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Geographical Influences on Settlement-Location Choices by Initial Colonizers: A Case Study of the Fiji Islands

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Abstract

From 3200-2850 cal BP (1250-900 BCE), the Lapita people of the Bismarck Archipelago (Papua New Guinea) undertook voyages eastward that led to their colonization of the eastern outer Solomon Islands, Vanuatu, New Caledonia, Fiji, Tonga and Samoa. The earliest (Lapita) settlements in Fiji are along the Rove Peninsula in southwest Viti Levu Island. At the time of colonization, sea level was 1.5 m higher than today and the Rove Peninsula was then a smaller island off the coast of larger Viti Levu with a broad fringing reef along its windward coasts which was probably the main attraction for Lapita colonizers. As elsewhere during Lapita times in the western tropical Pacific Islands, settlement choice for the initial colonizers of the Fiji Islands was at one level driven by site access, at another by the presence of broad fringing coral reefs.

The earliest settlement along the Rove Peninsula was at Bourewa, occupied first 3050 cal BP (1100 BCE), where people lived in houses on stilt platforms built along the axis of a subtidal sand barrier; on one side was a broad coral reef, on the other a partly-enclosed tidal inlet. There is no evidence that the Bourewa settlers practiced horticulture or agriculture at this time, their subsistence being predominantly marine foraging. After some 300 years of following this subsistence strategy, the inhabitants of Bourewa responded to sea-level fall and the arrival of cultivars (of taro and yam) by broadening this to include horticulture. As sea level fell further, a total 55 cm during the Lapita era, the tidal inlet dried up
and marine-food resources diminished to a point where the natural environment of the Rove Peninsula could no longer sustain its Lapita inhabitants. All Lapita sites in the area were abandoned about 2500 cal BP (550 BCE), at the same time as the Lapita culture, marked by the end of dentate-pottery manufacture, came to an end in Fiji.

**Key words**

colonization, Pacific Islands, Fiji, coral reef, settlement, sea-level change, subsistence, Lapita
Introduction

Particularly in the past 20 years, much information has been acquired about the initial human colonization of the Pacific Islands. The island groups of the western tropical Pacific were first settled around 3000 years ago by the Lapita people\(^1\) whose maritime achievements are no less awesome than some extant aspects of their material culture, especially the decorated pottery they made, compared to people elsewhere in the world at this time (Kirch, 1997, 2000). There are gaps in our understanding of the process of Lapita colonization including the types of oceangoing vessels used to cross unbroken water gaps of 1000-1200 km (Anderson, 2003; Irwin, 2008) and also the reasons behind their settlement-location choices, the subject of this paper.

At one level, these choices can be explained largely by geography and food-resource availability: respectively, the safest routes into large reef-dotted archipelagoes and the proximity of broad accessible coral reefs containing abundant food. At another level, these choices may appear somewhat odd to us today for they involved living above the sea in more complex structures (stilt houses) than would have been needed had they occupied adjacent land areas. The latter is one indication that, despite our considerable knowledge of certain aspects of Lapita culture, others remain obscure.

\(^1\) This term is used for clarity but it is recognized that Lapita properly refers to a cultural complex that may have involved one or more distinct peoples.
Since 2003, the author has directed six phases of field research on the Rove Peninsula in southwest Viti Levu Island, Fiji, where the earliest-known human settlements in the archipelago are found (Nunn et al., 2004; Nunn, 2007a).

There is reason to suppose that these are indeed the earliest settlements, the founder settlement probably at Bourewa, where excavations have concentrated. Sufficient information is now available to understand the successional chronology of Lapita settlements along the Rove Peninsula and postulate plausible relationships between them. It appears that the Rove Peninsula settlements represent the transition from colonizing settlement to early-period settlement in Fiji, the latter coming to an end when the subsistence systems that had evolved from the time of colonization could no longer be sustained. As such, this can be viewed as a case studies of the impacts of pre-modern peoples on pristine (yet comparatively impoverished) environments and the issue of the sustainability of such human-environment interactions (Berkes et al., 1995).

