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The Chronology of the Natunuku Site, Fiji

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ABSTRACT

Five radiocarbon dates are reported for the Lapita site of Natunuku (VL1/1), Fiji. These show that much of the supposedly early Lapita deposit dates to about 350 B.C., and that the single burial from the site, previously regarded as the remains of a 'Lapita person', is probably younger still, dating to about A.D. 100.

Keywords: FIJI, NATUNUKU, LAPITA, BURIAL, CHRONOLOGY, RADIOCARBON DATES.

INTRODUCTION

The Natunuku archaeological site in northwest Viti Levu has long been regarded as the earliest archaeological site in Fiji. However, analysis of the material recovered from Area C, the only part of the site where *in situ* Lapita material was found during excavations in 1967, suggested that only the basal layer 6 was of Early Eastern Lapita age (Davidson *et al.* 1990).

In an attempt to clarify the chronology of the site, four shell samples from layer 5 and one sample of bone from the burial believed to be associated with layer 5 were submitted to the former Nuclear Sciences Group, D.S.I.R., New Zealand, for radiocarbon dating. The results are reported and discussed below.

THE SITE

The excavations at Natunuku in 1967 by Elizabeth Hinds (nee Shaw), described elsewhere (Davidson *et al.* 1990), are briefly summarised here. Three areas of the extensive foreshore site were investigated, but only Area C, a modern cemetery, appeared to contain a primary Lapita deposit. Areas A and B produced pottery with carved-paddle impressed and incised decoration but few recognisably Lapita sherds and none apparently *in situ*.

Six rectangles and a small square were opened in Area C. Four rectangles were fully excavated and the others abandoned because of the presence of modern graves. Six natural layers, all containing pottery, were found. The two top layers, 1 and 2, contained European artefacts and appeared to be associated with the modern use of the area as a cemetery. Layer 3 was a deposit of sandy soil and layer 4 appeared to be an old soil horizon on the surface of a sand dune. During the excavation, layer 3 was interpreted as being partly due to forest clearance and erosion, and layer 4 as a top soil formed under vegetation on the surface of the dune. Layer 5 was a fine grey sand and layer 6 a coarser yellow sand, overlying sterile coral sand.

Apart from the artefacts of European origin from the upper layers, the material recovered consisted largely of potsherds. The only other pre-European items identified during the

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excavations were four shell ornament units. A single chert flake was subsequently found in one of the midden samples from which the radiocarbon samples were taken.

Analysis of pottery decoration showed a broad trend toward decline in dentate stamped decoration, a growth and subsequent decline of carved-paddle impressed decoration, and a late increase in incision. Sherds with distinctive dentate-stamped decoration were proportionately much more numerous in layer 6, declining rapidly thereafter. However, both dentate-stamped and carved-paddle impressed sherds were recovered from all layers. The distribution of decorated sherds suggested that there had been considerable sherd movement both up and down through the deposits. Postholes and other features associated with the various layers indicated how some of the disturbance had taken place.

Analysis of vessel form suggested that the site contained a significant Late Eastern Lapita or Plain Ware component as well as some typical Early Eastern Lapita forms.

The burial was found in Rectangle C. Although it was interpreted by the excavator as being associated with layer 5, it was first noticed at the base of layer 4 (Davidson *et al.* 1990: 130–131). This precludes precise interpretation of stratigraphic affiliation.

Several important questions were posed about the site as a result of the analysis. How much of the deposit was really associated with Early Eastern Lapita occupation? How substantial was the hypothesised Late Eastern Lapita or Plain Ware component? Did layers 5 and 6 represent a long period of continuous occupation with gradual change in pottery styles, or were there two or more discrete shorter occupations separated by intervals of abandonment? Was the burial associated with any kind of Lapita occupation, or was it more recent?

These questions demanded that more samples be subjected to radiocarbon dating.

THE RADIOCARBON SAMPLES

The only material available for dating was a relatively small amount of shell midden from layer 5 in Rectangle D, and the burial itself. Four shell samples were taken from two bags of midden catalogued as 305, Rectangle D, layer 5 and 306, Rectangle D, layer 5b. Rectangle D was one in which an upper and a lower division of layer 5 were distinguished during excavation and it was assumed that midden sample 305 was from what later became known as layer 5a whereas sample 306 was clearly from layer 5b. Although the composition of the samples was not dissimilar, they differed visibly in that many of the shells from layer 5b were heavily encrusted with calcareous sandy concretion which was either absent or only weakly developed on those from what we assume to be layer 5a.

