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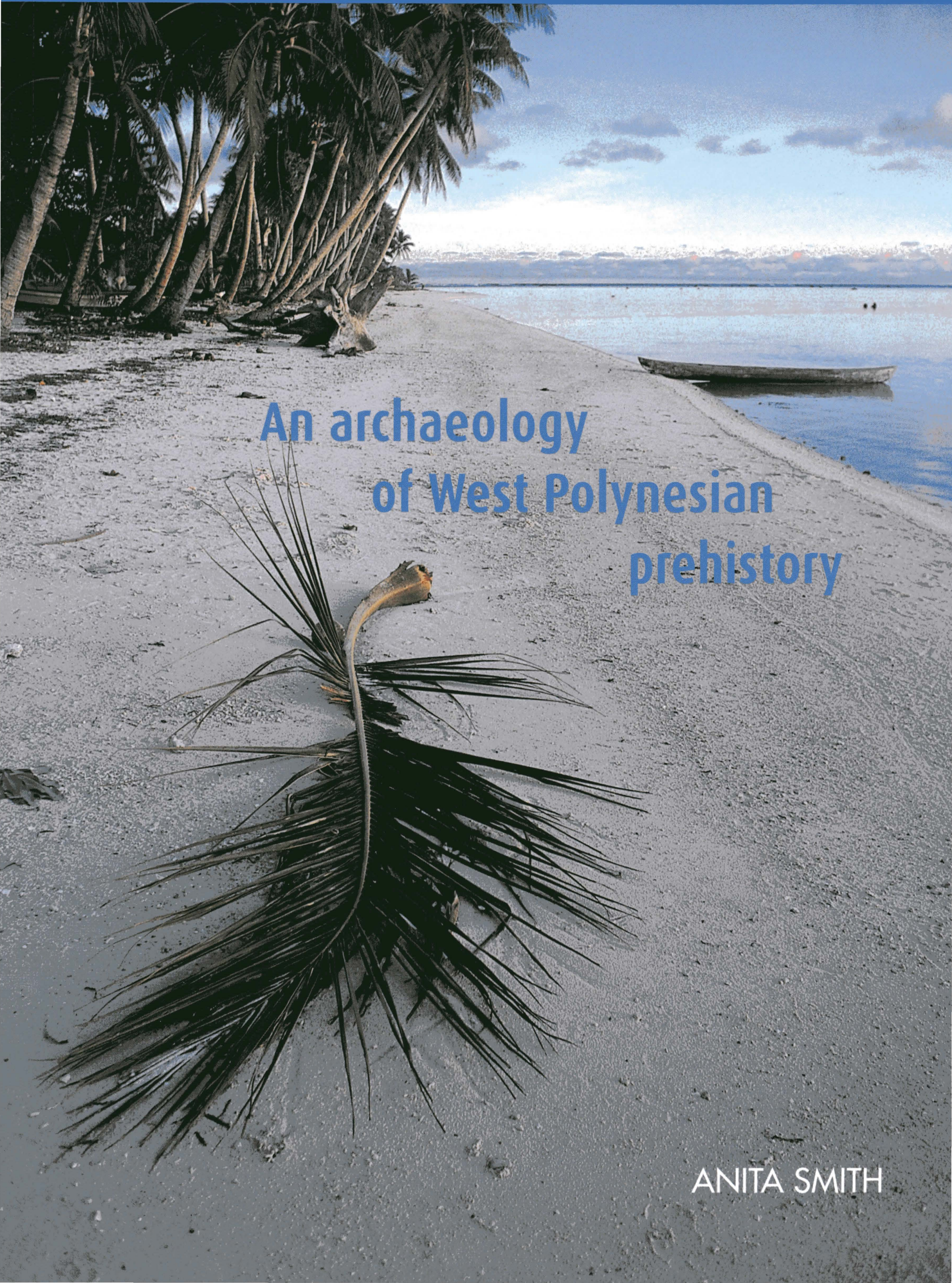

An archaeology of West Polynesian prehistory

ANITA SMITH

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Anita Smith

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The data and findings presented in this monograph formed the basis of my doctoral thesis, submitted through LaTrobe University in 1999. Since then some new data from the Northern Ha'apai Group in Tonga has been published and this, along with the valuable comments of my thesis examiners — John Terrell, Atholl Anderson and Janet Davidson - has been incorporated into the following monograph.

The principal supervisor of my doctoral research was Professor Jim Allen, who has graciously agreed to write the foreword for this volume. Jim has been my mentor and I thank him for his friendship and humour and the inspiration he has given to a generation of Australian archaeologists.

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This monograph presents a re-interpretation of early West Polynesian archaeological evidence. Without the pioneering field research of Jack Golson, Jens Poulsen, Les Groube, Roger Green, Janet Davidson and Patrick Kirch such ongoing dialogue with the archaeological past would not be possible. I offer them my respect.

This monograph is dedicated to my parents, Iris and David, to Glenn and to my daughter India.

Anita Smith

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The research and its context

THIS MONOGRAPH presents an assessment of the current model of early Polynesian prehistory in which an Ancestral Polynesian Society is considered to first appear in West Polynesia by ca. 2500 BP and to be visible in the archaeological record dating between ca. 2500 and 1800 BP. The assessment of published data from West Polynesian sites indicates that this model is not sustained by the archaeological evidence. It is argued that the early prehistory[1] of West Polynesia, that is, the period from initial colonisation to ca. 1000 BP, has been constructed in response to the question of Polynesian geographic and cultural origins using a linguistic framework to identify the Polynesian 'homeland'. This has created a prehistory for West Polynesia in which the role of archaeological evidence has been marginal. Interpretation of the pattern of archaeological evidence from West Polynesia outside this framework of Polynesian ethnogenesis suggests a very different view.

Assessment of the West Polynesian archaeological evidence is important, not only in terms of the regional prehistory, but for models of colonisation in Remote Oceania and for the origins of Polynesian linguistic and social structures in general. The concept of an Ancestral Polynesian Society in West Polynesia is an essential feature of the linguistic and phylogenetic model of Polynesian origins. Although the linguistic model may be satisfactory as an explanation of linguistic evidence, an archaeological model which best explains the pattern of early archaeological evidence in West Polynesia suggests a different kind of prehistory and process of colonisation.

Using the available published archaeological data from contexts radiocarbon dated earlier than ca. 1000 BP in the region, two key concepts of the orthodox prehistory of West Polynesia are investigated. Firstly, I consider what change through time in the archaeological assemblages is evident

1 'Prehistory' as used throughout this monograph refers to reconstructions of the past that have been created by archaeologists, and does not imply any fundamental discontinuity in the history of the Pacific islanders following European contact.

at a local and/or regional scale and secondly, whether a cultural explanation, such as the appearance of an Ancestral Polynesian Society, is the most parsimonious explanation for these changes.

The West Polynesian region

Political and geographic region

West Polynesia (Fig. 1.1) lies in the central Pacific to the east of Fiji and marks the westerly extent of the geo-cultural region of Polynesia. The region incorporates the present political states of the Kingdom of Tonga, Western Samoa, American Samoa, Futuna/Alofi, Uvea and Niue (Fig. 1.2). It consists of two main archipelagoes, the first comprising the Tongan Islands and the second the Samoan Islands, plus the small isolated islands of Futuna/Alofi, and 'Uvea to the north and Niue to the east. The islands of the Tongan Archipelago are primarily small raised coral limestone, the largest being Tongatapu together with a small number of volcanic islands, most of the latter of which are not permanently inhabited. Politically and geographically, the Samoan Archipelago is divided in two. To the west is Western Samoa, consisting of the large volcanic islands of Upolu and Savai'i and a number of smaller raised coral islands. The eastern end of the archipelago, American Samoa, consists of four volcanic islands clustered in two groups. To the west, Tutuila is the largest island in the group, while in the east, the Manu'a group consists of Ofu, Olosega and Ta'u Islands.

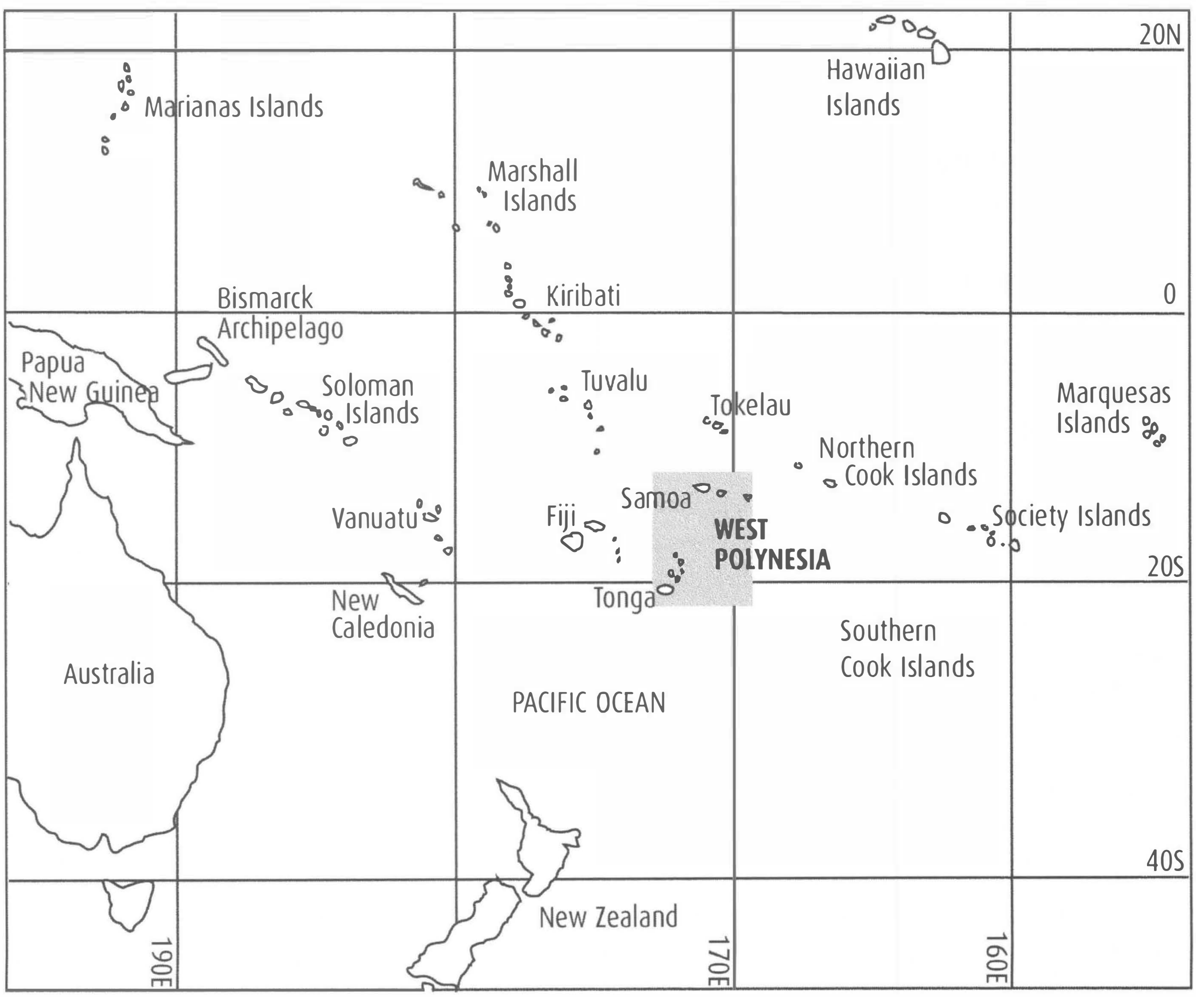

Figure 1.1 Location of West Polynesia in the Pacific Ocean

Geology

West Polynesia is geologically truly Oceanic in that the only landforms are high volcanic islands, raised coral islands and atolls (Green 1991:495). West Polynesia is dissected by the geological boundary of the Andesite line which encloses most of the Pacific Basin, separating it from islands of continental geology. The Tongan chain lies to the west or continental side of the Andesite Line, while Samoa, Uvea and Futuna lie to the east. This is reflected by the presence of olivine basalts on the volcanic islands to the east of the line (Green 1974a:143). The entire region may be characterised as having a pauperate Pacific island biota reflected in a limited range of terrestrial faunal and plant species (see Green 1991).

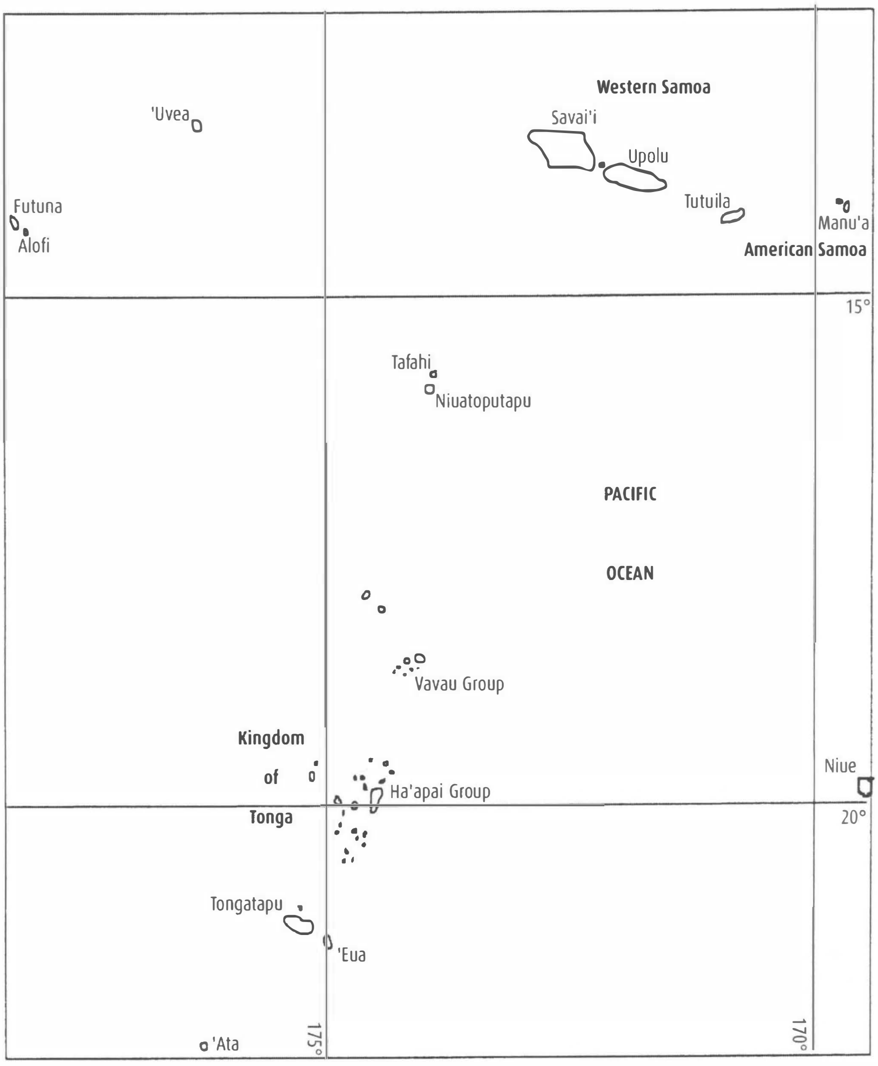

Figure 1.2 West Polynesian islands and political units

Languages

The languages of West Polynesia characterise the region as 'Polynesian', but the region was considered culturally distinct from East Polynesia by Burrows (1938) in his extensive analysis of ethnographic material. He concluded that differences between the material culture, social structure, mythology and religious practice of West and East Polynesia indicated a major cultural divide between the two regions, suggesting little contact in recent prehistory. A cultural unity in West Polynesia, at least in early prehistory, is suggested by archaeological evidence, namely Lapita and plainware ceramics excavated from sites throughout the region (with the exception of Niue). This is supported by linguistic evidence that also suggests a shared early prehistory for the region. The languages of West Polynesia fall within the Polynesian sub-group of the Eastern Oceanic Austronesian language group but at present consist of two language groups, the Tongic group spoken in Tonga and the Samoic group spoken throughout the Samoan Archipelago (Green 1981). Both have a shared common origin in an ancestral Proto-Polynesian language, although Samoic belongs to the Nuclear Polynesian subgroup and Tongic to a separate Central Oceanic subgroup.

Lapita in West Polynesia

West Polynesia was colonised as part of the Lapita diaspora (Kirch 1997), perhaps as early as 3100 BP (Kirch 1997:73; Spriggs 1990), although recent re-evaluation of the radiocarbon evidence suggests a date of no earlier than ca. 2900 BP (Anderson and Clark 1999; Burley et al. 1999). Lapita sites are common in many of the islands of the Tongan Archipelago and are ubiquitous on the main island of Tongatapu (Spennemann 1986, 1989). Lapita sites have been excavated on the northern islands of Uvea (Frimigacci and Vienne 1987) and Futuna/Alofi (Sand 1990). Only a single ceramic deposit containing dentate stamped sherds (the Ferry Berth Site of Mulifanua on Upolu) has been recovered from the Samoan Archipelago (Green 1974b), although Kirch (1997:148) includes the early plainware site of To'aga in American Samoa as Eastern Lapita. West Polynesia represents the easterly extent of known Lapita sites.

West Polynesian and Fijian Lapita sites together make up the Eastern Lapita interaction sphere, one of four geographic regions into which Lapita sites have been grouped on the basis of geography, shared decorative motifs and vessel forms (Green 1979; Kirch 1984:51, 1997:73; Summerhayes 2000:6). Kirch (1997:73) considers inter-community exchange and interaction networks to have continued throughout the Eastern Lapita region 'for some time' following colonisation, although Best (1984:631), and more recently Green (1996) have pointed out that there is little direct evidence in support of this. Stronger archaeological evidence is available for interaction within the islands of West Polynesia and within those of the Fiji group (Davidson 1977:86; Green 1996:126).

The 'consensus' cultural chronology

Change through time in ceramic assemblages has been used to establish a cultural chronology for West Polynesia. A consensus cultural chronology (Burley et al. 1995) is outlined in Table 1.1.

Table 1.1 A 'consensus' cultural chronology for West Polynesia (after Burley et al. 1995).

LAPITA PERIOD (EASTERN AND LATE EASTERN LAPITA)	
	ca. 3100–2500 BP
PLAINWARE PERIOD (ANCESTRAL POLYNESIAN SOCIETY)	
	ca. 2500–1700 BP (Samoa)
	ca. 2500–2000 BP (Tonga except Niuatoputapu)
ACERAMIC PERIOD ('DARK AGES')	
	ca. 1700–1000 BP (Samoa)
	ca. 2000–1000 BP (Tonga)
MONUMENT BUILDING PERIOD	
	ca. 1000–250 BP
HISTORIC PERIOD	
	250 BP–present

Since the early 1970s (Green 1974b; Groube 1971) the West Polynesian ceramic sequence has been characterised as a regional progression from Early Eastern Lapita to Late Eastern Lapita, through Polynesian plainware associated with the emergence of an Ancestral Polynesian Society, and finally aceramic assemblages. Decorated ceramics disappear from the regional sequence by 2500 BP (Kirch 1984:51–2). Ceramic manufacture ceased in most of the region by ca. 1500 BP, but may have continued in some localities until ca. 1200 BP (Kirch 1988) and perhaps as recently as ca. 500 BP (Clark and Michlovic 1996).

The disappearance of dentate stamped pottery from Fiji and West Polynesia, and the subsequent divergence of their ceramic sequences, have been interpreted as indicating the initial break up of the Eastern Lapita interaction network, the subsequent decline of interaction between Fiji and West Polynesia and, by ca. 2500 BP, the relative isolation of West Polynesian communities from those to the west (Best 1984:631–2). The divergence of ceramic sequences is parallelled by the break up of a Proto-Eastern Oceanic language into Proto-Fijian and Proto-Polynesian (Kirch 1984:47), associated with the appearance of fully plainware assemblages in West Polynesia.

The chronology of the colonisation of East Polynesia from West Polynesia is contentious. Early archaeological research in East Polynesia established that the Marquesas (and by logical inference Central Polynesia) were probably colonised by 2200 BP (Kirch 1986; Suggs 1961) and certainly by 1700 BP (Sinoto 1970). This suggested a pause of ca. 1000 years between initial Lapita colonisation of West Polynesia and East Polynesian colonisation, a period of time considered necessary for the development of an Ancestral Polynesian language in West Polynesia (Grace 1964). A date of around 2000–1700 BP for East Polynesian colonisation equated with the estimated chronology for the disappearance of ceramics in West Polynesia, and offered an explanation for the virtual absence of ceramics from early East Polynesian sites (Green 1974b:246–7). More recently claims have been made on the basis of seafaring and navigational evidence for colonisation of East Polynesia contemporary with, or only slightly later than, West Polynesia (Irwin 1981, 1992:87–8). At the other extreme, claims on the basis of radiocarbon evidence for colonisation as recently as 1400 BP have also been made (Spriggs and Anderson 1993). The implications of this for the West Polynesian cultural chronology are discussed below.

The post-ceramic phase of West Polynesian prehistory is commonly divided into an aceramic period, sometimes referred to as a 'Dark Age' (Poulsen 1976; Spennemann 1986) because of the paucity of archaeological deposits dated ca. 1700–1000 BP, and a mound-building period, from ca. 1000 BP, in which the social systems and settlement patterns evident in the historic period developed (Burley 1994, 1999; Kirch 1990). By the time of European contact in the 18th century, the West Polynesian political landscape was dominated by the Tongan maritime empire (Burley 1999).

The Polynesian 'homeland': the dominant paradigm

In the following chapters I specifically investigate the foundations of explanations which view the early archaeological record of West Polynesia as that of an Ancestral Polynesian Society. This construct is derived from the linguistic model for the origin and development of the Polynesian languages. The Polynesian languages are considered sufficiently different to other Austronesian languages of the Central Pacific to have required a period of development, of perhaps 1000 years, in isolation from language groups to the west (Grace 1964; Pawley and Ross 1993:446). Fully plainware assemblages appear throughout West Polynesia by ca. 2500 BP and have been considered the archaeological correlate for Proto-Polynesian and an associated Ancestral Polynesian Society. In this model of early West Polynesian prehistory, the proto-Polynesian language and Ancestral Polynesian Society form the 'baseline against which subsequent cultural divergence, evolution or transformation [of Polynesian societies] can be measured' (Kirch and Hunt 1993:236): they are pivotal in prehistories which seek to identify the origin of Polynesian societies in the Polynesian 'homeland' of West Polynesia (see Kirch and Hunt 1993:1).

Kirch (1997:66) has recently noted that no other issue in Pacific anthropology has 'inspired more debate and argument' than that of the problem of Polynesian origins. Since the 1960s, archaeological research in West Polynesia has been largely driven by, and interpreted in light of, questions arising from issues of Polynesian origins (Golson 1961; Green 1967). Early West Polynesian prehistory is consistently referred to as that of the 'Polynesian homeland' in both a linguistic (Pawley 1966, 1972; Pawley and Ross 1995) and archaeological sense (Clark and Michlovic 1996; Dye 1987; Green 1981, 1986; Kirch 1984; Kirch and Hunt 1993). Initially, ceramic and adze assemblages were the focus of studies of cultural change investigating the chronology for the appearance of an identifiably Polynesian society in West Polynesia (Green 1969a, 1971; Green and Davidson 1969; Groube 1971; Poulsen 1968). More recently, using both linguistic and archaeological evidence, Kirch, Green and others (Green 1986, 1994; Kirch 1984; Kirch and Green 1987; Kirch and Hunt 1993) have argued that a greatly expanded range of material culture, subsistence strategies, settlement patterns and social structure characterise West Polynesian society between ca. 2500 and 1700 BP and represent an Ancestral Polynesian Society. Although this evidence demonstrates continuities from Lapita to subsequent East Polynesian societies (Green 1986), it is also considered sufficiently different to warrant its own cultural label of Ancestral Polynesian Society. Kirch (1984:52) defines this society as 'the social forms and supporting technological base that emerged from the Lapita transition'.

The extensive range of evidence now argued to characterise an Ancestral Polynesian Society is, in part, a result of increasing knowledge through linguistic and archaeological research. However, recent emphasis on presenting a detailed picture of an Ancestral Polynesian Society is also a consequence of the use of an ethnogenetic model to investigate the historical relationships of Polynesian societies (Green 1986). The ethnogenetic model is, according to Terrell et al. (1997), derivative of Goodenough's (1957) earlier model for studying cultural development in Polynesia but was precisely outlined by Kirch and Green (1987) and subsequently elaborated by Bellwood (1996), Bellwood et al. (1995), Dewar (1995), Kirch (1997:18, 260) and Mace and Pagel (1994). The model uses a framework analogous to that of biological evolution to investigate the evolution of differences and similarities in societies which, on linguistic evidence, are identified as having a common ancestor. Polynesian societies at the time of European contact are argued by Kirch and Green (1987:432) to be a phylogenetic unit or a 'unit of historical analysis' because, by definition, Polynesian societies all speak languages of the

Polynesian sub-group of Austronesian languages, share a physical type and systemic cultural patterns and can be traced to a common ancestral culture. Shared traits in the phylogenetic model are argued to result from the retention of common ancestral characteristics, rather than acculturation, borrowing or diffusion (Dewar 1995:303–4), as in a reticulate model which stresses interaction between contemporary communities as the source of common traits (Bellwood 1996:881). That is, the evolution and differentiation of societies in a phylogenetic model may be envisaged as a branching tree-like or dendritic structure (Dewar 1995:303) that offers, in the case of Polynesian societies, a model of their historical development.

To argue that such a model is appropriate for investigating the history of a particular set of societies, it must be demonstrated that the present-day societies included in the phylogenetic unit 'diverged from a common ancestor according to an historical sequence which can be precisely defined in both time and space' (Kirch and Green 1987:431). As such, a:

> 'phylogenetic relationship revolves around derivation from a common source, in cultural terms identifiable through shared patterns of language and society, in biological terms identifiable through shared configurations of the gene pool. Phylogenetic units, whether cultural or biological, are subject to divergence or radiation of their internal elements through the operation of processes such as population fission with subsequent geographical separation, founder or bottleneck effects, selective adaptations to differing or changing environments, and the effects of contact with external societies.' (Bellwood et al.1995:3)

In the Polynesian phylogenetic unit, Ancestral Polynesian Society is identified as the 'common source' and West Polynesia as the 'circumscribed homeland region' (Bellwood 1996:881):

> … [T]he societies of East Polynesia converge into a recognisable East Polynesian language subgroup … an Archaic East Polynesian culture … and a common physical type. These in turn converge with the West Polynesian groups to form a proto-Polynesian language…an Ancestral Polynesian culture or society … and a parental Polynesian population. (Kirch and Green 1987:432)

In this model, temporal variability in early archaeological evidence from West Polynesia is explained as cultural change toward the appearance of an Ancestral Polynesian Society. The entire region, on linguistic and archaeological evidence, is considered the 'homeland' (Green 1981). Local variability in archaeological evidence is described as local adaptation within the homeland region (see Kirch 1981, 1988:246).

