Tamuarawai (EQS): An Early Lapita Site on Emirau, New Ireland, PNG

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ABSTRACT

In 2007 a new Early Lapita site called Tamuarawai (EQS) was located on Emirau Island, Papua New Guinea. Two seasons of excavation (2007, 2008) have been undertaken. This paper describes the site and some of the preliminary analyses undertaken. Some unusual results suggest that Tamuarawai will make an important contribution to modelling the Early Lapita occupation of the Bismarck Archipelago.

Keywords: Early Lapita, obsidian, colonisation, Bismarck Archipelago

INTRODUCTION

Over one hundred find spots of pottery have been recorded in the Bismarck Archipelago, but only nine have previously been identified as Early Lapita. They are: Lagenda Plantation (FCR/FCS) on the Willaumez Peninsula, (Specht 2007; Specht and Torrence 2007), and Boduna (FEA) (Specht and Summerhayes 2007) both in West New Britain; Kabakan Island (SEE) in the Duke of Yorks, East New Britain (White 2007); Talepakemalai (ECA), Etakasarai (ECB), and Etapakengaroasa (EHB) (Kirch 2001) all on the small islands south of the main island Mussau, New Ireland; Makekur (FOH) on Adwe Island, and Paligmente (FNY) on Pililo Island, the Arawe Islands (Summerhayes 2000a, b), southwest New Britain; and Kamgot (ERA) on Babase Island, the Anir Islands, New Ireland (Summerhayes 2000c). Any additional Early Lapita site would likely expand our understanding of the early stages of this colonisation.

In 2006 teacher Mr Kenneth Vito and students from Rongol Top Up primary school on Emirau Island found sherds at Tamuarawai and these were confirmed as Lapita from images sent to Summerhayes. In 2007, at the invitation of the local Emirau community, Summerhayes, Matisoo-Smith, Specht, Mandui and local historian, Jim Ridges, found Early Lapita deposits in test pits at Tamuarawai. Excavations were extended in 2008 by Summerhayes, Matisoo-Smith, Mandui, Allen and Hogg. Another field season is planned for 2010. The purpose here is to report our research so far.

THE SITE

Emirau lies 140 kilometres north-west of Kavieng (Figure 1). It is a small raised limestone island, 13 kilometres long and up to seven kilometres wide, reaching 55 metres elevation near the northern tip (Figure 2). The island is visible from Mussau (25 km distant), and both Mussau and New Hanover (88 km distant) are clearly visible from Emirau. Mussau was colonised c. 3,300 years ago (Kirch 1997; Kirch 2001, Kirch et al. 1991). There are reports on the pre-Christian ethnography of Emirau (Parkinson 1907, Chinnery 1925, Nevermann 1933), but the site at Tamaurawai is the first indication of early Lapita colonisation

Location

Tamuarawai (PNG National Museum site code EQS) is located 250 metres south of Hamburg Bay (Figures 2, 3 and 4), in garden land at the narrowest point of the island where, at the mid-Holocene high sea stand, there would have been a lagoon with EQS located on the edge of a channel dividing the island into two. The road to the north of Tamuarawai is built on old raised reef which would in the past have been an outer reef, with the area to the south being within the lagoon (Figure 4).

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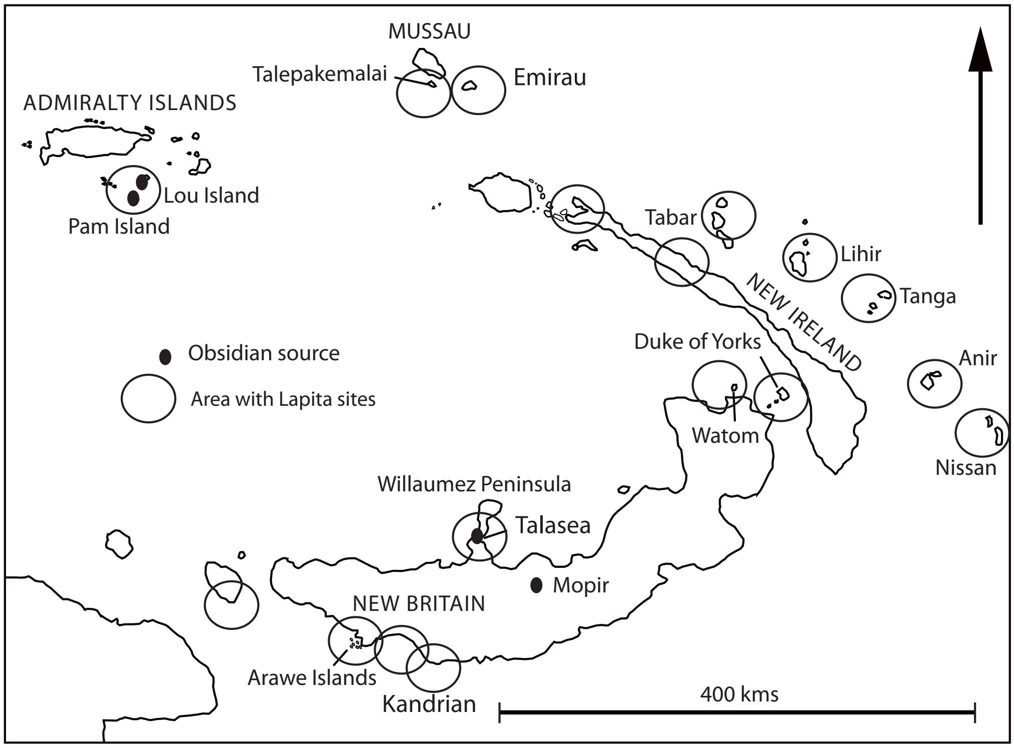


Figure 1. Map of the Bismarck Archipelago.

The site area is relatively flat. Shovel pits (Figure 3) defined the site area and showed that, close to the escarpment to the east, sterile deposits consisting of unconsolidated white coarse sand with the underlying reef appearing at 20 cm (shovel pit 4) to more than 2 metres (shovel pit 1) depth. To the west of the site, cultural deposits are not found further than Test Pit 2. Some 70 metres west of Test Pit 2 reef is found at a depth of 1.15 metres below the surface (Shovel Pit 6, see Figure 5). To the east of the site there is evidence of disturbance caused by modern road construction. At shovel pit 1 the reef could not be located at 2 metres depth and the original topsoil emerged at 65 cm depth. Results from the shovel pits and excavations suggest that Emirau was two islands at the time of Lapita occupation, with EQS sitting on a reef platform located next to an inner reef. Figure 6 sets out a reconstruction of the island at the time of initial Lapita occupation.