One sample of *Tridacna maxima* and one of *Gafrarium tumidum* was taken from each bag. *Tridacna maxima* has been used for dating other sites in the central Pacific. However, doubts have been expressed about the freshness of *Tridacna* shells in middens, particularly when they have been worked, as one of the samples here appeared to have been. The *Gafrarium* shells were therefore selected as most likely to be midden debris freshly deposited when the site was occupied, which would have little or no age differential between the death of the organism and the cultural event to be dated.

The two *Tridacna* samples were submitted for XRD analysis before dating and showed less than 2% and 3% calcite respectively. If the calcite has resulted from post-depositional alteration of the shell crystal structure then, given the small amount of calcite present, radiocarbon contamination resulting from the alteration is likely to have been negligible. XRD analysis of one of the *Gafrarium* samples indicated considerably less than one percent

calcite. Three shell samples were large enough for dating by the gas counting method; the fourth was dated by Accelerator Mass Spectrometry.

Several human bone fragments from the Natunuku skeleton were made available by Professor Michael Pietrusewsky. Permission was given by the Trustees of the Fiji Museum for a small sample to be dated by Accelerator Mass Spectrometry. The sample consisted of fragments associated with leg bones.

THE RADIOCARBON DATES

The results are shown in Table 1. The calibrated ages and the contexts of the samples are shown in Table 2.

The results of the shell dates suggest that layer 5 was deposited over a fairly short period, and that there is not a significant time difference between the upper and lower parts of the deposit. The encrustations on the shells from layer 5b may reflect a post-depositional phenomenon, such as a higher water-table in the past.

When the shell dates are pooled according to the method described in the Appendix, the resulting probability distribution shows a very strong peak at about 350 B.C. (Fig. 1). Pooled probability distributions were also generated for the two *Tridacna* dates, the two *Gafrarium* dates, the two layer 5 dates and the two layer 5b dates. All four diagrams show the same strong peak about 350 B.C. However, the diagrams for the two *Tridacna* dates and the two layer 5b dates show some probability of earlier occupation also. This is due to

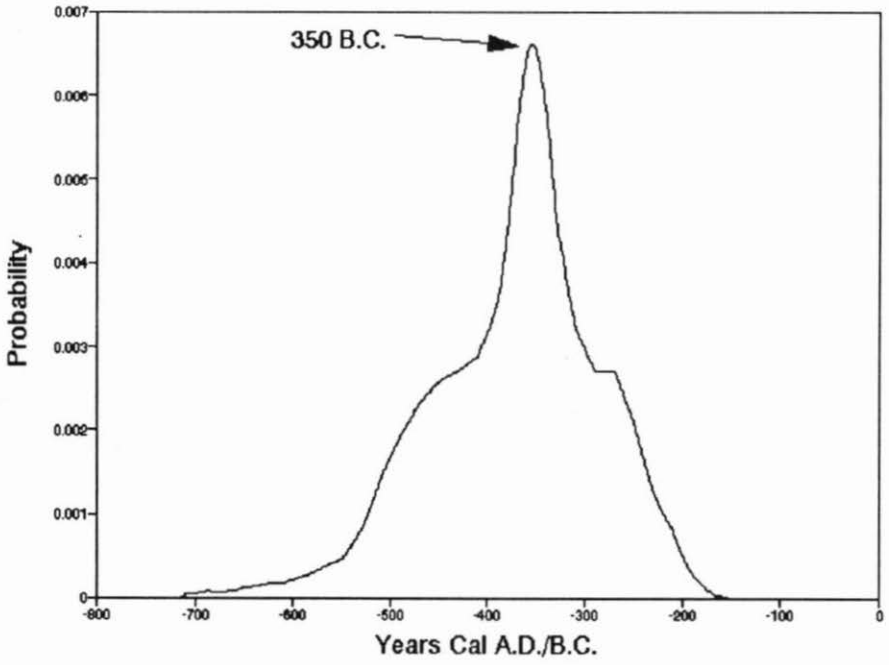

Figure 1: The age probability distribution after pooling the four shell samples from layer 5 at Natunuku. The ΔR offset was set to +25 radiocarbon years.

sample NZ7864, the *Tridacna* shell from layer 5b. It is possible that this was not freshly gathered at the time it was deposited; as noted above, the *Gafrarium* shells are more likely to be a reliable indication of the age of the midden component of layer 5. On the whole, the present evidence suggests that Layer 5 was deposited over a relatively short period around 350 B.C.