Linguistic and archaeological evidence in Pacific prehistory

Kirch and Green (1987) argue that the phylogenetic model also explains patterns in cultural evidence other than language, that is patterns of archaeological and biological evidence, and these various kinds of evidence can be substituted for each other to fill out prehistory. This not only assumes these various kinds of evidence are interchangeable, but they will 'remain intact [changing as a unit] over long periods of time and vast geographic distances' (Terrell et al. 1997:163). Terrell et al. (1997:163) argue such an assumption cannot be sustained because 'language, material culture and social customs are resources deployed by people in different ways under differing circumstances'. A further assumption underlies the use of archaeology in such a model: that *a* society or *a* culture can be delineated in time and space using shared traits identified in archaeological evidence. However, the nature of the relationship between the *empirical* archaeological evidence and the *idea* of culture or society remains under-theorised.

An ethnogenetic unit is argued initially on the evidence of historical linguistics but requires an archaeological correlate for the ancestral culture (Kirch and Green 1987:436). In West Polynesia, the appearance of a Proto-Polynesian language and associated cultural change must be reflected in the early archaeological record of the region, in order that the current model of an Ancestral Polynesian Society be sustained. This assumes that archaeological evidence can be used to test linguistic models and that archaeological and linguistic evidence provide similar, if not interchangeable, records of past human behaviour.

The need to associate a set of archaeological evidence with a reconstructed language is central to the ethnogenetic model because there is no absolute dating procedure available for historical linguistics. Linguists therefore rely on archaeological dating procedures to provide the chronology for language change (Pawley and Ross 1995). However, this introduces circularity into arguments for the association of linguistic 'events' with specific sets of archaeological evidence. In the defining of an Ancestral Polynesian Society, radiocarbon dates from archaeological deposits identified as Ancestral Polynesian provide the chronology for the appearance of the Proto-Polynesian language (Kirch and Green 1987:433). However, in initially establishing that Polynesian societies are a phylogenetic unit, this chronology for development of Proto-Polynesian is 'tested' against the archaeological evidence for Ancestral Polynesian Society, the evidence which provided the chronology for the appearance of the language (Kirch and Green 1987:434). Bellwood (1996:882) recognised this potential circularity in the identification of a phylogenetic unit. To avoid it he advocates:

> tracing the phylogenetic relationship and population dispersal revealed by the patterns of data within [the] independent disciplines [of archaeology and linguistics]. (Bellwood 1996:883)

Similarly, Green (1994:177) argues that, rather than assume a relationship between linguistic and archaeological evidence, '[o]ne has...to specify in tightly formulated arguments the time and place of the intersection of the two data sets'.

Sutton (1996:382) also makes this argument.

However, given the absence of independent dating methods in historical linguistics, the tendency toward circularity is inevitable when archaeological evidence is used to confirm a linguistic model of cultural development. A construct such as the Ancestral Polynesian Society is not an archaeological construct, but one assumed on the basis of linguistic evidence to have a historical reality. While the assumption remains that an Ancestral Polynesian Society has an archaeological correlate in the early West Polynesian record, archaeological evidence can only ever play a confirmatory role in the linguistic model. This is evident in cases where the absence of archaeological evidence for an object known through linguistic reconstruction is argued to reflect a lack of preservation or sampling problems, rather than an actual absence and thus a discrepancy between archaeological evidence and the linguistic model (for example see Green 1994:178 and Kirch 1984:53).

To avoid this circularity, claims for the association of language change and archaeological evidence must rely on arguments about the nature of the evidence itself. These arguments need to recognise the epistemological constraints of each discipline and not frame the interpretation of the evidence of one discipline in terms of another.

Spoehr (1968:174) argued that archaeologists face questions concerning the temporal and spatial distributions of archaeological evidence which only archaeological data will answer. The same may be said for linguists and linguistic data. Biggs (1972), in a much cited paper, agreed with Spoehr (1968) and cautioned against what he saw as the use of simplistic models of an A–B–C language differentiation to infer an equivalent process of Polynesian colonisation:

> It should be emphasised that linguistic subgrouping is concerned with the internal relationships of *languages* in a language family. Inferences as to migrations, first settlements, homelands, cultural affiliations and so on should be drawn from such data with caution, and a full awareness of the limited application of linguistic conclusions to such problems. (Biggs 1972:143–4, *original emphasis*)

These limitations became clear during the 1980s through the research of the Lapita Homeland Project (Allen and Gosden 1991; Kirch 1997). Sites containing Lapita pottery in Remote Oceania were interpreted as evidence of initial colonisation of the region by Austronesian speaking horticulturalists from Island Southeast Asia, the ancestors of the present day Polynesians (Bellwood 1980). The Lapita assemblages provided tangible evidence of the historical link between present-day Polynesian and Southeast Asian Austronesian languages. However, the strength of this interpretation was limited by the absence of a Southeast Asian precursor for the dentate stamped designs of Lapita ceramics. The

Lapita Homeland Project was specifically designed to test this interpretation of Lapita archaeology, that is, to investigate whether Lapita could be argued to have a Melanesian homeland, potentially separating models of the spread of Austronesian languages from those of the colonisation of Remote Oceania (Allen 1991). The Lapita Homeland Project located and identified Lapita sites in the Bismarck Archipelago. Pottery assemblages with complex Lapita designs appeared to be the earliest ceramics in the region, having no Melanesian precursor. Although Lapita sites had not been found further west, this evidence did suggest that Lapita was associated with some kind of cultural intrusion. However, along with Lapita sites, the Lapita Homeland Project located a series of Pleistocene-aged assemblages in the Bismarcks. These pre-Lapita sites contained evidence of a change through time from an initial hunter-gatherer economy to one in which the landscape was increasingly modified by the introduction of plant and animal resources, transportation of raw materials and arboriculture (for a review of the evidence see Allen 1993:140–6; Gosden 1993, 1995; Spriggs 1993a, 1997). The evidence indicated that aspects of material culture and economy hitherto associated with the appearance of Lapita ceramics, 'the Lapita cultural complex' (Green 1979), existed in Island Melanesia prior to the ceramics. The pattern represented by the archaeological evidence appeared to be far more complex than that suggested by the model of Lapita representing the intrusion of a wholly new Austronesian speaking cultural group. Various elements of Lapita in Melanesia can be argued to have indigenous or external Southeast Asian origins, but a model of a 'voyaging corridor' of interaction (Irwin 1992) between Island Southeast Asia and the Bismarcks best explains the evidence. While this does not refute the association of the spread of Austronesian languages with Lapita ceramics, it questions assuming a historical, cultural relationship between these two distinct kinds of evidence.

Although the Melanesian evidence cautions against assuming such relationships, similar associations of archaeological evidence with linguistic models for language development have not been questioned elsewhere in the Pacific. The model of linguistic change from Proto-Central Pacific to Proto-Polynesian has been uncritically associated with change through time identified in archaeological evidence, in particular ceramic and adze sequences. Pawley and Green (1973) have argued that a direct association between linguistic and archaeological evidence may be assumed, given that the founding culture of Lapita in West Polynesia appears, on archaeological evidence, to have developed without evidence of subsequent cultural 'intrusion'. That is, West Polynesia was colonised only once, by Austronesian-speaking ancestors of the present Polynesian-speaking population. Therefore, the association of linguistic evidence with archaeological evidence from the region is straightforward.

Regardless of whether it can be argued that Lapita in Remote Oceania (and therefore the colonisers of West Polynesia) represents a distinct cultural group who spoke an Austronesian language (Terrell 1989), the association of language change with variability in early West Polynesian archaeological evidence in West Polynesia still remains to be established. *Contra* Green (1994:177), language development and changes in the regional archaeological sequence have not been argued to have a behavioural association on the basis of the archaeological evidence. It has been assumed that change through time in archaeological evidence reflects language change. As discussed above, the chronology for the appearance of Proto-Polynesian rests on archaeological evidence although no specific theoretical arguments have been presented for how this language change may be reflected in archaeological evidence or, perhaps more importantly, how archaeological evidence may suggest social change.

Recent contradictory evidence in Polynesian archaeology

In this monograph I argue that the early archaeology of West Polynesia does say something different to the linguistic model. This has already been suggested not only by the theoretical arguments discussed above, but also by recent archaeological research in Polynesia. Two recently excavated sites in American Samoan have plainware assemblages contemporary with Lapita sites elsewhere and date to the period of initial colonisation of the region (Clark and Michlovic 1996; Kirch and Hunt 1993), thereby contradicting the sequence of ceramic devolution through time from Lapita to plainware. Burley et al. (1999) have argued on the basis of radiocarbon chronologies from the Ha'apai Group in Northern Tonga that dentate stamp decoration disappears from the ceramic sequence within a couple of hundred years of colonisation, a far shorter period than previously considered.

Several reassessments of the chronology of East Polynesian colonisation have been published in the past decade that suggest conflicting chronologies for this event. Reassessments of the early Marquesan data by Rollett and Conte (1995) and Anderson et al. (1994), coupled with Spriggs and Anderson's (1993) reassessment of the East Polynesian radiocarbon chronology in general, suggest on archaeological evidence a date of no earlier than ca. 1400 BP for East Polynesian colonisation. This is further supported by recent fieldwork by Walter and Anderson (1995), who report a radiocarbon sequence suggesting colonisation of Niue Island between 1500 and 1000 BP, although limited use of the Island may have taken place by 1900 BP. Conversely, Irwin's (1992) interpretation of navigational and seafaring evidence argues for a continuous colonisation of Remote Oceania with an expected chronological gap in archaeological evidence between West and East Polynesia of perhaps a few hundred years. Implications arise for the West Polynesian cultural chronology in either a long or short East Polynesian chronology.

Irwin's (1992) model of continuous colonisation beyond West Polynesia does not allow for the development of Proto-Polynesian within West Polynesia prior to eastward colonisation, nor its association with temporal change in the West Polynesian archaeological record. A linguistic and cultural Polynesian homeland could be argued to be an early interaction sphere including West Polynesia and central East Polynesia. However, while plausible based on the evidence of navigation and seafaring skills, such a model is currently not supported by artefactual evidence, despite intensive research in central East Polynesia (Allen and Schubel 1990; Allen and Steadman 1990; Kirch and Ellison 1994; Kirch et al. 1995; Walter 1990, 1994). In the 'late' model, East Polynesian colonisation takes place in the aceramic period of the West Polynesian cultural chronology dating to ca. 1700–1000 BP. Kirch (1984) has suggested that the Ancestral Polynesian Society begins to break up into recognisably local archaeological groups by ca. 1700 BP. If this is so, a late colonisation and the subsequent East Polynesian societies are not strictly associated with the ancestral culture of the phylogenetic model.

This scenario is further complicated by differences between early East Polynesian and West Polynesian assemblages. Minimally, homelands should be recognisable archaeologically by similar suites of artefacts being found in the coloniser and colonised regions with coloniser sites being older and/or exhibiting developmental sequences in their artefactual suites. Early East Polynesian assemblages are dominated by a suite of artefacts known as 'Archaic East Polynesian' (Walter 1996). Significant differences between these artefact forms and those of early West Polynesia have long been noted (Davidson 1976) and do not suggest a continuity between Ancestral Polynesian and East Polynesian artefact assemblages.

The assessment of West Polynesian evidence

This monograph presents the results of an assessment of the consensus cultural chronology and the claim that an Ancestral Polynesian Society is visible in the archaeological record of West Polynesia using archaeological evidence. Working from published material, without access to the original collections, poses certain constraints on the kinds of analyses that can be performed. However, it permits an assessment of the relationship of the evidence as described by the excavator to his/her explanation of it. In other words, given the data as described, is the published explanation adequate and are there other equally or more plausible explanations?

The archaeological evidence for change from the founding Lapita to an Ancestral Polynesian Society has been discussed and summarised in a number of publications (e.g. Green 1986, 1994; Kirch 1984, 1988; Kirch and Green 1987; Kirch and Hunt 1993). These have been used to develop a set of characteristics for each class of archaeological evidence — ceramics, adzes, other material culture and faunal remains — which, on the expectations of the consensus model, should be evident in the early archaeological record of both West and East Polynesia. These have been summarised as sets of questions and applied to the various kinds of archaeological evidence from each site included for assessment. These are sites which were:

a) systematically excavated; and
b) contain deposits radiocarbon dated to the period of concern, that is, earlier than ca. 1000 BP.

Recent research in the Pacific (Anderson 1991; Hunt and Holsen 1991; Spriggs 1989, 1990; Spriggs and Anderson 1993) has indicated that radiocarbon chronologies should not be uncritically used to interpret regional temporal patterns in archaeological evidence. This is especially true in cases where the radiocarbon dates were obtained in research conducted early in the history of radiocarbon dating (Spriggs 1989). An assessment of individual West Polynesian radiocarbon dates was therefore necessary, and followed the methodology used by Anderson et al. (1994) (detailed in Chapter 3). Results of the radiocarbon reassessment are presented in Chapter 4. The archaeological data from the Tongan and Futunan sites and the Samoan sites are outlined in Chapters 5 and 6, respectively. The evidence from each site is then looked at in light of the changes through time in assemblage composition expected in the orthodox cultural chronology in Chapters 7, 8 and 9. This information is drawn together in Chapter 10 in a synthesis of early West Polynesian archaeology that suggests there is little evidence to support suggestions of an Ancestral Polynesian Society. The implications of this finding for models of Polynesian ethnogenesis and East Polynesian colonisation are discussed in the concluding chapter.

2

Archaeological research and the creation of West Polynesian prehistory

THE WEST POLYNESIAN cultural chronology was established through initial fieldwork carried out in the region during the 1950s and 1960s. Although the emphasis in this consensus cultural chronology subsequently shifted from an exclusive focus on material culture typologies to the investigation of change through time in a range of evidence, the underlying aim of identifying Polynesian cultural origins has structured both the kinds of analyses undertaken and the explanations of the results.

The 1950s and 1960s: The creation of the Tongan and Samoan ceramic and adze sequences

Archaeological research in West Polynesia began in the late 1950s and accelerated in the early 1960s in response to defining the 'Polynesian problem' — questions concerning the geographic and cultural origins of the Polynesians. The excavation of a number of early East Polynesian sites during the 1950s revealed a range of distinct Archaic East Polynesian artefacts that differed from those known ethnographically in the region. These suggested that similar and earlier forms of the artefacts should be found to the west. Attention focussed on Fiji, Tonga and Samoa 'whose archaeological material was regarded as likely to provide a clue to the genesis of Polynesian culture' (Green 1967; see also Poulsen 1976:224).

Prior to the excavations undertaken by Golson and Ambrose at the Vailele mounds in Samoa in the late 1950s (Golson 1961, 1969), little field research had been carried out in West Polynesia. McKern (1929) had described in detail the field monuments on Tongatapu, excavating several in 1920 and 1921 and Freeman (1944) reported on the mounds at Vailele in Western Samoa.

Pawley (1966) and Green (1966) considered that the linguistic evidence pointed to Tonga as the homeland for proto-Polynesian, rather than West Polynesia as a whole. They argued differences between the modern Tongan and Samoan languages to be greater than those between the Samoan and East Polynesian languages, placing Samoan within the Nuclear Polynesian sub-group and Tongan as a separate subgroup (Green 1966:8). Archaeological research carried out in the mid-1960s in West Polynesia appeared to confirm this view, with differences in the ceramics and 'to a lesser extent in adze types and other items of material culture' (Green 1981:14) being noted in the early Tongan and Samoan cultural assemblages.

During the 1960s, delineating a ceramic sequence for West Polynesia was considered the key to understanding the development of Polynesian culture following the colonisation of Tonga by the makers of Lapita ceramics and prior to the colonisation of East Polynesia. Ceramics were not manufactured anywhere in Polynesia at European contact, although surface deposits of Lapita ceramics in Tonga indicated their manufacture in the past. In the late 1950s a small number of ceramics were recovered from the early Marquesan sites of Hane and Ha'atuatua (Sinoto 1979). This suggested, along with excavations in the late 1950s that revealed deposits of plainware ceramics in Samoa (Golson 1969), that determining the origin of these ceramics would provide insights into the origin of Polynesians. Adzes had been recovered from Polynesian deposits, but these differed markedly from those known from Melanesia (Duff 1959) suggesting that tracing the development of the unique East Polynesian adze forms would also provide insight into the geographic and cultural origin of the Polynesians. Fishhooks were the other major component of the East Polynesian assemblages used to investigate colonisation and cultural change in East Polynesia. Fishhooks were virtually absent from excavated West Polynesian assemblages, lending greater emphasis to the defining of an adze sequence which, in material terms, would link early West Polynesian to early East Polynesian assemblages.

The Tongan ceramic assemblages

In 1963 and 1964, Poulsen (1967, 1968, 1976, 1987) carried out a series of excavations of shell middens on Tongatapu containing ceramics. The purpose of the fieldwork 'was to establish a prehistoric time sequence for Tonga, based on pottery' (Poulsen 1968:89). Poulsen's research confirmed the presence of dentate stamped Lapita ceramics in Tonga and a long sequence of local ceramic manufacture. Lapita ceramics were already known from eastern Melanesian sites (Golson 1971) and associated with the spread of Austronesian speakers.

Poulsen (1987) excavated large areas of midden deposits around the Fanga Uta Lagoon on Tongatapu, many appearing visually conspicuous as small mounds in the landscape. The associated radiocarbon dates were initially interpreted as indicating ceramic manufacture, including Lapita decorative styles, dating from at least ca. 2500 BP and continuing to as recently as 400 or 500 BP (Poulsen 1968). Poulsen (1968:89) concluded that the sequence showed a gradual decrease in the number of decorated sherds and the overall amount of decoration on individual sherds, but that dentate decoration was present throughout the sequence.

In the late 1960s Groube (1971) carried out excavations at Vuki's Mound on Tongatapu. This site revealed a ceramic sequence containing a few dentate stamped Lapita sherds in the basal stratigraphic layer, whilst sherds from the overlying, successive layers of the mound were virtually all undecorated (Groube 1971:299). Along with the radiocarbon determinations in association with these ceramics, the Vuki's Mound evidence led Groube to reconsider Poulsen's original chronology for the Tongan ceramic sequence. By reinterpreting the stratigraphy in Poulsen's sites and obtaining new dates for crucial deposits, Groube demonstrated that by 2500 BP undecorated or 'plainware' dominated the Tongan ceramic sequence. Further, he argued that ceramic manufacture in Tonga did not continue until the proto-historic period as argued by Poulsen, but ceased substantially earlier, probably by ca. 2000 BP. Groube's (1971) revision of the Tongan ceramic sequence made plainware assemblages from Tonga and Samoa contemporaneous and suggested that, in the absence of earlier Samoan assemblages, Samoa was colonised from Tonga at about 2500 BP — substantiating the linguistic model of Tonga being the homeland of the Polynesian languages (Green 1966).

The Samoan ceramic assemblages

Samoan ceramic assemblages were first excavated at Vailele on Upolu by Golson and Ambrose in 1957 (Golson 1969). The undecorated ceramics were recovered from the base of a disturbed mound feature, a context subsequently radiocarbon dated to ca. 2000–1900 BP (Green and Davidson 1965). The absence of dentate Lapita ceramics from Samoan sites confirmed for Green (1971) that Tonga should be considered the Polynesian homeland, although Golson (1971) preferred to view ceramics from Tonga and Samoa as belonging to the same 'Lapitoid' tradition.

At the same time as Poulsen was conducting his investigations in Tonga, Green and Davidson (1974; Green 1969b) began a major research project in Western Samoa. The project ran over two main field seasons between 1963 and 1967 and aimed to identify and excavate a range of archaeological sites covering the entire prehistoric period. Green and his co-researchers, including Terrell (1969), found several mound sites in the Vailele area that yielded ceramics in a stratigraphic relationship similar to those originally noted by Golson (1961), the ceramic deposits being at the base of, or underlying, the mound construction proper.

The Vailele ceramic assemblages consisted almost entirely of undecorated sherds. No dentate stamped sherds were recovered, suggesting that Tonga represented the easterly extent of Lapita colonisation and the colonisation of Samoa took place sometime later, probably ca. 2500 BP as suggested by the earliest of the Vailele radiocarbon dates, from the site SUVa4 (Green 1966). Green suggested a terminal date for ceramic manufacture in Western Samoa of ca. 1800–1700 BP on the basis of the earliest radiocarbon determinations available from aceramic sites and the most recent determinations associated with the main ceramic deposits. This made the disappearance of ceramics in Samoa pene-contemporaneous with the earliest Marquesan dates, which were, at this time, the earliest dates for colonisation of East Polynesia and the only place in East Polynesia where ceramics had been recovered.

Adzes

Along with ceramics, adzes were used to explore West Polynesian cultural relationships. Green and Davidson (1969) created a typology for West Samoan adzes based on that of Buck (1930). This was subsequently expanded by Green (1971, 1974a) to encompass West Polynesian adzes in general and also those from early East Polynesian sites. Of particular cultural significance was Samoan Type V adze (Green and Davidson 1969), considered by Green (1971, 1974b) to be intermediate between Melanesian adzes recovered from Lapita sites in Fiji and Tonga and later East Polynesian assemblages. Recovery of Type V adzes from Western Samoan ceramic deposits led Green (1971) to conclude that this adze was a marker of early West Polynesian prehistory, associated with the ceramic phase, earlier than ca. 1700 BP.

Summary

By the end of the 1960s ceramic and adze sequences for Western Samoa and Tonga (based almost exclusively on the Tongatapu assemblages) had been created. The ceramic sequence was generalised to a regional cultural chronology or conventional culture historical reconstruction for West Polynesia. Only limited survey had been carried out on islands in northern Tonga and in American Samoa.

The 1970s: A 'consensus' cultural chronology for West Polynesia

The chronology for initial colonisation of Samoa was extended back to that of Tonga with the recovery of Lapita ceramics during dredging of the Ferry Berth at Mulifanua on the north coast of Upolu in Western Samoa in 1973 (Green 1974c; Jennings 1974). The submerged deposit, containing dentate

Table 2.1 The West Polynesian ceramic sequence (after Green 1974b and Kirch 1984:48-51).

EARLY EASTERN LAPITA

ca. 3300 BP-3000 BP

Decorated vessels including dentate stamped and other decorative elements plus a range of vessel forms including jugs, plates and shouldered pots.

LATE EASTERN LAPITA

ca. 3000 BP-2500 BP

Decoration restricted to rims and shoulders of vessels; some dentate stamping, notching and incised decoration and a diminished range of vessel forms.

POLYNESIAN PLAINWARE

ca. 2500 BP-2200 or 2000 BP in Tonga

ca. 2500 BP-1600 BP in Samoa

Undecorated or very rare simple rim decoration; vessel forms limited to simple bowls. Percentage of thick coarse ware to thin fine ware ceramics increases through time in the plainware assemblages.

ACERAMIC ASSEMBLAGES

ca. 1600 BP

stamped and incised sherds with designs similar to those observed in Fiji and Tonga (Green 1974c), was radiocarbon dated to ca. 3000 BP (Leach and Green 1989), within the range of Lapita sites in general. The Ferry Berth deposit indicated a uniformity in the Tongan and Samoan ceramic sequences and therefore a similar cultural chronology for all West Polynesia. Subsequently, West Polynesia as a whole became referred to as the Polynesian homeland (Green 1981). Green (1974b) presented a full description of the West Polynesian ceramic sequence, summarised in Table 2.1.

Three major research projects were undertaken in West Polynesia during the 1970s. Kirch (1981) surveyed and excavated sites on the islands of Uvea and Futuna in 1974, and then in 1976 excavated a range of sites on Niuatoputapu, the northernmost island of the Tongan archipelago (Kirch 1978, 1988). In Western Samoa, Jennings, Holmer and others from the University of Utah surveyed and excavated a range of sites over three field seasons in 1974, 1976 and 1977 (Jennings and Holmer 1980; Jennings et al. 1976).

Upolu and Manona

Whilst the main objective of the University of Utah team was to locate further Lapita deposits in the vicinity of the Ferry Berth site (Jennings et al. 1976:1), no further Samoan Lapita deposits were (or have since been) located. Four plainware ceramic sites were excavated and an additional range of surface features recorded and excavated. Analysis of ceramics from four sites, Jane's Camp and the Paradise site located on the north coast of Upolu, and Potusa and Falemoa on nearby Manono Island, found a 'marked resemblance' in their characteristics suggestive of a regional typology (Holmer 1980a:105). The radiocarbon determinations associated with these ceramics fall within Green's chronology for Samoan plainware assemblages (Holmer 1980a:115) and the fine and coarse wares identified in the assemblages accorded with Green's findings for plainware assemblages from elsewhere in Western Samoa (Holmer 1980a: Fig 42). Ceramics from the Ferry Berth Lapita deposit were included in Holmer's (1980a) analysis of a range of ceramic characteristics. He concluded that the ceramics demonstrated a continuous sequence from Lapita to later plainware assemblages, thereby supporting Green's (1974b) conclusion that the Samoan plainware was derivative of Lapita and not a separate ceramic tradition.

Adzes collected and excavated by the University of Utah team were examined using the adze typology of Green and Davidson (1969) and Green (1974b:258–60). The analysis by Hewitt (1980a:132) was found to support the Western Samoan typology, although not all of Green and Davidson's (1969) adze types were represented in the assemblage. Adzes from dated contexts were too few to permit any comparison with Green's chronology. Adzes identified as Type V were recovered only in association with ceramics, supporting Green and Davidson's (1969) claim that Type V is an early West Polynesian adze (Hewitt 1980a).

The plainware ceramic sites of Jane's Camp, Paradise, Potusa and Falemoa are middens containing well preserved organic material, including shell artefacts and a suite of faunal remains. These sites provided the first opportunity for analysis of organic material in an early Samoan context. A range of fishhooks, lures, shell ornaments and tools were identified by Janetski (1980a), who also analysed the faunal component of the assemblages (Janetski 1976a, 1980a).

Radiocarbon dates for a number of excavated or recorded sites, and surface features were obtained. Using the dates and site types Jennings and Holmer (1980:6), constructed a four phase cultural chronology similar to that of Green (1974b). The earliest phase is Lapita, dating to earlier than

3000 BP, followed by a 'coastal sequence' with dates ranging from 3000 BP–1650 BP, including the plainware ceramic sites discussed above. The sites dated from 1650 BP to 900–800 BP and from 900–800 BP to 200 BP are aceramic and primarily comprise of mounds, house platforms or earth ovens. Little interpretation of the sites or their relationship to previously published Samoan or Tongan sites is offered by Jennings et al. (1976) or Jennings and Holmer (1980).

Futuna and Alofi

In 1974, Kirch (1976, 1981) excavated three ceramic sites on Futuna and one on the adjacent island of Alofi. No dentate stamped Lapita ceramics were recovered and only a very small percentage of the sherds were decorated. Only one of the Futunan sites, FU-11, contained a sealed ceramic deposit, radiocarbon dated to ca. 2200 BP (Kirch 1981:131). In the three other sites, ceramic deposits had been disturbed by later gardening activities. Detailed analyses of the composition and size of tempers, sherd colour, manufacturing technique, vessel form and decoration highlighted significant differences between the assemblages interpreted as temporal variation between the sites (Kirch 1981). Kirch argued that the earliest assemblage was from one of the disturbed sites, on the basis that it contained a large percentage of sherds with calcareous sand and reef detritus temper. The latter was thought to be restricted to the early part of the Lapitoid ceramic series (Kirch 1981:131).

Although the ceramics from FU-11 are dated within Green's plainware phase, Kirch (1981) found that the vessel form characteristics are similar to those of Late Eastern Lapita assemblages known from sites in Tonga and Fiji. The variability observed in the Futuna-Alofi ceramic assemblages led him to consider whether the tripartite division of the West Polynesian ceramic sequence might mask significant temporal and geographic variations in regional ceramic change. To incorporate this variability Kirch adopted the term 'Lapitoid' to describe the Futunan assemblages and West Polynesian ceramics in general so as to include the entire West Polynesian ceramic tradition, incorporating Early and Late Eastern Lapita and Polynesian plainware assemblages.

