Identification	Context	Reference
Viti Levu	Tatuba Cave	Wk-11137	968	50	-28.0	740–930	Charcoal	–	TU1, Ft. 1, 45–55 cmbs	Field (2004: 90)
Viti Levu	Tomato patch	Wk-16205	1720	30	3.5 ± 0.2	1210–1340	Marine shell	<i>Trochus</i> sp.	Surface: 88 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Tomato patch	Wk-16215	370	40	-26.9	310–490	Charcoal	–	Surface: 90 cmbs	P. Nunn, pers. comm., USP
Viti Levu	Tuvu	ANU-11020	1570	100	-24.0	1260–1700	Charcoal	–	TP 1, Spit IV	ANU-EPF
Viti Levu	Vitoga	AA-50302	198	60	-24.9	0–300	Charcoal	–	TU1, 60–77 cmbs	Field (2004: 90)
Viti Levu	Vitoga	AA-50306	175	40	-25.0	0–280	Charcoal	–	TU1, 20–30 cmbs	Field (2004: 90)
Viti Levu	Vitoga	AA-50309	261	50	-25.1	0–450	Charcoal	–	TU2, 40–50 cmbs	Field (2004: 90)
Viti Levu	Volivoli II	ANU-10449	1120	70	-24.0	810–1170	Charcoal	–	TR. 1: 20–30 cmbs	ANU-EPF
Viti Levu	Volivoli II	ANU-10450	1960	70	-24.0	1630–2040	Charcoal	–	TR. 1: 40–50 cmbs	ANU-EPF
Viti Levu	Volivoli II	ANU-10451	1080	190	-24.0	580–1300	Charcoal	–	TR.1: 50–60 cmbs	ANU-EPF
Viti Levu	Volivoli III	ANU-11016	1100	90	-24.0	770–1170	Charcoal	–	TP. 1, Spit 5	ANU-EPF
Viti Levu	Volivoli III	ANU-11018	290	60	-24.0	0–490	Charcoal	–	TP. 1, Spit 2	ANU-EPF
Viti Levu	Volivoli III	ANU-11019	1060	80	-24.0	740–1070	Charcoal	–	TP. 1, Spit 8	ANU-EPF
Viti Levu	Vunda	? 6349	700	300	–	0–1170	Charcoal	–	24–30 inches bs	Gifford (1951b)
Viti Levu	Vunda	? 6353	650	300	–	0–1060	Charcoal	–	12–18 inches bs	Gifford (1951b)
Viti Levu	Yanuca	ANU-11413	2650	50	-12.3 ± 0.2	2170–2490	Marine shell	<i>Trachycardium</i> cf. <i>reeveanum</i>	Trench 4, Zone 3, Spit 2, 152.4 cmbs	Clark and Anderson (2001)
Viti Levu	Yanuca	ANU-11414	3150	60	-12.3 ± 2.0	2780–3120	Fresh water shell	<i>Batissa violacea</i>	Trench 2A, Zone 3, Spit 4, 167.6 cmbs	Clark and Anderson (2001)
Viti Levu	Yanuca	ANU-11415	2300	50	1.5 ± 2.0	1790–2060	Marine shell	<i>Tonna sulcosa</i>	Trench 3A, Zone 3, Spit 4, 167.6 cmbs	Clark and Anderson (2001)
Viti Levu	Yanuca	ANU-11416	2940	60	3.8 ± 2.0	2520–2850	Marine shell	<i>Anadara antiquata</i>	Trench 3, Zone 3, Spit 7, 190.5 cmbs	Clark and Anderson (2001)
Viti Levu	Yanuca	ANU-11417	3050	80	2.7 ± 5.7	2680–3050	Marine shell	<i>Cyprea tigris</i>	Trench 2-2A, Zone 3, Spit 3, 160.0 cmbs	Clark and Anderson (2001)
Viti Levu	Yanuca	GaK-1226	2980	90	–	2860–3340	Charcoal	–	Zone 3, 66 inches bs	Birks and Birks (1978)
Viti Levu	Yanuca	GaK-1227	2660	90	–	2360–2880	Charcoal	–	Zone 2, 48 inches bs	Birks and Birks (1978)
Viti Levu	Yanuca	GaK-1228	2060	100	–	1710–2300	Charcoal	–	Zone 2, 30 inches bs	Birks and Birks (1978)
Viti Levu	Yanuca	GaK-1229	Modern	–	–	–	Charcoal	–	Zone 2, 10 inches bs	Birks and Birks (1978)
Viti Levu	Karobo	ANU-10780	1780	80	-24 ± 2.0E	1420–1830	Charcoal	–	Square Ab-1: L7, 122 cmbs	ANU-EPF
Viti Levu	Karobo	ANU-10781	300	70	-24 ± 2.0E	0–500	Charcoal	–	Square Y: L3, 33 cmbs	ANU-EPF
Viti Levu	Karobo	ANU-11067	1680	70	-24 ± 2.0E	1370–1700	Charcoal	–	Square A2: L5, 100 cmbs	ANU-EPF
Viti Levu	Karobo	ANU-11068	2130	120	-24 ± 2.0E	1740–2340	Wood	cf. <i>Cocos nucifera</i>	Square A2: L5, 137 cmbs	ANU-EPF
Wakaya	Delaini	Beta 45789	300	70	-26.0	0–490	Charcoal	–	Unit 2-D4, 40 cmbs	Rechtman (1992: 202)
Wakaya	Delaini	Beta 46438	140	50	-17.5	0–130	Bone	?Species	Unit 3-C3, 120 cmbs	Rechtman (1992: 202)
Wakaya	Delaini	Beta 46439	410	60	-26.5	310–510	Charcoal	–	Unit 2-D4, 60 cmbs	Rechtman (1992: 202)
Wakaya	Delaini	Beta 46440	190	70	-25.5	0–300	Charcoal	–	Unit 3-C3, 100 cmbs	Rechtman (1992: 202)
Wakaya	Delaini	Beta 46441	210	50	-26.6	0–310	Charcoal	–	Unit 3-B4, 52 cmbs	Rechtman (1992: 202)
Wakaya	Delaini	Beta 46442	350	80	-28.7	150–520	Charcoal	–	Unit 2-D2, 50 cmbs	Rechtman (1992: 202)
Wakaya	Delaini	Beta 46444	210	50	-27.8	0–310	Charcoal	–	Unit 4-C4, 80 cmbs	Rechtman (1992: 202)