Following a background section about Lapita culture, this paper looks first at where the earliest settlements in the Fiji archipelago were located and how the choices of these locations can be explained by their geography and the food-resource targets of colonizing peoples. Acknowledging that the environments which existed at the time of colonization were often quite different to those of today, the next section demonstrates the importance of palaeoenvironmental reconstruction to understanding the precise nature of first settlement and the subsistence strategies of the settlers. The Discussion section focuses on the key
factors in settlement choice among colonizing peoples in the Pacific Islands region.

The Lapita people

The Lapita people were a distinctive cultural group whose origins can be traced to the Bismarck Archipelago of Papua New Guinea around 3400 cal BP (1450 BCE). Some 200 years later, having honed their seafaring skills in this ‘voyaging nursery’ (Irwin, 1992), the Lapita people began a series of long-distance voyages that led them to colonize by 2850 cal BP (900 BCE) the island groups of the eastern Solomon Islands, Vanuatu, New Caledonia, Fiji, Tonga and Samoa – a region known as Remote Oceania in recognition of the depauperate biotas of these islands compared to those in Near Oceania (Figure 1). For their time in this part of the Pacific Rim, the Lapita people were distinctive because they were sea people, invariably living in stilt houses above the water, whose subsistence involved marine foraging. Their voyaging across distances in excess of 1000 km marks them out globally as the most advanced seafarers of their age. Yet perhaps the best-known attribute of the Lapita people is their comparatively sophisticated material culture, expressed today most visibly by the intricate designs with which they decorated pottery: a design system that is also likely to have been manifested in woodcarving and skin tattooing (Spriggs, 1984; Kirch, 1997; Green, 2003).
The ancestors of the Lapita people came from Southeast Asia, perhaps ultimately from Taiwan, a journey that would have involved several ocean crossings of tens of kilometres. When they arrived in Papua New Guinea, they found many larger islands already occupied and settled on the smaller, generally more outlying ones. These settlers may already have had a marine-tethered lifestyle but this is likely to have been strengthened by their occupation of these resource-rich reef coasts. The long-distance voyages of colonization that began subsequently are likely to have been initiated in the expectation of finding similar reef-fringed islands where they could subsist on largely marine foods (Summerhayes, 2000).

The degree to which (early) Lapita subsistence in Near Oceania was dependent on marine foods is debated. The more entrenched view is that these Lapita people depended only partly on marine foods but also farmed taro and yam, had a range of domesticated animals (chicken, dog, rat), and generally depended as much if not more on terrestrial food sources (Spriggs, 1997; Kirch and Green, 2001). The corollary to this is that the Lapita colonizers of island groups farther east, particularly the biotically-impoverished islands of Remote Oceania, carried with them a ‘portmanteau biota’ of cultivars and domesticates with which they intended to re-create their home environments on the new uninhabited lands they expected to find. One problem with this model is that there is no evidence from Remote Oceania that cultivars and domesticates arrived with the earliest settlers.
(Burley et al., 2001; Nunn et al., 2004). This has led to an alternative model of the earliest settlers in Remote Oceania as being marine foragers, occasionally supplementing their diet with available terrestrial foods (Anderson, 2003; Kennett et al., 2006).

The debate about the subsistence strategy of the Lapita colonizers of Remote Oceania provides the context for interpreting site selection and character that are described below for Fiji. If on the one hand, these colonizers were the full-blown agriculturalists that some picture them to be, then it is likely that their choices for permanent settlement location would have been guided largely by the presence of well-watered fertile land. Yet were they the marine foragers that others believe them to have been, then their site choices would have been guided mostly by the presence of broad coral-reef flats contiguous with island coastlines. Most of what is known about the earliest settlements in Remote Oceania, including Fiji, favour the latter rather than the former model.

**Earliest settlements in Fiji**

Some 50 years of research in Fiji has revealed much about its prehistory, the earliest period of which is acknowledged to be its Lapita history, approximately 3050-2500 cal BP (1100-550 BCE). Figure 2 shows a map of the well-dated Lapita-era settlements in the group. There is a general decrease in age from
west to east suggesting that this was the likely direction through which colonizers moved through the group (Clark and Anderson, 2001), an observation supported by linguistic analysis (Geraghty, 1983). Exceptionally, the Lau Islands of eastern Fiji may have been colonized in an east-west migration from Tonga (Burley and Clark, 2003).