A range of lithic artefacts including adzes (including three identified as Type V), chert flakes and volcanic glass flakes was excavated from FU-11 and collected from the surface sites. The attribution of the ceramic assemblage to the Late Eastern Lapita phase permitted further confirmation of Green's (1971) claim that Type V are 'a significant marker of Lapita and early Polynesian assemblages' (Kirch 1981:139).

The most intensive archaeological research project in West Polynesia in the 1970s was Kirch's fieldwork on Niuatoputapu in 1976 (Kirch 1978, 1984, 1988). However, the results of the Niuatoputapu project were not fully published until 1988, and as such are discussed in the following section.

Summary

By the end of the 1970s the initial focus on establishing material culture typologies and sequences had broadened into an interest in subsistence strategies, including the exploitation of indigenous fauna, the origin of subsistence systems observed at the time of European contact, and the inter-relationship of cultural and environmental factors in island environments. However, the conceptual framework guiding research had not changed significantly. Identifying Polynesian cultural origins still dominated the research agenda:

> [V]ariation in [Lapitoid sites and assemblages] will be critical to an understanding of the evolutionary transformation from the Lapita Cultural Complex to Archaic Polynesian culture. (Kirch 1981:141–2)

The construction of West Polynesian linguistic history had also changed significantly during the 1970s. Research into the break up of the Oceanic subgroup of Austronesian languages suggested a complexity to the linguistic history of the Fiji-West Polynesian region not previously considered in models which associated language development with a simple A–B–C model of the settlement of island groups (Green 1981:134–8). Green (1981) reconsidered his earlier position in which he classified Samoan as part of the Nuclear Polynesian subgroup (Green 1966; Pawley and Green 1973), preferring now to see the languages of West Polynesia as a whole with eastern Fiji, especially the Lau group, a central Pacific subgroup and the Polynesian homeland. His reconsideration of the position of Samoan and the inclusion of some parts of eastern Fiji in the Polynesian homeland was based on both linguistic studies of the Fijian area and on archaeological evidence. In particular, the ceramic sequences of Fiji, Tonga and Samoa suggested a shared early prehistory of settlement by Lapita colonists followed by 1000 or 1500 years of interaction evident in parallel changes in the ceramic sequences from the entire region (Green 1981). However, Green (1981:154) stressed that it was in West Polynesia, in Tonga and Samoa, that societies differentiated from those further to the west and became distinctively Polynesian.

The 1980s: archaeology of the ancestral Polynesian homeland

The term 'Ancestral Polynesian Culture' became commonly used in the 1980s to describe West Polynesian assemblages containing plainware ceramics. Although the term had been first used in the late 1970s in reference to plainware assemblages and associated artefacts, it was not until the 1980s that the construct of an Ancestral Polynesian Society was elaborated. That is, the description of plainware ceramics and associated artefacts as Ancestral or Archaic Polynesian was broadened to encompass social structure, settlement patterns, and resource procurement strategies of a proto-Polynesian speaking society argued to have emerged in West Polynesia by 2500 BP.

Although surveys of archaeological sites in American Samoa had been undertaken since the 1960s, these were principally directed toward recording surface sites (e.g. Frost 1976; Kikuchi 1964) and features for the Historic Preservation Office in American Samoa (Clark 1993). It was not until the mid-1980s that major research projects, including subsurface archaeology, commenced in the region. Best et al. (1989; see also Leach and Witter 1990) carried out intensive fieldwork on the Tatagamatau basalt quarry on Tutuila, whilst Hunt and Kirch (1988; Kirch and Hunt 1993; Kirch et al. 1989, 1990) directed excavations at the To'aga site on Ofu Island in the Manu'a group over three field seasons in 1986, 1987 and 1989.

Elsewhere in West Polynesia during the 1980s, Sand (1990) carried out investigations designed to assess the ceramic chronology of Futuna and Alofi through excavation and dating of a series of ceramic deposits, while Dye (1987) investigated ceramic production in the islands of the Ha'apai Group in northern Tonga.

Northern Ha'apai Group, Tonga

Dye's (1987) research on the small islands of the northern Ha'apai Group of Tonga aimed to identify the mechanisms of ceramic manufacture on the islands and the social structure indicated by the mode of ceramic production. Prior to Dye's research, the Ha'apai group were archaeologically unknown, apart from a brief survey undertaken by Groube (1971) that identified surface scatters of ceramics. Dye excavated two sites, Tongoleleka and Fakatafenga, containing dentate stamped Lapita ceramics. Although radiocarbon determinations associated with the ceramics were outside the expected range for Lapita assemblages, Dye (1987:252) interpreted the assemblages, and in particular the decorative motifs, as being similar to early ceramics from both Tongatapu and Fiji, fitting within the Early Eastern Lapita tradition. Dye (1987:255) found that locally available tempers had been used in the assemblages, indicating local production and a rapid adaptation to local resources in ceramic manufacture. Turtle bones and evidence of now extinct giant iguanas (Pregill and Dye 1989) and megapode species and extirpated avian fauna were recovered in association with the Lapita ceramics, suggesting the sites represent initial human exploitation of the region (Dye 1987:254; Dye and Steadman 1990).

Although the dentate stamp motifs suggested interaction with Lapita communities on Tongatapu and in Fiji, Dye (1987:257) considered that a trend towards production of a closed-mouthed jar evident in the Ha'apai assemblages but absent from contemporary assemblages from Fiji and elsewhere in West Polynesia indicated an independence of the ceramic traditions in Ha'apai. However, the overall trend towards 'simplification and reduction of variability in vessel form and decoration' accorded with Green's (1974b) claim that such a trend was evident at a regional scale. Dye (1987:258) argued that small settlement populations must have existed in the early period, resulting in 'uncertainties … in the inter-generational transmission of technical information'. In other words, in small isolated communities technical information would have been lost between generations of potters which could not be retrieved, thereby leading to a decline in the complexity of ceramic production and ultimately culminating in cessation of ceramic manufacture.

Further research on Futuna and Alofi

From his excavation and dating of ceramic sites on Futuna and Alofi, Sand (1990) estimated that ceramic manufacture disappeared from the islands at ca. 1500 BP, but found no evidence to suggest that this was due to any social change. Like Kirch (1981), Sand (1990:132) considered that the ceramic sequence from Futuna-Alofi differed from the regional sequence proposed by Green (1974b) due to 'a too tightly defined regional chronology'. Sand excavated several ceramic sites of which three were dated, including the Asi Pani site from which dentate stamped Lapita ceramics were recovered for the first time on the islands. Sand (1990:130) gave the name Asi Pani to the earliest phase in his ceramic sequence (including the Lapita ceramics) dating to between ca. 2700 BP and 2400 BP. Although the calcareous sand temper of the decorated ceramics suggested they were part of Early Eastern Lapita, the limited range of motifs and vessel forms in the Asi Pani ceramic assemblage distinguished them from other Early Eastern Lapita assemblages. Sand (1990:131) characterised the succeeding phase, named Tavai after the FU-11 site (Kirch 1981), as plainware without calcareous temper. This differed from Samoan plainware in the absence of an open bowl form and the presence of a handled jar, also seen in the Ha'apai assemblages (Dye 1987). Sand also considered that no 'evolution' in the ceramics could be identified in Futuna-Alofi assemblages, unlike the Western Samoan assemblages.

Both Sand (1990) and Dye (1987a) thus identified aspects of their ceramic assemblages that differed from the proposed regional ceramic typology, but did not question the typology itself. Sand (1990:131) considered the Futunan sequence could be integrated into the regional chronology, but would also include a number of unique pieces.

Niuatoputapu

In his research carried out on Niuatoputapu, Kirch (1988) went further and questioned the use of a regional sequence of ceramic or cultural phases. Although he advocated the use of 'phases' — in the culture-historical sense — because such frameworks are convenient for summarising changes in long sequences and for making inter-island comparisons, they could not provide a satisfactory model of the dynamics of cultural change (Kirch 1988:240). Studying socio-cultural change with the aim of investigating the transformation of Lapita culture to an Ancestral Polynesian culture was central to Kirch's (1988) interpretation of results of the Niuatoputapu excavations. Kirch (1988:14) lists several questions guiding the Niuatoputapu research. Of these, the aims to produce a cultural-historical outline of the prehistoric occupation sequence and identify the archaeological evidence of Ancestral Polynesian Culture reiterate the overarching research interest in identifying Polynesian social and cultural origins 'since the accurate reconstruction of the ancestral baseline is essential for regional studies of cultural differentiation and evolution' (Kirch 1988:14).

Kirch (1988:14–15) also wished to investigate evidence for subsistence strategies in the early period, in particular those of the Lapita colonists, and the human and non-cultural causes of change in the island environment since colonisation. This reflected the increasing interest among Pacific archaeologists during the 1980s in early economies and the environmental impact of colonisation.

Kirch (1978, 1988) excavated a range of ceramic and aceramic sites on Niuatoputapu, including one Lapita site, as well as recording monuments and features in the landscape. The excavated ceramic assemblages conformed to Green's (1974b) Samoan ceramic sequence with two exceptions. Plainware manufacture continued on Niuatoputapu until as recently as 1200 BP, far longer than in Samoa or Tongatapu; and the shift in Samoan plainware assemblages from a predominance of thin fine ware to that of thick coarse ware was not evident in Niuatoputapu assemblages (Kirch 1988:246, 242).

The Niuatoputapu stone adzes were analysed according to the Samoan typology of Green and Davidson (1969) and Green (1974b). In association with the plainware assemblages, Kirch (1988) interpreted the adzes as evidence of innovations in adze technology seen throughout West Polynesia during the plainware period. This innovation was characterised by the plano-convex Type V adze, the dominant form in the plainware period. The Type V adze was absent from aceramic assemblages in Niuatoputapu.

Organic material was well preserved in the sandy deposits of the Niuatoputapu sites, and consisted of a range of faunal material and shell artefacts (Kirch 1988). The Niuatoputapu excavations added to the very limited number of fishhooks that had previously been recovered from West Polynesian archaeological contexts. Poulsen (1987) recovered a single one-piece fishhook from the Tongatapu ceramic deposits, whilst Davidson (1969a) had recovered a fishhook fragment from the Lotofaga site in Western Samoan from a context dated to ca. 700 BP. Three shell trolling lures and five shell fishhooks were excavated from the Manono sites of Potusa and Falemoa, in association with ceramics (Janetski 1980a). Four one-piece fishhooks and seven pieces of worked shell identified as fishhook tabs, all of *Turbo* sp. shell, were excavated from the Niuatoputapu sites, from both Lapita and plainware contexts (Kirch 1988). Kirch (1988:206) argued that the one-piece *Turbo* sp. shell fishhooks were a component of the Ancestral Polynesian fishing kit.

Based on an analysis of the faunal assemblages in which he identified a number of changes through time, Kirch (1988:235) presented an interpretation of Niuatoputapu subsistence patterns. In particular, the presence of marine fauna (including fish, shellfish and turtle) and indigenous bird species decreased through time, while pig, although present only in small quantities, increased through time. No trends were identified for the other domesticates, dog and chicken. Kirch (1988:250–3) offered a number of explanations for these trends, including over-predation and changing environment. Kirch (1988:242–3 and Fig. 135) argued that intensive marine exploitation is associated with the early deposits, although, since pig, dog and chicken were also present, some reliance on horticulture existed from the time of initial colonisation. In the subsequent plainware (or Pome'e) phase on Niuatoputapu, terrestrial production and marine exploitation continued, although the emphasis on marine resources significantly decreased.

Ofu Island

A divergence from the regional ceramic sequence was also noted in the excavations of ceramic assemblages at the American Samoan site of To'aga on Ofu Island, excavated between 1986 and 1989 by Kirch and Hunt (1993; see also Kirch et al. 1990). The research was guided by five aims: the establishment of a temporal framework and prehistoric sequence for the Manu'a Group; determination of environmental change since colonisation; reconstruction of aspects of the Ancestral Polynesian Culture, especially the settlement pattern and subsistence economy; explanation of ceramic change in West Polynesia; and investigation of inter-island exchange through ceramic and adze analyses (Kirch and Hunt 1993:5–6).

Kirch and Hunt (1993:230) argued, on the basis of radiocarbon evidence, that the To'aga site was continuously occupied from ca. 3600 BP to 1000 BP. The last 1000 years of prehistory are reflected in the various undated surface features such as pavements, mounds and pits on the beach site. Although the early dates indicate initial occupation during or prior to the Lapita colonisation elsewhere, no dentate stamped sherds were recovered from To'aga. Kirch and Hunt (1993:230) considered three possibilities which might account for this phenomenon: sampling error; the deposits containing Lapita ceramics might lie inland, deeply buried; or that the use of dentate stamped decoration ceased prior to colonisation of the island. However, they argued that the To'aga dates demonstrate that Lapita colonisation of the entire Fiji-Western Polynesian region was rapid, with no lag visible in the radiocarbon dates across the region. The excavators suggested a date of 1500–1400 BP for the cessation of ceramic manufacture in the Manu'a Group on the basis of associated radiocarbon dates, together with dates from the earliest aceramic deposits at To'aga (Kirch and Hunt 1993:231). Such a date is slightly more recent than the established date of ca. 1700 BP in Western Samoa.

The investigation of palaeo-environmental evidence and the faunal suite from the To'aga site builds on Kirch's (1988) previous research on Niuatoputapu. The varying representation of indigenous terrestrial and marine fauna in both sites was used to argue that an emphasis on these resources immediately following colonisation diminished over time, with a concurrent increasing reliance on agriculture. However, little change through time could be identified in the composition of the To'aga faunal assemblage (Kirch and Hunt 1993:240; Nagaoka 1993), with the exception of the extinction of several species of bird. Megapode and turtle were also found only in the early deposits. These were interpreted as evidence of over-predation in the early period and subsequent humanly induced environmental change (Kirch and Hunt 1993:242). Small amounts of chicken were recovered from the early deposits, in addition to small quantities of dog and pig from the recent deposits (Kirch and Hunt 1993:240).

In their synthesis of material culture analyses, Kirch and Hunt (1993:236, 239) describe the To'aga assemblages as evidence of an Ancestral Polynesian Culture or Society, identified primarily through material culture, especially ceramics and adzes, and equating to Green's (1974b) plainware period. However, contrary to the established ceramic sequence, pottery vessel form in the To'aga assemblage remained constant, with only a simple bowl being present throughout the sequence. Thin ware was more common in the earlier levels of the deposit, although coarse ware was present throughout the sequence (Hunt and Erkelens 1993:147).

The plano-convex, or Type V, adze was present in association with ceramics at the To'aga site, giving further support to the notion that this particular artefact type was a widespread and common form throughout the Ancestral Polynesian region (Kirch and Hunt 1993:239). Similar to evidence elsewhere in West Polynesia, the Type V adze disappears from the To'aga assemblage along with ceramics by ca. 1500 BP. Sourcing of basalt indicated the Tatagamatau basalt quarry on Tutuila Island approximately 100 km to the west was the likely raw material source for these artefacts.

The To'aga excavations also yielded the largest fishhook assemblage yet recovered from a West Polynesian site (Kirch and Hunt 1993:160). The excavators explained the presence of the fishhooks at To'aga, in light of their virtual absence from contemporary West Polynesian sites, as reflecting the absence of extensive barrier reef or lagoon systems around To'aga which required the use of angling (rather than spearing or netting) to exploit many species. They identified the hooks as a prototype stage from which the greater diversity of Eastern Polynesian forms subsequently developed (Kirch and Hunt 1993:240).

Tutuila Island

During the 1980s Leach and Witter (1987, 1990) and Best et al. (1989) carried out intensive field research at Tatagamatau, a fortified quarry complex on Tutuila Island, American Samoa. The aims of the fieldwork were to date the initial use of the quarry as a source of basalt for adze manufacture, and to establish the chronological relationship of the fortress and associated star mounds to the use of the quarry. Radiocarbon determinations from several test pits at the site indicated intensive use of the quarry only in the last 1000 years, although some use of the site prior to this was suggested by the presence of pottery sherds at the site (Best et al. 1989:69).

Other studies

The 1980s added detailed technological analyses and sourcing studies of stone artefacts and ceramic tempers to West Polynesian prehistory (Best et al. 1989, 1992; Dickinson 1988; Dye 1987; Sheppard et al. 1989). These studies provided a new layer of data for prehistories previously constructed on the basis of morphological or stylistic traits of material culture items. They also provided insight into the movement of raw materials and inter-island contact (Kirch 1988:254; Kirch and Hunt 1993:243). However, despite the potential of such studies to provide alternative approaches to interpreting artefact variability, none of the studies made a substantial impact on the early West Polynesian material culture sequences.

In the 1980s, the attention of historical linguists in the Pacific focused on the break-up of Proto-Oceanic languages to the west of Polynesia (Pawley and Green 1985; Ross 1989). The region of West Polynesia continued to be accepted as the geographic origin of proto-Polynesian (Kirch 1988:6, Kirch and Green 1987). Linguistic data were used in the archaeological literature of West Polynesia published in the 1980s (and the 1990s) primarily to 'flesh out' the archaeological evidence for the transformation of Lapita into an Ancestral Polynesian society by 2500 BP (Kirch and Green 1987:438). Reconstructed proto-Polynesian terminologies were used to provide a basis upon which to investigate the social and economic structure of the hypothesised society, and to provide a range of evidence considered lacking in the archaeological record due to poor preservation and/or sampling strategies (for example see Green 1986 and Kirch 1984:Table 4).

The 1990s: inconsistencies in the regional ceramic sequence

Two further plainware sites, contemporary with Lapita sites elsewhere, were excavated in the 1990s: the 'Aoa site in American Samoa and Holopeka in the Tongan Ha'apai Group.

Tutuila Island

The site of 'Aoa, located on Tutuila Island, American Samoa, and excavated by Clark and Michlovic (1996), revealed a radiocarbon chronology suggesting that local ceramic manufacture may have continued into the last 1000 years. Cultural deposits from the 'Aoa site are divided into two distinct phases. Dates from the basal deposit suggest an initial occupation ca. 3000 BP. The more recent dates suggest a secondary phase of occupation ca. 500–300 BP. Both these occupation levels contained ceramics, although Clark and Michlovic (1996:13) identify differences between the assemblages in the density of ceramics and in the type of worked stone present. Similarly to the To'aga ceramic assemblage, vessel types from both units at 'Aoa are restricted to globular pots. Thick coarse tempered and thin sand, or untempered, sherds are present in both units.

The recent dates associated with ceramics from 'Aoa led Clark (n.d.) to reassess the Western Samoan evidence for the cessation of ceramic manufacture. In review, Clark found significant evidence for ceramics in association with radiocarbon dates more recent than 1700 BP. This phenomenon had been previously explained by either the ceramics occurring in a secondary depositional context, or the associated dates being incorrect. The established chronology guided the interpretation. Clark (n.d.) concluded that:

> if most, or even some, of the cases of late ceramics are accepted, a very different model of the ceramic sequence can be produced. In that model, pottery was widely used in Samoa through about 1500 BP. Over the next few centuries pottery use declined, perhaps even disappeared at some locations. After approximately 950 BP, pottery was probably uncommon in Samoa, and was absent from some areas. Between 650 BP and 300 BP pottery became very rare, being retained in very small amounts in very few locations. By about 300 BP, pottery had been abandoned throughout the islands.

Analysis of the adzes from 'Aoa revealed four of Green and Davidson's (1969) Samoan types were present in the site, including three Type V adzes, all from the early depositional unit (Clark and Michlovic 1996:8).

Geochemical analysis of volcanic glass artefacts from 'Aoa by Clark and Wright (1995) indicated a Tutuila source for the glass, although the exact location was not determined. The geochemical composition of volcanic glass from Western Samoan sites analysed by Sheppard et al.

(1989) also suggested a Tutuila source (Clark and Wright 1995). Green (1974a:148) found volcanic glass was present in the Western Samoan ceramic assemblages, but that it disappears from the sequence at the same time as ceramics.

Ha'apai Group

The research by Shutler et al. (1994) and Burley et al. (1995, 1999) in the Ha'apai group of Tonga expanded Dye's (1987a) earlier fieldwork in the islands. Single Lapita shell middens have been located on each of the islands surveyed. Unlike the 'Aoa site, these ceramic sites provided excellent conditions for the preservation of faunal materials. Shutler et al. (1994) carried out initial excavations at the Faleloa and Pukotala sites. The Faleloa site has a stratigraphy similar to that described by Dye (1987a) for the Tongoleleka site and contained a large assemblage of decorated Lapita ceramics, dated to ca. 3000 BP, with decorative motifs and vessel forms within the range identified by Kirch (1984:45) for Lapita in West Polynesian assemblages. Initial excavation of the Pukotala site revealed dentate stamped ceramics, although in subsequent fieldwork this deposit was shown to be in a secondary context, having been used as fill in a mound structure (Shutler et al. 1994:64). The primary deposit was located and excavated; however, only a single decorated rim sherd was retrieved despite two radiocarbon dates from the deposit falling within the accepted range of Early Eastern Lapita chronology. Shutler et al. (1994:64-5) attributed the absence of decorated ceramics to the location of the excavation square on the periphery of the Lapita deposit, and concluded that contemporary dates for Lapita deposits throughout the Tongan archipelago provide evidence of an archaeologically simultaneous colonisation of the region on most inhabitable islands. They considered the Faleloa and Pukotala assemblages to:

> support the argument of a unified ceramic technology, one with a consistent set of decorative applications and basic design elements. These appear to be so consistent that one can explain their widespread presence only through a high degree of inter-village interaction, inter-island voyaging and the probable presence of an integrated Lapita province extending from Fiji and Tonga to most probably Samoa. (Shutler et al. 1994:66)

Burley et al. (1995) subsequently dated a further Ha'apai site, the plainware site of Holopeka. Although containing in excess of 8000 sherds, none was decorated in the Eastern or Late Eastern Lapita style; however, the radiocarbon dates (ca. 2900 BP–2500 BP) were within the range usually associated with Lapita in West Polynesia. The excavators offered various hypotheses to explain the dating of a plainware assemblage to the Lapita period, but preferred the explanation that the temporal extent of Lapita decoration may be more limited than previously considered (Burley et al. 1995:132).

In 1997, Burley et al. (1999) re-excavated the Faleloa and Pukotala sites: the Tongoleleka site and two further Ha'apai Lapita sites, Mele Havea and Vaipuna. Burley et al. (1999) have presented the findings of an analysis of 31 radiocarbon determinations from these five sites containing Lapita ceramics, as well as the Holopeka plainware site in the Ha'apai Group, Northern Tonga. The dated charcoal was collected from well defined stratigraphic contexts with the aim of assessing the chronology of Lapita and plainware deposits, and investigating the broader issue of whether the plainware is derived from, or contemporary with, Lapita, as had been suggested by previous research in the region (Burley et al. 1995). A considerable degree of overlap was noted in the calibrated ranges of the dates; however, a pattern was revealed by the large sample of dates which Burley et al. (1999) interpret as indicating a date for Lapita colonisation of Ha'apai 2850–2800 cal BP, with the appearance of fully plainware sites 2700–2650 cal BP. These results suggest the very rapid loss of Lapita throughout the Ha'apai Islands, within ca. 200 years of colonisation. In a review of the radiocarbon sequences from Lapita and plainware sites elsewhere in West Polynesia, Burley et al. (1999) found many of the early dates to be questionable, especially those on marine shell, with many suggesting a chronology for Lapita and plainware similar to that from Ha'apai.

Niue Island

Walter and Anderson's (1995) fieldwork on Niue Island in 1994 aimed to investigate the chronology of colonisation of the Island, particularly whether the Island was colonised during the Lapita period, or later as part of the colonisation of East Polynesia from West Polynesia. They failed to locate any ceramic sites and the radiocarbon sequence from test excavations undertaken at several sites suggests the Island was colonised in the post-ceramic period.

Research into the post-1000 BP past

In the above review, emphasis has been on research concerning the early prehistory of the region, that is, prior to ca. 1000 BP. Research into the later prehistory, post-1000 BP, has continued alongside that of the earlier period, but in response to very different research questions. These have focused on the development of the socio-political systems evident in Tonga at the time of European contact, which gave rise to the Tongan maritime empire in the 15th and 16th centuries (Burley 1994, 1999; Kirch 1988, 1990), and on the recording and interpretation of the surface features and monuments evident throughout the region (Clark and Herdrich 1993; Davidson 1974a, 1977; Hunt and Kirch 1988; Kirch 1988, 1990).

Summary

The above review of West Polynesian archaeological research highlights that an increasing number of inconsistencies in this regional sequence become apparent following the initial interpretation of intra-regional variation and agreement on a shared regional sequence. It is not surprising that with increasing archaeological research undertaken in West Polynesia, deviations from the ceramic sequence initially established in the 1960s would appear. However, the persistent use of the established cultural chronology as the standard against which new evidence has been assessed has led to exceptions to the typology being referred to as local deviations from the regional sequence, rather than as evidence to challenge to the concept of a regional signature.

Suggestions have been made that the concept of a regional ceramic sequence in West Polynesia may no longer be tenable (see Burley et al. 1995, 1999; Clarke n.d.), but a picture of early West Polynesian prehistory which explores the diversity now apparent in the archaeological evidence is yet to emerge. The re-analysis of the West Polynesian archaeological evidence discussed in the following chapters begins to build such a picture.

3

Methodology for assessing the early West Polynesian evidence

IN THIS CHAPTER the method by which evidence from excavated West Polynesian sites has been assessed in light of the expectations of the model of an Ancestral Polynesian homeland is outlined. The task required two kinds of comparative frameworks:

1. A means of looking at change through time within sites and of establishing a chronological relationship between assemblages from different sites.
2. A procedure for making the published data from a large number of sites comparable.

Reassessments of East Polynesian colonisation

Over the past two decades, a number of reassessments of the established or 'orthodox' model of East Polynesian colonisation have been undertaken (Anderson et al. 1994; Kirch 1986; Rolett and Conte 1995; Spriggs and Anderson 1993). These have investigated the established chronology and pattern of initial settlement of the region, and subsequent cultural change. Each has contested the established interpretation(s) of one or more key sites in the Marquesas Islands on which the orthodox model was based.

In these reassessments, current protocols for the interpretation of radiocarbon dates, re-excavation of a site or reassessment of the original excavation reports and site data have been used to argue that the original interpretation of the site(s) may be incorrect. This has significant implications for the orthodox model in which the Marquesas were considered, on radiocarbon evidence, to have been settled earlier than elsewhere in East Polynesia and to have acted as a dispersal centre for subsequent colonisation (see Jennings 1979:Fig. 1.1). Although the chronology for initial use of a site or colonisation of the region is the primary concern in each reassessment, a secondary concern is the effect that an altered chronology may have on the developmental sequence for the Marquesas initially outlined by Suggs (1961) and refined by Sinoto (1966, 1979; see also Rolett and Conte 1995:196). In this sequence a series of developmental stages in Marquesan culture were outlined according to changes in artefact typologies and the appearance of new artefact forms. The development of Archaic East Polynesian artefacts from earlier forms apparent in these sites provided further confirmation of the sites' antiquity.