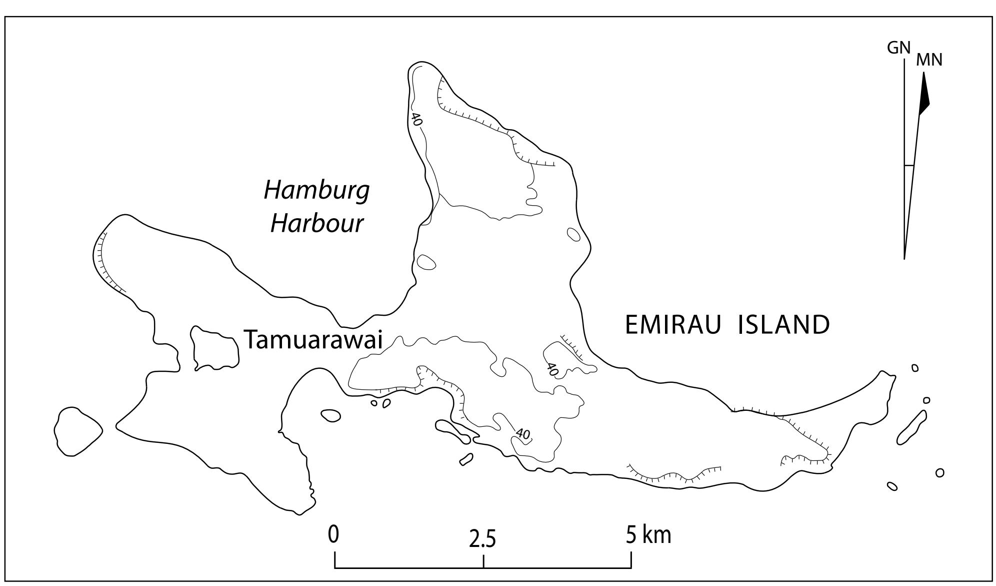


Figure 2. Emirau Island.

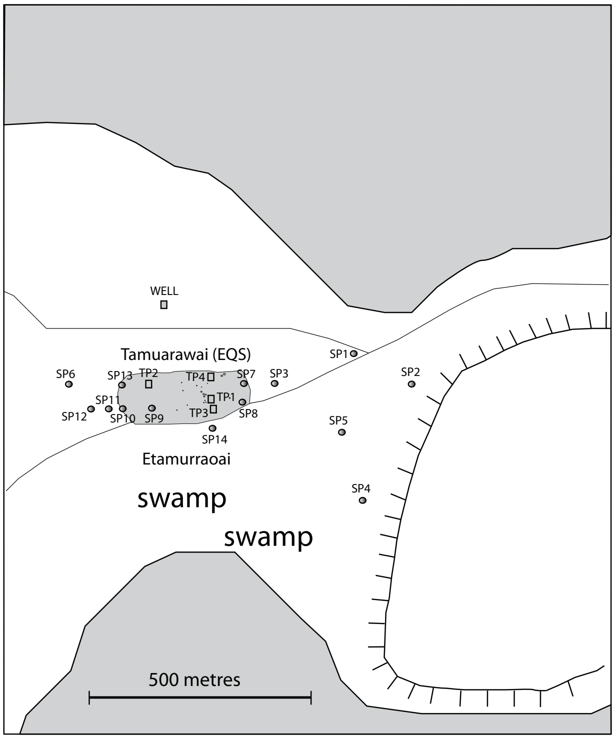


Figure 3. Map of Tamuarawai (EQS) showing test pits (TP) and shovel pits (SP).

Excavations and stratigraphy

In 2007 Test Pits 1 and 2 (each 1 × 1 m) were excavated to establish the *in situ* presence and age of Lapita pottery. Excavation was by trowel, in 10 cm spits, with the material sieved through 7 mm mesh. These pits yielded a range of ceramics, obsidian, shell, bone and charcoal. In 2008, Test Pits 3 (2 × 2 m) and 4 (1 × 1 m) were excavated, to resolve issues of stratigraphy and the nature of the settlement particularly whether, as suggested in Test Pit 1, the earliest artefact deposition had occurred at the water's edge or over the lagoon, and also to test the absence, in 2007 data, of remains of pig, dog and *Rattus exulans* (see Figure 7).

In Test Pit 3 coral bedrock was encountered at c. 120 cm depth, with cultural material found to a depth of 130 cm in crevices in the coral. Only one of the squares was excavated from top to bottom (Test Pit 3/square A). The upper layers were discarded in the other squares without sieving because they comprised disturbed garden soils. Test Pit 4 reached 92cm below surface before coral bedrock was encountered.

Site stratigraphy was similar throughout, exhibiting four layers (see Figure 8). *Layer 1* is a black to brown garden loam containing worn sherds, obsidian, and fish bones and shell. The thickness of Layer 1 increases from north to south, from 10 cm in Test Pit 4 to over 30cms in Test Pit 3. *Layer 2* is a brown to yellow sand. There is a clear separation between Layers 1 and 2 in most test pits, although a transition is seen at its borders with Layer 3. In Test Pit 3/A Layer 2 was seen to be a transition zone and some artefact analyses combined Layers 1 and 2. Test Pit 1 suggested that the two layers could be separated on artefact sizes and degrees of fragmentation. The thickness of Layer 2 varied from c. 8–12 cm in Test Pit 4 to between 10 cm and 30 cm in Test Pit 1 where a pit from layer 2 was cut into Layer 3. *Layer 3* is an unconsolidated beach sand, yellow/grey to white. The depth of the surface of layer 3 varies from 25–40 cms in Test Pits 3 and 4 to 15–20 cm in Test Pit 1. Artefactual material was found in this layer, but it was not as dense as that found above or below. *Layer 4* sits on the coral reef and is composed of dense deposits of coarse, gritty, sand with branch coral, and large fragments of shell in addition to assumed shell food refuse.

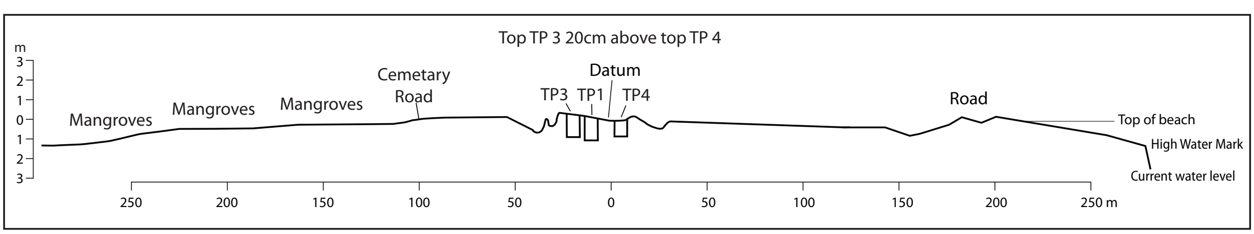


Figure 4. South to North (Hamburg Bay) transect across EQS.