Continued on next page

Table 19 *continued*

Island	Site	Lab Code	CRA	CRA SE	C13	Cal. BP	Sample Type	Identification	Context	Reference
Wakaya	Delaini	Beta 46445	Modern	—	-26.2	—	Charcoal		Unit EP-5, depth 40 cmbs	Rechtman (1992: 202)
Wakaya	Delaini	Beta 46446	120	50	-24.9	0–280	Charcoal	—	Unit 4-C4, 70 cmbs	Rechtman (1992: 202)
Wakaya	Delaini	Beta 49824	420	90	-18.5	0–430	Bone	?Species	Unit 2-C3, 30 cmbs	Rechtman (1992: 202)
Wakaya	Delaini	Beta 49825	40	50	-22	—	Bone		Unit EP-11, depth 30 cmbs	Rechtman (1992: 202)
Wakaya	Delaini	Beta 49826	120	50	-18.3	0–60	Bone	?Species	Unit 3-C3, 70 cmbs	Rechtman (1992: 202)
Wakaya	Korolevu A	Beta 45785	610	60	-24.3	510–650	Charcoal	—	Unit 1, 60 cmbs	Rechtman (1992: 202)
Wakaya	Korolevu A	Beta 45786	440	60	-25.8	320–530	Charcoal	—	Unit 2, 85 cmbs	Rechtman (1992: 202)
Wakaya	Korolevu A	Beta 45787	410	60	-25.7	310–510	Charcoal	—	Unit 3, 85 cmbs	Rechtman (1992: 202)
Wakaya	Korolevu A	Beta 45790	540	80	-19.0	150–510	Bone	?Species	Unit 5, 40 cmbs	Rechtman (1992: 202)
Wakaya	Korolevu A	Beta 49827	60	50	3.3	—	Marine shell	?Species	Unit EPA, 20 cmbs	Rechtman (1992: 202)
Wakaya	Korolevu A	Beta 49828	160	50	3.4	—	Marine shell	?Species	Unit EPA, 20 cmbs	Rechtman (1992: 202)
Wakaya	Korolevu B	Beta 45788	80	60	-27.3	—	Charcoal	—	Unit 2a, 36 cmbs	Rechtman (1992: 202)
Wakaya	Korolevu B	Beta 45791	190	60	-18.9	0–240	Bone	?Species	Unit 1, 100 cmbs	Rechtman (1992: 202)
Wakaya	Korolevu B	Beta 46443	1950	70	-27.7	1630–2000	Charcoal		Unit 5, 122 cmbs	Rechtman (1992: 202)
Wakaya	Korolevu B	Beta 50522	40	70	-19.6	—	Bone	?Species	Unit 5, 35 cmbs	Rechtman (1992: 202)
Wakaya	Korolevu B	Beta 50523	210	80	-20.2	0–260	Bone	?Species	Unit 1, 20 cmbs	Rechtman (1992: 202)
Yacata	Nadrodrodro	ANU-10811	1040	90	-24.0 E	690–1080	Charcoal	—	Layer 2: 52–60 cmbs	Clark and Hope (2001)
Yadua	Vagairiki-1	Wk-15423	870	30	3.1 ± 0.2	440–540	Marine shell	<i>Trochus niloticus</i>	Pit T1:130–140 cmbs	Nunn et al. (2004)
Yadua	Vagairiki-2	Wk-15424	760	40	3.3 ± 0.2	300–480	Marine shell	<i>Trochus niloticus</i>	Pit T1:140–150 cmbs	Nunn et al. (2004)
Yadua	Denimanu	Wk-15425	2427	40	-26.0 ± 0.2	2320–2700	Charcoal	—	Pit T3:120–130 cmbs	Nunn et al. (2004)
Yasawa	Y1-12	AA-60257	156	30	-24.2	0–280	Charcoal	—	TU1, L.I, lvl. 2	Cochrane (2004: 191)
Yasawa	Y1-15	AA-60255	2207	40	-25.6	2000–2310	Carbonised residue	—	TU 5, L.III, lvl. 14	Cochrane (2004: 191)
Yasawa	Y1-15	AA-60256	607	30	-27.1	520–630	Carbonised residue	—	TU 5, L.I, lvl. 7	Cochrane (2004: 191)
Yasawa	Y2-22	Wk-6482	500	50	—	0–240	Marine shell	<i>Trochus</i> sp.	Surface	Cochrane (2004: 191)
Yasawa	Y2-25	Beta-86839	2540	50	-28.2	2360–2730	Charcoal	—	TU3, L.II base	Cochrane (2004: 191)
Yasawa	Y2-25	Beta-86840	2570	90	-28.7	2360–2760	Charcoal	—	TU3, pit feature1	Cochrane (2004: 191)
Yasawa	Y2-25	CAMS-24946	2530	50	—	2160–2650	Bone	Human	L.II	Cochrane (2004: 191)
Yasawa	Y2-39	Beta-174986	780	40	-26.4	570–730	Charcoal	—	TU3, L.III	Cochrane (2004: 191)
Yasawa	Y2-39	Beta-52221	2260	90	-28.2	1950–2430	Charcoal	—	TU1, L.IV, lvl. 22	Cochrane (2004: 191)
Yasawa	Y2-39	Beta-53193	2790	260	-28.0	2160–3470	Charcoal	—	TU1, L.IV, lvl. 23	Cochrane (2004: 191)
Yasawa	Y2-39	Beta-53194	2870	110	-27.2	2740–3250	Charcoal	—	TU1, L.IV, lvl. 21	Cochrane (2004: 191)
Yasawa	Y2-39	Beta-53195	2400	80	-27.2	2160–2710	Charcoal	—	TU1, L.IV, lvl. 17	Cochrane (2004: 191)
Yasawa	Y2-39	Beta-53196	1160	80	-26.6	820–1260	Charcoal	—	TU1, L.III, lvl. 12	Cochrane (2004: 191)
Yasawa	Y2-39	Beta-53197	330	70	-27.4	150–500	Charcoal	—	TU1, L.II, lvl. 6	Cochrane (2004: 191)
Yasawa	Y2-45	Wk-6485	480	50	—	0–230	Marine shell	<i>Trochus</i> sp.	Surface	Cochrane (2004: 191)
Yasawa	Y2-46	Beta-93971	360	90	-25.7	0–530	Charcoal	—	TU1, L.I, lvl. 1	Cochrane (2004: 191)

Kulu Bay

The Lapita site at Kulu Bay is in swampy terrain behind a low beach ridge that had been affected by stream cutting and mixing of beach materials with a fine, sticky clay-soil from nearby hill slopes. The six radiocarbon determinations clearly demonstrate extensive site disturbance, as three charcoal samples have a modern or recent age regardless of sample depth (ANU-10743, ANU-107949, ANU-107950), and one result on charcoal has a recent age of 560–910 (ANU-10727) that is too recent considering the presence of early pottery. Results indicate substantial mobilisation and deposition of slope sediments on to the Kulu beach flat in the last millennium. In contrast, two marine-shell dates with identical results of 2120–2380 cal. BP (Beta-107947, Beta-107948) indicate the redeposition of cultural material of Lapita and post-Lapita age in the stream-affected back-beach deposits.

Karobo

Adequate provenance information was available for one wood and three charcoal samples and these were submitted to the QDRC (Table 17). The first sample listed was collected from the base of Layer 3 in Square Y, and dated an earth oven (ANU-10781). The excavation notes mention the possibility that Square Y ceramics were not associated with the oven as most were found below Layer 3. The recent age of the oven (0–500 cal. BP) suggests this was probably the case. The remaining two determinations on charcoal came from a ceramic ‘horizon’ where Palmer and Golson had recorded abundant remains of flat-bottomed dishes, relief-marked ceramics and oven stones. The dates range from 1370 to 1830 cal. BP (ANU-10780, ANU-11067), similar to Level 2 determinations from Sigatoka where cognate ceramics have been recorded (Birks 1973; Burley 1997: Table 2).

The fourth date (ANU-11068) from Layer 5 is older and barely overlaps with charcoal determinations from the same layer (1740–2340 cal. BP). The sample is a rectangular piece of cut palm wood, thought to be coconut (Palmer 1965:56). At Karobo, the excavators recorded no evidence for an occupation below the ‘horizon’ containing platter fragments, lenses of charcoal and oven stones.

Introduction of the worked palm wood might have occurred at an earlier time during the formation of the sand ridge, perhaps by flooding and channel cutting of the sand ridge by swamp water. Alternatively, the date itself might be questioned in view of the difficult pre-treatment required to extract cellulose from wood samples (A. Alimanovic, pers. comm., QDRC).

Malaqereqere

Three determinations on charcoal from the highly stratified cultural sediments in the Malaqereqere rock shelter gave consistent age-depth results. The shelter is dated by ANU-10453 immediately above the limestone floor with an age of 560–910 cal. BP, and a date in the overlying level 10–20 cm below the surface extending to 330 cal. BP (ANU-10452). The stratigraphy and radiocarbon dates show that the relatively small and low shelter was first used late in prehistory around 750 cal. BP and was regularly visited from then on.