The motivation behind the reassessments of the orthodox model is analogous to that of the assessment of the West Polynesian sequence presented in this monograph. Implicit in these reassessments is a perceived need to re-examine the foundations of the model in light of more recent, apparently contradictory findings that suggest the established explanatory framework cannot account for the observed pattern of archaeological evidence. As a consequence of changing theoretical paradigms and an increasing availability of data, it is inevitable that models of the past will be modified. However, the authors of these papers argue that, rather than continue to modify the orthodox pattern and chronology of East Polynesian colonisation, a complete reassessment of its foundations is required to provide a more satisfactory basis on which to interpret current evidence.

The Hane Dune site

Anderson et al. (1994) present a reanalysis of the Hane Dune site, originally excavated by Sinoto in the 1960s. Sinoto (1979) considered initial site usage to date to ca. 1700 BP, making it, along with the Ha'atuatua site, the then earliest site in the Marquesas and East Polynesia. This chronology was contested by Kirch (1986), who reassessed the radiocarbon and stratigraphic evidence and consequently argued for initial occupation as early as ca. 2200 BP. In contrast, the reassessment of Anderson et al. (1994) suggested the site was occupied no earlier than ca. 1500 BP. This, along with Spriggs and Anderson's (1993) assessment of the East Polynesian radiocarbon evidence, provided support for a 'late' (recent) rapid colonisation of the entire region.

Using the available site plans, field reports and published descriptions of the stratigraphy and cultural material, Anderson et al. (1994) examined the evidence used originally by Sinoto (1966; Sinoto and Kellum 1965) to create the chronological units for the site. They found the arguments for the initial interpretation of the deposits were based entirely on artefact assemblages and radiocarbon dates, with little or no account of the stratigraphy (Anderson et al. 1994:31). Using stratigraphic evidence and sediment descriptions as an independent means of establishing a relative chronology, they constructed analytical units which differed significantly from those of Sinoto and also Kirch (1986). This provided them with a framework for investigating change through time in the cultural assemblages, the findings of which are then compared to Sinoto's (1966, 1967, 1970, 1979) and Kirch's (1986) cultural sequences.

Anderson et al. (1994) also assessed all of the available radiocarbon determinations. Although no criteria were presented against which the dates were assessed, they rejected a number for specific reasons (Anderson et al. 1994:32–4) but stopped short of excluding all questionable dates as this would leave a chronology so imprecise as to be of no use. Following this, the relationship of the radiocarbon dates to the stratigraphic units was investigated, and a combination of both kinds of evidence was used to create an absolute and a relative chronology for deposits in the site. The relative chronology permitted intra-site comparison of change through time in cultural material, while the absolute chronology allowed a means of comparing the findings to other sites in the Marquesas.

Cultural material was analysed by Anderson et al. (1994) as categories of evidence used by Sinoto as indicators of cultural change: adzes, fishhooks, other artefacts and faunal evidence. The artefacts were originally reported according to morphological (and occasionally functional) typologies, thereby limiting the possibility of undertaking a different approach to the material culture analysis. Assessment of the original sequence relied on the assignation of artefacts to the new analytical units created through the assessment of radiocarbon and stratigraphic evidence. In the case of each artefact category, the revised chronology significantly altered the original sequence of change through time, refuting the accepted developmental sequence and providing the basis for an alternative interpretation.

Procedures adopted for reassessing the West Polynesian evidence

The procedure of Anderson et al. (1994) described above was considered appropriate to the needs of the present analysis and has therefore been used as the model for the assessment of West Polynesian archaeological evidence. In summary, following the selection of sites based on the assessment of the radiocarbon determinations (see Chapter 4):

1. The site structure and stratigraphic evidence is used to establish intra-site analytical units which provide a relative chronology for cultural material.
2. The associated radiocarbon determinations are used in combination with the analytical units to provide an absolute chronology for the site that can be used as the framework for inter-site comparison in assessment of the regional sequence.
3. The cultural material from each site is grouped into categories of evidence central to claims for the established cultural chronology, these being ceramics, adzes, other artefacts and faunal remains.
4. The categories of evidence are reported according to the analytical units for each site in an investigation of change through time within the site.
5. The strength of the regional sequence and any change through time is assessed through inter-site comparison of categories of evidence using the absolute chronology of the site to create a temporal framework.

Unlike the assessment of the Hane Dune site (Anderson et al. 1994), in the study reported herein cultural material from a large number of sites is included. Hence, a means of making these sets of evidence comparable was necessary.

A range of archaeological evidence has been argued by various authors to support a model of cultural change from Lapita to an Ancestral Polynesian Society in early West Polynesian prehistory. If this model is correct, then a set of expectations about the patterning of evidence in early West Polynesian contexts can be generated. These expectations are discussed below and used to generate a series of questions about characteristics of the West Polynesian assemblages that should be visible archaeologically if these models are correct. The questions have been uniformly applied to the available data from each site (see Chapters 5 and 6).

Expectations of the dominant model

The West Polynesian ceramic sequence

The sequence consists of three major phases: Lapita (further divided into Early and Late Eastern components), Polynesian plainware and, most recently, an aceramic phase. These phases are considered to indicate the devolution of ceramic production across West Polynesia, culminating in the disappearance of ceramic manufacture (Green 1974b). The process of devolution, or directional change in the regional ceramic sequence, is argued on the basis of changes observed in the following morphological and technical characteristics: decoration, vessel form, sherd thickness, temper type and prevalence of ceramics.

Decoration

All ceramic assemblages identified as Lapita include sherds with dentate decoration and may also include pieces displaying a range of other decorative techniques such as incising, appliqué and notching. The decorative motifs of Western Polynesian Lapita are considered by Green (1979) and others (e.g. Kirch 1984) to be within the range of designs also found in Fiji, which together form the Eastern Lapita complex. Together with the movement of artefacts and raw materials (Kirch 1997:73), this suggests an interaction sphere in Fiji-West Polynesia following colonisation.

The transition from Early to Late Eastern Lapita is characterised by a decrease in the variety of decorative techniques employed, a decrease in the parts of the vessel on which decoration is located, and change in vessel forms (discussed below) (Green 1974b). The decline in decoration and complexity of vessel form seen in Late Eastern Lapita assemblages is interpreted as a decline in interaction with communities to the west, which all but ceased by ca. 2500 with the appearance of distinctly different ceramic assemblages in Fiji and West Polynesia (Kirch 1984:51).

Plainware assemblages may contain a very small number of decorated sherds. These are usually rim sherds with incised or notched decoration or a red slip.

Vessel form

A trend towards a simplification in, and reduction of vessel forms characterises the shift from Early Eastern Lapita to Polynesian plainware assemblages. The range of vessel forms declines through time from the complex forms of carinated pots, flat-based plates, pot stands and handled jars of Lapita assemblages, to simple open bowls or globular pots in plainware assemblages (Green 1974b; Kirch 1984:51; Smith 1976b). That some decline in the range and complexity of vessel forms occurs between the Early and Late Eastern Lapita assemblages is argued by Green (1974b), although in Kirch's (1988:185, Table 28) review of the range of vessel forms from Eastern Lapita sites in general, there is significant variation in the range of vessels in sites which appears unrelated to the chronologies of the sites. Although some forms, such as carinated bowls, are common, some varieties of large jars are only found in a small number of sites. Attributing assemblages to Early or Late Eastern Lapita on the basis of the presence/absence of vessel forms may therefore be misleading.

In all plainware assemblages the most common or sometimes the only vessel form present is a simple open bowl or globular pot, although Green (1974b) identified several variants of these forms in Western Samoan sites. Handled jars have been identified in a small number of plainware sites on Futuna (Kirch 1981), Niuatoputapu (Kirch 1988) and in the Ha'apai Group (Dye 1987).

Sherd thickness and temper type

Green (1974a) identified a rapid change through time in the sherd thickness in the Western Samoan plainware sites probably occurring ca. 2100–1900 BP (Green 1974b). On the basis of sherd thickness and temper type, he identified two discrete types of ceramics: a thin fine ware from sites SUVa4 (Layer F1) and SUSa3 (Layer 5) and a thick coarse ware from sites SUVa1 (Layer V) and SUSa3 (Layer 4) (Green 1974a). The lower proportion of thin fine ware sherds in the more recent deposits was explained as evidence of a decrease over time in the thin fine ware component of Samoan plainware assemblages, and an accompanying increase in the proportion of thick coarse ware. On the basis of uncalibrated radiocarbon determinations from the SUSa3 site, Green (1974b) suggested that this change took place over only a few centuries and was a final stage in the devolution of ceramic manufacture, heralding its final abandonment in the following one or two centuries.

Green (1974b) was never explicit about his definition of thin or thick ware. However, the wares contained different tempers, referred to as thin *fine* or thick *coarse* ware. Subsequently, researchers used sherd thickness and temper type and/or coarseness to compare assemblages to Green's Western Samoan sequence. To some extent, subsequent researchers looking for change through time in sherd thickness ignored the short chronology of the changes in Green's assemblages. Smith (1976a) has argued similar changes are evident in the Jane's Camp ceramics and a decrease in the presence of fine ware is evident in the To'aga (Hunt and Erkelens 1993) and 'Aoa ceramics (Clark and Michlovic 1996). These assemblages all represent a far longer period of time than the 200 to 300 years of Green's original sequence.

Kirch (1981) noted a change through time in the temper of the Futunan ceramics, from a calcareous sand temper in the earlier assemblages to a coarser basalt temper in the later assemblages. Calcareous sand tempers have been recorded in Lapita assemblages from Tonga and also from the Ferry Berth site in Western Samoa (Holmer 1980a) and appear to be associated with the earlier end of the plainware sequence. In contrast, basaltic sand tempers are associated with more recent plainware assemblages and thicker walled vessels (Dickinson 1993; Holmer 1980a).

Prevalence of ceramics

A decrease in density of ceramics in archaeological deposits over time has been noted for the Tongatapu midden sites (Poulsen 1987), Ha'apai Lapita sites (Dye 1987), SUSa3 in Western Samoa (Green 1974b) and the To'aga plainware assemblage (Hunt and Erkelens 1993). Green (1974b) and others (e.g. Kirch 1984) consider this phenomenon to reflect a decrease in ceramic manufacture towards its eventual cessation by ca. 1700 BP.

The characteristics of the ceramic sequence detailed above have been used to formulate a series of questions to be asked of ceramic assemblages from all sites included in the analysis. These are listed in Table 3.1, along with questions concerning the provenance and dating of the assemblages and their original interpretation.

Table 3.1 Questions to be addressed in relation to the ceramic assemblages from West Polynesian sites.

CERAMIC ASSEMBLAGE CONTEXT AND AGE
From which stratigraphic unit(s) were ceramics excavated?
Where the analytical unit(s) differs from the stratigraphic unit(s), from which analytical unit(s) were ceramics excavated?
How is the assemblage characterised in regard to the established ceramic sequence?
Into which phase(s) of the established sequence does the 14C age of the ceramic assemblage fall?
Is the ceramic assemblage from each stratigraphic unit described?
Were all the sherds from the site analysed? If not, what percentage were analysed?
CERAMIC ASSEMBLAGE CHARACTERISTICS
Are decorated sherds present?
If decorated sherds are present, what is the nature of the decoration?
What percentage of the assemblage is decorated?
What part of the vessel(s) is decorated?
Are thin and thick or fine and coarse wares described?
If so, how are they categorised and quantified?
What vessel forms are identified?
What is the density of sherds in the site/stratigraphic unit?
Are temper type(s) and/or sources discussed?
INTERPRETATION OF THE CERAMIC ASSEMBLAGE
Where there is more than one stratigraphic unit containing ceramics, what, if any, differences in the ceramic assemblages from the various units are discussed?
What explanation is provided for these differences?
Where the analytical unit(s) differs from the stratigraphic unit(s), what effect does this have on the assemblage composition?
Where the analytical unit(s) differs from the stratigraphic unit(s), what effect does this have on previous interpretations of the ceramic assemblages?

West Polynesian adze sequence

The morphological typology and the chronology of formal adze types used to define the West Polynesian adze sequence was presented in three major papers: Green and Davidson (1969), Green (1971) and Green (1974b). These continue to provide the main framework in which adzes from early West Polynesian contexts are analysed.

Green and Davidson (1969)

West Polynesian adzes were originally classified by Buck (1930:333–56) on the basis of variability in morphological attributes, in particular the adze cross-section and the degree of finishing. Green and Davidson (1969) created a modified version of Buck's classification using length, width and thickness measures, and their inter-relationships to describe and quantify diversity in Samoan adze assemblages. Although recognising similarities between the Samoan and Central East Polynesian adze assemblages, Green and Davidson (1969) chose to develop an adze typology specifically for Samoan assemblages rather than adopt a typology for Polynesian assemblages in general, as they felt 'distinctions that might prove important in Samoa tend to appear minor in contrast to distinctions between, for instance, Samoan and East Polynesian adzes'.

Their typology, consisting of ten principal adze types (Types I–X) and a small number of intermediate types, was created using excavated adzes, surface and museum collections. A chronology for the adze types was inferred using their association with ceramic or aceramic deposits and their frequency in surface collections. Adzes associated with ceramics were assumed to be present early in the sequence, and where present in the surface collections, to have continued to be manufactured throughout Samoan prehistory. The prevalence of adze types in the surface collection was interpreted as a sign of their importance in more recent prehistory. Absence of an adze type from ceramic contexts was argued to suggest post-ceramic development of that type (Green and Davidson 1969). Using this rationale, Type I was the most common form throughout prehistory, followed by Type II. Types IV and V appear to be early forms, associated with ceramic contexts and possibly missing from later assemblages. Types VI and VII were not as common overall, but found in ceramic and later contexts. Type VIII is rare. Type IX is numerous in surface collections and is probably a late type. Type X is similar to Type IX, but found in ceramic deposits. Green and Davidson (1969:32) concluded that all adze types except VIII and IX are present in early contexts.

The typology of Green and Davidson (1969) provides the framework in which the adze components of all early West Polynesian assemblages, with the exception of Poulsen's (1967) Tongatapu sites, have been described and interpreted. Poulsen (1967) developed a typology specifically for the Tongatapu sites that also built on Buck's adze typology. This is discussed in Chapter 5 in relation to the Tongatapu excavations.

Green (1971)

Green (1971) subsequently incorporated Poulsen's (1967) typology within an expanded typology for adzes from early contexts in Remote Oceania in general, thereby permitting comparison of adzes from Melanesian Lapita, Tongan, Samoan and early East Polynesian deposits. Duff (1970) had previously used distributions of adzes from surface collections to investigate the relationship of East Polynesian and Southeast Asian adze types which he argued indicated people had arrived in East Polynesia from Southeast Asia with a fully formed adze kit. Using the expanded typology of Green and Davidson (1969), Green (1971) was able to demonstrate both a similarity in the adze assemblages from Melanesia, West Polynesia and East Polynesia, and a progressive development across time and space from Melanesian Lapita sites to early East Polynesian deposits. In doing so, he provided material evidence that East Polynesian material culture was derived from West Polynesia, for West Polynesia being the Polynesian homeland and evidence for Polynesian society having developed from a Lapita precursor in West Polynesia. Within this model, the early pre-1700 BP West Polynesian adze kit is envisaged as an intermediary stage between the Fijian and East Polynesian forms, retaining some Melanesian characteristics (e.g. lenticular and plano-convex forms) and heralding the later East Polynesian adzes (characterised by quadrangular forms and incipient tangs) (Green 1971). Adze assemblages provided crucial evidence for arguments concerning social and cultural change in West Polynesia because they were the only form of material culture in which a sequence from Lapita to East Polynesia could be identified and used as a material correlate for change. As a consequence, the emphasis in analysis of these assemblages has been to establish the chronology of the West Polynesian adze types which may be used to infer a chronology for social change.

Of central importance in Green's (1971) model was the Samoan Type V plano-convex adze. This is the only adze type represented in assemblages from Fiji, West Polynesia and East Polynesia, thereby providing crucial evidence for establishing a cultural association between the regions. Adzes with a plano-convex cross-section were first described in West Polynesian assemblages by Buck (1930), but given cultural significance by Suggs (1961) following his recovery of plano-convex adzes from the early deposits in the Ha'atuatua site in the Marquesas. Subsequently, plano-convex adzes were recovered from Lapita sites in Fiji (Birks 1973), providing the basis for a comparative framework for assemblages from all three regions.

The Type V adze was of particular importance within West Polynesia because Green (1971) had noted significant differences in the range and frequency of adze types from Tongan (37 specimens) and Samoan (47 specimens) assemblages. Type V, found in both assemblages, provided a cultural link between the island groups which permitted the diversity in the remainder of the assemblages to be explained in terms other than cultural difference, for example as indicative of change through time, function or raw material availability (see below). Significant differences had also been noted between West Polynesian and East Polynesian adzes, in particular, the presence of a tang in East Polynesian assemblages. Although Green (1974a) had noted some evidence for an 'incipient' tang or butt modification in the adze assemblage from SUSa3 in Western Samoa, he concluded that the morphology and technology of manufacture were different to those seen in the East Polynesian assemblages. Thus the Type V adze, and to a lesser extent Type I, remained as the main source of evidence for establishing a cultural link between West and East Polynesian adze assemblages. Green's (1971) analysis linked the definition of adze types and their chronology to issues of colonisation and the origins of Polynesian society.

Green (1974a, 1974b)

Green (1974a, 1974b) further elaborated the Samoan adze typology of Green and Davidson (1969). Using excavated assemblages, museum and surface collections, he sought to refine the chronological relationships of the ten Samoan adze types recognised by Green and Davidson (1969). The adzes analysed by Green (1974b:Table 28) appear to consist of 846 surface collected and museum specimens, and 100 adzes from excavated contexts. Museum examples and surface finds of known provenance, (n=724 adzes), were used to establish an expected proportion of each type. This was compared to the proportional representation of adze types from the excavated assemblages and surface collections from a known location. Deviations from the proportions of adze types in the museum and unprovenanced surface collections were then noted and afforded a statistical significance. Cases of high significance were explained in terms of change through time. In other words, adzes which were common in the excavated assemblages but uncommon in museum and surface collections were considered to have been popular in the past, but had either disappeared or became less popular in more recent prehistory. Green (1974b:257) considered that, given the small number of adzes from excavated contexts:

> the strategy of testing observed frequencies in small samples against frequencies which are assumed as the population norm on the basis of a large standard sample of diverse origins, constitutes an appropriate method of establishing chronological relationships of the adze types.

The results of analysis were then interpreted in light of the context of the excavated sample, whether they are associated with decorated or plainware ceramics, and in the case of plainware, coarse or fine ware. The association of adzes with a particular type of ceramic permitted refinement of the chronology of types with reference to the radiocarbon dates obtained by Green and Davidson (1974:216) from Western Samoan ceramic deposits.

Green (1974b) concluded that the Samoan Type V plano-convex adze and Type I trapezoidal section adze were not only dominant in Samoan ceramic assemblages, occurring in equal proportions in Samoan assemblages dated to ca. 2000–1800 BP, but also in early West and East Polynesian assemblages. Type I adzes continued to be common throughout Samoan prehistory. It also appeared that several adze types common in later Samoan assemblages (Types II, IX/X and VI) first appear in Samoan coarse ware ceramic deposits and are missing from Tongan Lapita assemblages:

> [T]he changes from the Lapita adze kit to a typically Polynesian one took place before the second century AD and on the evidence of the adze assemblage associated with the fine ware context, at least some of the changes occurred about that time or not long before. Unfortunately the change in Samoan adzes in the period prior to the first century AD, which would involve Types II, III, IX/X, VI and VII is not directly documented in our present Samoan materials. (Green 1974b:259)

It was not possible in 1974 to investigate the early chronology of most of the adze types owing to the small sample numbers of some types and the limited number of dated excavated contexts from which they had been recovered. The Type V, and to a lesser degree, Type I adzes were exceptions to this. While Green and Davidson (1969) had found a strong association between the Type V adze and ceramic assemblages, they suggested this type may have continued to be manufactured in the aceramic period. Green (1974b:261) found the Type V adze, a 'heavier general purpose shaping tool', in the aceramic Samoan surface collections in proportions higher than expected, leading him to speculate that the type may have persisted until as recently as 800 BP.

The Type VI adze is characterised by a triangular cross-section, regarded as a Polynesian elaboration (Green 1974a). The earliest examples occur with plainware deposits in Western Samoa and they are absent from earlier Tongan and Fijian contexts. Although the triangular cross-section adzes may be a modified version of a Type V adze, Green (1974a) considers that the Type VI and VII triangular cross-section adzes are more likely to be wholly new forms and no good morphological case can be made for the gradual evolution of triangular adzes from one of the existing forms except perhaps Type Vb, because chronologically they appear quite suddenly in Samoa with no obvious antecedents.

More recently Kirch (1988:198) and Kirch and Hunt (1993) have argued that the Type V adze was not manufactured after the cessation of ceramic production. Kirch (1988:198) concluded on the basis of the Niuatoputapu adze assemblage that Types I, II, IV and V are Samoan innovations of the first millennium of Samoan prehistory.

Discussion

A summary of the West Polynesian adze sequence is presented in Table 3.2. With the exception of Kirch's (1988:192) minor modification to Green and Davidson's (1969) initial typology, the ten formal adze types have continued to provide the basis for classifying West Polynesian adze assemblages. The Type V adze is consistently used as a chronological marker for West Polynesian assemblages, being described as an innovation associated with Ancestral Polynesian Society (Kirch and Hunt 1993:239). The Type I adze, considered by Green (1974b) to be an early West Polynesian innovation, has received substantially less attention, possibly because this adze form was manufactured throughout Samoan prehistory and is therefore not exclusively associated with ceramic assemblages or the Ancestral Polynesian Society.

Change through time is not the only explanation provided by Green for variability in the adze sequence. He also (Green 1974a:141–3) provided an environmental explanation for the innovations he identified in the Western Samoan adzes, suggesting that morphological innovations were a response to the restricted and different raw materials available east of the Andesite Line. This would appear to contradict his explanation of morphological variability indicating social or cultural change, although the evidence by which social change may be reflected in stone artefacts is never explicitly discussed. Although some work has been undertaken on sourcing basalt in West Polynesia (Best et al. 1989; Leach and Witter 1987; Weisler 1993), no technological studies of adze manufacture are available against which the morphological typology may be assessed. In the analysis presented herein, the adze sequence is assessed only on its internal logic, since the collections were not available for reanalysis using any alternative approach. A set of questions concerning the representation of adze types in the West Polynesian assemblages, information about raw materials used and their sources, and previous interpretations are listed in Table 3.3.

Table 3.2 Summary of the West Polynesian adze sequence.

ADZE TYPE	SAMOAN CERAMIC CONTEXT	CHRONOLOGY
I	most common type throughout sequence	early to the historic period, several varieties, especially in the early period
II	coarse ware contexts	confined to Samoa, probably post-2000 BP
III	coarse ware contexts	possibly early, known from early Tongan contexts
IV	fine ware contexts	early (Tongan assemblages pre-2000 BP)
V	coarse and plainware common 2000–1800 BP	early (Tongan and Fijian Lapita, and early East Polynesian assemblages)
VI	coarse ware contexts	triangular cross-section, Polynesian innovation, uncommon in Tongan assemblages
VII	? coarse ware	last 1000 years
VIII	aceramic	? late
IX/X	coarse ware contexts	probably early ca. 2500 BP

Table 3.3 Questions to be addressed in relation to the adze assemblages from West Polynesian sites.

ADZE ASSEMBLAGE CONTEXT AND AGE
How many adzes or adze fragments are present in the site?
Are they excavated or surface finds?
If excavated finds, from which stratigraphic unit(s) were they excavated?
Where the analytical unit(s) differs from the stratigraphic unit(s), from which analytical unit(s) were they excavated?
ADZE ASSEMBLAGE CHARACTERISTICS
According to Green and Davidson's (1969; Green 1971, 1974a, 1974b) adze typology, which type(s) of adze is represented?
What is the raw material(s)?
Is a raw material source discussed?
Are there basalt flakes or debitage reported?
INTERPRETATION OF THE ADZE ASSEMBLAGE
How has the adze assemblage been interpreted?
Has change through time in the assemblage been noted?
Do the analytical unit(s) used in the present analysis affect this interpretation?

Other artefact component of early West Polynesian assemblages

In this monograph, artefacts other than ceramics and adzes are referred to as the 'other artefact' component of sites. This component consists of a large range of artefact types including shell rings, fishhooks, abraders, stone flakes, as well as other tools manufactured from stone, bone and shell. With the occasional exception of flaked stone artefacts, these other artefacts are relatively infrequent when compared to ceramics and rarely feature prominently in site reports. Unlike the ceramic and adze assemblages, the variability in morphological characteristics of individual artefact types has not been used to argue socio-cultural change in West Polynesia. This may be due to an assumption that ceramics provide the most sensitive indicators of social change (Poulsen 1968) or as a result of poor organic preservation in the West Samoan ceramic sites used by Green and Davidson (1969; Green 1974b) to initially define the Samoan cultural sequence.

In East Polynesia sites that lack a ceramic component, fishhooks have been central to establishing patterns of colonisation and cultural change (see Allen 1996). A similar use of fishhooks in early West Polynesian prehistory has been precluded by their virtual absence from early deposits, a phenomenon initially considered to be due to preservational factors. However, the excavation of a number of midden sites with well preserved organic material in which fishhooks were still relatively infrequent has led to more recent suggestions that line fishing was not an important strategy in early West Polynesia (Kirch and Hunt 1993:239–40).

The other artefacts are usually categorised according to functional typologies such as 'ornament', 'manufacturing tool' or 'food preparation tool', or are simply described, for example shell disk, bone point or stone flake. Where a function is implied by the descriptive category, the evidence for this is rarely made explicit by the researcher. The function may originally have been ascribed through ethnographic analogy, but has since become codified in the literature as a method of describing artefacts of similar shape and/or manufacture. It is clear from archaeological literature from the Pacific that a range of artefacts of similar appearance are consistently found in archaeological deposits over large areas, in particular those associated with dentate Lapita ceramics. It has been assumed, or implied through the nomenclature, that a morphological similarity in artefacts from different sites or regions equates with functional similarity, as well as reflecting a cultural link. Artefacts such as fishhooks have a readily identifiable use, however more amorphous artefact forms such as shell vegetable scrapers may have a variety of uses. Further, as Spennemann (1993) has demonstrated, non-cultural breakage patterns in shell may mimic the breakage patterns of use and artefact manufacture. Little research has been undertaken to establish criteria for recognising amorphous shell artefacts or the debitage of shell artefact manufacture in general (Smith 1991; Smith and Allen 1999). Studies that incorporate use-wear and residue analyses and that potentially provide a measure of similarity in use(s) across time and space in this region are rare.

In some cases, a function for the artefacts may be implied by their description, such as grindstone, but the behavioural implications are rarely discussed. An exception to this has been the association of artefacts identified as food preparation tools with agriculture (Janetski 1980a; Kirch 1988:208–9, 1997:213–15). Kirch (1988:252) considers shell artefacts from the Niuatoputapu excavations identified as vegetable scrapers and peelers to provide direct evidence for agriculture having arrived in West Polynesia at the time of Lapita colonisation, although as Best (1984:495) points out:

> It is perhaps unfortunate that we are not provided with the criteria by which these shells have been identified as such, as they seem to form one of the main pieces of evidence that Kirch sees as rebutting the 'strandlooper' theory of Groube (1971).