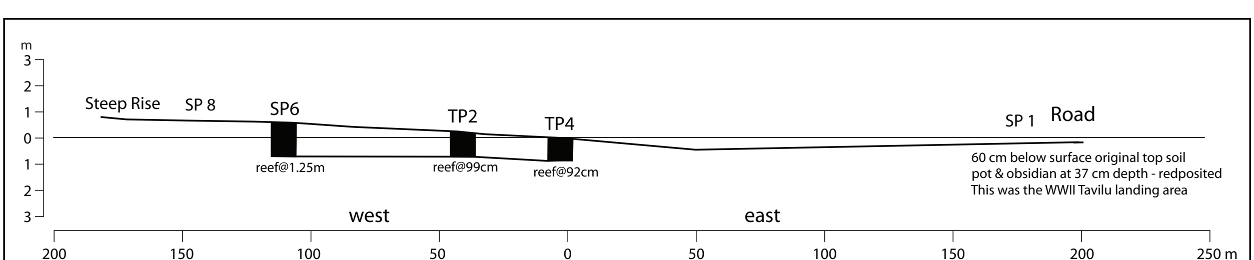
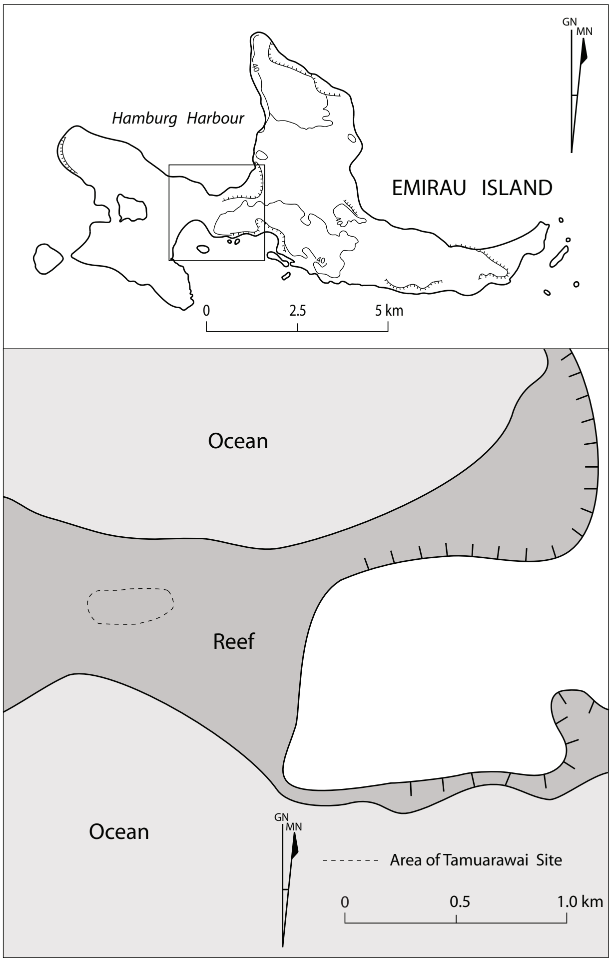
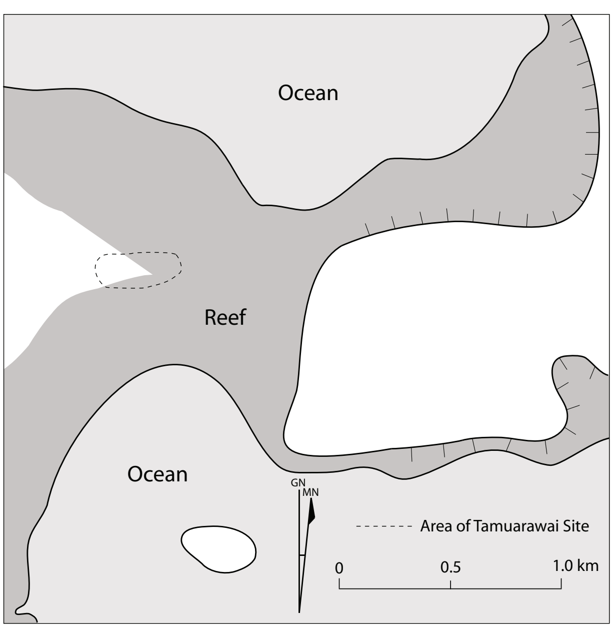


Figure 5. East to West transect across EQS.



a. Initial settlement on reef platform



b. within short period of time there is a build up of sand

Figure 6. EQS – suggested plan of the island at the time of initial Lapita occupation and after the build up of sand.

The surface depth of this layer is 40–50 cm. Lapita pottery, obsidian, fishbone and other cultural material such as fishhooks, fishhook blanks and shell beads are found in Layer 4. The material from Layer 4 in Test Pits 1 and 3 seems to have been deposited when the location was covered with water, but that from Layer 4 in Test Pits 2 and 4 may have been discarded on a beach above the water line to judge from the matrix and the distribution and condition of the artefacts.

Throughout Layers 3 and 4 in Test Pits 1 and 3 large cemented blocks of beach rock were encountered. Beach rock forms in the intertidal zone beneath unconsolidated sediments, indicating an intertidal position at and subsequent to the earliest cultural deposition. The intact nature of artefacts from Test Pits 1 and 3, Layer 4, suggests discard in a low energy lagoonal environment, as seen at nearby Talepakemalai on Mussau, and in the Arawe Island deposits. Large pieces of pottery with un-abraded edges were found lying horizontally, while a complete fishhook which looked pristine (below) was recovered. Throughout this layer bivalves in the closed 'death position' indicate deposition under water. Tamuarawai is now dry, reflecting either uplift and/or lower sea levels since the time of deposition.

The sea at 3,300–3,200 years ago was higher than today, and Gosden and Webb (1994: 40) argue for rapid accumulation of deposits covering the stilt village of Adwe. Kumbun and Adwe Islands are raised limestone islands covered with allophanic soils derived from volcanic tephra. Subsequent erosion caused by forest clearance was catastrophic, with sediment build up creating sand banks, infilling the lagoon and extending the beach zone (Gosden and Webb 1994: 41). Kirch argued in regard to Talepakemalai that the covering of the stilt structures, located originally on the 'subtidal sandy reef flat', had less to do with people than natural events (Kirch 2001: 132). A rapid drop in sea level caused erosion of an outer reef and platform, 'thus generating an increased quantity of calcareous sediment' (Kirch 2001: 132). The deposition at EQS is seen similarly, with artefacts deposited into low energy lagoonal conditions, then sand deposition in the lagoon and a new beach dune appearing.