Volivoli II and III

The excavation in the narrow chamber of Volivoli II produced three samples of charcoal, which were dated. Two dates on samples from 30–40 cm and 50–60 cm were similar and had a range of 580–1300 ca. BP (ANU-10449, ANU-10451), while the other from 40–50 cm was older 1630–2040 cal. BP. (ANU-10450). It appears that despite the relatively clear stratigraphy

recorded in excavation, the cultural deposit in the enclosed shelter space has been disturbed significantly.

Similar to other rock shelters, like Malaqereqere, Qaranioso I and II, and Tuvu, three age results from the Volivoli III site point to human use in the period 1200–1000 cal. BP. Two dates have almost identical CRAs and span 740–1170 cal. BP, although the charcoal was collected from 80–90 cm and 50–60 cm respectively (ANU-11019, ANU-11016), indicating either rapid deposit build-up, or the mixing of archaeological charcoals with older and younger deposits. The remaining result on charcoal collected from 20–30 cm depth had an age of 0–460 cal. BP (ANU-11018).

Tuvu

A single result on charcoal from a thin lens in Spit IV (30–40 cm) returned a calibrated age of 1180–1700 cal. BP (ANU-11020), with the large standard error of ± 100 responsible for the substantial age range. The single date suggests people were using rock shelters in the middle reaches of the Sigatoka Valley towards the middle of the first millennium AD.

Qaranioso I and II

At the large cave known as Qaranioso I, a single ^{14}C date was obtained on charcoal collected from a small hearth at 30 cm depth. The result (ANU-11015) was an age of 920–1350 cal. BP. Excavation in the nearby but smaller cave called Qaranioso II revealed paddle-impressed and shell-stamped pottery in Layer 2 (14–49 cm), with bone of the extinct giant iguana in Layer 3 (50–65 cm). Giant-iguana bone was submitted for ^{14}C AMS dating to the Oxford University Radiocarbon Accelerator Unit. However, it proved to contain too little collagen for dating. A single result on charcoal from 30 cm depth had a recent age of 530–670 cal. BP (ANU-11014).

Natunuku

Excavations at Natunuku were in a disturbed area where early and late prehistoric remains had been mixed together in the surface zone of the coastal site. Species and context information for three samples (ANU-11305, ANU-11306, ANU-11307) was misplaced, and a sample origin in Trench 3 is the only provenance information available. Two dates on charcoal were modern (ANU-10382, ANU-10381), while six marine-shell determinations were prehistoric, similar to Ugaga, where ovens had introduced recent charcoal into the deposit, and the marine-shell ages were prehistoric. The oldest shell dates (ANU-11305, ANU-10698, ANU-11307) extend to the terminal phase of the Lapita era, but no determinations appear to date the earliest cultural remains reported from Natunuku (Davidson et al. 1990; Davidson and Leach 1993), which were encountered by us only in displaced contexts. The other three marine-shell results have a span of 160–890 cal. BP (ANU-10699, ANU-10700, ANU-11306). Pottery from the site is stylistically varied, with diagnostic sherds from all periods of the sequence.

Navatu 17A

Six charcoal and three marine-shell samples from Trench B, and one charcoal sample from Trench A were dated at the QDRC. Radiocarbon results given in Table 17 have a consistent age-with-depth relationship. Median dates from the upper Layer 1 indicate an age of 150–500 cal. BP (ANU-10385, ANU-10710, ANU-10389). Layer 2 has an age spread of approximately 480–910 cal. BP (ANU-10709, ANU-10384). Basal dates on charcoal and marine shell from Layer 4 indicate deposition between 1360 and 1710 cal. BP (ANU-10708, ANU-10386), but

two charcoal dates from levels slightly above these dates are more recent and overlap with the Layer 2 determinations. These dates (ANU-10390, ANU-10387) are from the eastern B1+2 squares, while the earlier dates are from the down-slope B3+4 squares. It appears that cultural remains from the oldest Layer 4 occupation, dating to ca. 1500 cal. BP, were mixed, at least in the B1+2 area, with more recent remains with an age of 660–1350 cal. BP.

Thermoluminescence results

Six pot sherds and samples of surrounding soil were sent to Gillian Robertson (Department of Physics, University of Adelaide). Two plain sherds were found to be suitable for dating with the fine-grain thermoluminescence (TL) technique. Dose rates from radioactive elements in the sherds and surrounding soils were calculated from thick-source alpha counting of uranium and thorium, and from X-ray spectrometer analysis of potassium (Table 18). A contribution from cosmic rays was included in the calculation of total dose. The uranium and thorium concentrations are very low, as expected from previous experiences with South Pacific pottery. The potassium levels are also similar to other Fijian samples (Prescott et al. 1982). In calculating the dose rate it is necessary to take into account the water content of the site. At Navatu the samples were high in water content (22–24%). A decrease in water content would increase the dose rate, and thus the estimated age could be lower by a few percent than that quoted.

Even so, the TL ages appear too old compared with calibrated marine-shell and charcoal radiocarbon ages from similar contexts which do not overlap at two standard deviations. The discrepancy between the two dating techniques could be caused by the small quantity of quartz often present in Navatu and Fijian ceramics (Dickinson 1971; Prescott et al. 1982), and uncertainty over the water content of the Navatu 17A deposits during the period of burial. Whatever the reason for the discrepancy, the radiocarbon results are considered the more reliable age estimates.

Votua

Eight radiocarbon determinations on marine shell and charcoal from the 1996 excavations at Votua were reported in Clark et al. (2001), and another two dates were obtained on samples from Area 2 excavated in 2000. Table 17 lists the full set of Votua age results, which comprises seven marine shell and three charcoal dates. Determinations were on two shellfish species with different environmental preferences – with *Anadara antiquata* a common inhabitant of intertidal coral sand and *Trochus niloticus* associated with intertidal reef flats, and on unidentified wood charcoal. Seven ^{14}C ages indicate Lapita occupation at Votua between 2650 and 2800 cal. BP.

Two determinations have longer spans, with lower ranges extending to the period 2170–2470 cal. BP, but ANU-10706 on charcoal has a large standard error (± 120 years), while ANU-11527 on *Anadara* intercepts a plateau on the marine calibration curve (Stuiver and Braziunas 1993:Figure 17F). Neither provides reliable evidence that occupation at Votua lasted several centuries. A third date on *Trochus niloticus* (ANU-11069A) has an age of 1900–2300 cal. BP. The sample came from within the Area 1 shell midden and is suspected to have been contaminated by younger carbonates that were not removed by the pretreatment process (A. Alimanovic, pers. comm., QDRC). The difference is not related to the effects of dietary variation between species because a ‘B’ sample of *Trochus* shell from the spit above ANU-11069A gave a CRA of 2990 ± 60 BP (ANU-11069B).

The pooled mean for six marine-shell dates was 2940 BP, which has a calibrated range of 2680–2760 cal. BP. Two charcoal ages have a pooled mean of 2690 BP, and an age span of 2690–2850 cal. BP ($p=0.83$), which is almost identical to the calibrated age of the pooled marine-shell age.

Sovanibeka

There are three radiocarbon dates for Sovanibeka on three different types of material. The first was on a sample of *Anadara antiquata* taken from a bulk sample of Test Pit 2 material collected at 30–50 cm depth, which also produced a dentate-stamped sherd. This date (ANU-10779) has a calibrated age of 2360–2720 cal. BP, which overlaps with determinations from the nearby Votua site. The association of the shell sample with Lapita materials is unclear from the context and it might indicate later use of the cave after abandonment of the Votua site.

The second determination (ANU-11246) was on land-snail shell (*Gonatorhaphe lavensis*) from a Test Pit 1 bulk sample at the interface between an upper cultural-material/rat-bone deposit and the lower deposit of red silt with abundant land snails. The small number of land snails in the upper sediment suggests either that human activity impacted the local vegetation, or that the introduction of rats (*Rattus praetor* and *Rattus exulans*) in prehistory caused a decline in the number of land snails.