This issue is discussed further in the following section. The presence of a specific artefact type, or the raw material from which it is made, has occasionally been used as evidence for the interaction and movement of people. Kirch (1988:254) suggests that shell ornaments recovered from Lapita contexts are valuables and a component of long-distance exchange. He argues that the presence of shell ornaments in the Niuatoputapu site with an absence of evidence for their manufacture indicates that these items were being imported from elsewhere, possibly Fiji. The absence of shell valuables in more recent sites (NT-93 and NT-100) is considered indicative of the breakdown of exchange networks in the post-Lapita period (Kirch 1988:255).

Following the excavation of a number of midden sites with well preserved organic material in Samoa and Tonga, the behavioural and cultural implications of the assemblages have been discussed by several researchers. Kirch (1984) has used the excavated assemblages, together with linguistic and ethnographic evidence, to infer social and subsistence patterns of an Ancestral Polynesian Society. Kirch (1984:53) argues, principally using evidence from his Niuatoputapu excavations, that the:

> Ancestral Polynesian tool kit included a variety of adze forms, stone and shell chisels, hammerstones, abraders of branch coral and echinoid spines, rubbing or polishing stones, grindstones and smaller whetstones...we have numerous examples of several varieties of vegetable peelers and scrapers...the earth oven is well attested, with excavated examples from seven sites. Fishing gear has been only sparsely represented...but one-piece shell fishhooks, net weights, and Cypraea-shell caps for octopus lure gear are attested; several possible trolling lures are also in evidence...we have a series of shell ornaments, including Trochus shell armbands, a variety of shell beads and rings, and several kinds of 'bracelet' segments of Tridacna or Spondylus shell.

His identification of an Ancestral Polynesian tool kit implies that a distinct material culture assemblage developed in West Polynesia from earlier Lapita assemblages and is a forerunner of subsequent Polynesian material culture in West and East Polynesia. Although the differences are not specifically discussed, the labelling of artefacts belonging to the other artefact component as Ancestral Polynesian reinforces the cultural sequence based on variability in the ceramic and adze assemblages.

The other artefact component of the West Polynesian assemblages, has been tabularised according to the questions presented in Table 3.4. This permits the temporal and spatial distribution of artefact types to be investigated and arguments for a distinct Ancestral Polynesian tool kit to be assessed. The results of the assessment of the other artefact evidence are discussed in Chapter 8.

Table 3.4 Questions to be addressed in relation to the other artefact assemblages from West Polynesian sites.

CONTEXTUAL AND DESCRIPTIVE INFORMATION
What other artefactual material is reported from the site?
What is the provenance, raw material and raw material source for each functional type?
INTERPRETATION OF THE OTHER ARTEFACT ASSEMBLAGE
What behavioural explanation is offered for the presence of specific artefacts in the site?
Is any change through time reported in the presence, type or function of artefacts?
How do the analytical unit(s) used in the present analysis affect the distribution of functional types in the assemblage?
What effect does this have on previous interpretations of the artefacts?

Early West Polynesian faunal assemblages

Over the past decade much archaeological research in Remote Oceania has emphasised the exploitation of easily accessible indigenous food resources by initial colonisers, often appearing to result in, or contribute to, local extinctions (e.g. Dye and Steadman 1990; Steadman 1989, 1993). This archaeological signature provides a means of assessing whether archaeological deposits are likely to be among the earliest on an island or island group because of the association of endemic terrestrial and some marine fauna with initial human use of an island or region (Burley et al. 1995). Two explanations have been used to account for this pattern in Fiji-West Polynesia. In both, the endemic resources are seen as easily accessible and abundant food supplies, but are vulnerable to over-exploitation and hence quickly decline in the archaeological record. The first explanation suggests that that local resources sustain the population until agriculture is established using the plants and domesticates brought by the colonisers (see Kirch 1988:252). The implication of this hypothesis is that the colonisers were actively colonising islands, effectively 'transporting landscapes' (Kirch 1997:217) comprising a suite of cultigens and domesticates in order to provide staple food resources once permanent occupation had been established. While this is in progress, wild, easily exploitable fauna form the subsistence base. The archaeological pattern of such a strategy is one in which indigenous resources dominate early deposits, but subsequently decline in range, possibly size (in the case of shellfish), and in quantity. Species such as land birds and turtles, sensitive to over-exploitation and the introduction of domesticates such as dog and chicken and commensals such as Polynesian rat, are likely to disappear relatively rapidly from the faunal sequence. Marine resources of shellfish and fish continue to be exploited, but decrease in importance as agriculture is established. Domesticates and 'indirect' evidence of agriculture (such as shell scrapers and peelers) are present in the record from initial colonisation, but increase proportionately with the decrease in endemic fauna. This pattern of resource utilisation has been argued to be visible in early West Polynesian sites (Kirch 1982, 1988; Kirch and Hunt 1993). Following initial Lapita colonisation, agriculture becomes dominant. The subsequent Ancestral Polynesian subsistence economy is described as 'integrating broad-spectrum exploitation of natural faunal resources (marine and terrestrial) with agricultural production' (Kirch and Hunt 1993:242).

An alternative explanation was offered by Groube (1971) and subsequently elaborated upon by Best (1984). Both consider that initial human visitors to islands may have been transient, mobile groups, possibly seasonal visitors, who exploited the abundant indigenous terrestrial and marine resources but who did not settle permanently. It appears:

> Lapita potters, initially at least, had a restricted maritime/lagoonal economy and that either the development or introduction of a viable horticultural economy enabled them to expand and survive in Fiji and Tonga. (Groube 1971:312)

Groube (1971) identified the initial maritime/lagoonal Lapita economy of West Polynesia as 'strandlooper'. This argument is based on the presence of indigenous fauna in early archaeological deposits coincident with the absence or paucity of direct evidence for agriculture or domesticates. In particular, sea turtle bones in Lapita deposits and their scarcity or absence in later plainware sites provide evidence of this early resource strategy and an explanation for the location of Lapita sites on beaches where sea turtle would be easily procured (Dye and Steadman 1990).

The archaeological pattern for this alternative explanation is therefore similar to that of the first, in that the range of endemic fauna is likely to be greatest in the earliest deposits. This is clearly different to the archaeological evidence of a later horticultural or agricultural economy. However, although Best (1984:562) was able to identify an initial stage of periodic visits of ca. 200 years in the Lakeba sequence, archaeological evidence is rarely fine-grained enough to be able to discern between archaeological deposits of initial exploration and those of subsequent, more permanent, settlement (cf. Irwin 1992:61). Therefore, the chronology for the appearance of direct evidence for agriculture in the archaeological sequence provides the focus on which arguments for and against a strandlooper model rest.

Central to establishing this chronology has been the dating of pig bone in archaeological deposits, with the presence of pig acting as proxy evidence of horticulture. It has long been considered that domesticates (i.e. pig, dog and chicken) reached Remote Oceania as part of a Lapita colonisation strategy which included the active transport of a suite of cultigens and domesticates with which to establish an agricultural subsistence economy (Kirch 1984:56, 1997:193). Underlying this theory is the belief that the subsistence economy of Lapita, like the language, material culture and physical biology, is directly ancestral to that of later Polynesian economies, having arrived in West Polynesia during initial colonisation as a complete cultural package from Southeast Asia.

Three major assumptions underlie this scenario. Firstly, that a direct correlation may be made between pigs and agriculture. Secondly, that the 'package' of subsistence observed ethnographically arrived in West Polynesia as such, rather than developing over time in interaction with communities to the west. Thirdly, that Lapita sites, whether situated in West Polynesia or Island Melanesia, while exhibiting some variability in cultural material, reflect a similar underlying social and economic system.

The particular depositional contexts of a number of Lapita sites in Island Melanesia have permitted the preservation of direct evidence of a range of fruit and nut species indicating the practice of arboriculture (Kirch 1997:205). Although direct evidence for the cultivation of roots or tubers is lacking, according to Kirch (1997:205) this should be seen as a kind of 'sampling error' resulting from lack of preservation of softer organics, which can be overcome by looking at linguistic reconstructions of Proto-Oceanic plant terms.

The other main evidence in Lapita sites for animal husbandry, and by inference horticulture, is the presence of chicken bone (in several sites) and pig bone [albeit in small quantities from the Talapakamalai site in the Mussau Islands (Kirch 1997:211)].

Kirch, Green and others consider there is ample evidence for agriculture in West Polynesian Lapita and Ancestral Polynesian sites. However, with the exception of a small amount of pig bone from Poulsen's (1987) Tongatapu sites and from Kirch's (1988) Niuatoputapu sites, the evidence consists almost entirely of indirect evidence such as shell scrapers and pits, the function of which have not been conclusively demonstrated.

Best (1984:544–5) has argued for Lakeba, and possibly other locations in the Fijian islands, that the primary evidence for agriculture, i.e. pig, does not appear earlier than ca. 1000 BP. This is despite evidence for expansion of settlement inland from about 2500 BP (Best 1984:631), and evidence for a major episode of erosion ca. 1900 BP (Best 1984:563), of which both events suggest the introduction or expansion of agriculture.

Table 3.5 lists questions which are used to formalise the faunal data from West Polynesian sites in order to address questions concerning the early West Polynesian subsistence base and the chronology for the introduction of agriculture to the region. The data are reported in Chapters 5 and 6 and discussed in Chapter 9 in reference to issues of change through time evident in the faunal assemblages.

Table 3.5 Questions to be addressed in relation to the faunal assemblages from West Polynesian sites.

FAUNAL ASSEMBLAGE CONTEXTUAL INFORMATION
Is faunal material reported as occurring in the site?
If not, what is the reason offered for the absence of faunal material?
If so, is the assemblage composition detailed for each stratigraphic unit?
MARINE FAUNA COMPONENT
What marine fauna occur in the site?
What variability is there in the composition of marine fauna assemblages?
How is this explained?
TERRESTRIAL FAUNA COMPONENT
What indigenous terrestrial fauna occur in the site?
What is the stratigraphic context of this material?
What domesticates and commensals occur in the site?
What is the stratigraphic context of this material?
INTERPRETATION OF THE FAUNAL ASSEMBLAGE
Is a change through time in the composition of faunal assemblage described?
How is it explained?
Where the analytical unit(s) differs from the stratigraphic unit(s), what effect does this have on the character of the faunal assemblage?
What effect does this have on previous interpretations of the faunal assemblage?

Summary

It has been illustrated through the discussion above that there has been an overwhelming reliance on morphological characteristics of ceramic and adze assemblages for inferring socio-cultural change in early West Polynesian prehistory. Both the ceramic and adze sequences were initially developed on the basis of limited evidence from a small number of sites. They have been subsequently used as a framework for interpretation of assemblages from other sites. However, discussion of the comparability of evidence, in particular in the identification and quantification of specific characteristics and/or artefacts exhibiting particular characteristics, has not been pursued in the literature. Alternative methods of assessing variability in artefact assemblages, such as technological and functional analyses are rare, cultural variability being assumed to be a primary determinant of morphological variability in artefacts and their presence or absence from an assemblage.

Given this, the questions developed for the various categories of data (Tables 3.1, 3.3, 3.4 and 3.5) provide a means to make data from a large number of sites comparable. The data from sites selected for analysis are reported in Chapters 5 and 6. The method and results of site selection procedure are presented in the next chapter.

4

Assessment of West Polynesian radiocarbon dates

THE PROCEDURE for assessing the West Polynesian archaeological evidence against the expectations of the established cultural sequence relies on the creation of a comparative regional framework based on the radiocarbon chronology. Hence, the initial criterion for inclusion of any specific site in the analysis was that radiocarbon dates were available for the site. However, while radiocarbon determinations provide an independent means with which to create such a framework, as has been demonstrated by Pacific archaeologists (Anderson 1991; Anderson et al. 1994; Spriggs 1990; Spriggs and Anderson 1993) the accuracy of radiocarbon determinations cannot automatically be assumed. The second criterion was that at least one radiocarbon date from each site be demonstrated to be acceptable on the basis of a number of assessment protocols. This was considered particularly relevant to the West Polynesian radiocarbon sequence because many of the published dates had not been calibrated or corrected according to current conventions. The range of probabilities encompassed by conventional determinations had also not been considered in the interpretation of dates in many of the reports published prior to the 1980s.

The third criterion for selection of a site for analysis was that at least one of the dates from the site has a conventional radiocarbon age ≥ 1000 BP, or a calibrated range including the period pre-1000 cal BP. The early prehistory of West Polynesia is usually considered to be the period prior to ca.1000 BP. This is the date commonly associated with the establishment, at least in Tonga, of the social system recorded at European contact, evident in the appearance of mounds and other monumental features in the landscape. This date is somewhat arbitrary, being based in part on the dating of genealogies which extend back close to 1000 BP (Burley 1994), and partly on three phases into which Poulsen divided the 3000 years of Tongan prehistory (Janet Davidson pers. comm.). While to some extent selecting sites with cultural deposits dated older than 1000 BP reinforces the established cultural chronology, in practice the calibrated dates blur this boundary, permitting some investigation of the arguments for change in the archaeological record considered to take place at this time.

Methodological and interpretive issues in radiometric dating

Complexities of radiocarbon determinations

Establishing the chronology of cultural material is fundamental to archaeological research. Absolute dating techniques potentially provide archaeologists with an independent and accurate means of dating archaeological deposits and establishing chronological relationships within and between sites. However, reviewing the history of radiocarbon dating reveals that the optimism with which the method was embraced by archaeologists in the 1950s and 1960s was perhaps premature. A constantly expanding body of data concerning variables affecting the outcome of ^{14}C dating (such as sample size and type, variability in the carbon reservoir or fluctuations in the breakdown of ^{14}C to ^{12}C) has substantially complicated interpretation of radiocarbon results. Furthermore, archaeologists have increasingly recognised the influence of taphonomic processes in the patterning of archaeological evidence, introducing a complexity to present arguments for the association of dated samples with evidence for the events or phenomena the samples are claimed to date.

Many of the radiocarbon determinations from West Polynesia, including those on which the established cultural chronology was based, were obtained before the mid-1980s, and therefore prior to the use of currently recognised protocols for obtaining, detailing and interpreting radiocarbon dates. Importantly, this includes use of the universally recognised curve for the calibration of conventional dates (Mook 1986). In order to assess the West Polynesian radiocarbon chronology, dates need to be calibrated and the ^{13}C and/or marine reservoir correction factors need to be considered. Although more recently obtained dates are reported according to present standards, to ensure comparability, all available ^{14}C determinations (both pre- and post-1980s) were re-calibrated and corrected as necessary.

There are a number of texts outlining the major issues of concern for archaeologists in evaluating chronologies assigned using ^{14}C determinations (e.g. Aitken 1990; Bowman 1990; Taylor 1987). Taylor (1987:15) identifies these issues as falling into two components:

1. Sample provenance factors or the 'contextual parameters that document the relationship of a sample to a specific archaeological feature'; and,
2. The 'degree to which the geophysical and/or geochemical assumptions of the method hold for a particular sample or related set of samples'. This is influenced by sample composition factors such as variations in the carbon isotope ratios, statistical and experimental factors relating to the nature of radiocarbon decay and measurement of it, and systemic factors including temporal and secular variation in atmospheric ^{14}C concentrations and reservoir effects.

In the analysis of West Polynesian radiocarbon dates presented herein, both of these factors are taken into account. Sample provenance factors are considered with reference to individual ^{14}C determinations. Prior to this, factors listed under (2) above affecting the accuracy and precision of the dates are discussed in detail.

Accuracy of radiocarbon determinations

Taylor (1987:106) defines the *accuracy* of an individual ^{14}C determination as being how close the number produced is to the true age of the actual event or phenomenon it relates to. *Precision* is defined as the time range of the ^{14}C determination within which the event or phenomenon is considered to lie (Taylor 1987:106).

Of central significance in the factors which affect the accuracy of a date are:

1. Secular variation effects, i.e. fluctuations in the relationship between production and decay rate of carbon. These fluctuations include both long-term major trends and short-term, higher-frequency or 'de Vries' effects (Aitken 1990:67). They can result in differences between the measured ^{14}C age and the known or actual age of archaeological material. There are a number of calibration curves available for correction of secular variation. The one used in the analysis reported herein is Stuiver and Reimer's (1993) CALIB 3.0 program.

2. Contamination of the sample with carbon from other sources may result in an inaccurate date. Also important to recognise is that charcoal from wood with a built-in age will give an age for the death of the tree, but not necessarily the event or phenomenon of interest.
3. Natural variation in the ratios of stable carbon isotopes (13C/ 12C), known as δ^{13}C values. This may result in differences in the ^{14}C/^{12}C ratio, measured to obtain the ^{14}C age, in samples of different materials that are actually the same age. This fractionation effect, due to differential uptake of the carbon isotopes in different environments, in particular marine versus terrestrial, results in a difference in ^{14}C ages between samples from these different environments known to be of the same age. A common δ^{13}C scale is available for correction of 14C determinations for fractionation effects, giving a conventional corrected age prior to calibration.

Systematic factors

Systemic factors affecting ^{14}C values are 'those deriving from violations of the primary assumptions of the ^{14}C method' (Taylor 1987:126). These assumptions are that ^{14}C concentration is constant in living materials over time and that 14C concentrations are constant in each of the carbon reservoirs. The marine reservoir effect results from the upwelling of 'older' water from deeper parts of the ocean to the surface. The ^{14}C concentration of the deeper, older water is reduced and, as a consequence of mixing with surface water, the overall proportion of ^{14}C in the water from which a marine shell draws its carbon is also reduced. This has the effect of making the shell appear older in radiocarbon years than it actually is. Correction factors for the marine reservoir effect vary with geographic regions, as some areas are more liable to upwelling than others. ΔR values for correcting for marine reservoir effects are available for some regions (see below) and have been applied where relevant as part of the calibration process.

Contextual factors

The contextual or 'sample provenance factors' (Taylor 1987:15) are those concerned not with the accuracy of the date itself, but with the accuracy of the association of the date with a particular 'event'. The event is whatever phenomenon the archaeologist is dating, be it the cultural material excavated from a particular stratigraphic unit, or a specific event such as a burial. The contextual factors are those with which the archaeologist, rather than the radiocarbon dating expert, is directly concerned. The degree of reliability that the date of the event falls within the range of a ^{14}C determination is dependent upon establishing the association of the dated sample and evidence for the event. Dates from samples that are part of the event, such as human bone used to date a burial, have a greater reliability than dates from samples that are merely in the same stratigraphic unit. These in turn have a greater reliability than dates from samples from an adjacent feature and so on (Aitken 1990:90). However, the reliability of the association is dependent upon the archaeologist's interpretation of the site and the strength of their arguments for the reality of the event.

The practice of 'chronometric hygiene' in the Pacific

Factors likely to affect the accuracy of radiocarbon sequences have been discussed generally by Pacific archaeologists since the early 1970s (Green and Davidson 1974:213), but were not systematically used to assess radiocarbon sequences until the mid-1980s (Weisler 1989). Since then a number of analyses have been published, collectively labelled 'chronometric hygiene', that were designed to 'clean up' radiocarbon sequences through the removal of erroneous dates (Anderson et al. 1994; Rolett and Conte 1995; Spriggs 1990; Spriggs and Anderson 1993).

Initially, Spriggs (1989) critically assessed Southeast Asian radiocarbon determinations used to construct the chronology for what he identifies as Austronesian expansion from insular Southeast Asia into the Pacific. His work drew on analyses from other regions such as Egypt, where radiocarbon chronologies are considered critical in evaluating sequences based on other evidence (e.g. Hassan and Robinson 1987). Although not explicit in the specific criteria he applied, Spriggs (1989:604) identified the following general areas of concern in assessing the accuracy and reliability of radiocarbon determinations:

- large standard deviations resulting from small sample sizes;
- the dependency of the result (and its calibration) on the sample material;
- inadequate reporting of individual determinations;
- the association or relationship of the dated sample to cultural material;

And, specifically in relation to Pacific archaeology,

- the unreliability of dates produced by the Gakushuin laboratory during the early years of its operation.

In more recent chronometric hygiene analyses (Anderson 1991; Graves and Addison 1995; Spriggs 1990; Spriggs and Anderson 1993), these concerns have been formalised into specific criteria or protocols with which individual dates have been assessed. Guiding these analyses are questions concerning the chronology of colonisation in the Pacific, particularly the dating of the earliest human presence at a site, island or region. Using the criteria, individual determinations can be assessed and those found to be unacceptable rejected. In each case study listed previously, this resulted in a shortening of the established chronology for the region or site. In the New Zealand (Anderson 1991) and Eastern Polynesian (Spriggs and Anderson 1993) assessments, the pattern of radiocarbon determinations which remained following rejection of erroneous dates are interpreted as evidence for the chronology, and sometimes the process of colonisation (Anderson 1995). Although the assessment protocol requires that an association between dated sample and archaeological evidence be established, the nature of the cultural material is secondary or insignificant.

The more recent analysis of the Hane sequence from the Marquesas by Anderson et al. (1994) used the principles of previous chronometric hygiene analyses to establish reliable dates from the site as an initial means to investigating the relative chronology of cultural deposits within a single site. As discussed in detail in Chapter 3, the results of this assessment had consequences for the way in which the stratigraphy had previously been used to create temporal units in the site. Using the Hane site reports in association with the revised radiocarbon sequence, alternative chronostratigraphic units for the site were argued.

In this monograph a similar approach is taken in that an assessment of the radiocarbon chronology is used to provide a secure framework in which temporal and spatial variability in the assemblages may be investigated.

Chronometric hygiene in West Polynesia

The data base

The published reports of the West Polynesian archaeological research reviewed in Chapter 2 serve as the sources of radiocarbon determinations included in this analysis. All available radiocarbon determinations (n=139) have been assessed according to the protocol discussed below. The determinations derive from all excavated deposits throughout West Polynesia, with the exception of sites on 'Uvea (Frimigacci and Vienne 1987) for which details of dates could not be obtained. Details of the 139 individual radiocarbon determinations (from 47 sites) are provided in Table 4.1. Whilst several sites have a number of dates, in most cases these date the same stratigraphic unit within the site, leaving very few dated sequences within sites. Prior to assessment of the dates, all determinations were calibrated to investigate what impact this may have on the chronological relationships between sites as currently interpreted and on the chronology of the established West Polynesian cultural sequence.

For many of the determinations published prior to the mid-1980s, details about the sample dated, its size and material, and the preparation and dating procedures employed were rarely included in the report, which to some extent made the assessment procedure more difficult.

Table 4.1 West Polynesian radiocarbon dates discussed in the text.

LAB NO.	SITE NAME	PROVENANCE	BP	SD	CALIBRATED DATE BP (1 SIGMA)	CALIBRATED DATE BP (2 SIGMA)	CATEGORY
Beta-19742	To'aga AS-13-1	initial test pit, Layer D, Level 10	2350	50	1897 (1839) 1782	1962 (1839) 1705	2
Beta-25033	To'aga AS-13-1	main excavation Unit 6, Layer IIA-1	2640	80	2308 (2179) 2089	2354 (2179) 1975	1
Beta-25034	To'aga AS-13-1	main excavation, Unit 6, Layer IIB	2570	80	2189 (2105) 1999	2306 (2105) 1916	1
Beta-25035	To'aga AS-13-1	main excavation, Unit 6, Layer V	3820	70	3702 (3622) 3538	3823 (3622) 3445	3
Beta-25673	To'aga AS-13-1	main excavation, Unit 1, Layer V	3620	80	3470 (3379) 3316	3587 (3379) 3204	3
Beta-26463	To'aga AS-13-1	Unit 3, Layer II	1910	50	1388 (1326) 1285	1465 (1326) 1251	3
Beta-26464	To'aga AS-13-1	Unit 10, Layer IIB	2620	140	2848 (2744) 2396	3023 (2744) 2344	1
Beta-26465	To'aga AS-13-1	Unit 13, Layer III	1600	70	1124 (1036) 948	1203 (1036) 902	3
Beta-35600	To'aga AS-13-1	Unit 17, 53 cm bs	1190	70	1175 (1166, 1164, 1076) 971	1275 (1166, 1164, 1076) 935	1
Beta-35601	To'aga AS-13-1	Unit 28, base Layer II	2900	110	3235 (3018, 3013, 2999, 2983, 2970) 2854	3356 (3018, 3013, 2999, 2983, 2970) 2761	2
Beta-35602	To'aga AS-13-1	Unit 23, Layer IIIA	2630	100	2838 (2747) 2545	2947 (2747) 2361	1
Beta-35603	To'aga AS-13-1	Unit 23, base Layer IIIB	2600	170	2915 (2740) 2362	3156 (2740) 2210	3
Beta-35604	To'aga' AS-13-1	Unit 23, Layer IIIB	2770	80	2440 (2332) 2284	2649 (2332) 2133	1
Beta-35924	To'aga AS-13-1	Unit 15, Layer II	2100	70	1625 (1536) 1466	1716 (1536) 1368	1
Beta-48049	'Aoa AS-21-5	Locality 2, Unit 7, Layer VII ca. 170 cm bs	2890	140	3240 (2998, 2986, 2965) 2784	3382 (2998, 2986, 2965) 2742	2
Beta-48911	'Aoa AS-21-5	Locality 2, Layer VII, 128–148 cm bs	2460	110	2736 (2633, 2608, 2468, 2413, 2381) 2347	2764 (2633, 2608, 2468, 2413, 2381) 2164	2
Beta-48912	Leone AS-34-45	Test pit 6, Layer V, Level 9, 85–90 cm bs	930	80	930 (884, 864, 827, 813, 798) 737	967 (884, 864, 827, 813, 798) 672	3
Beta-38438	Alega AS-23-21	interface Layers I and II, 30–40 cm bs	1040	230	1255 (950, 936, 934) 692	1387 (950, 936, 934) 547	3
Beta-38752	Faga AS-11-1	Unit 1, Layer VII, 130-136 cm bs	910	80	926 (794) 731	962 (794) 668	3
I-10632	Lolokoka NT-90	S24 II (2), IB	3770	90	3676 (3563) 3449	3814 (3563) 3350	2
I-10633	Lolokoka NT-90	I21III(3),IB	3620	85	3473 (3379) 3311	3600 (3379) 3192	2
I-9934	Lolokoka NT-90	A25,IB, 34-54 cm	1815	130	1885 (1713) 1559	2035 (1713) 1411	2
I-10481	Lolokoka NT-90	Q28II(3), IB,32-36 cm	1110	75	1166 (1048, 1039, 970) 933	1176 (1048, 1039, 970) 802	2
I-9936	Loto'aa NT-100	220, IB,57-66 cm	1120	165	1257 (1049, 1034, 972) 801	1339 (1049, 1034, 972) 688	3
I-9937	Loto'aa NT-100	269,IIA,67-75 cm	1220	95	1262 (1170, 1159, 1147, 1096, 1094) 972	1306 (1170, 1159, 1147, 1096, 1094) 932	1
I-10634	Loto'aa NT-100	269,IIA	1720	80	1258 (1169) 1068	1308 (1169) 971	1
Beta-8682	Loto'aa NT-100	210,40-60 cm	1290	100	832 (711) 643	928 (711) 548	2
Beta-8684	Loto'aa NT-100	269, IIA, 67-75 cm	1160	60	1173 (1069) 971	1261 (1069) 953	1
Beta-8683	Pome'e-Nahau NT-93	120, IC,40-60 cm	1750	60	1265 (1205) 1136	1302 (1205) 1053	2
I-10482	Niutoua NT-125	20N, Bed 4	1140	75	1169 (1053, 1028, 1007) 956	1259 (1053, 1028, 1007) 924	3
CAMS-7145	Faleloa	Unit 7, Stratum III	2940	60	3192 (3154, 3136...3075, 3057, 3004) 2962	3320 (3154, 3136...3075, 3057, 3004) 2873	1
CAMS-7146	Faleloa	Unit 10, Stratum III, pit feature U	2560	70	2748 (2720) 2397	2778 (2720) 2359	1
CAMS-8074	Faleloa	Unit 12, Stratum III, pit feature W	2560	60	2745 (2720) 2400	2771 (2720) 2362	1
CAMS-41529	Faleloa	Unit 18, Level 3, Stratum III	2550	50	2680 (2710, 2580, 2570, 2560, 2540) 2430	2730 (2710, 2580, 2570, 2560, 2540) 2370	1
CAMS-41530	Faleloa	Unit 18, Stratum III	2600	50	2720 (2720) 2480	2750 (2720) 2380	1
CAMS-41523	Vaipuna	Unit 12, Level 5, Stratum IIa	2580	50	2710 (2720) 2460	2740 (2720) 2380	1
CAMS-41524	Vaipuna	Unit 8, Level 10, Stratum III	2760	50	2870 (2780) 2770	2940 (2780) 2750	1
CAMS-41525	Vaipuna	Unit 14, Level 5, Stratum II	2560	50	2680 (2710, 2560, 2540) 2440	2730 (2710, 2560, 2540) 2370	1
CAMS-41526	Vaipuna	Unit 14, Level 8, Stratum III	2690	50	2810 (2750) 2730	2850 (2750) 2530	1
CAMS-41531	Vaipuna	Unit 3, Level 8, Stratum III	2620	50	2740 (2740) 2500	2760 (2740) 2390	1
CAMS-41519	Mele Havea	Unit 3, Level 5, Stratum II	2490	50	2660 (2620, 2610...2410, 2380) 2410	2710 (2620, 2610...2410, 2380) 2360	1