Chronology and Finds

Charcoal from Test Pit 1, Layer 4 dates to 3,360–3,160 cal BP at two standard deviations (95.4% probability). This fits within the Early Lapita period (Summerhayes 2001). From Test Pit 2, charcoal from Layer 4 at 91 cm below the surface was dated to between 3,210–2,960 cal BP (Table 1). The deposit in Test Pit 2 thus appears younger than the early occupation which deposited material in Layer 4 in Test Pits 1 and 3 located to the east. Occupation at Test Pit 2 may indeed have occurred during the formation of Layer 2 as an active beach dune. Further dating and a detailed analysis of the pottery and obsidian will resolve this issue.

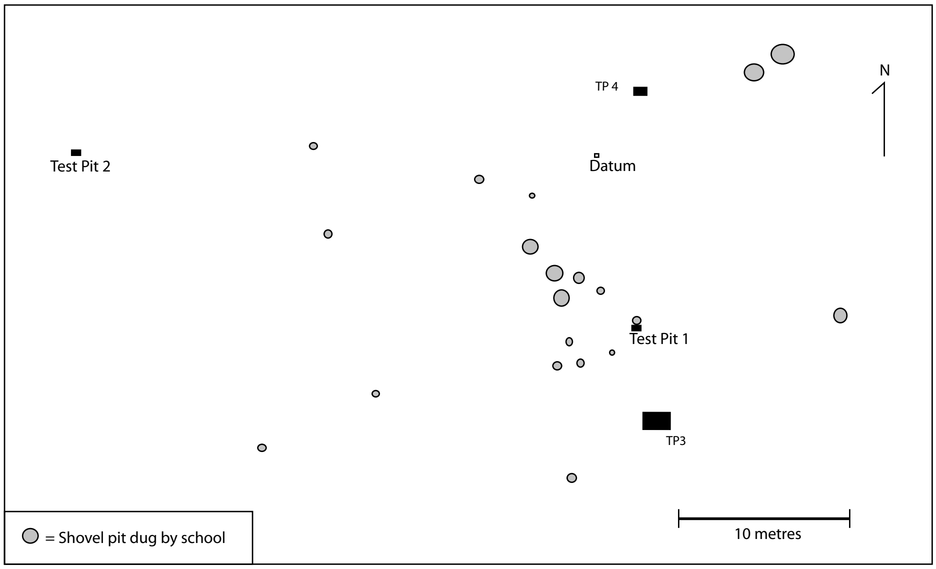


Figure 7. Plan of excavations – EQS showing test pits, and shovel pits dug by local teacher and students.

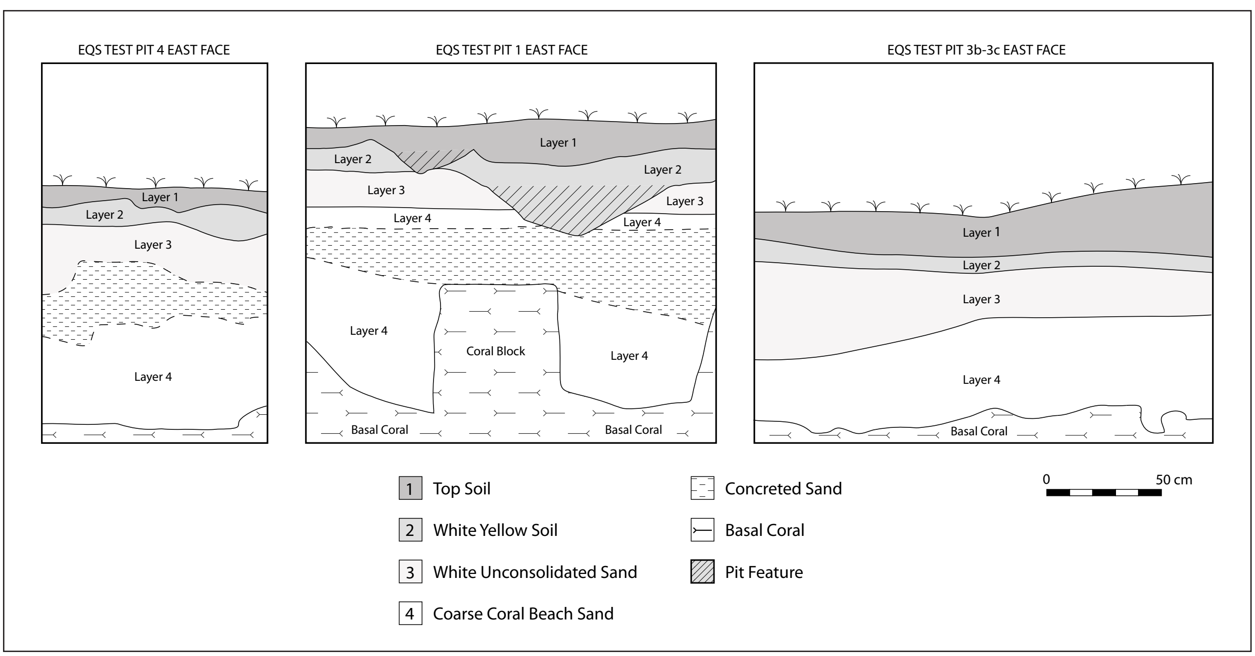


Figure 8. Section of test pits EQS.

Table 1. *Radiocarbon estimates from EQS.*

Lab. Reference	Sample	δ^{14}C	δ^{13}C	D14C	% Modern	Uncalibrated	Calibrated Age 2σ (95.4%) cal BP
WK-21349	charcoal	−310.6+2.5 %	−23.4+0.2	−315.4+2.7%	68.5+0.3	3044+31	3360BP(90.2%)3200BP 3190BP(5.2%)3160BP
WK-21345	charcoal	−305.5+2.5%	−27.4+0.2	−304.5+2.7%	69.5+0.3	2917+31	3210BP(3.4%)3180BP 3170BP(92.0%)2960BP

Pottery. Over 2000 pottery sherds have been excavated from EQS. Petrographic and chemical analyses of the fabric are in progress (N. Hogg). A stylistic analysis of the pottery will be presented after completion of these [petrographic and chemical] analyses. A low incidence of sherds within Layer 3 in Test Pits 1 and 3, suggests a hiatus in occupation. Test Pit 4 on the other hand has a higher percentage of sherds in the lowest levels, including Layer 3, suggesting either functional differences across the site, or temporal variability. The lack of pottery in the upper levels of Test Pit 4 suggests a spatial restriction of occupation in the later levels. While most of the sherds are plain, dentate decoration is common in the Layer 4 deposits, while notching of the rims may have a wider time span. The decorated sherds are representative of Early Lapita pottery (see figure 9 & Table 2).