If the land-snail result was post-Lapita in age it might suggest the Votua occupation caused only minor vegetation modification in areas close to the Lapita occupation. Alternatively, an age result coterminous with Lapita settlement might indicate that widespread vegetation change occurred during the phase of initial settlement and extended beyond the immediate zone of occupation, indicating widespread clearing.

The sample of land-snail shell gave a CRA of 4290 ± 60 BP, which does not provide a useful estimate for dating human impact on local vegetation. It is feasible that the age is too old because land snails living in the limestone chamber were absorbing old carbon in their diet. Dating of modern and prehistoric land snails suggests that species living in limestone areas are more likely to absorb old carbon than those living in non-limestone areas (e.g. Rafter et al. 1972; Goodfriend and Stipp 1983). The explanation for the early land-snail age advanced here is that either prehistoric human and rat activity in the chamber caused sediment compaction and mixing of cultural remains with those of land snails deposited in the mid-Holocene, or the land snails were absorbing old carbon from limestone.

The third determination was on a purified bone collagen from a rat humerus identified as *Rattus praetor*, the large spiny rat (K. Aplin, pers. comm., CSIRO). The humerus was recovered from Test Pit 1 at 50–60 cm depth in the transition zone between sediments containing cultural material and the underlying natural deposit. Rat bone in the size range of *Rattus praetor* was also found in the Votua excavations, but two samples submitted to ANSTO had insufficient collagen after pretreatment to obtain an AMS date. The calibrated result for OZF882 of 670–770 cal. BP is considerably later than anticipated and, if accurate, might suggest that *Rattus praetor* was a relatively late prehistoric arrival to Fiji, or that it was introduced in the Lapita phase and survived until the arrival of European rats in the early 19th century. An attempt to clarify whether rat arrival was coincident with Lapita expansion by AMS dating of two *Rattus praetor* bones recovered from the basal levels of the Navaprah site in Vanuatu (Bedford 2000) also failed due to low collagen yields. In short, although *Rattus praetor* remains have been identified in New Ireland, Reef/Santa Cruz Islands, Tikopia, Vanuatu and Fiji (White et al. 2000), it is unclear when the species first arrived in Fiji, how long it persisted, what impact the rat had on native fauna and flora, and when it became extinct.

Review of radiocarbon dates from Fiji

A goal of the EPF dating program was to establish whether evidence of human occupation older than Lapita culture could be identified in open sites and caves/rock shelters, and if it could not, to accurately date the Lapita phase in Fiji. A second objective examined the change from

Lapita-influenced ceramic assemblages to those with a distinctive Fijian character during the first millennium AD. The stylistic boundary between Lapita and post-Lapita pottery assemblages has been viewed as a formative period when traits characteristic of the late prehistoric period emerged in nascent form. These include an explicit concern with defence and territory, manifested by the development of constructed fortifications, cannibalism, agricultural intensification, craft specialisation and the movement of populations inland.

These topics have been to the forefront of archaeological research in the archipelago. They were first set out as three distinct issues in the 1960s by Bruce Palmer, Director of the Fiji Museum, and they continue to be important to prehistorians working in the Central Pacific. This is illustrated by considering the population of radiocarbon dates recovered from Fijian archaeological sites since the 1950s, a list compiled by recording the ^{14}C ages listed in theses, reports and publications. We recorded all results, including modern determinations, ages which have large standard errors, and dates on material of potentially high inbuilt age such as turtle bone, and have not evaluated the cultural association of the analysed samples, an issue we return to in our discussion of the Fiji radiocarbon sequence. Determinations on bulk palaeosol humin were omitted, as sediment antiquity may be different from the age of cultural material found in it.

The results reported in Table 19 include the majority of ^{14}C determinations from Fiji, and although a few results have no doubt been missed, the dates demonstrate a continuing concern with major aspects of Bruce Palmer's research agenda. When examined by geographic location, most of the CRAs are from the large island of Viti Levu. Elsewhere, there is a reasonable number of determinations from the Yasawa Islands, Taveuni and parts of the Lau Group. Island size is not correlated with the amount of research activity, and there are no age results from Vanua Levu and Kandavu, respectively the second and third-equal largest landmasses, or from substantial islands such as Vatulele. Within Viti Levu most determinations are from the southwest coast area where several Lapita and mid-sequence ceramics sites, in addition to fortifications in the Sigatoka Valley, were recorded by Palmer (1965, 1966, 1967, 1969). An absolute chronology for human occupation of the interior of large islands of Fiji in prehistory has received little attention, with the exception of Field's (2004) study of fortifications in the Sigatoka Valley.

Thesis and published research also divide neatly into Palmer's three research subjects, with the study of warfare, fortifications and socio-political complexity (Frost 1970; Clunie 1977; Best 1984; Parry 1987; Rechtman 1992; Cochrane 2004; Field 2004), mid-sequence ceramic and social change (Hunt 1980; Best 1984; DeGusta 1999; Clark 2000; Burley 2003, 2005), and the excavation and analysis of Lapita sites (Birks 1973; Mead et al. 1973; Best 1981, 1984; Kay 1984; Anderson and Clark 1999, Clark and Anderson 2001a). The radiocarbon results from the EPF, along with age determinations obtained in recent investigations, now make it practicable to revisit the chronology of these recognised inflection points in the Fijian sequence. Calibrated ages at 2SD for the ^{14}C results listed in Table 19 are shown in Figure 84. Excluded dates were those with a standard error larger than ± 100 years, 'modern' results, CRAs with an age less than 110 BP, and land-snail shell dates. Removing these leaves a total of 281 radiocarbon results.

Lapita settlement of Fiji

The chronology of Lapita expansion is controlled at the regional level by the age of the oldest site on an island or archipelago, since colonising populations are by definition inherently mobile, and uninhabited landscapes, even those relatively poor in natural food resources, appear to offer few impediments to the spread of Neolithic populations (Clark et al. 2006). Kirch and Hunt (1988:24) argued that 'frequency distributions for dates from the eastern and westernmost

Figure 84. Calibrated ^{14}C ages from archaeological sites in Fiji. Labels identify determination to a site, but the large number of analyses mean that site labels may be difficult to read. See Table 19 for further details of plotted radiocarbon results.

regions (Bismarcks and Fiji–Western Polynesia) displayed nearly identical ranges and modes', and that the Fijian radiocarbon ages on Lapita sites extended to about 3500 cal. BP. Spriggs (1990:19–20) in a critical review of available dates suggested that Fiji–West Polynesia was not occupied earlier than 3050 cal. BP, with the colonisation of Fiji later revised to 2800–2900 cal. BP from a survey of screened dates from Lapita sites (Anderson and Clark 1999).

The trend towards a more recent colonisation age reflected in the literature from the 1980s to the end of the 1990s began almost immediately to reverse, with the Yanuca Lapita site dated to 2950 cal. BP or older (Clark and Anderson 2001b), and reports that the newly discovered Lapita sites of Bourwea and Naitabale might date to 3220 cal. BP (Kumar et al. 2004; Nunn et al. 2004b). Such claims were given support by the revision of the age of the Nukuleka (TO.2) site in Tonga to ca. 2900 cal. BP (Burley and Dickinson 2001), and the possibility that the Teouma site in Vanuatu dated to 3200–3000 cal. BP (Bedford et al. 2006). The revised colonisation age for Fiji and neighbouring island groups to the east and west was intriguing, as the age of Lapita sites in the Bismarck Archipelago was previously argued to be no older than 3300–3200 cal. BP (Specht and Gosden 1997). If Lapita occupation of Fiji began at 3200 cal. BP, it would imply a very rapid spread of Lapita groups eastward to Vanuatu and Fiji by 3200 cal. BP, followed by a substantial and puzzling hiatus of around 200–300 years before settlement of New Caledonia and Tonga at 3000–2900 cal. BP (Sand 1997; Burley and Dickinson 2001).