continued over

Table 4.1 continued

LAB NO.	SITE NAME	PROVENANCE	BP	SD	CALIBRATED DATE BP (1 SIGMA)	CALIBRATED DATE BP (2 SIGMA)	CATEGORY
CAMS-41520	Mele Havea	Unit 8, Level 9, Stratum III/IV	2640	50	2750 (2740) 2520	2780 (2740) 2400	1
CAMS-41521	Mele Havea	Unit 10, Level 5, Stratum II	2510	50	2670 (2700, 2670...2410, 2380) 2410	2710 (2700, 2670...2410, 2380) 2360	1
CAMS-41522	Mele Havea	Unit 10, Level 8, Stratum III	2620	50	2740 (2740) 2500	2760 (2740) 2390	1
Gak-502	SUVa2	Sq.B6, Layer 2	850	70	880 (737) 674	927 (737) 660	3
Gak-503	SUVa3	Sq.C-5, Layer 5a, firepit	865	70	892 (741) 689	930 (741) 664	3
NZ-1429	SULe12	interface Layer 4 and non-cultural layer	881	20	794 (787, 781, 759, 747, 745) 738	883 (787, 781, 759, 747, 745) 695	3
Gak-1200	SSO1C1	firepit in house platform	890	70	916 (790, 777, 762) 694	950 (790, 777, 762) 668	3
Gak-1442	SULe12	Sq.F-5, Layer 1	890	80	920 (790, 777, 762) 692	954 (790, 777, 762) 665	3
NZ-855	SUVa4	Layer F-1a, fire hearth	927	241	1063 (882, 866, 826, 813, 797) 657	1304 (882, 866, 826, 813, 797) 508	3
Gak-1438	SULam1	Sq.C, SubSq.G-3, Layer II, Level 3	1050	80	1052 (953) 804	1169 (953) 760	3
Gak-1443	SULe12	Sq.F-6, surface Layer 7	1410	80	1367 (1304) 1262	1517 (1304) 1173	3
Gak-1435	SUFo1	House 2, brown layer under terrace	1410	110	1407 (1304) 1189	1528 (1304) 1073	3
Gak-799	SULu41	Layer 4, cutting VIII	1500	80	1518 (1386, 1384, 1370, 1358, 1354) 1305	1540 (1386, 1384, 1370, 1358, 1354) 1263	3
Gak-1439	SUVa38	firepit under mound Layer 14	1550	80	1528 (1411) 1315	1607 (1411) 1295	3
Gak-1198	SUVa4	base Layer F-1	1660	80	1689 (1537) 1415	1767 (1537) 1352	3
Gak-1693	SUVa4	Sq.A-1, Layer E, oven	1600	350	1915 (1521, 1428, 1423) 1174	2336 (1521, 1428, 1423) 765	3
Gak-1340	SULu53	A-2, agricultural Layer 2	1660	80	1689 (1537) 1415	1767 (1537) 1352	3
Gak-1199	SUVa4	Hearth horizon, cooking pit	1680	80	1691 (1556) 1422	1778 (1556) 1374	2
Gak-1341	SUSa3	Sq.F-6, Layer 4, Level 2	1800	80	1820 (1709) 1574	1918 (1709) 1528	2
Gak-1441	SUSa3	Sq.I-6, Layer 5	1840	100	1882 (1772, 1754, 1730) 1615	1992 (1772, 1754, 1730) 1529	2
NZ-362	SUVa1	base Layer V	1850	50	1865 (1815, 1811, 1785, 1749, 1735) 1709	1917 (1815, 1811, 1785, 1749, 1735) 1615	1
NZ-361	SUVa1	top part of Layer V	1880	60	1882 (1820) 1714	1946 (1820) 1627	1
NZ-363	SUVa1	pit sealed by Layer V	1950	120	2000 (1915, 1887) 1724	2296 (1915, 1887) 1570	1
Gak-1194	SUVa4	Sq.N-2, Hearth Horizon	2150	100	2307 (2144, 2119) 1953	2347 (2144, 2119) 1885	2
Gak-1339	SULu53	surface Layer 1, firepit under terrace	2170	100	2312 (2149, 2136, 2123) 2000	2351 (2149 ,2136, 2123) 1896	3
GaK-1444	SuLe12	Sq.F7, Layer 5b, pit	2210	100	2339 (2298, 2264, 2177, 2171, 2157) 2064	2359 (2298, 2264, 2177, 2171, 2157) 1933	2
K-904	To.1	Trench I, Pit A	2779	100	2477 (2336) 2275	2694 (2336) 2108	3
ANU-541	To.2	Sq.50/54, base of Zone 1	2680	95	2337 (2280) 2117	2471 (2280) 1987	1
NZ-635	To.2	Oven M, top of Midden Horizon	1620	60	1558 (1524) 1412	1689 (1524) 1351	3
NZ-637	To.5	Trench I, Oven B	1600	87	1586 (1521, 1428, 1423) 1373	1694 (1521, 1428, 1423) 1306	3
NZ-636	To.6	Oven K in subsoil	2380	51	2446 (2352) 2341	2708 (2352) 2212	1
ANU-24	To.6	Oven DN in subsoil	2350	200	2719 (2346) 2120	2845 (2346) 1886	3
ANU-873	To.6	Horizon I	2320	60	1874 (1810) 1719	1949 (1810) 1660	1
RL-459	Cog Site SuMu165	Fs1, bottom of fire basin	1150	110	1175 (1055, 1025, 1010) 934	1293 (1055, 1025, 1010) 797	3
RL-464	Jane's Camp SuF11F	Test 1, Stratum 1	2632	110	2320 (2161) 2034	2446 (2161) 1896	3
RL-479	Jane's Camp SuF11	Test 1, Stratum II	3632	130	3559 (3392) 3258	3705 (3392) 3077	2
RL-478	Jane's Camp SuF11	Test 1, Stratum III	2542	30	2116 (2067) 2007	2150 (2067) 1963	1
RL-481	Jane's Camp SuF11	Test II, Stratum IV	2632	120	2325 (2161) 2017	2472 (2161) 1875	1

continued over

Table 4.1 continued

LAB NO.	SITE NAME	PROVENANCE	BP	SD	CALIBRATED DATE BP (1 SIGMA)	CALIBRATED DATE BP (2 SIGMA)	CATEGORY
RL-477	Jane's Camp SuF11	Test II, Stratum IV	2922	120	2724 (2586) 2348	2812 (2586) 2276	1
UGa-1986	Apulu SU17483	fill of shallow basin	945	60	929 (908, 859, 832, 810, 800) 744	961 (908, 859, 832, 810, 800) 694	3
UGa-1985	Tulaga Fale Su17130	fire basin under platform	1115	75	1166 (1049, 1036, 971) 934	1256 (1049, 1036, 971) 802	3
UGa-1990	Apulu Su17483	bottom of storage pit	1205	70	1256 (1168, 1161... 1124, 1106, 1084) 974	1286 (1168, 1161...1124, 1106, 1084) 955	3
UGa-2210	Falemoa SM172	Stratum II	1565	60	1063 (984) 930	1147 (984) 891	3
UGa-1991	Ten Points SU17552	base of star mound	1620	65	1585 (1524) 1411	1690 (1524) 1334	3
UGa-1485	Potusa SM171	Stratum II	1660	60	1173 (1098) 1028	1248 (1098) 951	3
NZ-4342B	Potusa SM171	same sample as UGa-1485	1800	40	1316 (1283) 1255	1365 (1283) 1214	3
UGa-2208	Falemoa SM172	Stratum III	2020	55	1583 (1521) 1455	1679 (1521) 1378	2
UGa-2211	Falemoa SM172	Stratum IV, surface of platform	2030	60	1591 (1521) 1446	1686 (1521) 1365	2
UGa-1484	Falemoa SM172	same sample as NZ4343	2260	65	1818 (1727) 1662	1889 (1727) 1555	3
NZ-2726B	Jane's Camp Su181	same sample as RL-464	2760	60			2
NZ-2727B	Jane's Camp Su181	Stratum II, same as RL-464	2781	36	2342 (2322) 2300	2370 (2322) 2265	2
NZ-2728B	Jane's Camp Su181	Stratum II, same as RL-464	2823	30			2
NZ-4343B	Falemoa SM172	same sample as UGa-484	2868	40	2548 (2460) 2361	2678 (2460) 2332	2
NZ-1958B	Ferry Berth Su171	base of coquina layer	2980	80	3144 (2917) 2749	3339 (2917) 2642	3
UGa-1671	Sapapali'i SS1385	earth oven	14920	175			3
I-8355	Tavai FU-11	lowest 20cm level of Layer IX	2120	80	2297 (2114, 2079, 2069) 1952	2329 (2114, 2079, 2069) 1890	1
I-9942	Tavai FU-11	Layer VII	1315	175	1367 (1261) 1006	1540 (1261) 803	3
Beta-19741	Ta'u village AS1151	Unit 1, ceramic bearing deposit	2330	50	1875 (1818) 1746	1939 (1818) 1690	2
AA-1920	Tongoleleka	Unit 0N0W, Layer IV	3660	190	3717 (3476) 3302	3979 (3476) 3024	3
AA-1921	Tongoleleka	Unit 45N1W, Layer IV	2960	120	2777 (2709) 2489	2932 (2709) 2331	2
AA-1923	Tongoleleka	Unit 0N0W, Layer IV	2960	60	2743 (2709) 2660	2788 (2709) 2474	2
Beta-14171	Tongoleleka	Unit 45N1W, top of Layer III	2330	60	2355 (2342) 2212	2702 (2342) 2156	1
Beta-11243	Tongoleleka	Unit 0N11W, top of Layer III	1370	120	1367 (1291) 1173	1523 (1291) 973	3
CAMS-34558	Tongoleleka	Unit 4, Level 5, Stratum IIa	2450	40	2650 (2360) 2370	2700 (2360) 2350	1
CAMS-34559	Tongoleleka	Unit 4, Level 8, Stratum IIb	2600	60	2720 (2720) 2470	2760 (2720) 2380	1
CAMS-34560	Tongoleleka	Unit 4, Level 10, Stratum III	2560	50	2680 (2710, 2560, 2540) 2440	2730 (2710, 2560, 2540) 2370	1
CAMS-34561	Tongoleleka	Unit 4, Level 15, Stratum III/IV	2720	60	2840 (2760) 2750	2920 (2760) 2560	1
CAMS-41512	Tongoleleka	Unit 11, Level 4, Stratum IIa	2490	50	2660 (2620, 2610... 2410, 2380) 2410	2710 (2620, 2610...2410, 2380) 2360	1
CAMS-41513	Tongoleleka	Unit 11, Level 7, Stratum IIb	2430	50	2650 (2350) 2360	2700 (2350) 2310	1
CAMS-41514	Tongoleleka	Unit 10, Stratum III	2690	50	2810 (2750) 2730	2850 (2750) 2530	1
Beta-14170	Fakatafenga	Unit 82N2W, living surface, Layer III	5030	70	5893 (5840, 5832, 5747) 5664	5919 (5840, 5832, 5747) 5603	2
Beta-11244	Fakatafenga	Unit 8N1E, earth oven 105 cm bs	1800	120	1872 (1709) 1544	1992 (1709) 1412	2
ANU-442	Vuki's Mound	Layer 1b	1150	90	1173 (1055, 1025, 1010) 954	1263 (1055, 1025, 1010) 803	3
ANU-429	Vuki's Mound	Layer 4	2210	145	2348 (2298, 2264, 2177, 2171, 2157) 1998	2710 (2298, 2264, 2177, 2171, 2157) 1838	2

continued over

Table 4.1 continued

LAB NO.	SITE NAME	PROVENANCE	BP	SD	CALIBRATED DATE BP (1 SIGMA)	CALIBRATED DATE BP (2 SIGMA)	CATEGORY
ANU-435	Vuki's Mound	Layer 10	1830	800	2748 (1768, 1759, 1726) 933	3680 (1758, 1759, 1726) 286	3
ANU-441	Vuki's Mound	Layer 14	2440	110	2719 (2448, 2441...2371, 2362) 2342	2758 (2448, 2441...2371, 2362) 2159	2
ANU-424	Vuki's Mound	Layer 14	2540	160	2777 (2716) 2353	2995 (2716) 2160	3
ANU-436	Vuki's Mound	Layer 15	2260	415	2761 (2308, 2219, 2209) 1732	3324 (2308, 2219, 2209) 1308	3
CAMS-7147	Pukotala	1992 Test Unit , Stratum III	2630	60	2776 (2747) 2721	2847 (2747) 2400	1
CAMS-7148	Pukotala	1992 Test Unit, Stratum IV	2870	60	3137 (2995, 2992, 2960) 2869	3190 (2995, 2992, 2960) 2784	1
CAMS-41515	Pukotala	Unit 14, Level 9, Stratum II	2560	50	2680 (2710, 2560, 2540) 2440	2730 (2710, 2560, 2540) 2370	1
CAMS-41516	Pukotala	Unit 14, Level 14, Stratum III	2640	50	2750 (2740) 2520	2780 (2740) 2400	1
CAMS-41517	Pukotala	Unit 12, Level 7, Stratum II	2540	50	2670 (2710, 2580, 2540, 2530, 2510, 2400) 2430	2730 (2710, 2580, 2540, 2530, 2510, 2400) 2370	1
CAMS-41518	Pukotala	Unit 13, Level 15, Stratum III/IV	2480	50	2660 (2490, 2440, 2430, 2420, 2420, 2370, 2360) 2400	2710 (2490, 2440, 2430, 2420, 2420, 2370, 2360) 2360	1
CAMS-12918	Holopeka	Unit 96N/100W, Stratum III	2800	70	2997 (2917, 2910, 2863) 2781	3157 (2917, 2910, 2863) 2755	2
CAMS-12919	Holopeka	Unit 97N/100W, Stratum III	2590	60	2755 (2739) 2544	2780 (2739) 2382	2
CAMS-41527	Holopeka	Unit 95N/100W, Stratum II	2540	50	2670 (2710, 2580, 2540, 2530, 2510, 2400) 2370	2730 (2710, 2580, 2540, 2530, 2510, 2400) 2370	2
CAMS-41528	Holopeka	Unit 96N/100W, Stratum II	2510	50	2670 (2700, 2670, 2650... 2460, 2410, 2380) 2360	2710 (2700, 2670, 2650 ...2460, 2410, 2380) 2360	2
NZ-728	Mangaia Mound	Layer 2	1765	45	1696 (1625) 1559	1761 (1625) 1513	3
NZ-727	Mangaia Mound	Layer 3	2630	50	2749 (2721) 2691	2790 (2721) 2603	2
NZ-725	Mangaia Mound	Pit J	2100	50	2102 (2018) 1952	2151 (2018) 1885	3
NZ-726	Mangaia Mound	Pit C	3130	70	3376 (3320) 3215	3460 (3320) 3112	3
Gif-7489	Asi Pani SI001A	lower pottery horizon	2050	280	2443 (1993, 1957, 1952) 1631	2743 (1993, 1957, 1952) 1351	3
Gif-7488	Asi Pani SI001A	upper pottery horizon	2180	280	2702 (2151) 1823	2841 (2151) 1524	3
Gif-7487	Asi Pani SI001A	lowest horticultural horizon	1120	70	1166 (1049, 1034, 972) 952	1176 (1049, 1034, 972) 805	3
Gif-7485	Alofitai AF34B	lower pottery horizon	2340	280	2745 (2344) 1955	3021 (2344) 1632	3
Gif-7484	Alofitai AF34B	upper pottery horizon	1500	80	1518 (1386, 1384, 1370, 1358, 1354) 1305	1540 (1386, 1384, 1370, 1358, 1354) 1263	1
Gif-7486	Plateau D'asoa AL32B	anthropogenic horizon	1140	50	1166 (1053, 1028, 1007) 966	1173 (1053, 1028, 1007) 932	3

Calibration of radiocarbon determinations

All calibrated dates are reported at 1σ and 2σ ranges in Table 4.1. Determinations made on marine shell and mammal bone samples were assayed for marine reservoir effect. Unfortunately, no ΔR value for calculating marine reservoir effect is available for the West Polynesian region. Stuiver and Brazunias (1993) recommend that pooling the ΔR values of those areas closest to the location from which the sample was taken is the most appropriate approach. The available ΔR values for the Pacific are few in number and derive from a large geographical area: Eniwetok, Hawai'i, Mo'orea and Tahiti. Not surprisingly, they vary considerably. For their recent excavations in American Samoa, Kirch and Hunt (1993:87) used a ΔR value of 100.0±24.0, pooled from the known values. However, of these locations, Tahiti is geographically closest to West Polynesia and the Tahitian ΔR value (40.0±30.0) alone is commonly used in the calibration of radiocarbon determinations from central East Polynesia.

To assess what difference the choice of ΔR value might make, a sample of the ^{14}C shell dates from West Polynesia were calibrated using both the pooled ΔR value (100.0±24) and the Tahitian value (40.0±30.0). This exercise revealed a difference of approximately 100 years in the 2σ calibrated ranges, although this varied slightly. This difference was not considered significant in the scale of the present analysis and subsequently the recommended procedure of using a pooled ΔR was employed for all determinations on shell samples. For ^{14}C dates from turtle bone from Dye's (1990) excavations in Tongoleleka the ΔR of 45±30 used by Dye was retained.

The calibrated dates reported in the analysis may vary slightly from published calibrated and corrected dates according to the ΔR value and version of the calibration program used. Where possible the conventional corrected ^{14}C date has been used. In some instances it was unclear whether a $\delta^{13}C$ correction for fractionation had been applied to the date as published.

Distribution of re-calibrated West Polynesian ^{14}C determinations

Figure 4.1 presents the regional West Polynesian sequence of re-calibrated and corrected ^{14}C dates older than ca. 1000 BP. Each determination is given at 1σ and 2σ calibrated ranges and dates are sorted according to their calibrated means. The earliest date of 14920±175 BP (UGa-1671) has been excluded from Figure 4.1 because it lies outside the present range of the calibration curve. A further determination, Beta-14170, with a conventional age of 5030±70 BP (5919–5603 cal BP 2σ range) is much earlier than the other West Polynesian dates and has been omitted to enable the sequence of dates to be presented at an easily visible scale. Dates associated with aceramic deposits are highlighted with an 'a'. The chronology for the established ceramic and cultural sequence is also indicated.

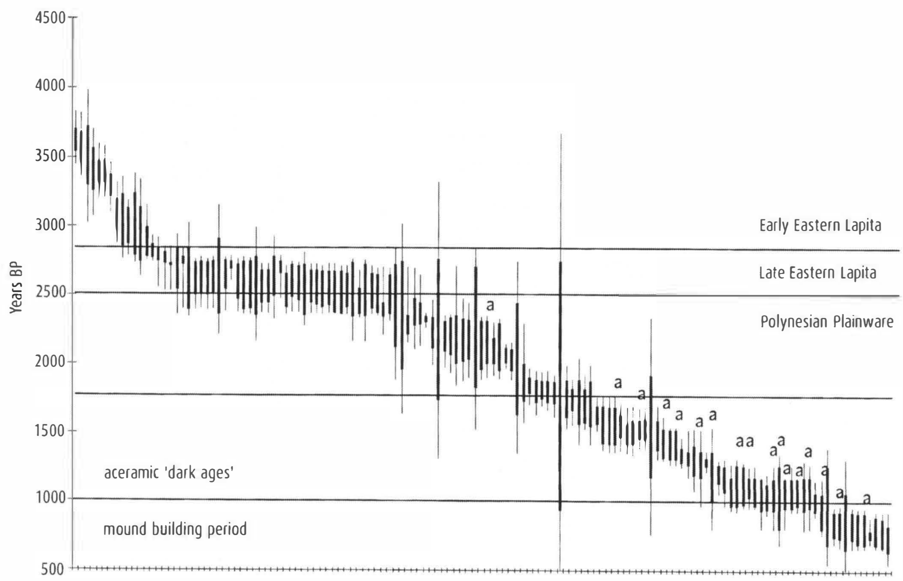

Figure 4.1 West Polynesian radiocarbon determinations. Thick line = 1σ calibrated range, thin line = 2σ calibrated range. a = determinations associated with aceramic deposits

Several points can be made about the distribution of recalibrated radiocarbon determinations as presented in Figure 4.1, prior to individual assessment. Firstly, ^{14}C determinations are available for the entire period from 3500 BP to 1000 BP.

^{14}C determinations with a conventional age of between 2500 and 700 BP generally become more recent with calibration, although typically only by about 150 radiocarbon years. This effect partially accounts for a number of the dates with a conventional age ca. 1000 BP having a calibrated range younger than 1000 BP, and therefore falling in the 'mound-building' phase of the established chronology. Three of these dates, from Niuatoputapu sites are associated with plainware ceramics and, at the more recent end of their ranges, approach the dates associated with a plainware deposit dated from 650 BP to the proto-historic period from the 'Aoa site in American Samoa (Clark and Michlovic 1996).

The number of available dates with a calibrated range older than 2000 BP is equivalent to the number younger than 2000 BP. Hence, the archaeological 'dark age' referred to by many researchers is not reflected by any deficiency in the radiocarbon sequence.

Plotting the 2σ ranges of the radiocarbon determination indicates an overlap in the chronology for cultural deposits not apparent in inter- and intrasite interpretations of chronology using conventional dates. The 2σ ranges for the West Polynesian dates are rarely less than 400 radiocarbon years. Therefore, the change through time in ceramic assemblages from Early to Late Lapita, a period estimated in the established chronology to be between 500 and 700 years, is unlikely to be evident in the radiocarbon sequence. The calibrated ranges of almost all ^{14}C dates associated with Lapita ceramics in West Polynesia fall into both the currently defined Lapita and Late Lapita periods.

Protocol for assessment of contextual factors of ^{14}C determinations

The sequence of calibrated ^{14}C dates in Figure 4.1 represents (where information concerning individual dates permitted) current standards for correction of sample composition and systemic factors affecting the accuracy of radiocarbon dates. However, the contextual factors affecting the accuracy of the determination have not yet been taken into account. According to Taylor (1987:108):

> The contextual elements of a critical utilisation or evaluation of ^{14}C data involve, first, the specific delineation of the nature of the event, phenomenon, or object for which temporal placement is being sought, and, second, the identification of the nature of the relationship or association between an event/phenomenon and sample material(s) to be used for the ^{14}C analysis.

A protocol used to assess contextual factors must therefore take into account both the archaeological evidence claimed to be associated with the dated sample and the behavioural interpretation of that evidence. Ideally, such an assessment requires detailed information on the provenance of the dated sample, description of the site, the stratigraphy and excavation, sample retrieval methods and on the relationships of the dated sample to cultural materials and to other radiocarbon determinations from the site. As noted earlier, the availability and quality of this information for West Polynesian ^{14}C determinations varied considerably and the assessment process needed to take this into account in some manner. Where information was lacking a judgement had to be made as to whether the missing information was essential to arguments demonstrating the association of the sample with the cultural material. Following this verdict, a decision was made whether to exclude the date from further consideration or include it as 'questionable'. Consequently, the protocol for assessment could not always be applied in an entirely objective manner.

The 141 individual radiocarbon determinations were investigated using the outlined protocol and assessed as being either (1) acceptable, (2) questionable or (3) unacceptable (see Table 4.1).

The rationale used in the assessment of each individual ^{14}C determination is detailed in Appendix I.

Acceptable determinations

An acceptable determination is from a sample that is clearly associated with the cultural deposit which it is argued to date. The cultural deposit appears to be largely or wholly undisturbed through post-depositional activity. There is more than one radiocarbon determination available from the site. The sample material is reported. While it is possible to construct hypothetical situations where incorrect dates might satisfy these criteria, in practice, they provide a reasonable basis for acceptance. Ultimately, acceptable dates are those that are unaffected by any of the protocol used to determine questionable or unacceptable dates as discussed below.

Questionable determinations

Questionable determinations are those for which some concern has been raised by the excavator or author about the dated sample itself, its relationship to cultural material or an interpretation which suggests that the date may be spurious, but for which no conclusive evidence is reported. An example may be where the excavator questions a date because it appears to contradict an established cultural sequence. To reject such dates outright might defeat the purpose of this examination, for example where such a date challenges conventional wisdom. Rather than exclude these determinations from further consideration, a question mark remains over their usefulness in establishing a chronological sequence.

Other questionable determinations consist of those from the Gakushuin Laboratory numbered prior to Gak-4500. Although the Gakushuin dates are commonly considered unreliable (Rolett 1993; Spriggs 1990:604), the degree of inaccuracies in individual determinations and the number of determinations affected is unclear. In the establishment of the Western Samoan chronology, the Gakushuin Laboratory was commonly used for dating excavated samples. Eighteen Western Samoan dates are from this laboratory and are potentially affected (numbered prior to Gak-4500). Spriggs (pers. comm.) suggests these 18 dates are so unreliable that they should be rejected rather than considered questionable. However, following the lead of Anderson et al. (1994) the Gakushuin dates have not been rejected outright in the present analysis, although their usefulness is recognised as limited.

A further category of questionable determinations includes dates that are stratigraphically inverted in a sequence and which do not overlap at two standard deviations with the dates from contexts stratigraphically above or below. A sequence of this kind can be difficult to assess if the stratigraphy of the deposits is undisturbed and there is nothing to suggest a problem in the samples or dating procedure, which means it is not always possible to decide which date in the sequence is incorrect. Where this is the case, both dates are considered questionable.

Determinations on marine shell or mammal bone are considered questionable where they do not overlap with radiocarbon determinations from other sample material from the same context at 2σ. Furthermore, radiocarbon dated marine shell and mammal bone must be convincingly argued to be cultural and contemporaneous with the associated cultural deposit or they are considered questionable.