Obsidian. Analysis of the 159 pieces of obsidian from Test Pit 3 (combining the data for Layers 1 and 2) shows little variation in distribution of industrial types, indicating that on-site processing and uses did not alter greatly through time (Tables 3 & 4). The mean size of obsidian flakes, broken flakes and flaked pieces combined is greater in Layer 4 than in either of the other two analytical units (Table 5). A Student's t-test on maximum length gave a statistically significant difference between Layer 1–2 and Layer 4 ($p = 0.0034$). The same test suggests a statistically significant difference in mean maximum lengths for whole flakes between Layer 1 and Layer 4 ($p = 0.0183$). In the weights of whole flakes there was no statistically significant difference between the samples ($p = 0.0584$) at the 95% confidence level, although on oriented length of whole flakes, as a different indicator of flake size, the t-test resulted in a sta-

Figure 9. Early Lapita style pottery – EQS.

Table 2. *Pottery from EQS per Test Pit*

Test Pit	Layer	No. sherds	% within site
1	1	396	39%
	2	350	34%
	3	41	4%
	4	237	23%
3a	1 & 2	248	40%
	3	71	12%
	4	298	48%
4	1	30	7%
	2	8	2%
	3	199	49%
	4	173	42%

tistically significant difference (p = 0.0396). These results indicate that individual obsidian artefacts in Layer 4 are bigger than those in Layer 1–2, given the proviso that the whole flake sample sizes are small, and that in the case of Layer 4 the 10 items in the sample reflect the minimum sample size normally recommended in applying the Student's t-test.

Whole flakes were also measured for shape by calculating the oriented length divided by the width (L/W) for the assemblages within analytical units. A result of 1.0 indicates that the average length and width are the same; a result of 2.0 indicates that length is twice width; a result of 0.5 indicates width is twice the average length. The results (Table 8) for both analytical units are similar: a Student's t-test indicates no statistical difference in this respect between the two groups (p = 0.5929). Overall this test suggests no specialised flake production was being sought either earlier or later. Together with the maximum length data discussed above, these data suggest little change through time in the nature of obsidian artefact production on the site.

In general little deliberate retouch and unambiguous usewear has been noted on Melanesian obsidian assemblages, and that from Tamuarawai (EQS) is no different in this respect. Only a single flake from Layer 1–2 has been retouched along a single edge, while a single broken flake, also from Layer 1–2 shows use damage. A third piece, a core from Layer 3 has some ambiguous edge damage thought to be either the result of bipolar flaking or, more probably, use of this core as a scraping tool.

Table 3. *Artefact counts by square and analytical unit for all obsidian in Test Pit 3 according to industrial type.*

Whole Flakes	Square A	Square B	Square C	Square D	Total
Layer 1–2	19	0	0	0	**19**
Layer 3	0	0	2	3	**5**
Layer 4	1	3	5	1	**10**
Broken Flakes					
Layer 1–2	34	0	0	0	**34**
Layer 3	0	0	3	4	**7**
Layer 4	4	9	8	8	**29**
Flaked Pieces					
Layer 1–2	21	0	0	0	**21**
Layer 3	3	6	2	4	**15**
Layer 4	6	2	5	4	**17**
Cores					
Layer 1–2	0	0	0	0	**0**
Layer 3	0	0	0	1	**1**
Layer 4	0	0	1	0	**1**
Total	**88**	**20**	**26**	**25**	**159**

Table 4. *Test Pit 3 obsidian artefact numbers and percentages of industrial types by unit.*

	Flake		Broken Flake		Flaked Piece		Core		Total
Layer	No.	%	No.	%	No.	%	No.	%	
1–2	19	25.6	34	46.0	21	28.4	0	0	**74**
3	5	18.9	15	54.1	7	24.3	1	2.7	**28**
4	10	17.5	29	50.9	17	29.8	1	1.8	**57**
Total	**34**		**78**		**45**		**2**		**159**

Table 5. *Mean maximum lengths and weights for all obsidian excluding cores from Test Pit 3 by analytical unit. Bracketted numbers indicate sample sizes.*

	Maximum Length (mm)			Weight (gm)		
Layer	Mean	Sd	Range	Mean	Sd	Range
1–2 (74)	16.0	4.6	9.2–37.1	0.54	0.56	0.1–3.7
3 (27)	16.5	5.2	5.5–28.3	0.79	0.89	0.1–4.1
4 (56)	18.7	6.0	6.9–33.0	1.10	1.20	0.1–5.8

Table 6. *Mean maximum lengths and weights for obsidian whole flakes from Test Pit 3 for Layers 1–2 and 4. Bracketted numbers indicate sample sizes*

	Maximum Length (mm)			Weight (gm)		
Layer	Mean	Sd	Range	Mean	Sd	Range
1–2 (19)	15.6	6.1	10.8-37.1	0.52	0.80	0.1-3.7
4 (10)	21.5	5.9	12.9-31.2	1.42	1.67	0.1-5.8

Table 7. *Mean oriented lengths for obsidian whole flakes from Test Pit 3 for Layers 1–2 and 4. Bracketted numbers indicate sample sizes.*

	Oriented Length (mm)		
Layer	Mean	Sd	Range
1–2 (19)	11.9	5.7	7.1–33.4
4 (10)	16.4	4.5	10.8–25.3

Table 8. *Test pit 3 obsidian whole flakes, showing oriented length divided by width. See text for details. Sample size shown in brackets*

Layer	Mean oriented L/W	Standard deviation	Range
1–2 (19)	1.49	0.40	0.6–1.5
4 (10)	1.01	0.34	0.6–1.2

Cortex occurs on 10 items, five from Layer 1–2, one from Layer 3 and four from Layer 4 and these include all industrial categories. Since cortex occurs on only 6.4% of the assemblage it is likely that obsidian arrived on the site mainly or totally in flaked form rather than as nodules.