Inspection of the oldest ^{14}C results from Fiji has determinations from eight locations with calibrated spans extending to 3000 cal. BP or older. Rejected from this set are Gak-1218 (3240 ± 100 BP) from Natunuku (see Clark and Anderson 2001a), NZ-4594 (2960 ± 70 BP) from Qaranipuqa, as it is out of sequence with other results, and Wk-17544 (3480 ± 40 BP) from Bourewa which is significantly older than all other age results from the site. Single determinations on marine shell and charcoal from Ugaga Island, Sigatoka and Naitabale (Beta-107953, Wk-8239, Wk-11481) are also excluded, along with ANU-11414 (3150 ± 60 BP) on *Batissa violacea*, a freshwater shellfish that may incorporate old carbon from dissolved limestone in its shell. The last five dates may in fact be accurate determinations, but individual results on material known to produce unreliable results, and samples of uncertain cultural association, are inadequate to establish the antiquity of human colonisation.

Remaining dates are ANU-11417 (3050 ± 60 BP) from Yanuca on *Cyprea tigris*, excavated by Birks and Birks (1978), with a calibrated age span of 2680–3050 cal. BP, and four marine-shell dates from Naigani with a pooled CRA of 3110 BP, and a calibrated age of 2790–2980 cal. BP. The results suggest human arrival in the period ca. 3000–2900 cal. BP. Evidence for older occupation has recently been recorded from Bourewa, where there are eight dates indicating Lapita occupation in Fiji began before 3000 cal. BP. These include paired dates on charcoal from Unit 3 (Wk-14235, Wk-14236) and Unit X3 (Wk-17542, Wk-17937), and paired charcoal-marine shell results from Unit 4 (Wk-14237, Wk-14595). Although two early ages on marine shell were on small species (*Tellinidae* sp. and *Atacodea striata*) that are often found naturally deposited on beaches, the oldest CRA (Wk-14237) from Unit 4 is supported by Wk-14595 on charcoal from the same level. The six oldest charcoal determinations from Bourewa have a pooled CRA of 2894 BP and a 2SD age span of 2870–3080 cal. BP. The two oldest marine-shell dates have a pooled CRA of 3180 BP, and an almost identical range to the combined charcoal result of 2870–3090 cal. BP. A conservative interpretation of these dates, considering that the charcoal has not been identified to taxa, and the possibility that some marine shellfish have been wave deposited, suggests Lapita colonisation of Fiji in the period 2950–3050 cal. BP, rather than 3200 cal. BP.

Mid-sequence ceramic change

The three sites where some of the most important mid-sequence deposits in Fiji have been found – Sigatoka VL 16/1, Yanuca VL 16/81 and Natunuku VL 1/1 – were excavated initially because of the discovery of Lapita ceramics, and the mid-sequence materials recovered were used only to aid the establishment of a ceramic sequence. Initially described by Green (1963) as the Navatu phase (2100–900 BP), the mid-sequence was distinguished by a high proportion of relief-marked sherds (up to 50%), including cross-hatch or diamond relief, parallel rib and ‘wavy’ impressed sherds, with the proportion of relief-marked pottery declining by the end of the phase to approximately 20% of the assemblage.

Differences between Lapita and mid-sequence ceramics in vessel form and decoration were linked by Palmer (1965:33) to the Sa-Huynh-Kalanay ceramics of Southeast Asia. The makers of relief pottery were therefore identified as proto-Polynesians. Previously, Gifford and Shutler (1956) had noted the similarity between parallel-rib and cross-hatch relief sherds from New Caledonia and sherds from Fiji, and Garanger (1971:58) linked cord-impressed ceramics found on the Mele Plain on Efate Island in Vanuatu with two Fijian sherds impressed with woven fibre and excavated from Navatu 17A (Gifford 1951a). However, recent work has shown that the Mele Plain sherds were made in Japan and belong to the early Jomon tradition (Dickinson et al. 1999). Until the past decade, there have been few well-dated archaeological sites in Fiji, New Caledonia and Vanuatu with which to compare the antiquity of widespread decorative traits, and examine the similarities and differences among regional ceramic sequences.

A chronology of mid-sequence ceramic change was first proposed by Best (1984), who identified two points of stylistic change in Lakeba ceramics, which he interpreted as evidence for population movements from New Caledonia and Vanuatu. The first, emanating from New Caledonia at ca. 2100 cal. BP, introduced an ovoid vessel with sharply everted rims and square lips that was decorated with parallel-rib or cross-hatch relief markings. The second, at 1700 cal. BP, correlated with the appearance of minor decorative techniques such as asymmetric and fingernail incision, finger pinching, cord-wrapped paddle impressing and rim notching. These traits were seen as characteristic of Vanuatu ceramic traditions that had been introduced to Fiji.

Radiocarbon results from the EPF at the mid-sequence sites of Navatu 17A, Karobo and Ugaga also suggested a major ceramic change took place around 2300–1900 cal. BP, when the Lapita-derived ceramic trajectory was altered when jars and bowls marked with heavy parallel-relief impressions, dents and deep wiping appeared (Clark 2000). The dating of the transition was poorly focused, however, due to substantial site disturbance at Ugaga (Table 17), although the presence of mid-sequence ceramics dating to around 1500 cal. BP at Navatu 17A and Karobo indicated that ceramic change had occurred somewhat earlier.

Investigations at the Sigatoka Sand Dune by Burley (2003, 2005) revealed two distinct mid-sequence ceramic assemblages separated by a thin sand layer. The lower, termed ‘Fijian Plainware’, includes ovoid jars and decorative techniques of parallel and cross-hatch relief, punctate and lip notching. This assemblage is seen as having continuity in vessel form and technology with Lapita ceramics (Burley 2005:321). The upper ceramics, called ‘Navatu’, comprise globular jars with highly everted rims, lip notching, end-tool and side impressions, and fingernail pinching/gouging (see Chapter 12).

The ‘Navatu’ deposit at Sigatoka was dated by three ^{14}C results (CAMS-70090, CAMS-70091, CAMS-70920), with a pooled CRA of 1437 BP, calibrating to 1275–1340 cal. BP. Five results date the lower Fijian Plainware levels, with two determinations (CAMS-68195 and CAMS-70921) considered to be outliers (Burley 2005:325). The three oldest ^{14}C ages have a pooled age of 1570 BP, and an age range of 1335–1516 cal. BP, indicating a rapid transition

to 'Navatu' pottery over a century. The presence of 'Navatu' pottery traits on Lakeba in east Fiji at 1700–1600 cal. BP, and the later arrival of these traits in north and south Viti Levu at about 1300 cal. BP is suggested to be the result of gradual east-to-west movement of 'Navatu'-related groups, or ceramic transmission from the Lau Group (Burley 2005:342). Additional examination of stylistic phases and ceramic transformation through ^{14}C dating mid-sequence deposits is particularly important for identifying the direction and extent of population movements within and beyond the Fiji Islands.

Fortifications and defensive sites

Studies have shown that the development of social complexity in Fiji was associated with the appearance of fortifications and horticultural intensification (Palmer 1969; Frost 1970; Parry 1987), with population growth and control over horticultural resources being key attributes that led to the 'classic' Fijian chiefdoms (Parry 1987; Field 2004). Establishing an absolute chronology for defensive sites provides a proxy for the broader socio-political and economic transformations in Fiji prehistory.

Radiocarbon dating of fortified sites suggests that most of those on Taveuni, Wakaya and Lakeba date to the past 700 years or less. On Taveuni, defensive sites like Navolivoli and Nawa were probably first used about 500–700 cal. BP (Gak-2411, Gak-2414), while those on Wakaya (Delaini and Korolevu) date slightly later to 500–300 cal. BP (Beta-45787, Beta-45790). The massive hill fort of Ulunikoro, located on a limestone plateau on Lakeba in the Lau Group, is older still, with CRAs on charcoal and marine shell (NZ-4044, NZ-4585, NZ-4586, NZ-4587, NZ-5180) indicating occupation at 800–1000 cal. BP. On Beqa Island, a very large fortification, also known as Korolevu, has been recorded, but according to Crosby (1988:236), it is probably less than 500 years old.