Finally, where only a single determination is available for a site it has been identified as questionable because there is no independent means of verifying the accuracy of the date (cf. Taylor 1987:105) or the time represented by the deposit with which the date is associated. Aitken (1990:95) considers single dates to be of little or no value; however, provided the contextual arguments for the date are satisfactory they have not been rejected outright.

Unacceptable determinations

Unacceptable determinations may include those from deposits considered to be in a secondary context or where there has been post-depositional disturbance to the deposit.

Other unacceptable determinations include those for which an association with cultural material is unclear or unreported. The sample does not appear, from the excavator's description, to come from the same context as the cultural material with which it is associated. The sample may be intrusive in the stratigraphic context which it is argued to date, such as samples from a pit or posthole features.

Determinations with single standard deviations >150 radiocarbon years are considered unacceptable in the present analysis because the range of probabilities is considered too great to be of interpretive value in assessing change through time in the West Polynesian archaeological record. A figure of 150 years is arbitrary, simply providing a useful cut off point.

Results of the assessment of ^{14}C determinations

A summary of the assessment results is presented below, including a general discussion of the findings for specific dates. The specific details of the assessment of each individual radiocarbon determination are provided in Appendix I.

Three of the 139 determinations (NZ-2726B, NZ-2727B, NZ-2828B) presented in Table 4.1date the same *Tridacna* sp. valve and the pooled mean of their calibrated ranges is given as a single date (NZ-2726/7/8), reducing the overall number of ^{14}C dates to 137. Of these dates, using the described protocol, 56 were found to be unacceptable and were thus rejected, 32 are considered questionable and 49 dates are acceptable.

The ^{14}C determinations categorised as acceptable or questionable are presented in Figure 4.2. As noted for Figure 4.1, the date Beta-14170 (5919–5603 cal BP) is significantly older than the other dates and, as for Figure 4.1, has not been included in Figure 4.2. Comparison of these two figures indicates that, although almost half the determinations were rejected, a continuous sequence of radiocarbon dates is available for West Polynesia from at least 3500 to 1000 BP.

Prior to assessment, an approximately equivalent number of radiocarbon determinations were available for the periods 3500–2000 cal BP and 2000–1000 cal BP. A more rigorous examination of the dates significantly alters that, with a comparatively far greater number of radiocarbon determinations now available for the earlier part of the sequence. It should be noted that 30 of these radiocarbon determinations are from the Ha'apai sites in Northern Tonga and date only one or two stratigraphic units in seven sites. Despite this, a relatively high number of the unacceptable dates are from the post-2000 BP period.

Dates associated with plainware assemblages are still found throughout the sequence and those associated with Lapita assemblages occur only in the early half of the sequence. The number of radiocarbon determinations associated with aceramic assemblages has markedly decreased, a phenomenon possibly attributable to a number of causes. ^{14}C dates associated with aceramic deposits are almost always the only dates available from a site; and/or commonly do not date the deposit containing cultural material, but rather provide a 'not earlier than' or 'not later than' estimation of the age of the cultural deposit. These two issues are discussed in detail below with reference to specific dates.

The overall results of the assessment confirm that it is not possible to separate Lapita assemblages into Early or Late Eastern Lapita periods merely on the basis of radiocarbon evidence, because the

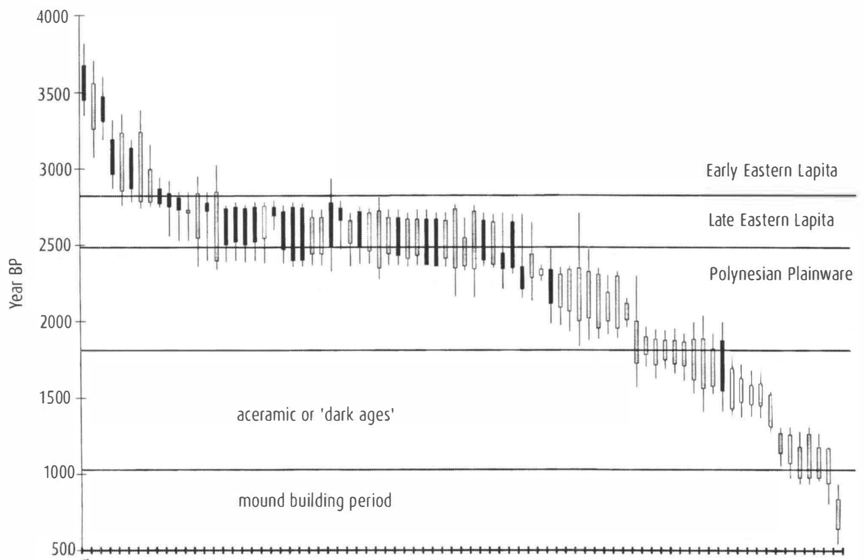

Figure 4.2 West Polynesian radiocarbon determinations found to be acceptable or questionable. 1σ and 2σ calibrated ranges. Black = dates associated with Lapita ceramics; Grey = dates associated with plainware ceramics

calibrated ranges of the dates are too great. The stratigraphic and material evidence for any change through time from Lapita to Late Lapita ceramic assemblages is discussed in the following chapters.

Plainware assemblages dominate the period ca. 2500 BP–1500 BP and continue through to post-1000 BP. This includes the plainware, aceramic and mound-building periods of the established chronology.

Unacceptable ^{14}C determinations

Slightly less than 50% of the West Polynesian radiocarbon determinations were found to be unacceptable (Fig. 4.3). A summary of the reasons for rejecting these determinations is presented below.

^{14}C determinations with standard deviations >150 radiocarbon years

Fifteen of the rejected ^{14}C determinations have standard deviations of >150 radiocarbon years. Large standard deviations may result from a number of factors, but commonly small sample size does not permit the same degree of precision in counting of carbon isotopes that a larger sample may. Such determinations lie primarily in the early half of the radiocarbon sequence and in most cases are one of a sequence of dates from a stratigraphic unit or site. Their rejection does not result in the exclusion of a site from further consideration, except in the case of the Alega site in American Samoa (Beta-38438) and Sapapali'i in Western Samoa (UGa-1671, not shown in Fig. 4.3), where they represent the only available date. Half the dates from the Vuki's Mound site on Tongatapu (ANU-424, ANU-435, ANU-436), two from SUVa-4 on Upolu (Gak-1693, NZ-855) and four dates from Futuna/Alofi (Gif-7489, Gif-7488, Gif-7485, I-9936) have standard deviations >150 years. Other dates with unacceptably large standard deviations are AA-1920 from Tongoleleka, Beta-35603 from To'aga, ANU-24 from To.6 on Tongatapu, Gak-1693 from SUVa-4 on Upolu and I-9942 from Niuatoputapu.

^{14}C determinations rejected on contextual grounds

The remaining dates shown in Figure 4.3 were found to be unacceptable on contextual grounds, meaning the relationship between the dated sample and the archaeological material it is argued to date is considered unclear. This may be due to insufficient detail regarding the physical association of the dated sample and archaeological evidence, post-depositional disturbance of the deposit or where the description of the context of dated sample is different to that of the archaeological material it is used to date.

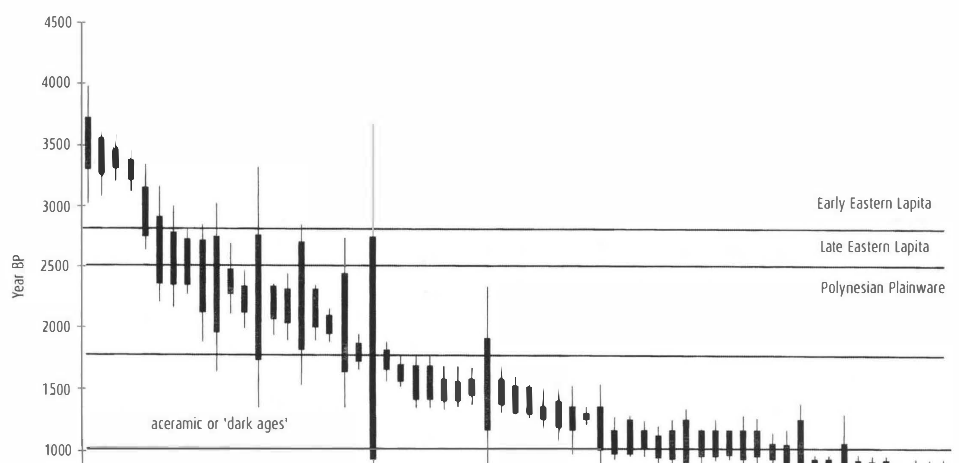

Figure 4.3 Rejected West Polynesian radiocarbon determinations. 1σ and 2σ calibrated ranges.

Inadequate reporting

In the case of ten ^{14}C determinations, there was either no information provided regarding the context of the dated sample or associated cultural material (UGa-1985, Beta-48912, Gif-7487, Gif-7486, I-10482 and UGa-2210) or the information was confused or contradictory (Beta-26463, Beta-26465, Gak-1198 and RL-464).

UGa-1985 is listed as dating the Tulaga Fale site on Upolu (Jennings and Holmer 1980:8); however, in the discussion of the site there is no mention of UGa-1985 (Hewitt 1980b).

The report citing the date Beta-48912 (Clark 1993) discusses the stratigraphic layer and depth below surface from which the charcoal sample was excavated; however, there is no description of the site or any associated cultural remains.

The cultural association of Gif-7487 from the Asi Pani site on Futuna is minimally reported by Sand (1990:124) as dating the 'lowest horticultural horizon' with no further information provided.

No detail is given by the excavator regarding the charcoal sample for Gif-7486 from the Plateau D'asao site also on Futuna, nor description beyond its deriving from an anthropogenic horizon (Sand 1990:124). Similarly, no description is available of the stratigraphy or cultural deposit for the test pit from which the sample for I-10482 in the NT-125 site on Niuatoputapu was taken. UGa-2210 is listed as a shell sample from Stratum II in the Falemoa site (Jennings and Holmer 1980:Table 2); However, no further description of the sample's provenance or associated cultural material is available.

Beta-26463 and Beta-26465 both relate to the To'aga site on Ofu Island, American Samoa. Beta-26463 is a shell sample claimed to have come from Layer II in excavation Unit 3 (Kirch and Hunt 1993:88) in one part of the report, but elsewhere is stated to derive from the base of an aceramic occupation deposit 'which stratigraphically postdates Layer II in the main trench' (Kirch and Hunt 1993:56). It is not explained whether the shell sample is associated with the aceramic occupation deposit, or pre-dates it. Beta-26465 is listed as being from a shell sample, excavated from Layer III of Unit 13 (Kirch and Hunt 1993:88); however, in the description of the stratigraphy for this unit (Kirch and Hunt 1993:55) there is no Layer III mentioned. The shell sample is described as coming from 35–45 cm below the surface (Kirch and Hunt 1993:88) which, in the description of stratigraphy (Kirch and Hunt 1993:55), appears to equate with Layer IB.

There are conflicting reports for the provenance of the charcoal sample for Gak-1198 from the Vailele Mound site, SUVa4. The shell sample dated to give RL-464 was subsequently re-dated, giving three further, almost identical determinations (NZ-2726B, NZ-2727B and NZ-2728B) with far smaller standard deviations that RL-464. No discussion of the differences is presented by the excavators and the initial data RL-464 was rejected in favour of the subsequent dates.

Disturbed or secondary contexts

The samples for a further seven radiocarbon determinations were reported as having come from disturbed or secondary contexts.

Beta-11243 is from the Fakatafenga site in the Ha'apai group of Tonga. Dye (1987a:45) describes this sample as having come from an excavation unit in which post-depositional disturbance was likely. He attributes this possibility to the presence of a feature evident in the section of the excavation unit, although he does not describe the feature.

UGa-1485 and NZ-4342B are from the same *Tridacna sp.* sample from Layer II of the Potusa site on Manono Island. The deposit is considered to be colluvial and to originate from a knoll behind the beach where it was excavated (Jennings and Holmer 1980:222). No argument is made for the cultural association of the shell with the archaeological material.

Sand (1990:131) himself excludes the date Gif-7486 (from the Plateau D'asoa site on Alofi) from consideration, arguing the 'anthropogenic horizon' from which the dated sample was obtained is not necessarily in a primary depositional context.

K-904, from the mound site To.1 on Tongatapu, is a shell date taken from a pit feature in the mound, and is significantly older than a charcoal date from the same context. Groube (1971) originally argued, and Poulsen (1987:23) agreed, that the site is disturbed and the discrepancy in dates is due to the shell being introduced to the pit feature from an earlier context following disturbance.

NZ-728 is from Layer 2 of Mangaia Mound also on Tongatapu. Golson considers that Layer 2 comprises redeposited material and NZ-728 does not date the associated ceramics (Groube 1971:302).

The charcoal sample for Gak-1442, described as diffuse charcoal (Davidson and Fagan 1974:77), comes from the disturbed surface layer of SULe12.

Imprecise chronological relationship with cultural material

The remaining rejected ^{14}C dates were found to be unacceptable on the grounds that the sample was obtained from a context, in most cases either a stratigraphic unit or feature, other than that which it was used to date. For example, a sample excavated from a stratigraphic layer beneath a terrace construction may have been used as an estimate for the date of terrace construction. The chronological relationship between the event which created the dated sample and the evidence it dates is unclear except to say that on the basis of the stratigraphic evidence, the sample pre-dates or post-dates the evidence. In a stratified site, if an undated stratigraphic unit is sandwiched between two dated units, these provide an upper and lower age range. However, where only a single date is obtained, the stratigraphic units above and below the dated unit have an open range either less than or greater than the one determination for the site. This is the case for 20 of the West Polynesian dates, which, in each case represent the only date available from a site and are associated with a particular feature or stratigraphic unit which does not contain the cultural material under consideration.

Overall, these determinations can be divided into three groups: (1) those that, on stratigraphic evidence, pre-date the associated cultural material; (2) those that post-date the cultural material; and (3) those taken from a stratigraphic layer with cultural material stratigraphically above and below the dated sample. Belonging to the first group are 12 dates, six of which (Gak-502, Gak-503, Gak-1438, Gak-1339, Gak-1340 and UGa-1991) derive from charcoal excavated from deposits at the base of Western Samoan mound features. Each date is considered to pre-date mound construction and no cultural material is reported from the stratigraphic unit containing the dated sample. In the case of Gak-503, Green (1969c) considered the charcoal beneath the mound site (SUVa-3) to be evidence of horticultural activities. At the site of SULam-1, Hansen (1974) considered charcoal to provide evidence for clearing of the area prior to mound construction. Similarly, the charcoal sample for Gak-1340 was recovered from a pocket of charcoal in the former ground surface beneath the star mound SULu-53. Scott and Green (1969) argue it is evidence of clearing prior to mound construction. The sample Gak-1339, also from SULam-1, is described as obtained from a 'firepit' at the base of the mound, as is Gak-1439 from the SUVa-38 site. UGa-1991 was collected from the soil of the 'forest floor' (Hewitt 1980c) at the base of the Ten Points star mound, SU-17-552.

Gak-502, another charcoal sample, is considered to predate construction of the SUVa2 mound. The sample was taken from a lens of organic material on the surface of Layer 2, beneath deposits forming the mound proper (Green 1969d:144). However, Layer 2 contains some artefactual material and Gak-502 could also be interpreted as post-dating this cultural deposit.

A further sample, NZ-637, may be similarly interpreted. This charcoal sample from the Tongatapu mound, To.5, was excavated from a feature described as an oven cut into the surface of a ceramic midden (Poulsen 1987:33-7), overlying the midden. Sealing the oven feature is the mound proper. NZ-627 may therefore be interpreted only as post-dating the midden deposit and pre-dating the mound construction.

Four further charcoal samples are also described as having been excavated from beneath features they pre-date. NZ-1429, Gak-1435, Gak-1443 and Beta-38752 are all argued to provide estimates for the construction of terraces or floors of house sites on which successive house floors have been constructed. The sample Beta-38752, from beneath a house floor at the Faga site on Ta'u Island, American Samoa, is described as approximating the date of initial use of the coastal flat (Clark 1993:329). NZ-1429, from the house site of SULe-12, is considered by the excavators (Davidson and Fagan 1974:74) to date the construction of a terrace adjacent to the site proper. The charcoal was obtained from between the natural land surface and the bottom cultural layer of the terrace. Also from SULe12, Gak-1443 is a charcoal date possibly associated with the basal cultural deposit. However, the excavators consider the charcoal may represent cleaning prior to the platform construction (Davidson and Fagan 1974:83). Ishizuki (1969:56) collected charcoal beneath a terrace (SUFo-1) and lying on top of a non-cultural clay horizon for sample Gak-1435. The shell samples from To'aga dated to give Beta-25035 and Beta-25673 were both taken from the basal Layer V, which appears to be the original active beach ridge, predating the cultural deposits. Their cultural association is questioned y the excavators (Kirch 1993a:87–8).

Nine ^{14}C determinations were rejected because they stratigraphically post-date the cultural material or feature with which they have been associated. Gak-1200, UGa-1986 and RL-459 are all charcoal samples obtained from the surface of features. Buist (1969:48) describes sample Gak-1200 as coming from a firepit located on a platform at Ologogo in Western Samoa. While RL-459 is associated with the Cog Mound site, the charcoal sample was obtained from a 'firebasin' located approximately 1.5m from the mound, which itself yielded much more recent dates of ca. 500 BP (RL-460, RL-461) (Holmer 1976:29). RL-459 can only be said to date, or post-date, the firebasin, which is not further described. Similarly, the charcoal sample for UGa-1986 was collected from a basin filled with stones and some artefacts at the Apulu site, Western Samoa. The basin is open and described as cut into the stone mound (Holmer 1980b:82). A behavioural or chronological relationship between the artefactual material in the basin and the charcoal sample is not discussed. RL-459 may be interpreted only as post-dating the construction of this stone mound. Also from the Apulu site, which consists of a number of house platforms, the charcoal sample for UGa-1990 was excavated from a feature described as one of two lozenge shaped pits which may have been food storage pits (Holmer 1980b:82). The features are partially covered by a platform; however, the excavator was unsure whether the pit features pre- or post-date platform construction. UGa-1990 post-dates the pit.

ANU-442 (from Vuki's Mound) and NZ-725 and NZ-726 (from Mangaia Mound), are from sites on Tongatapu. All three dates are from charcoal samples excavated from pits or fireplaces that were cut into the surface of the mounds sometime after their construction (Groube 1971). The charcoal sample for NZ-635 is considered by the excavator to derive from an oven feature that post-dates the formation of the To.2 midden and may be associated with a more recent, overlying burial mound.

The final ^{14}C date in this group is NZ-1958B, associated with Lapita ceramics from the Ferry Berth site in Western Samoa. The shell sample was collected from a coquina layer that sealed the submerged ceramic deposit. NZ-1958B has been considered an approximation of the date of the ceramics, because it falls within the chronology of other Lapita sites. However, the shell was not directly associated with the ceramic deposit itself and the behavioural and chronological relationship of the shell to the ceramic deposit is unclear.

Most of the ^{14}C dates discussed in this section provide an estimate of 'not earlier than' or 'not later than' for cultural material from sites. When such dates are the only ^{14}C determinations available for a site, they individually have little interpretive value. However, a number of dates in a similar relationship to the same kind of evidence may suggest a pattern in the chronology which can be argued to have a behavioural significance.

Questionable ^{14}C determinations

Twenty of the West Polynesia dates were considered questionable. Only two determinations, Beta-19741 from the Ta'u Village site in American Samoa and Beta-8683 from the Niuatoputapu site NT-93, were categorised as such because they are the only dates available from a site. In all other cases where only one determination was available for a site, the date was rejected on other grounds.

Similarly, only three of the remaining 18 determinations are considered questionable because they were obtained early in the Gakushuin laboratory sequence. These were Gak-1341 and Gak-1441 from the Sasoa'a site (SUSa3) and Gak-1199 from the mound site SUVa4.

The other 15 dates were categorised as questionable on other grounds, mainly due to a lack of published information about the association of the dated sample with other archaeological evidence. In particular, where the stratigraphy has not been discussed in the text and/or illustrated, the determinations were considered questionable. This was the case for ANU-429 and ANU-441, both from Vuki's Mound; NZ-727 from Mangaia Mound; Gif-7484 from the Alofitai site on Alofi Island; and all the dates from the Holopeka site (CAMS-12918, CAMS-12919, CAMS-41527 and CAMS-41528). Three Falemoa dates are considered questionable. UGa-2208 is a shell sample (species unreported) from Stratum III for which there is evidence of inundation from the sea (Lohse 1980:29). Given this, the cultural association of the shell and other archaeological evidence in the Stratum must be questioned. UGa-2211, a shell sample (species unreported) from Stratum IV, is mentioned only in a table of dates (Jennings and Holmer 1980:Table 2) and is not discussed in the text. A *Tridacna* sp. valve from Stratum II was dated twice to give UGa-1484 and NZ-4343B (Jennings and Holmer 1980:26), dates which do not overlap at 2σ. No explanation for the difference is offered and the excavators reject UGa-1484 in favour of NZ-4343B. Spriggs (1990:15) provides a $\delta^{13}C$ corrected date for NZ-4343B. In the present analysis, NZ-4343B is found questionable and UGa-1484 has been rejected.

In several instances some disturbance of the stratigraphic context from which the dated sample was obtained has been reported, although the excavator has not questioned the dates and the exact provenance of the sample in relation to the disturbed deposit is not discussed. For the purposes of this analysis these determinations are considered questionable. This was the case for all four dates (I-10632, I-10633, I-9934 and I-10481) from the NT-90 site on Niuatoputapu. These samples derive from Layer Ib, which is described as being disturbed by gardening activities in the upper portion (Kirch 1988), although the exact provenance of the samples in relation to this disturbance is not discussed.

This is also the case for AA-1921 and AA-1923 which are turtle bone samples from the lowest cultural layer of Tongoleleka in the Ha'apai Group. The excavation unit from which the samples come is not discussed; however, Dye (1987a:145) regards a third date (Beta-11243) from this layer as spurious and possibly a result of disturbance in the excavation unit. In the absence of further information concerning sample provenance, AA-1921 and AA-1923 are considered questionable.

In the case of Beta-35601 and Beta-19742, from the To'aga site, and Beta-8682 from NT-100 on Niuatoputapu, the stratigraphic context of the date is clear but conflicting information about the position of the sample within the stratigraphic unit has been reported. The charcoal for Beta-35601 is described as coming from 290-300 cm below the surface in Unit 28 and the sample is listed as coming from the base of Layer II (Kirch and Hunt 1993:88). In the description of the stratigraphy of Unit 28 (Kirch and Hunt 1993:66–7), Layer II is divided into IIA, IIB and IIC, and Beta-35601 is reported to come from Layer IIB, which overlies Layer IICA. This contradicts the provenance of Beta-35601 as being the base of Layer II. The same charcoal is also discussed as coming from the 'Layer II/III interface' (Kirch and Hunt 1993:67), which suggests it may pre-date Layer II. For these reasons Beta-35601 is considered questionable.

Beta-19742 is a shell sample excavated from the 1986 test pit at To'aga from Layer D, Level 10 (Kirch and Hunt 1993:87). However, in their discussion of the stratigraphy of the test pit Kirch and Hunt (1993:46) make no reference to Layer D, the layers being designated I to III. Beta-19742 is described as dating Layer II (Kirch and Hunt 1993:46). Although Layer D may equate with Layer II, no evidence is provided for this and hence the date is considered questionable.

The shell sample for Beta-8682 was collected from NT-100 on Niuatoputapu. A depth below surface for the sample is provided, but there is no description of the stratigraphic context (see Kirch 1988:141). Correlation of the depth below surface with the schematic diagram of site (Kirch 1988:99 Fig. 59) suggests it may date Layer IB, but there are no means of confirming this.

In the case of five other questionable ^{14}C determinations, the excavator/author raises the possibility of disturbance to the site because a date does not accord with their expectations on the basis of associated cultural material, although no evidence of disturbance is reported. Gak-1194, a charcoal sample from the hearth layer of the SUVa4 mound, is considered too early by Green and Davidson (1974:217) and possibly reflecting disturbance and intrusion of the sample into the hearth layer from below. Dye (1987a:120) questions the Beta-14170 and Beta-11244 dates from the Fakatafenga site, which he considers to be too early and too late, respectively, to date the associated ceramics and suggests there may have been some disturbance (Dye 1987:145). However, no evidence is provided to support this claim.

Clark and Michlovic (1996) suggest that the deposit of the 'Aoa site on Tutuila Island, from which the charcoal for Beta-48049 and Beta-48911 was obtained, may be in a secondary depositional context, but argue that the charcoal does date the associated cultural material.

In two instances, two dates in stratigraphic sequence are inverted and there is insufficient evidence presented to identify which date in each sequence might be in error and subsequently all four dates are considered questionable. In the site of Jane's Camp, RL-479 and NZ-2726/7/8 (the pooled mean of NZ-2726, NZ-2727 and NZ-2728) appear inverted. RL-479 is the earlier date and derives from Stratum II. NZ-2726/7/8, which does not overlap with RL-479 at 2σ, is the later date and derives from the underlying Stratum I. RL-479 is considered unacceptably early by the excavator (Smith 1976a:64), but equally likely NZ-2726/7/8 may be too late. There is no distinct boundary between Strata I and II and therefore no way to determine which of the dates is out of sequence.

In the Samoan house site of SULe-12, Gak-1444, from Layer 5b is inverted in relation to Gak-1443 from the stratigraphically earlier Layer 6/7 (see Davidson and Fagan 1974:76 Fig. 42). The sample for Gak-1444 was taken from the very base of a depression in Layer 5b. Davidson and Fagan (1974:84) explain the early age of this date, 2210±100 BP, as either accurately dating Layer 5b which would mean Gak-1443 was too recent, or that the sample came from Layer 7 into which the base of the depression or pit intrudes. There is insufficient evidence to assess whether Gak-1443 or Gak-1444 is out of sequence and/or an erroneous date. Gak-1444 is considered questionable, whilst Gak-1443 has been rejected on other grounds.

Acceptable ^{14}C determinations

For each of the acceptable dates, the association of the dated sample with cultural material was convincingly demonstrated through discussion of the specific context and material of the dated sample, the stratigraphy or structure of the site, and description of the associated cultural material. The acceptable radiocarbon determinations all came from sites for which more than one date was available. However, in three instances only one of the dates from the site was assessed as being acceptable. These were ANU-541, from the Tongatapu mound site of To.2; I-8355, from the Tavai site on Futuna; and Gif-7484, from the Alofitai site on Alofi.

Six sites have more than one acceptable date from only one stratigraphic layer. Three dates (NZ-361, NZ-362 and NZ-363) from the mound SUVa1, from a single stratigraphic layer (Layer 5) are acceptable. Similarly, two acceptable dates, ANU-873 and NZ-636 from the Tongan mound site TO.6 both date Horizon 1, the basal cultural deposit. The Niuatoputapu site of NT-100 has three acceptable dates, all from samples excavated from Layer IIA. Although two of the acceptable dates from Jane's Camp are from Stratum IV (RL-477 and RL-481) and a third (RL-478) is from Stratum III, the deposit from the strata appears to be identical, probably representing a single stratigraphic unit.

Faleloa in the Ha'apai Group has more than one acceptable date from the same stratigraphic context. Layer II is dated by CAMS-7145, CAMS-7146 and CAMS 8074. Also in the Ha'apai group, the Pukotala, Mele Havea, Vaipuna and Tongoleleka sites have acceptable dates from more than one stratigraphic unit site.