The earliest settlements are in the west of Fiji, concentrated along the Rove Peninsula in the southwest part of Viti Levu Island (Figure 3). A plausible scenario is that the first people, coming from the west, saw the islands of Fiji or at least the cloud build-up over Viti Levu and Vanua Levu islands from 40-50 km away (Irwin, 2008). Steering their watercraft, probably large rafts, towards this target, it is likely that they would first have encountered the broad barrier reef rising from the edge of the shallow shelf off western Viti Levu (see Figure 2 for location of reef edge). Perhaps they thought about passing within it but doubted their ability of their watercraft to successfully Negotiate the myriad of small reef knolls and islands that may have existed there (as they do today). They may have landed temporarily on one of the small arid islands in the Yasawa and Mamanuca groups but soon abandoned it for the promise of large Viti Levu Island in the distance. Unable to navigate within the barrier reef, the Lapita voyagers followed its outer edge to the south and east until the point at which it met the land for the first time – at the Rove Peninsula.
Today this locale has many attributes that the Lapita colonizers of Fiji valued. Principal among these is the broad fringing reef, almost 3 km wide in places, that is accessible on foot from the shore (Figure 4). This reef contains an abundance of marine foods. It is also bounded on its southeastern side by the deepwater Natadola Harbour, a fault-controlled embayment that may have provided a safe anchorage for Lapita watercraft. But we cannot fully understand the geographical reasons for the choice of the Rove Peninsula area without looking at its palaeogeography.

**Palaeogeography**

Three thousand years ago when the Lapita people settled the Fiji Archipelago, climate and sea level were slowly changing and, as a result, environments and ecosystems were adjusting. This time marks the start of the Late Holocene, when the many effects of deglaciation on the Earth’s climate were no longer being felt. It was a period of global cooling, a retreat from the warm climatic optimum that had marked the Middle Holocene (6000-3000 BP). Cooling had a direct steric effect on sea level, which began falling in consequence (Peltier, 1998; Nunn, 1999).

As sea level rose as a consequence of deglaciation during the Early Holocene (12,000-6000 BP), ocean waters were warming in the Pacific and many coral
reefs, killed during the Last Glaciation, became re-established, growing upwards as sea level rose. But only a few coral reefs, generally in the equatorial Pacific, were able to keep up with sea-level rise (Neumann and Macintyre, 1985). Most lagged behind, catching up only when sea level began falling during the Late Holocene. So in island groups like Fiji 3000 years ago, the area of coral reef at the ocean surface (mean low-tide level) would have been far less than today. Most reefs would have been found along those windward coasts exposed to far-fetch waves where suitable substrates were present. The broad barrier reef off the island platform in the west of Fiji meets these criteria as does that fringing the southwest-facing coast of the Rove Peninsula.

In the Fiji Islands, sea level at the time of Lapita colonization 3050 cal BP (1100 BCE) was about 1.5 m higher than today. By the end of the Lapita era in Fiji 2500 cal BP (550 BCE), sea level was about 0.95 m higher than today (Nunn and Peltier, 2001). At the time of colonization, the geography of the Rove Peninsula was significantly different to what it is today. By the end of its Lapita occupation, sea level had fallen 55 cm and environments had changed in ways that help explain why people abandoned it. The nature of palaeoenvironments on the Rove Peninsula is discussed below at two levels: one that of the entire peninsula, which was an offshore island during Lapita times; the other at that of Bourewa, regarded as the founder settlement, the environment of which was quite different to that of today.
Palaeogeography of the Rove Peninsula at the time of colonization 3050 cal BP (1100 BCE)

If mean sea level around the Rove Peninsula, where mean tidal range is 1.0 m, was 1.5 m higher, as it was at the time of colonization, then the area becomes an island (~4 km²) lying some 2 km off the larger island of Viti Levu (Figure 5A). The net sea-level fall since that time, combined with sedimentation from the Tuva River has caused the gap between the two islands to close, although they are now joined only along the Natadola barrier beach (Figure 5B).