Fortifications, like most prehistoric structures built of earth and stone in the Central Pacific such as house mounds, tombs, walls and roads, are difficult to radiocarbon date because construction, use and reuse can incorporate samples of different ages in a structure. In addition, unmodified strategic locations used for defence and refuge are likely to have lower site visibility than sites associated with constructed defences. In a nuanced study of sites in the Sigatoka Valley, Field (2004, 2005) showed that natural defences such as large caves and remote peaks (Tatuba, Nokonoko) were used as territorial strongholds and refuges by 1400 cal. BP (AA-50287, AA-50283, AA-50298). The establishment of sites with constructed features on highly visible outcrops (Malua, Korovatuma) began at 500–600 cal. BP (AA-50295, AA-50300), with the emergence of new ring-ditch sites on the valley floor (Bukusia and Vitonga) at 150–350 cal. BP (AA-50309, AA-50302, AA-50304, Wk-11135).

The EPF dating program, while not aimed specifically at defensive sites, nonetheless investigated several rock shelters and deposits with a potential refuge/defensive aspect. Chief among these is the Navatu 17A site on the flanks of a volcanic plug, which was used as a refuge in the 19th century. The lowest cultural deposit included cannibalised human bone from the B3+4 square, and is dated to 1360–1710 cal. BP. The site position is not strongly defensive, but might have been chosen due to its proximity to a high refuge. The presence of cannibalism at Navatu supports Field's hypothesis that inter-group conflict was becoming more prevalent, and as a result, defensive considerations began to influence site location and position in the period 1000–1500 cal. BP. Interestingly, this is the period when Burley (2003, 2005) identifies a significant mid-sequence change in the ceramics and economy at the Sigatoka Sand Dunes, and Dickinson (2006:117–119) records several examples of long-distance ceramic transfer from Fiji to islands outside the archipelago.

Conclusion

The EPF resulted in reliable radiocarbon dates for the late-Lapita site at Votua, but at Natunuku, Ugaga and Kulu Bay, the antiquity of the oldest remains could not be determined due to redeposition and mixing of cultural material of different ages and the absence of dateable material at Qaranioso II. Deposits of mid-sequence age at Navatu 17A and Karobo were better delineated, and at Ugaga the majority of ^{14}C dates spanned 2500–1200 cal. BP, suggesting that many of the cultural remains from the island covered the late-Lapita to mid-sequence transition. Several rock shelters on Viti Levi (Malaqereqere, Volivoli II and III, Tuvu and Qaranioso II) were mainly used in the past 1000 years, with several of the cultural deposits including evidence for occasional use in late-Lapita (Qaranioso II) and mid-sequence (Volivoli II) times.

Combining the EPF determinations with those from recent and earlier studies showed that the earliest evidence for Lapita colonisation is at Bourewa in western Viti Levu, which is dated to 2950–3050 cal. BP. Other results from sites on Viti Levu and nearby islands such as Ugaga, Naigani, Yanuca and Naitabale suggest that Lapita groups were either highly mobile or relatively numerous, and both attributes may have been in play. While the size of the migrant population entering Fiji was sufficient to leave a presence on Viti Levu and nearby islands, the population does not appear to have reached the Lau Group until 2850–2900 cal. BP.

The intra-archipelago colonisation interval is significant, as it suggests that the presence of large islands like Viti Levu (10,947 sq. km) diverted human movement, for a time, away from long-distance expansion and instead towards coastal and inland exploration of a large island. One means of testing this hypothesis is to look at the southernmost islands of the Lau Group that are roughly equidistant from Viti Levu and Tonga. For instance, the ceramic and material-culture assemblages of Lapita sites on islands like those in the Ono-i-lau Group and Vatoa could show, when examined, a closer affinity to Tongan Lapita materials than to Lapita ceramics from western Fiji. Such a finding would be consistent with the independent colonisation of Tonga from a location like the Reef Santa Cruz Islands (Burley and Dickinson 2001), and the expansion of Lapita groups in Tonga to neighbouring and possibly unoccupied islands in the Lau Group. Similarly, if the oldest Lapita ceramics in southern Lau were shown to have an affinity with ceramics from other parts of Fiji, but dated 100–200 years later, it would indicate a noticeable decline in the dispersal rate of Lapita groups after human arrival in west Fiji. One outcome of such a finding would be that very different social and demographic conditions characterised the colonisation of west Fiji than the colonisation of east Fiji.

Dating the mid-sequence transition at the Sigatoka Sand Dunes indicates that stylistic change can occur rapidly over about century from ca. 1400–1300 cal. BP, which is significant, as the rate of ceramic change is frequently correlated in archaeology with major social change, particularly the arrival or influence of new populations (Hunt 1986). The ceramic record of the Fiji Islands, located on the ethnological border between Melanesia and Polynesia, has been scrutinised particularly for evidence of cultural intrusion (Clark 2003) because the people of Fiji have different physical characteristics from nearby populations in West Polynesia. It is important to note that while the rate of ceramic change appears to be rapid, radiocarbon dating of fortifications and habitation sites indicates that wider changes were occurring in Fijian society during the mid-sequence. These include the expansion of populations to the interior of large and small islands, the use of naturally defended locations, and the presence of cannibalism at ca. 1400 cal. BP. A significant episode of external population arrival and impact in Fiji has not been identified convincingly in the archaeological record, and several researchers have rejected migration as an explanation for the advent of fortifications, or the cause of stylistic change

in pottery (Clark 2000; Cochrane 2004; Field 2004). This is an issue yet to be resolved (e.g. Chapter 12; Burley 2005).

The chronology of the Fiji sequence, although based on a relatively large number of ^{14}C results, has long focused on clarifying the temporal boundaries of three parts of the sequence (colonisation/mid-sequence/social complexity). As the above review shows, refinements to the absolute chronology have raised new questions about the pattern of Lapita dispersal, and have closed the gap between the timing of mid-sequence ceramic change and the advent of population expansion and territoriality, previously seen as distinct events separated by 500 or more years. Several major geographical and temporal gaps remain, with few intact assemblages from the interval 2500–1500 cal. BP adequately dated, and the possibility of regional variation in Fijian material culture still to be examined by the recovery of well-dated sequences from Vanua Levu and several other large islands that have yet to receive even cursory archaeological research. A number of recognised site types have also to be dated, such as the enigmatic *naga* enclosures (Palmer 1971), agricultural field systems (e.g. Kuhlken and Crosby 1999) and adze and flake quarries (see Chapter 14).