Only two cores were recovered from Test Pit 3, one each from Layers 3 and 4. Both are relatively small (maximum dimension 34.3 mm, weight 17.4 gm). One is a single platform core, the other has three platforms. The former piece has either usewear or bipolar flaking damage. Apart from this last example there is no evidence of bipolar flaking in this assemblage (see below). The absence of bipolar flaking, a technique present in Melanesia in the Pleistocene (i.e. Matenbek Cave on New Ireland–Summerhayes and Allen 1993) and in the post-Lapita period (i.e. Oposisi on Yule Island – Vanderwal 1973: 124; Summerhayes et al. in prep), suggests no careful reduction of this material and thus a ready access to it. While superficially this seems at odds with the absence of cores at the site, if obsidian was imported partially reduced to large flakes and chunks its further on-site reduction may have been of a haphazard nature that reduced the discard to the sort of distribution seen here, where whole flakes represent only c. 20% throughout and the vast majority of the assemblages comprises broken flakes and flaked pieces. There seems little doubt, given the nature of the assemblage and the absence of retouch and usewear, that the object here was to produce sharp cutting edges that were used while the edges retained sharpness and then were discarded.

Obsidian sourcing. In 2008, eighteen percent of obsidian from Test Pit 1 (Table 9) was chemically characterised for sourcing studies using Proton Induced X-ray and Proton Induced Gamma-ray emission (PIXE-PIGME) at the Australian Nuclear Science and Technology Organisation (Summerhayes et al. 1998 outlines this technique).The majority of samples were sourced to the Admiralties, in particular to the Umrei source on Lou Island. Only one piece was sourced to 'Wekwok', another source on Lou Island. The sample as a whole had 75% of all obsidian analysed sourced to the Admiralties, and the remainder to west New Britain. The samples from Layers 1 and 2 were very similar with between 80% and 75% allocated to Admiralty sources, while Layer 4 with many fewer samples had 66% allocated to the Admiralties.

These results are not comparable with sourcing results based on density that have already been published on the Mussau assemblages. Those results suggest that about half the obsidian from the earliest sites at Mussau came from the Admiralties, and the other half from New Britain sources (Kirch et al. 1991). Discrepancies are known between the results from PIXE-PIGME and the use of density analyses (see Torrence and Victor 1995). Publication of results of PIXE-PIGME analyses of the obsidian from Mussau Lapita sites is awaited.

Table 9. *EQS Test Pit 1 obsidian sourced using PIXE-PIGME*

Layer	Total obsidian	no. selected	% selected	Umrei	Wekwok	Kutau
Layer 1	112	15	13%	11 73%	1 7%	3 20%
Layer 2	95	20	21%	15 75%	– –	5 25%
Layer 3	7	2	29%	1 50%	– –	1 50%
Layer 4	4	3	75%	2 66%	– –	1 33%
Admiralty (75%)			West New Britain (25%)			

Admiralty obsidian is found in other Early Lapita sites, but in varying percentages depending of distance from the sources. From the Early Lapita site of Kamgot (ERA) (see Figure 1) which is roughly equidistant from both major obsidian source regions, Admiralty sources only accounted for 20% of the obsidian, with 80% from west New Britain sources. Sites closer to New Britain have more obsidian from west New Britain. From the Duke of York site of Test Pit 1 SEE, 99% of obsidian was from west New Britain sources. Only three obsidian pieces sourced from the Admiralty Islands were identified in the Arawe Lapita assemblages (see Summerhayes 2003b, 2004, 2009). Such a result is what might be logically expected. Yet, the presence of between 25%-33% of obsidian from west New Britain in Tamuarawai (EQS), which is much closer to the Admiralty sources, suggests more complex interaction than down-the-line exchange.

Also of interest is the lack of obsidian in Tamuarawai from Pam Lin, which is an island source near Lou Island in the Admiralties. Pam Lin makes up a quarter of Admiralty obsidian found from Kamgot (ERA) on Anir. Yet not one piece was identified in EQS.

Obsidian Discussion. Technological analysis confirms that obsidian at Tamuarawai was imported in flaked form rather than as nodules, a procedure that did not change over time. The absence of cores is consistent with what is known of Admiralty obsidian in other Lapita sites. Summerhayes (2003a: 140) notes that where Admiralty Island obsidian is found, it has been heavily reduced. This includes obsidian from Mussau, Anir and the Duke of Yorks. Cores from Admiralty sources are rare. Summerhayes suggested that Mussau obtained obsidian from either an unknown Lapita site in the eastern islands of the Admiralties or from Admiralty Islanders who undertook and regulated the distribution themselves. This scenario would have the Lapita communities from Mussau tapping into an already existing obsidian network operating from the eastern Admiralties. The analysis of obsidian from Tamuarawai agrees with such a scenario.

Other cultural finds

Shell artefacts. In 2007 a small number of shell tools were found in Test Pit 1. These included three drilled shell beads: one from Layer 1, and two from Layer 3. A *Conus* shell armband was found from Layer 4, while a *Conus* shell disk was recovered from Layer 1. A fishhook blank came from Layer 2. Of interest was the excavation of volcanic stones (not from the island) with evidence of burning (charcoal) in Layer 4. From the 2008 season, four fishhooks and blanks were excavated, all from Layer 4 (one in TP 4, three from TP 3B, and one from TP 3C). Figure 10 shows two of the broken fishhooks, and two blanks. One of the fishhooks was in pristine condition and will be published in detail elsewhere (Test Pit 3 square 3B). Five drilled shell beads were also excavated, two from Layers 1–2 (TP 3A), one from Layer 3 (TP 4), and two from Layer 4 (TP 3B) (see Figure 10). Other finds included two net sinkers (TP 4 and TP 3B) and two cowrie octopus lures (TP 3B and TP 3D), all in Layer 4. A single hammerstone and stone slingshot were also recovered from Layer 4 (TP 3D).

Fauna. Of a total of 1,862 bones, more than 93% came from fish with of the remainder being bird, mammal, turtle and 'unidentified' (Figure 11). Less than 1 percent could not be assigned to a class, order or family. Only two bird bone fragments were identified. One is very small, probably a tibiotarsus, from Test Pit 1, Layer 2. The other is an unidentified long bone, possibly a femur, from Test Pit 4, Layer 4. Turtle bone was found from all test pits (Table 10). All pieces are unidentified carapace/plastron fragments. Most turtle bone was found in Layer 4 and the top layers. A single dog (atlas) and pig bone (premolar) were recovered in Test Pit 4, Layer 1. The crown of a very worn human molar was found in Test Pit 3, Layer 4. and an unidentified marsupial canine was found in Test Pit 1, Layer 1.