The recognition that the Rove Peninsula was a smaller island offshore a larger one at the time of its colonization is important inferential evidence for its early age within the Lapita history of Fiji for, throughout the Lapita world, early settlements are commonly located on such smaller islands (see Discussion). Among the reasons suggested for this are the desire to avoid larger islands because of their perceived association with malaria; the boundedness of smaller islands which meant that animals such as chickens, dogs and rats (later pigs) could be released in the expectation that they would be easy to recapture when needed for food. In the case of the Rove Peninsula island, the principal reason may have been more pragmatic; a windward location, a smaller island offshore, its coasts shielded from the large sediment outputs associated with rivers on larger islands (like the Tuva River on Viti Levu Island), was better suited to the
development of a broad healthy coral reef. In contrast, as today, reefs that fringe
the coasts of larger Pacific Islands are commonly narrower, less healthy and
therefore less productive.

The fact of the Rove Peninsula being an island at the time of colonization also
helps explain the apparent mystery of why Fiji’s first inhabitants selected this low
dry riverless limestone area for their homes rather than the well-watered volcanic
landscapes of Viti Levu Island a few kilometres away. It does seem plausible, as
suggested above, that these Lapita colonizers were largely indifferent to the
nature of the hinterland because their subsistence strategy, underscored by their
occupation of stilt houses over the shallow sea floor, focused on marine foods
not the terrestrial environment. Added to this is the issue of where the Lapita
settlers of the Rove Peninsula island obtained freshwater; the answer may lie in
the existence of a zone of upwelling from the limestone bedrock which today lies
25-150 m offshore.

*Palaeogeography of Bourewa and Qoqo at the time of colonization 3050 cal
BP (1100 BCE)*

All known Lapita settlements on the Rove Peninsula (see Figure 3) have been
excavated and radiocarbon ages for occupation (n=75) obtained for each. From
these, it is clear that the Bourewa settlement was the earliest to be established,
probably around 3050 cal BP (1100 BCE). The next settlement to be established, probably from a separate in-migration event, was that on Qoqo Island. It is significant that Bourewa and Qoqo are the only two stilt-house occupations on the Rove Peninsula (indeed in all Fiji). All other Lapita settlements on the Rove Peninsula are regarded as satellite or spillover settlements, established significantly later by people from Bourewa (Nunn, 2007a).

The earliest settlement at Bourewa comprised a stilt-platform occupation along the axis of a submerged sand barrier (Figure 6A). On the ocean side there was a broad fringing reef comparable in size and perhaps in productivity to that which exists there today. On the landward side was a sand-floored tidal inlet. There is no evidence that the people living at Bourewa during the earliest phase of settlement (Bourewa I, perhaps 3050-2800 cal BP or 1100-850 BCE) had domesticated animals or planted taro and yam, the evidence defines the next phase (Bourewa II, 2800-2550 cal BP or 850-600 BCE: Horrocks and Nunn, 2007). At Qoqo, the earliest stilt-house settlement straddled an elongate tombolo connecting two bedrock islands surrounded by an extensive reef flat (Figure 6B). From these observations, we can conclude that the selection of Bourewa and Qoqo for settlement was indeed guided largely by the proximity of a broad accessible reef flat with all other considerations being secondary.

As the Lapita era progressed, population growth and the arrival of more migrants saw the expansion of settlement across the Rove Peninsula. The continuing fall
of sea level - 10cm/100 years during the Lapita era – combined with the localized build-up of shell middens beneath stilt platforms to cause the area’s coasts to emerge. About 2500 cal BP (550 BCE) at the end of the Lapita era, marked by the end of dentate-stamped pot manufacture, the former tidal inlet at Bourewa had dried up. The reefs fringing the Rove Peninsula island had emerged slightly leading to a drastic reduction in the marine foods available thereon. The combination of the increasing shortage of marine foods and the development of the horticulture that had characterized the later half of the Lapita occupation of the area led to its settlements all being abandoned around 2450 cal BP (500 BCE). It is plausible to suppose that the descendants of the Lapita inhabitants of the Rove Peninsula moved elsewhere in search of better-watered locations with fertile soils where they were able to sustain themselves largely from horticulture, later agriculture.