References

- Anderson, A. and Clark, G. 1999. The age of Lapita settlement in Fiji. *Archaeology in Oceania* 34: 31–39.
- Anderson, A., Roberts, R., Dickinson, W., Clark, G., Burley, D., De Biran, A., Hope, G. and Nunn, P. 2006. Times of sand: Sedimentary history and archaeology at the Sigatoka Dunes, Fiji. *Geoarchaeology* 21: 131–154.
- Anderson, A., Clark, G. and Worthy, T. 2000. An inland Lapita site in Fiji. *Journal of the Polynesian Society* 109: 311–316.
- Bedford, S.H. 2000. Pieces of the Vanuatu puzzle: Archaeology of the North, South and Centre. Unpublished PhD thesis, Australian National University, Canberra.
- Bedford, S., Spriggs, M. and Regenvanu, R. 2006. The Teouma Lapita site and the early human settlement of the Pacific Islands. *Antiquity* 80: 812–828.
- Best, S. 1981. Excavations at Site VL 21/5 Naigani Island, Fiji, a preliminary report. Department of Anthropology, University of Auckland.
- Best, S. 1984. Lakeba: The prehistory of a Fijian Island. Unpublished PhD thesis, Department of Anthropology, University of Auckland.
- Best, S. 1987. The Sigatoka dune burials (Site VL 16/1). Unpublished report to the Fiji Museum, Suva.
- Birks, L. 1973. Archaeological excavations at Sigatoka dune site, Fiji. *Bulletin of the Fiji Museum* No.1.
- Birks, L. and Birks, H. 1978. Archaeological excavations at site VL16/81, Yanuca Island, Fiji. *Oceanic Prehistory Records* No. 6. University of Auckland.
- Burley, D. 1997. Archaeological research Sigatoka Sand Dune National Park. Unpublished report to the Fiji Museum, Suva.
- Burley, D.V. 2003. Dynamic landscapes and episodic occupations: Archaeological interpretation and implications in the prehistory of the Sigatoka Sand Dunes. In: Sand, C. (ed), *Pacific Archaeology: Assessments and prospects*, pp. 307–315. Les Cahiers de l' Archéologie en Nouvelle-Calédonie Number 15, New Caledonia.
- Burley, D.V. 2005. Mid-sequence archaeology at the Sigatoka Sand Dunes with interpretive implications for Fijian and oceanic culture history. *Asian Perspectives* 44: 320–348.
- Burley, D.V. and Dickinson, W.R. 2001. Origin and significance of a founding settlement in Polynesia. *Proceedings of the National Academy of Sciences of the USA* 98: 11829–11831.

- Clark, G. 2000. Post-Lapita Fiji: Cultural transformation in the Mid-sequence. Unpublished PhD thesis, Australian National University, Canberra.
- Clark, G. 2003. Shards of meaning: Archaeology and the Melanesia–Polynesia distinction. *Journal of Pacific History* 38: 197–213.
- Clark, G. and Sorovi-Vunidilo, T. 1999. Fijian double-spouted vessels. *Domodomo* 11: 6–14.
- Clark, G. and Anderson, A. 2001a. The pattern of Lapita settlement in Fiji. *Archaeology in Oceania* 36: 77–88.
- Clark, G. and Anderson, A. 2001b. The age of the Yanuca Lapita site, Viti Levu, Fiji. *New Zealand Journal of Archaeology* 22: 15–30.
- Clark, G., Anderson, A. and Matararaba, S. 2001. The Lapita site at Votua, northern Lau Islands, Fiji. *Archaeology in Oceania* 36: 134–145.
- Clark, G. and Hope, G. 2001. Archaeological and palaeoenvironmental investigations on Yacata Island, northern Lau, Fiji. *Domodomo* 13: 29–47.
- Clark, G., Anderson, A. and Wright, D. 2006. Human colonization of the Palau Islands, western Micronesia. *Journal of Island and Coastal Archaeology* 1: 215–232.
- Clark, J.T. and Cole, A.O. 1997. Environmental change and human prehistory in the Central Pacific: Archaeological and palynological investigations on Totoya Island, Fiji. Report to the Fiji Museum, Suva.
- Clunie, F. 1977. Fijian weapons and warfare. *Bulletin of the Fiji Museum* No. 2.
- Cochrane, E.C. 2004. Explaining cultural diversity in ancient Fiji: The transmission of ceramic variability. Unpublished PhD thesis, University of Hawaii.
- Crosby, A. 1988. Beqa: archaeology, structure and history in Fiji. Unpublished MA thesis, Department of Anthropology, University of Auckland.
- Davidson, J., Hinds, E., Holdaway, S. and Leach, F. 1990. The Lapita site of Natunuku, Fiji. *New Zealand Journal of Archaeology* 12: 121–155.
- Davidson, J. and Leach, F. 1993. The chronology of the Natunuku site, Fiji. *New Zealand Journal of Archaeology* 15: 99–105.
- De Biran, A. 2001. The Holocene geomorphic evolution of the Sigatoka Delta, Viti Levu, Fiji Islands. Unpublished PhD thesis, University of the South Pacific, Suva, Fiji Islands.
- DeGusta, D. 1999. Fijian cannibalism: Osteological evidence from Navatu. *American Journal of Physical Anthropology* 110: 215–241.
- Dickinson, W.R. 1971. Petrography of some sand tempers in prehistoric pottery from Viti Levu, Fiji. Final report No. 2. *Records of the Fiji Museum* 1: 108–121.
- Dickinson, W.R. 2006. *Temper sands in prehistoric Oceanian pottery: Geotectonics, sedimentology, petrography, provenance*. The Geological Society of America Special Paper 406.
- Dickinson, W.R., Burley, D.V., Nunn, P.D., Anderson, A., Hope, G., De Biran, A., Burke, C. and Matararaba, S. 1998. Geomorphic and archaeological landscapes of the Sigatoka Dune site, Viti Levu, Fiji: Interdisciplinary investigations. *Asian Perspectives* 37: 1–31.
- Dickinson, W.R., Sinoto, Y. H., Shutler, R. Jr., Shutler, M.E., Garanger, J. and Teska, T.H. 1999. Japanese Jomon sherds in artifact collections from Mele Plain on Efate in Vanuatu. *Archaeology in Oceania* 34: 15–24.
- Field, J.S. 2004. Environmental and climatic considerations: A hypothesis for conflict and the emergence of social complexity in Fijian prehistory. *Journal of Anthropological Archaeology* 23: 79–99.
- Field, J.S. 2005. Land tenure, competition and ecology in Fijian prehistory. *Antiquity* 79: 586–600.
- Frost, E.L. 1970. Archaeological excavations of fortified sites on Taveuni, Fiji. Unpublished PhD thesis, University of Oregon.
- Frost, E.L. 1979. Fiji. In: Jennings, J.D. (ed), *The prehistory of Polynesia*, pp. 61–81. Australian National University Press.
- Garanger, J. 1971. Incised and applied-relief pottery, its chronology and development in southeastern