Of the fish, a total of 12 families, one subclass (Elasmobranchii) and one species, *Monotaxis grandoculis* were identified in the Tamuarawai assemblage using NISP values (Table 10). Scaridae are by far the most abundant of identified fish (Table 11) at EQS (30%), followed by Lethrinidae (16%) and Lutjanidae (15%). There is variation found between the layers, with Layers 2 and 4 exhibiting more modality in the distribution. In both these layers the relative abundance of Scaridae is smaller and Lethrinidae is more abundant. In Layer 4 Lethrindae is the most abundant fish (23%), followed by Scaridae (20%), with Lutjanidae close behind (18%). Carangidae is also found in quantity (14%) in Layer 4, while it is rare in the top three layers. An MNI was calculated for these assemblages indicating 83 fish present in the EQS assemblage.

The fish bone assemblage suggests an inshore fishing/foraging regime typical of Indo-Pacific Islands. Scarids, Balistids and Lethrinids are all families common to benthic and reef edge zones and they are most abundant in this assemblage, suggesting fishing from water craft just off the reef edge or by standing on the reef edge (Walter 1998: 69–70). The presence of Scombridae is possible evidence for offshore fishing. Most of the specimens are of relatively small individuals, but some very large fish are also present. Evidence for the fishing of larger pelagic species is confined to the unidentified shark tooth.

The marine component of this Lapita assemblage fits with what is known of fish assemblages from Early Lapita assemblages at Kamgot (ERA). Here, as with Tamuarawai (EQS), fish bone dominates the faunal assemblage. The most popular fish at Kamgot were inshore varieties such as Scaridae and Diodontidae. Most of the fishing was inshore or from the reef. Shark, tuna, dolphin, turtle and barracuda are also reported from Mussau, but while we have the single shark tooth and remains of turtle at Tamuarawai,

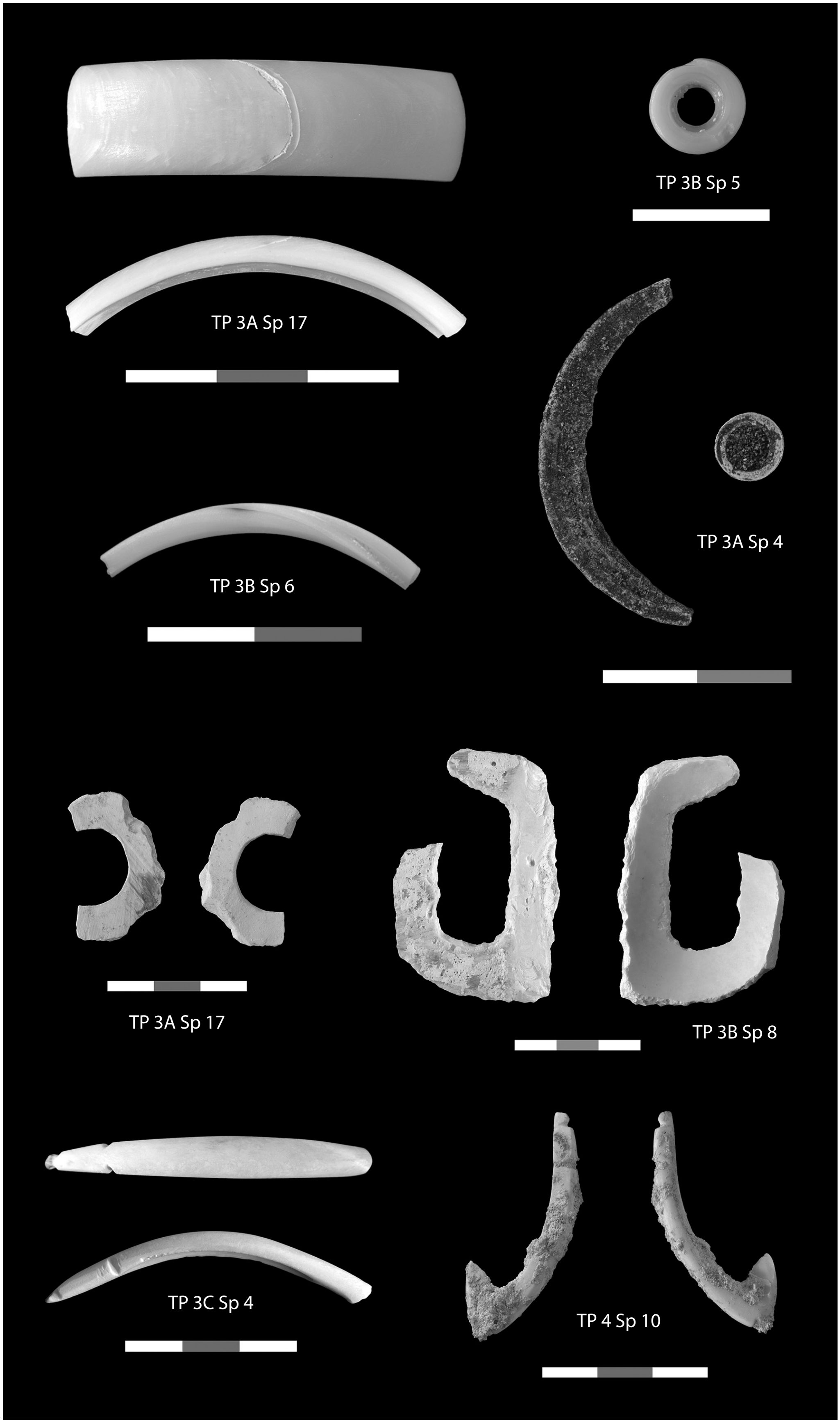


Figure 10. Shell artefacts from EQS.

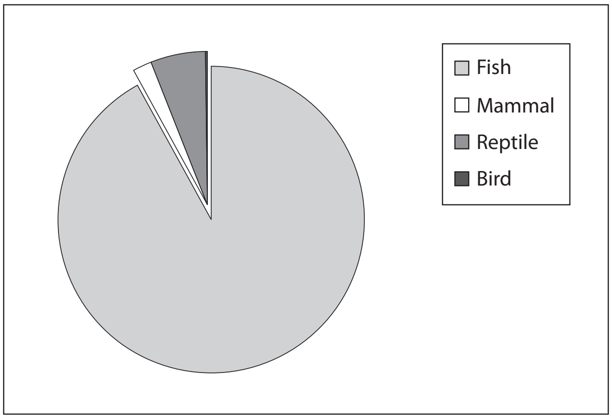


Figure 11. Quantity of each identified class based on NISP values.

tuna, dolphin and barracuda are so far absent.

Fishhooks were recovered from Anir (Szabo and Summerhayes 2002) and in the Early Lapita sites on Mussau and also the later Lapita site of Watom (Kirch *et al.* 1991; Butler 1988; Green and Anson 2000a: 52). A similar situation occurs at Tamuarawai where a number of *Trochus* one piece fishhooks were recovered (see above).