**Discussion: key factors in settlement choice among colonizing people in the Pacific Islands**

The geographical configuration of particular archipelagoes was the principal control of settlement-location choice among colonizing peoples in the Pacific Islands. Potentially difficult routes through an archipelago would have been spurned by experienced seafarers in favour of safer routes, such as those that hugged the outside of a broad reef barrier. Aside from Fiji, other examples of this
involving Lapita colonizers are the settlement of Nendö Island in the eastern outer Solomon Islands (Nunn and Heorake, forthcoming), the St Maurice-Vatcha site on the Île-des-Pins in New Caledonia which is opposite “one of the island’s most easily accessible natural passes in the coral reef” (Sand, 1999: 309), and various sites in Tonga including the founder site at Nukuleka on Tongatapu Island which was not screened by smaller islands during Lapita times as it is today (Dickinson, 2007).

The evidence from Fiji described earlier suggests that, once a colonizing group was within an archipelago, they likely headed for the largest islands in the belief that these would be better resourced than the smaller ones. But then within that target area they appear to have consistently eschewed large-island settlement in favour of smaller islands close by. In the tropical Pacific, the principal reason for this is likely to have to do with the superior condition and greater extent of windward reefs off smaller-island coasts. In addition to the Rove Peninsula, examples of this kind of situation are found elsewhere in the Lapita realm. For example, “the distribution of the earliest sites in the Bismarck Archipelago … remains heavily weighted towards coastal and offshore island situations, even after allowing for bias in site discovery strategies and post-Lapita geomorphic changes, especially on larger islands” (Specht, 2007: 56). Similar conclusions can be drawn from the distribution of early Lapita sites in the eastern outer Solomon Islands (Green, 1976; Lepofsky, 1988; Nunn and Heorake, forthcoming) and Vanuatu (Bedford, 2003; Galipaud and Kelly, 2007).
While the precise choice of colonizing-settlement location may have been resource-driven, the degree to which such a settlement continued to be occupied would depend initially on the size of the adjoining reef relative to the population of the dependent settlement(s). In the case of Bourewa, the massive size of the fringing reef (up to 3 km broad) explains why it appears to have been able to sustain a large settlement (and satellites) for as much as 600 years, but the same does not appear true during Lapita times everywhere in Remote Oceania. At the Naitabale site on Moturiki Island in Fiji, the site was occupied within a period of some 400 years and the fringing reef was about 1.4 km in breadth (Nunn et al., 2007). At the Makué site on Aore Island in central Vanuatu, the site was also occupied within a period of about 400 years and the fringing reef is about 1.6 km wide (Galipaud and Kelly, 2007).

In seeking to counter the unsustainable view that the Lapita colonizers of Remote Oceania were full-blown agriculturalists, otherwise unable to survive, Anderson revisited the idea of Groube (1971) that these Lapita colonizers were rather strandloopers, “foragers who skimmed the highest ranked marine and terrestrial resources as they dispersed” (Kennett et al., 2006: 281). Yet while this model may explain the behaviour of some colonizing people in Remote Oceania, it clearly demands that apparently sustained occupations by marine foragers such as those at Bourewa, Naitabale and Makué (see above) be regarded as exceptional.
The demand for marine foods from reefs such as that fringing Bourewa is likely to have been offset during the Lapita era by the introduction of domesticated animals for food as well as the development of horticulture. A plausible scenario for Bourewa is shown in Figure 7. The earliest period of settlement (Bourewa I) was the result of a single colonization event, the people subsisting largely from foraging marine foods. Around 2800 cal BP (850 BCE), a second group of migrants arrived introducing a suite of domestic animals and cultivars of taro and yam. This led to a steadily reduced dependence on marine foraging and an increased dependence on horticulture, a trend encouraged by the conversion of the tidal inlet to a brackish-water lagoon (Bourewa II). A third in-migration occurred about 2550 cal BP (600 BCE) at Bourewa after which sea level is envisioned as having fallen below a key threshold which had huge and widespread impacts on marine-food availability (Bourewa III). Shortly after this, out-migration of Lapita groups from the Rove Peninsula began, with all settlements being abandoned within 100 years or so. More empirical data are needed to validate this model.