- Melanesia, and extra areal comparisons. In: Green, R.C. and Kelly M. (eds), *Studies in Oceanic Culture History volume 2*, pp. 53–99. Pacific Anthropological Records No. 12.
- Gifford, E.W. 1951a. Archaeological excavations in Fiji. *University of California Anthropological Records* 13: 189–288.
- Gifford, E.W. 1951b. Six Fijian radiocarbon dates. *Journal of the Polynesian Society* 64: 240.
- Gifford, E.W. and Shutler, D. Jr. 1956. Archaeological excavations in New Caledonia. *Anthropological Records* 18, No. 1. University of California Press, Berkeley and Los Angeles.
- Green, R.C. 1963. A suggested revision of the Fiji sequence. *Journal of the Polynesian Society* 72: 235–253.
- Goodfriend, G.A. and Stipp, J.J. 1983. Limestone and the problem of radiocarbon dating land-snail shell carbonate. *Geology* 11: 575–577.
- Hughen, K.A., Baillie, M.G.L., Bard, E., Bayliss, A., Beck, J.W., Bertrand, C., Blackwell, P.G., Buck, C.E., Burr, G., Cutler, K.B., Damon, P.E., Edwards, R.L., Fairbanks, R.G., Friedrich, M., Guilderson, T.P., Kromer, B., McCormac, F.G., Manning, S., Bronk Ramsey, C., Reimer, P.J., Reimer, R.W., Remmele, S., Southon, J.R., Stuiver, M., Talamo, S., Taylor, F.W., Plicht, J. van der and Weyhenmeyer C.E. 2004. Marine04 marine radiocarbon age calibration 26–0 ka BP. *Radiocarbon* 46: 1059–1086.
- Hunt, T.L. 1980. Toward Fiji's past; archaeological research on southwestern Viti Levu. Unpublished MA thesis, University of Auckland.
- Hunt, T.L. 1986. Conceptual and substantive issues in Fijian prehistory. In: Kirch, P.V. (ed), *Archaeological approaches to evolution and transformation*, pp. 20–32. Cambridge University Press, Cambridge.
- Jones, S., Steadman, D.W. and O'Day, P.M. 2007. Archaeological investigations on the Small Islands of Aiwa Levu and Aiwa Lailai, Lau Group Fiji. *Journal of Island and Coastal Archaeology* 2: 72–98.
- Kay, R. 1984. Analysis of archaeological material from Naigani. Unpublished MA thesis, University of Auckland.
- Kirch, P.V. and Hunt, T.L. 1988. The spatial and temporal boundaries of Lapita. In: Kirch, P.V. and Hunt, T.L. (eds), *Archaeology of the Lapita cultural complex: A critical review*, pp. 9–32. Thomas Burke Memorial Washington State Museum Research Report No. 5. Seattle: The Burke Museum.
- Kuhlken, R. and Crosby, A. 1999. Agricultural terracing at Nakauvadra, Viti Levu: A late prehistoric irrigated agrosystem in Fiji. *Asian Perspectives* 38: 62–89.
- Kumar, R., Nunn, P.D., Katayama, K., Oda, H., Matararaba, S. and Osborne, T. 2004. The earliest-known humans in Fiji and their pottery: The first dates from the 2002 excavations at Naitabale (Nartururuku), Moturiki Island. *South Pacific Journal of Natural Science* 22: 15–21.
- Kumar, R., Nunn, P.D., Field, J. and De Biran, A. 2006. Human response to climate change around AD 1300: A case study of the Sigatoka Valley, Viti Levu Island, Fiji. *Quaternary International* 151: 133–143.
- Leach, F., Quinn, C., Morrison, J. and Lyon, G. 2001. The use of multiple isotope signatures in reconstructing prehistoric human diet from archaeological bone from the Pacific and New Zealand. *New Zealand Journal of Archaeology* 23: 31–98.
- McCormac, F.G., Hogg, A.G., Blackwell, P.G., Buck, C.E., Higham, T.F.G. and Reimer, P.J. 2004. SHCal04 Southern Hemisphere Calibration 0–11.0 cal kyr BP. *Radiocarbon* 46: 1087–1092.
- Mead, S.M., Birks, L., Birks, H. and Shaw, E. 1973. The decorative system of the Lapita potters of Sigatoka, Fiji. *Journal of the Polynesian Society Memoir Supplement* 82: 1–43, 44–98.
- Nunn, P.D., Matararaba, S., Ishimura, T., Kumar, R. and Nakoro, E. 2004a. Reconstructing the Lapita-era geography of Northern Fiji: A newly discovered Lapita site on Yadua Island and its implications. *New Zealand Journal of Archaeology* 26: 41–55.
- Nunn, P.D., Kumar, R., Matararaba, S., Ishimura, T., Seeto, J., Rayawa, S., Kuruyawa, S., Nasila, A., Oloni, B., Ram, A.R., Saunivalu, P., Sing, P and Tegu, E. 2004b. Early Lapita settlement site at Bourewa, southwest Viti Levu Island, Fiji. *Archaeology in Oceania* 39: 139–143.

- Nunn, P.D., Pepe, C., Matararaba, S., Kumar, R., Sing, P., Nakoro, E., Gwilliam, M., Heorake, T., Kuilanisautabu, L., Nakoro, E., Narayan, L., Pastorizo, M.A., Robinson, S., Saunivalu, P. and Tamani, F. 2005. Human occupations of caves of the Rove Peninsula, southwest Viti Levu Island, Fiji. *South Pacific Journal of Natural Science* 23: 16–23.
- Nunn, P.D., Matararaba, S., Kumar, R., Pene, C., Yuen, L., Pastorizo, M.A. 2006. Lapita on an island in the mangroves? The earliest human occupation at Qoqo Island, Southwest Viti Levu, Fiji. *Archaeology in New Zealand* 49: 205–212.
- O'Day, S. Jones, O'Day, P., and Steadman, D.W. 2003. Defining the Lau context: Recent findings on Nayau, Lau Islands, Fiji. *New Zealand Journal of Archaeology* 25: 31–56.
- Palmer, B. 1965. Excavations at Karobo, Viti Levu. *New Zealand Archaeological Association Newsletter* 8: 26–33.
- Palmer, B. 1966. Lapita style potsherds from Fiji. *Journal of the Polynesian Society* 75: 373–377.
- Palmer, B. 1967. Sigatoka research project. *New Zealand Archaeological Association Newsletter* 10: 2–15.
- Palmer, B. 1969. Ring-ditch fortifications on windward Viti Levu, Fiji. *Archaeology and Physical Anthropology in Oceania* 4: 181–197.
- Palmer, B. 1971. Naga ceremonial sites in the Navosa Upper Sigatoka valley. Final Report No. 1. *Records of the Fiji Museum* 5: 92–106.
- Parry, J. 1987. The Sigatoka valley – pathways into prehistory. *Bulletin of the Fiji Museum* No. 9.
- Petchey, F. 1995. Archaeology of Kudon: Archaeological analysis of Lapita ceramics from Mulifanua, Samoa and Sigatoka, Fiji. Unpublished MA thesis, Department of Anthropology, University of Auckland.
- Prescott, J.R., Robertson, G.B. and Green, R.C. 1982. Thermoluminescence dating of Pacific island pottery: Successes and failures. *Archaeology in Oceania* 17: 142–147.
- Rafter, T.A., Jansen, H.S., Lockerbie, L. and Trotter, M.M. 1972. New Zealand radiocarbon reference standards. In: Rafter, T.A. and Grant-Taylor, T. (eds), *Proceedings of the Eighth International Radiocarbon Dating Conference*, pp. 625–668. Royal Society of New Zealand, Wellington.
- Rechtman, R.B. 1992. *The evolution of socio-political complexity in the Fiji Islands*. PhD thesis, Ann Arbor, Michigan.
- Rosenthal, M.E. 1995. The archaeological excavation of an outrigger canoe from the Nasilai site, Rewa Delta, Viti Levu, Fiji. *Asian Perspectives* 34: 91–118.
- Sand, C. 1997. The chronology of Lapita ware in New Caledonia. *Antiquity* 71: 539–547.
- Sand, C. and Valentin, F. 1997. Cikobia et Nagelevu. Programme archeologique et anthropologique sur deux îles de Fidje. Resultats preliminaires de la mission 1997. Noumea, New Caledonia.
- Specht, J. and Gosden, C. 1997. Dating Lapita pottery in the Bismarck Archipelago, Papua New Guinea. *Asian Perspectives* 36(2): 175–199.
- Spriggs, M. 1990. Dating Lapita: another view. In Spriggs, M. (ed), *Lapita design, form and composition*, pp. 83–122. Occasional Papers in Prehistory, No. 20. Canberra, Department of Prehistory, Australian National University.
- Stuiver, M. and Braziunas, T.F. 1993. Modeling atmospheric ^{14}C influences and ^{14}C ages of marinesamples to 10,000 BC. *Radiocarbon* 35: 137–189.
- Stuiver, M. and Reimer, P.J. 1993. Extended ^{14}C data base and revised CALIB 3.0 ^{14}C age calibration program. *Radiocarbon* 35: 215–230.
- Thomas, F.R., Nunn, P.D., Osborne, T., Kumar, R., Areki, F., Matararaba, S., Steadman, D. and Hope G. 2004. Recent archaeological findings at Qaranilaca Cave, Vanuabalavu Island, Fiji. *Archaeology in Oceania* 39: 42–49.
- Toggweiler, J.R., Dixon, K. and Broecker, W.S. 1991. The Peru upwelling and the ventilation of the South Pacific thermocline. *Journal of Geophysical Research* 96: 467–497.
- White, P.J., Clark, G. and Bedford, S. 2000. Distribution, present and past, of *Rattus praetor* in the Pacific and its implications. *Pacific Science* 54: 105–117.