Tamuarawai differs considerably from Kamgot (ERA) and other Lapita assemblages such as Talepakemalai (ECA) in the almost complete lack of mammal remains. The absence of *Rattus exulans*, which occurs widely in Lapita sites, is most striking. Within Lapita settlements at Anir, for comparison, the midden remains include the phalanger, *Thylogale browni,* pig, dog, and *Rattus exulans*.

Stone Chisel. Among the finds recovered from the primary school excavation at a depth of 1.4 metres next to Test Pit 1, is a small greenstone chisel which is clearly exotic to Emirau, and attempts to source the raw material are ongoing. This piece will be fully published elsewhere.

DISCUSSION AND CONCLUSIONS

It is apparent from both the condition of the artefacts and the nature of the sand matrix that the earliest deposits from Test Pits 1 and 3 were discarded into a lagoon, implying that at least some houses were constructed there, although there is only ambiguous evidence for such structures (small, approximately 10 cm diameter circular discolourations of the matrix in Test Pit 3). The evidence from Test Pits 2 and 4 is more equivocal and might reflect dry beach occupation. The concentration of artefacts seen in Layer 4 of Test Pits 1 and 3 is less apparent in Test Pit 4, whereas there is more cultural deposition in Layer 3 of Test Pit 4 than in Test pits 1 and 3.

In Test Pits 1 and 3, Layer 4 material is different in appearance from the material in Layer 2, and artefact discard was lower in layer 3. These data suggest that site occupation occurred in two phases. That is much less clear in Test Pits 2 and 4 and some of the shovel pits, where occupation appears more continuous. This matter is likely to be resolved with the completion of the ceramic analysis.

The relatively small area of the site and its restricted faunal range with a preponderance of fish and turtle indicates the possibility that Tamuarawai was a specialised fishing camp. Against this, the wide range of material culture present and the investment of building houses in the lagoon – if indeed this was the case – are more in keeping with a village. Equally, Lapita settlements located on small offshore islands to the south of Mussau, and sites in the Arawe Islands and the Anir Island Group occur in locations suited to either one seasonal wind pattern or the other and have given rise to models of a mobile people who may not have had permanent villages until later (Summerhayes 2000). Tamuarawai, similarly, would have been exposed to the northwest winds, yet protected from the southeast trade winds. The location of the settlement is in line with the argument that these early colonists were mobile (see Summerhayes 2000 for a detailed argument).

It is at least clear that Tamuarawai is as old as the oldest bracket of Lapita sites and that the faunal suite indicates that this island did not have an agricultural base unlike in early settlements at Mussau, and elsewhere. This gives hope that the site will provide insights into the initial settlement of islands or island groups by Lapita colonists. Clearly detailed comparisons with the Mussau Lapita sites are called for, given that Mussau and Emirau are only 25 km apart.

The obsidian results support Summerhayes' (2003a) assertion that obsidian from the Admiralty sources, unlike those from west New Britain, was brought into the site as flakes, not as cores. This suggests that further attention to the role of the Admiralty Islands in the procurement and distribution of obsidian for the Lapita network is needed, concentrating initially on the eastern islands of the Admiralty Island Group. More importantly, obsidian characterisation analysis using PIXE-PIGME, increases the percentage of Admiralty obsidian from Lapita sites in this region from 50% found in Mussau (Kirch et al. 1991) to 75% in Tamuarawai (EQS). While previously it was argued that distance to source was not the primary factor in obsidian procurement (Summerhayes 2004), these new results cast doubt on that idea. Distance to the obsidian sources on the Admiralty Islands appears to be an important factor in its distribution on Tamuarawai. At the same time there was still a significant amount reaching Emirau from west New Britain obsidian sources, indicating contact with distant communities and suggesting that social ties may have outweighed purely economic considerations.

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Table 10. *Bones from the 2007–8 EQS excavations based on NISP values*

Test Pit	1					3				4				
Layer	1	2	3	4	Total	1–2	3	4	Total	1	2	3	4	Total
Taxa														
Bird														
Unidentified		1			**1**								1	**1**
Fish														
Acanthuridae	5				**5**	2	2	4	**8**				1	**1**
Balistidae	4	2		1	**7**			2	**2**					
Carangidae		2		1	**3**			16	**16**			1	2	**3**
Diodontidae	2	3	1		**6**	1		1	**2**					
Holoncentridae			1		**1**				**0**					
Labridae				1	**1**			5	**5**			1	1	**2**
Lethrinidae	1	7	1	4	**13**			27	**27**				1	**1**
Lutjanidae	3	4		1	**8**	2	3	22	**27**			1	2	**3**
M. grandoculis	4	2		1	**7**			4	**4**				2	**2**
Mullidae		1			**1**				**0**					
Muraenidae				1	**1**	1	3	2	**6**					
Priacanthidae?			1		**1**				**0**					
Scaridae	25	9	1	3	**38**		8	19	**27**	2		4	5	**11**
Scombridae	1		1		**2**			3	**3**	0	1	1		**2**
Scorpanidae						1			**1**	0			1	**1**
Serranidae	4				**4**			4	**4**	1		1		**2**
Shark *sp.*	1				**1**					1		1		**2**
Unidentified	291	142	61	126	**620**	27	57	599	**683**	15	5	46	97	**163**
Mammal														
Canis										1				**1**
Human									**1**	1				
Sus										1				**1**
Marsupial *sp.*	1				**1**									
Unidentified	6	3			**9**	3		1	**4**	3		3		**6**
Reptile														
Turtle	8	10		1	**19**	4	1	46	**51**	6	2	8	8	**24**
Unidentified														
Unidentified	1				**1**			1	**1**	1		1		**2**

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Table 11. *Relative abundance of fish identified at EQS per layer*

	1	2	3	4
Acanthuridae	11%	0%	6%	4%
Balistidae	7%	6%	0%	2%
Carangidae	0%	6%	3%	14%
Diodontidae	5%	10%	3%	1%
Holoncentridae	0%	0%	3%	0%
Labridae	0%	0%	3%	5%
Lethrinidae	2%	23%	3%	23%
Lutjanidae	8%	13%	13%	18%
M. grandoculis	7%	6%	0%	5%
Mullidae	0%	3%	0%	0%
Muraenidae	2%	0%	9%	2%
Priacanthidae?	0%	0%	3%	0%
Scaridae	44%	29%	41%	20%
Scombridae	2%	3%	6%	2%
Scorpanidae	2%	0%	0%	1%
Serranidae	8%	0%	3%	3%
Shark *sp.*	3%	0%	3%	0%

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