The Fijian sequence cannot yet be said to be well dated. According to our present understanding, however, the dates for layer 5 suggest that it belongs to the terminal Late Eastern Lapita period or the succeeding Plain Ware period, before the introduction of carved paddle-impressed pottery. Certainly, the analysis of the pottery suggested a strong Plain Ware component (Davidson *et al.* 1990: 150, 152). Features such as handles and some of the rims are very similar to examples from the Sigatoka Dune site (Birks 1973: figs 9–23, 32, 35–37) and Lakeba (Best 1984: 301).

The date for the burial suggests that it was not associated with even a terminal Lapita occupation. The date in the first centuries A.D. would place it firmly in the Paddle-impressed period.

TABLE 1

RADIOCARBON DATES FROM NATUNUKU

Lab. No.	**Material**	$\delta^{13}C$	**CRA**
NZA2512	Human bone	-14.8‰	1896 ± 86
NZ7863	Shell *Tridacna maxima*	0.7‰	2640 ± 34
NZA2117	Shell *Gafrarium tumidum*	1.8‰	2676 ± 57
NZ7865	Shell *Gafrarium tumidum*	-0.3‰	2622 ± 30
NZ7864	Shell *Tridacna maxima*	0.3‰	2750 ± 30

DISCUSSION

Area C of the Natunuku site spans the entire sequence of occupation of Fiji. It now seems certain, however, that only the basal layer 6 contains Early Eastern Lapita material in primary position. The cultural content of the succeeding layer 5 was deposited about 350 B.C. Contrary to what has previously been published, the burial was apparently not associated with layer 5, but dug into it from a higher level. It dates from a time when carved paddle-impressed pottery was being made and used in Fiji.

TABLE 2

CALIBRATED AGES OF NATUNUKU RADIOCARBON SAMPLES

Lab. No.	Context	CAL A.D. 95%	CAL A.D.68%
NZA2512	burial	62 B.C.–A.D.372	A.D.29–243 (69%)
NZ7863	layer 5	414–199 B.C.	389–290 B.C. (66%)
NZA2117	layer 5	612–177 B.C.	489–290 B.C. (65%)
NZ7865	layer 5b	388–203 B.C.	370–267 B.C.
NZ7864	layer 5b	624–367 B.C.	509–393 B.C.

The radiocarbon dates confirm the impression formed during analysis of the material from Area C. The Lapita component of the site is very small, comprising only the lowest layer at Area C, and not represented in other tested parts of the site at all. On present evidence, the Late Eastern/Plain Ware component is also restricted to Area C, although full analysis of the material from Areas A and B might show that it was more extensive. Paddle impressed and later incised pottery, however, are found in all three areas of the site and are much more abundant than the earlier pottery. Paddle-impressed pottery is well represented in Area C, and it is possible that layer 4 was formed and layer 3 deposited when this pottery was in use.

Little can be added to what has previously been written about the actual occupations at the site at various times. The nature of the Early Eastern Lapita occupation, consisting of potsherds in clean yellow sand, represented by Layer 6, remains obscure. The layer 5 occupation involved shell midden deposition and some structures, represented by postholes, on a sand dune. Large quantities of pottery and some structures were associated with layers 4 and 3, which probably formed part of a much more extensive occupation of the foreshore area.

The site is known to have eroded considerably since it was excavated in 1967 (although there appears to have been relatively little change in the position of the beach-line since 1976). Evidence of both Lapita and Plain Ware deposits may well have been lost as a result. The evidence of the 1967 excavations at three localities suggests that what remains of the site offers potential only for further investigation of occupational horizons from the Paddle-impressed period and later.