Conclusions

It is sometimes salutary to remind ourselves that pre-modern peoples, like the Lapita colonizers of the Fiji archipelago, were essentially pragmatists, making
decisions about matters like settlement location largely on the basis of their potential for food acquisition. The evidence suggests that this motive overwhelmed all others; sites with visible freshwater were not explicitly sought, sites suitable for agriculture were not sought, sites with superior terrestrial biodiversity were not sought. And to underline their affinity with the sea and its resources, the Lapita settlers at Bourewa and Qoqo (as elsewhere in the Lapita world) built their dwellings on stilt platforms raised above the sea floor, apparently eschewing the land. If this seems puzzling, then we might think that these people may not have shared our value system, perhaps regarding the land as inhospitable for permanent occupation as we today regard the sea.

There is no evidence that a sustainable relationship existed between the Lapita people and their environments. Claims of sustainability in some pre-modern societies (Berkes et al., 1995; Holthaus, 2008) may be illusory, created by low population densities in resource-rich environments. For the Lapita colonizers of Remote Oceania, as for Pacific Islanders during the last millennium, the liquidation of this natural capital was largely a consequence of climate change, typically filtered through sea-level change in this region (Nunn, 2007b, 2007c).

There are many remaining mysteries about the colonization of Pacific Islands which broad-ranging geographers are well equipped to answer. Among these are whether there was a reconnaissance phase that preceded colonization: the reconstruction of colonizer pathways east to west across the Pacific; the nature
of initial encounters with atoll islands; the introduction of agriculture; and the reasons behind what appear to be abrupt shifts in the nature of pottery at various times.

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Captions for figures

Figure 1. Island groups of the tropical western South Pacific including those colonized by the Lapita people in the period 3300-2700 cal BP (1350-750 BCE). There were differences in inter-island distances, island size and island biotas between Near Oceania and Remote Oceania that influenced the timing and nature of human colonization.

Figure 2. The Fiji Islands showing likely colonization dates of well-dated Lapita settlements. The earliest-known settlements are along the coasts of the Rove Peninsula in southwest Viti Levu Island. The only coral reef shown is the broad one bordering the island shelf in the west of the group, along the outer edge of which the Lapita colonizers of Fiji may have sailed to reach the Rove Peninsula.

Figure 3. The earliest-known (Lapita-era) settlements in Fiji are all found along the Rove Peninsula in southwest Viti Levu Island. This map shows the Lapita settlements located at Bourewa, Jugendar’s Farm, Matelita Tree, Qoqo Island, Rove Beach, Tomato Patch and Waikereira. The large mangrove swamp that now exists in the
estuary of the Tuva River was far less extensive, if it indeed existed, in Lapita times (3050-2500 cal BP or 1100-550 BCE) here.

Figure 4. View across the fringing reef flat at Bourewa from the modern beach. Photo by author.

Figure 5. Contrast between the geography of southwest Viti Levu at the time of its initial human occupation about 3050 cal BP (1100 BCE) (left map) and today (right map). Note that when people arrived first, Bourewa and other Lapita sites along the Rove Peninsula were all on offshore islands, for which reason they likely had broader healthier fringing reefs than those along larger-island coasts (like Viti Levu) where nearshore sediment inputs and mobility were greater. Today, owing to a net sea-level fall of 1.5 m, the island that existed in Lapita times has become joined to Viti Levu, the largest in the Fiji group, along the beach barrier at the head of Natadola Harbour.

Figure 6. Around 3000 cal BP (1050 BCE) at the time of initial human occupation of the Lapita settlements of Bourewa and Qoqo (see Figure 3 for locations), the coastal environment of the Rove Peninsula was different from today, largely owing to the higher sea level. These maps (note the scale difference) show the
reconstructed palaeoenvironments of Bourewa and Qoqo at this time. The maximum extent of settlement is defined in both cases by finds of *in situ* Lapita (dentate-stamped) pottery. The stilt-house occupations shown are defined by the extent of postholes.

**Figure 7.** Effects of changing environment and changing human subsistence strategy at Bourewa. Upper part of figure shows a plausible chronology for Lapita-era settlement at Bourewa based on radiocarbon ages (Nunn, 2007a); vertical scale is an indication of population-size change not absolute numbers. Lower part of figure shows the changing dependence on marine foraging through time by the inhabitants of Bourewa, changes that were mediated by both human innovations (like the start of horticulture) and the progressive sea-level fall.