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APPENDIX

Method of Pooling Radiocarbon Dates

There are many possible ways of pooling radiocarbon dates, and there is now an extensive literature on this subject with advocates and critics of the various approaches (Ward and Wilson 1978). The simplest method is to combine two or more ages statistically into one (Leach 1972) assuming that they are both Gaussian curves. This is no longer satisfactory, now that the wiggles in the calibration curve have found widespread acceptance. By projecting the normal distribution curve for any one radiocarbon age determination on to a calibration curve, a new probability distribution is obtained, which unfortunately is not a simple normal curve, but frequently multi-nodal and/or irregular, especially over the last 3,000 years, of special importance to Pacific prehistorians. It is a simple matter to combine several such probability distributions, subsequent to the calibration of a number of radiocarbon dates. This is the approach adopted in this paper.

A program was written in Turbo Pascal 5 for this purpose, and for anyone interested this is freely available in the anonymous FTP site 131.203.8.2, which is a node used by the Society for Archaeological Sciences for software and databases of interest to members. The program, which is called POOLC14, is in the sub-directory [.SAS] at this site. The software incorporates the southern hemisphere terrestrial calibration which is based on the compilation of Stuiver and Reimer (1986), and marine calibration is based on the carbon cycle model calibration curve of Stuiver *et al.* (1986). Choosing an acceptable value for the geographic offset ΔR is a considerable problem in the Pacific. The survey published by

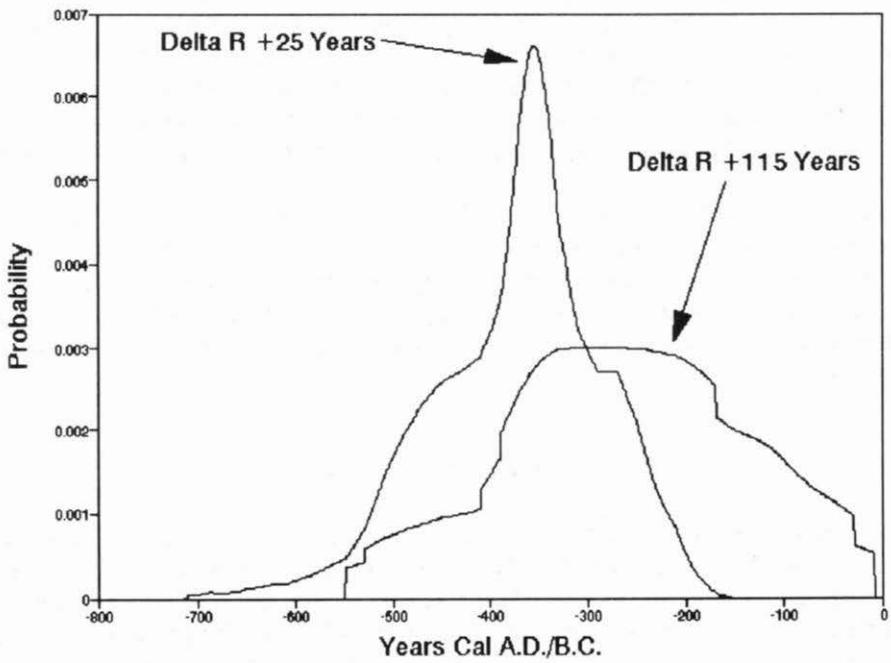

Figure 2: The four shell dates from Natunuku pooled using different values for ΔR.

Stuiver *et al.* (1986), suggested values ranging from -5 to +185 years in the tropical region of the Pacific, and -65 to +885 in temperate to arctic Pacific regions. In a recent review of values of ΔR for New Zealand, McFadgen and Manning (1990) showed values ranging from -100 to +40. They concluded that these are not significantly different, and provided a weighted mean for the whole of New Zealand of -31 ± 13 years, rounding this to -30 years. The effect of choosing two different values for ΔR is illustrated in Figure 2. It will be readily observed that this would make a considerable difference to the interpretation of layer 5 at Natunuku. By choosing the Hawaiian value of +115 years for ΔR, the age of layer 5 would appear to be anywhere from 100 to 400 B.C.

Unfortunately, present knowledge of what value of ΔR prevails for any one locality in the Pacific is imperfect; indeed there is no reason to think it should be the same at different periods, because current circulation patterns are unlikely to have been stable over the past few thousand years. In the meantime, we must tread cautiously in this minefield. The Institute of Geological and Nuclear Sciences suggested using a value for ΔR of +25 for Fiji, and this is followed in this paper.

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