The remaining seven acceptable ^{14}C determinations all come from the To'aga site on Ofu Island. Kirch and Hunt (1993) report the stratigraphic layers for each excavation unit or adjacent units at the To'aga site, although these are not explicitly correlated across the site. The relationship of the stratigraphic units from which the dated samples were taken is discussed in Chapter 6.

Discussion

The assessment of the West Polynesian radiocarbon sequence found 23 sites to have acceptable and/or questionable radiocarbon determinations. All are ceramic sites and are detailed in Table 4.2.

With the exception of dates with large standard deviations, the majority of rejected dates come from aceramic sites. This discrepancy is probably due to several causes. The aceramic sites typically comprise mounds or other features in the landscape. As discussed above, the dated samples are commonly taken from beneath the mound or from a feature such as an oven on the surface, and are not directly associated with deposit that could be described as a cultural assemblage. A clear stratigraphic association with cultural material was required under the assessment protocol, thereby excluding not only these dates, but also a particular kind of site. The ceramic deposits all represent stratified subsurface deposits. The reporting of the excavation and stratigraphy of the sites is, in general, much more detailed, and in most cases the relationship between cultural material and the dated sample has been clearly identified. The difference in the reporting of site types and their excavation appears to stem from research priorities given to ceramic sites. Although mounds and other features have been consistently recorded and excavated, these have not received the attention that ceramic deposits have, because the ceramic sequence has been tied to establishing Polynesian origins, whereas mounds and

Table 4.2 Description and location of sites with acceptable and/or questionable radiocarbon determinations.

POLITICAL REGION	GEOGRAPHIC SUB-REGION	SITE NAME	SITE TYPE	CERAMICS	ASSOCIATED ^{14}C DATES
Kingdom of Tonga	Niuatoputapu	NT-90	coastal midden	Lapita	I-10632, I-10633, I-9934, I-10481
	Niuatoputapu	NT-100	coastal midden	plainware	I-9937, I-10634, Beta-8682, Beta-8684
	Niuatoputapu	NT-93	coastal midden	plainware	Beta-8683
	Ha'apai Group	Tongoleleka	coastal midden	Lapita/ plainware	Beta-14171, AA1921, AA1923, CAMS-34558. CAMS-34559, CAMS-34560, CAMS-34561, CAMS-41512, CAMS-41513, CAMS-41514
	Ha'apai Group	Mele Havea	coastal midden	Lapita/ plainware	CAMS-41519, CAMS-41520, CAMS-41521, CAMS-41522,
	Ha'apai Group	Vaipuna	coastal midden	Lapita/ plainware	CAMS-41523, CAMS-41524, CAMS-41525, CAMS-41526, CAMS-41531
	Ha'apai Group	Fakatafenga	coastal midden	Lapita	Beta-14170, Beta-11244
	Ha'apai Group	Faleloa	coastal midden	Lapita	CAMS-7145, CAMS-7146, CAMS-8074, CAMS-41529, CAMS-41530
	Ha'apai Group	Pukotala	coastal midden	plainware	CAMS-7147, CAMS-7148, CAMS-41515, CAMS-41516, CAMS-41517, CAMS-41518
	Ha'apai Group	Holopeka	coastal midden	plainware	CAMS-12918, CAMS-12919, CAMS-41527, CAMS-41528
	Tongatapu	To.2	coastal midden	Lapita	ANU-541
	Tongatapu	To.6	coastal midden	Lapita	NZ-636, ANU-873
	Tongatapu	Vuki's Mound	mound	plainware	ANU-429, ANU-441
	Tongatapu	Mangaia Mound	mound	Lapita	NZ-727
Futuna/Alofi	Futuna	Tavai	buried cultural deposit	plainware	I-8355
	Alofi	Alofitai	buried cultural deposit	plainware	Gif-7484
American Samoa	Manu'a Group	To'aga	coastal midden	plainware	Beta-19742, Beta-25033, Beta-25034, Beta-26464, Beta-35600, Beta-35601, Beta-35602, Beta-35604, Beta-35924
	Manu'a Group	Ta'u Village	coastal midden	plainware	Beta-19741
	Tutuila	'Aoa	buried cultural deposit	plainware	Beta-48049, Beta-48911
Western Samoa	Manono	Falemoa	coastal midden	plainware	UGa-2208, UGa-2211
	'Upolu	Jane's Camp	coastal midden	plainware	RL-479, RL-478, RL-481, RL-477, NZ-2726/7/8
	Upolu	SUVa1	mound	plainware	NZ-361, NZ-362, NZ-363
	Upolu	SUVa4	mound	plainware	Gak-1199, Gak-1194
	Upolu	SUSa3	house site	plainware	Gak-1341, Gak-1441
	Upolu	SULe12	house site	plainware	Gak-1444

other features have been associated with more recent prehistory, subsequent to post-East Polynesian colonisation. It is also the case that no West Polynesian aceramic midden has been dated earlier than 1000 BP. Whether this reflects an actual absence of early aceramic sites, or merely an assumption that aceramic deposits are recent and therefore not of research interest, is unclear.

Over half of the rejected dates relate to the recent end of the period of concern in the present analysis (see Fig. 4.3). Fifteen radiocarbon determinations have part or all of their 2σ calibrated ranges within the period 1700–1000 BP, the aceramic period of the established chronology. Clearly, although the number of radiocarbon dates from this period is far less than in the previous 1000 year period, an aceramic phase prior to ca. 1000 BP is not apparent in the radiocarbon chronology. The radiocarbon age range of a number of dates associated with ceramic deposits continues beyond 1000 BP. These are from Niuatoputapu sites and suggest, at least for this area, that the plainware and mound building period are consecutive.

The sites with acceptable and/or questionable radiocarbon determinations are primarily coastal midden sites (Table 4.2). All the regions of West Polynesia, with the exception of Futuna/Alofi, are represented by at least one ceramic midden site. Sites in Futuna/Alofi are described as buried cultural deposits and any shell midden the sites may have contained has not been preserved.

Conclusion

The assessment of radiocarbon determinations has demonstrated the value of such an analysis prior to pursuance of any interpretation of the West Polynesian archaeological record. To investigate change through time in the cultural assemblages within and between sites, the relationship of the radiocarbon determinations to site stratigraphy and cultural material needs to be established. The cultural assemblages from sites found to have only acceptable and/or questionable dates are used in the following chapters to assess the strength of the West Polynesian cultural sequence.

Radiocarbon determinations alone cannot be used to identify appropriate chronological units within sites. Even when a site contains a reliable sequence of dates, the relationship of the dates to the stratigraphic units in the site needs to be evaluated prior to establishing an absolute chronology for the associated cultural material. In the West Polynesian sites found to have acceptable and/or questionable dates, it is rare that more than one stratigraphic unit has an associated radiocarbon determination (Table 4.3). Therefore, intra-site chronology relies primarily on stratigraphic evidence alone.

In Chapters 5 and 6 to follow, appropriate chronological, or 'chronostratigraphic', units are created for each site. These provide the basis for investigating intra- and inter-site variability in West Polynesian cultural assemblages in Chapters 7, 8 and 9.

Table 4.3 West Polynesian sites with radiocarbon determinations found to be acceptable or questionable.

SITES WITH A SINGLE ^{14}C DATE	SITES WITH TWO OR MORE ^{14}C DATES FROM ONLY ONE STRATIGRAPHIC UNIT	SITES WITH TWO OR MORE STRATIGRAPHIC UNITS WITH A ^{14}C DATE
Mangaia Mound	NT-90	Jane's Camp
To.1	Faleloa	To'aga
SULe2	'Aoa	Pukotala
Tavaii	To.6	Mele Havea
Ta'u Village	SUVa4	Holopeka
Fakatafenga	SUVa1	Tongoleleka
Alofitai		Vaipuna
NT-93		Vuki's Mound
		SUSa3
		NT-100
		Falemoa

5

Tongan and Futunan site stratigraphy and data

IN THIS CHAPTER the archaeological data from Tongan and Futunan sites found to have acceptable or questionable radiocarbon dates (see Chapter 4) are presented. The data from American Samoan and Western Samoan sites are similarly presented in Chapter 6.

In Chapter 3, sets of questions about specific components of the West Polynesian cultural assemblages were developed on the basis of expectations of the patterning of archaeological evidence in the established cultural sequence. In this and the following chapter, these sets of questions are applied to the published data from each site. This procedure enables the large volume of data to be systematically summarised and provides the background material for the regional syntheses presented in Chapters 7, 8 and 9. For each site, the data are reported as direct responses to the sets of questions developed in Chapter 3 and interpretations are those of the excavator(s) unless stated otherwise.

Preceding the summary of cultural material from each site is a discussion of chronological or chronostratigraphic units for the site which I consider appropriate on the basis of the published description of the stratigraphy and the results of the assessment of the radiocarbon sequence presented in the preceding chapter. The chronological units are the analytical units used in subsequent chapters to investigate intra-site and regional change through time in the cultural assemblages. In the majority of sites, chronological units match those identified in the published reports. Where my analytical units differ from those of the excavator, the rationale for this is discussed.

The sites are discussed in clusters according to geographic sub-regions: Niuatoputapu, Northern Ha'apai, Tongatapu and Futuna/Alofi. Presenting the data according to these sub-regions is logical not only because it systematises the large volume of data; but, in most cases a number of sites within each region have been excavated as part of a single project and the results for the sites are similarly reported and analysed. Further, in some circumstances, such as Niuatoputapu, different sites have been interpreted as representing phases in a local chronological sequence. The use of subregions also recognises that local environmental and social factors influence the composition of archaeological assemblages. Following description of the analytical units and cultural assemblages for sites in each subregion, a summary discussion of the relative chronology of the sites is presented.

Niuatoputapu sites

The Niuatoputapu sites of NT-90, NT-100 and NT-93 (Fig. 5.1) are just three of a large number of ceramic sites found in an area of Niuatoputapu identified by Kirch (1988:38) as the ceramic zone of the island, which is described as:

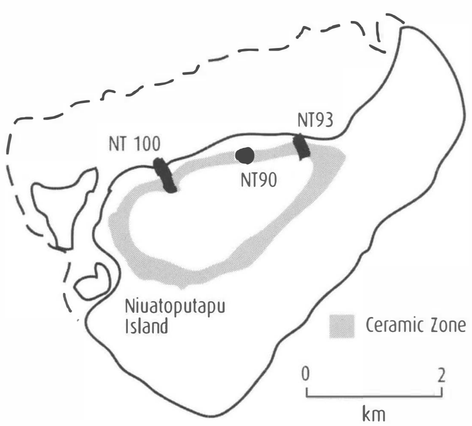

Figure 5.1 Niuatoputapu sites discussed in the text

> a single narrow zone of continuous deposits...situated at the base of the island's central volcanic ridge and terrace. The area of the ceramic zone is an upraised beach terrace of coral sand lying immediately inland from a series of former shorelines, beach ridges, and elevated lagoons.

Kirch (1988:38) interprets the ceramic zone as the original beach on which human occupation of the island first took place. The shoreline has subsequently prograded, enlarging the habitable area of the island and resulting in the ceramic sites being situated in their present inland location.

As discussed in Chapter 4, all three Niuatoputapu sites were found to have acceptable or questionable radiocarbon determinations. The probability distributions of these dates are illustrated in Figure 5.2.

All have a standard stratigraphy consisting of a main, partially disturbed, occupation layer (the ceramic zone) beneath a disturbed deposit of garden soils, the latter presumably containing more recent cultural material mixed with that of the earlier ceramic deposit. The ceramic zone consists of anthropogenically created loam overlying white sand. The ceramic zone is presently intensively cultivated. Ceramics are visible on the surface in varying densities across the zone due to continual reworking of earlier occupation deposits by gardening activities (Kirch 1988:41). Kirch (1988) analyses the cultural assemblages from each of these sites as a single chronological unit (the stratigraphic context of cultural material is not reported). The evidence from each site is interpreted as representing a different phase in a cultural sequence, thereby creating an inter-site chronological framework for looking at change through time (Kirch 1988:Chapter 7). A similar framework has been employed in the present analysis because the available data does not permit any intra-site variation to be investigated. However, the radiocarbon determinations associated with the sites limits their use as chronological units. This issue is discussed in detail below.

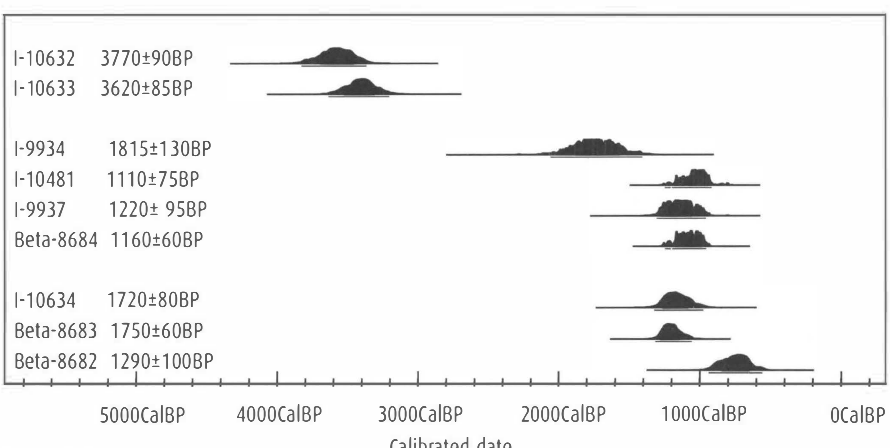

Figure 5.2

NT-90, Lolokoka

Stratigraphy

The spatial extent of the NT-90 site was identified by cultural material on the ground surface. A random sampling strategy was used to locate 25cm x 25cm test pits across the site. Areas of high subsurface concentrations of cultural material were then selected for further excavation (Kirch 1988:85). Cultural deposits at the site rarely reached 1 m in depth and have a uniform stratigraphy. The uppermost Layer I is loam, containing cultural deposit and is a product of the incorporation of organic material and more recently leaf litter and humus with the parent calcareous sand, coral and shell which forms the underlying deposit of Layer II (Kirch 1988:85). Kirch (1988:87) subdivides Layer I into Layer IA, extensively reworked garden soil, and Layer IB, less disturbed cultural deposit with some intact features near the base. Layer II is divided into Layer IIA, unconsolidated calcareous sand with some cultural material, and Layer IIB, the basal deposit of cemented coral sand.

Kirch (1988:90) states that the:

> disturbed shallow stratigraphy at NT-90…creates serious problems for archaeological interpretation. Not only is a well-stratified succession of occupational horizons lacking, but the primary cultural deposit (Layer I) has suffered a great deal of mixing. Intact features and large sherds were often found at the base of Layer IB and cutting into Layer IIA, but the higher portions of Layer IB and all of Layer IA were usually thoroughly churned.

Analytical units

The mixing of the Layer I deposit may account for the widely divergent ^{14}C dates available for NT-90 (see Fig. 5.2). The four dated samples were excavated across Layer IB in four separate test pits. I-10632 (3814–3350 cal BP 2σ range) and I-10633 (3600–3192 cal BP 2σ range) are both from *Tridacna* sp. shell samples and overlap. Two much more recent dates, I-9934 (2035–1411 cal BP 2σ range) and I-10481 (1176–802 cal BP 2σ range) were obtained from charcoal samples. In combination the dates give a possible calibrated range of ca. 3800 to 800 cal BP for the age of Layer IB. Identification of any change through time in archaeological material from this site is limited by the disturbed stratigraphy and Kirch's (1988) adoption of a single chronological unit for this and the other Niuatoputapu sites.

Ceramic component

Ceramics were recovered from all stratigraphic units, but have been analysed as a total assemblage rather than according to their stratigraphic context. The assemblage includes dentate stamped Lapita ceramics and a plainware component. Kirch (1988:184) states that, based on the presence of a number of dentate stamped Lapita motifs and the range of vessel types present, the assemblage (or a component of it) can be clearly assigned to the Early Eastern Lapita phase as defined by Green (1974b). As discussed previously, the ^{14}C dates associated with the site span the entire established ceramic sequence, as well as the aceramic and early mound-building period.

A total of 31,405 sherds were excavated or surface collected from NT-90. Only 379 (<1%) body sherds were analysed from a total of 36,414 sherds from NT-90, NT-100 and NT-93. All diagnostic sherds (n=1106) were analysed. These came from all sites including surface collections.

Decorative techniques present include dentate stamping, incising, applique/modelling, punctation, paddle impressing, notching and slipping. A total of 122 sherds (0.39%) of the NT-90 ceramics are decorated (Kirch 1988:Table 15). Decoration, including dentate stamping, was noted on both the interior and exterior surfaces and lip of two cup varieties; on the lip edge and exterior of a large bowl variety; between the lip and carination of a carinated bowl form; on the rim of a collared bowl form; on the exterior of a carinated collared bowl; and above the carination of a carinated jar form (Kirch 1988:157–64).

Sherd thickness was measured and plotted as a histogram that was unimodal. No significant inter-site or stratigraphic differences in sherd thickness was noted (Kirch 1988:152).

Vessel forms identified by Kirch (1988:Table 23) include three variants of small bowls or cups, five variants of large bowls, three variants of carinated bowls, two variants of carinated jars, four variants of large jars and a water jar. Everted rims predominate in the assemblage.

The density of excavated sherds is 612.8 sherds/m^2 (Kirch 1988:Table 15).

While several types of temper were identified in the Niuatoputapu ceramics, calcareous and ferromagnesium tempers were only found in sherds from NT-90. The calcareous temper is associated with one of three paste types identified in the combined assemblages but prevalent only at NT-90 (Kirch 1988:150–51). Kirch (1988:151) concluded on the basis of temper and paste analyses that ceramic manufacture was local and no importation of Samoan or Fijian ceramics is evident.

Kirch (1988:175) identifies that pots with calcareous tempers are more likely to have dentate stamped decoration than pots of other temper types. He suggests this is evidence that calcareous tempers and dentate stamping are both early techniques which disappear quickly from the ceramic sequence.

A similarity is noted between the design elements seen in the decoration of Lapita ceramics from Fijian sites and those of NT-90 (Kirch 1988:177). Similar decorative motifs are found in 'Uvean Lapita assemblages, the Ferry Berth assemblage and that from NT-90 (Kirch 1988:187).

No details about the stratigraphic distribution of the ceramics are reported and consequently no intra-site variability can be assessed.

Adze component

Kirch (1988:Tables 31 and 32) discusses the Niuatoputapu adzes, (surface collected and excavated), as a single assemblage, listing 28 whole adzes or fragments, of which 25 could be typed. Twenty four are from surface collections, thereby limiting the usefulness of the assemblage for investigating temporal change (Kirch 1988:189). The majority of the specimens are Types III, IX and X, while Types I, Va and VI make up a minor component. No change through time in the assemblage is noted, but an association of Types IX and X with later prehistoric assemblages is made on the basis of their distribution across recently uplifted areas of the Island.

Kirch (1988:191) lists six adze fragments as coming from the NT-90 site, with all but one being surface finds. The stratigraphic context of the single excavated adze fragment is not reported. The excavated adze piece was too fragmented to assign a type according to Green and Davidson's (1969; Green 1971, 1974b) adze typology. In the surface collection are fragments of one Type Va, one or possibly two Type III, one Type IX/X and one Type IX. Kirch considers the Type Va adze from the surface collection to have been recently disturbed by gardening activities and likely to be associated with the ceramic assemblage.

Raw materials for the entire excavated and collected Niuatoputapu stone assemblage are described as 'fine-grained greyish or blue-black volcanics, either basalt or andesite' (Kirch 1988:192). Kirch (1988:192) mentions a possible Niuatoputapu source for the material and there is no discussion of any other possible sources.

In addition to the adze fragments, 75 basalt or andesite flakes were recovered from NT-90. All lack signs of grinding and it has been suggested by Kirch (1988:217) that some may have been used for scraping.

Other artefact component

The non-ceramic artefacts (not including stone adzes) from the Niuatoputapu sites are listed in Table 5.1. Forty of the NT-90 portable artefacts were surface finds (Kirch 1988:Table 7). Where a specific artefact is described as a surface find, this has been noted in Table 5.1. The descriptive or functional artefact categories are described individually by Kirch (1988:198–218).

Kirch (1988:205) likens the Niuatoputapu fishhooks to the *Turbo* sp. fishhooks from Anuta and Tikopia, which are roughly contemporary with the fishhook from NT-93 and a single fishhook from a Tongatapu site. The lack of fishhooks in West Polynesian sites is argued to reflect an emphasis on other fishing strategies (Kirch 1988:206).

Table 5.1 Niuatoputapu other artefact assemblage (Code: P = present in the deposit but no quantity is reported).

ARTEFACT TYPE	RAW MATERIAL	NT-90	NT-100	NT-93
shell adze	*Tridacna* sp.	1	1	4 (3 surface)
	Conus sp.		1	
	Terebra sp.		1 (surface)	
one-piece fishhook	Turbo sp.			2
	pearl shell		1	
fishhook blank	*Turbo* sp.	7	1	
net weight	*Cypraea* sp.	P	P	P
	bivalve	1		
shell ring fragment	Tridacna sp.	2		
	Conus sp.	9		2
	Trochus sp.	2		
shell bead	*Spondylus* sp.	1		
	Conus sp.	1		
shell disk	*Conus* sp.	1		
	Spondylus sp.	1		
bi-perforated units	*Conus* sp.	1		
shell peeler	*Cypraea* sp.	1		
shell scraper	bivalve	2	1	
	Cypraea sp.	4		4
abrader	echinoid spine	7		1
	coral			2
	stone	1 (surface)		
hammerstone	basalt/andesite	3	2	
	coral	1	1	
flaked stone	chert	38	1	
	volcanic glass	8778	548	784
awl/drill	stone	1 (surface)		
abraded haematite		1		
worked bone	turtle	2		2
worked shell		P	P	P
Total (approximate)		8866	560	803

Kirch (1988:208) considers that ornaments such as shell rings, disks and beads may be exchange valuables and a possible indicator of social rank differentiation, especially where an artefact has a wide distribution, such as the bi-perforated *Conus* sp. segments. A food preparation function is attributed to the artefacts identified as scrapers and peelers (Kirch 1988:208–9). Eighteen pieces of worked shell were also recovered from the Niuatoputapu sites, but their individual site and stratigraphic provenances are not discussed.

Chert does not occur locally on Niuatoputapu and was therefore imported to the island. A chert source is known on Futuna and chert has also been identified in the Naigani Lapita site in Fiji (Kirch 1988:213). A further source may be 'Eua Island in Tonga (Kirch 1988:214). Volcanic glass occurs locally on Niuatoputapu and on neighbouring Tafahi. The volcanic glass assemblage consists of mainly of plain flakes with occasional retouch. Cores are present but are not discussed further by Kirch (1988:216).

No change through time is noted in the non-ceramic artefact assemblage from NT-90.

Faunal assemblage

A faunal assemblage was excavated from NT-90 and is reported by Kirch (1988) as a single assemblage, rather than by stratigraphic context.

Marine fauna
The marine fauna includes fish, molluscs and echinoderms (Kirch 1988:221–34). Nine fish taxa were identified in the site, most of which are reef dwelling and can be taken by spearing and netting, or less commonly by poisoning. Only two of the genera represented are known to be caught by angling, but both may also be taken by other methods (Kirch 1988:222-5). Based on the Niuatoputapu assemblages collectively, the fish species recovered are predominantly inshore with very few pelagic and benthic species (Kirch 1988:225).

The molluscan assemblage is primarily gastropod and has a concentration index of 19.74kg/m^3 (Kirch 1988:227-8) NT-90 has the highest concentration and greatest diversity of shellfish species of all the Niuatoputapu sites investigated.

Terrestrial fauna
The terrestrial vertebrate assemblage consists of 272 bones, of which eight are human, 141 are described as 'medium vertebrate' and three are 'medium mammal'.

Indigenous fauna recovered from the site includes five families of bird, including gulls and terns, turtle [classified as terrestrial fauna because of the likelihood that nesting colonies of turtle were present on the island (Kirch 1988:221)] and fruit bat (*Pteropus* sp.), the latter being represented by a single bone.

Two bones of *Sus scrofa* (pig), *Gallus gallus* (chicken) and four bones of *Canis familiaris* (dog) were recovered. A single bone of the commensal *Rattus exulans* was recovered, along with the remains of several humanly introduced terrestrial gastropods. Kirch (1988:235) states that three of the species of land snails have wide distributions in early archaeological deposits in the southwestern Pacific and their presence strengthens arguments relating to the transportation of plants between islands during and after colonisation.

The faunal assemblage from NT-90 has been analysed in association with the Niuatoputapu sites which, as a whole, are considered by Kirch (1988:235) to demonstrate a change through time in resource strategies. Domesticates have been part of the diet from the period of initial colonisation, with pig increasing in frequency over time. The amount of shellfish, fish and turtle consumed decreases throughout the sequence. This is argued to reflect both the changing lagoon environment and the effects of continual predation (Kirch 1988:235). The only site with significant amounts of wild birds is NT-90, suggesting exploitation by initial colonists (Kirch 1988:235).

NT-100, Loto'aa

Stratigraphy
The NT-100 site was visible as a scatter of sherds, located approximately 1 km to the west of NT-90. The subsurface deposits were sampled by a transect of excavation units, 1m x 1m square, at 10 m intervals (Kirch 1988:97). The stratigraphy of NT-100 closely parallels that of NT-90 and was similarly numbered. Layer IA is reworked surface deposit and cultural material, while Layer IB is described as loam with 'relatively undisturbed' cultural deposit (Kirch 1988:98). Layer IIA in NT-100 is not specifically described, but the same layer in NT-90 was described as unconsolidated calcareous sand with limited amounts of cultural material (Kirch 1988:87).

Analytical units
Three ^{14}C determinations from the NT-100 site are from Layer IIA in a single excavation unit: I-9937(1306–932 cal BP 2σ range); I-10634 (1308 - 971 cal BP 2σ range); and Beta-8684 (1261–953 cal BP 2σ range). Beta-8682 (928–548 cal BP 2σ range) is from a separate unit and appears in a stratigraphic diagram to come from Layer IB (Kirch 1988:Fig. 59); however, the provenance of the sample is reported only as a depth below surface (Kirch 1988:Table 13). Layer IB is distinguished from Layer IIA by the

presence of cultural material including organic material, which has darkened the deposit. It is unclear whether the cultural material from Layer IIA and the associated ^{14}C dates should be considered an earlier deposit than that of Layer IB, or whether, like the NT-90 site, material in Layer IIA originates from the main cultural deposit. Kirch does not differentiate between the stratigraphic layers in the site when describing the associated cultural material and the material can only be assessed in the present analysis as a single unit with an associated radiocarbon age range of ca. 1300–600 cal BP.

Ceramic component

Ceramics were excavated from all stratigraphic units at NT-100, but are reported as a single assemblage. The assemblage spans Late Eastern Lapita to Polynesian plainware (Kirch 1988:228). The radiocarbon age range of the site spans the aceramic and mound-building periods of the established cultural sequence.

A total of 2385 sherds were recovered from the site. The 58 diagnostic sherds recovered were all analysed, but only a small percentage (the exact number is not reported) of the plain body sherds were analysed.

Four decorated sherds (0.17% of the assemblage) were recovered (Kirch 1988:Table 15). All have decoration on the rim: two have notching and two have incising (Kirch 1988:Table 25). Sherd thickness was measured and plotted as a histogram, which was unimodal. No significant inter-site or stratigraphic differences in sherd thickness was noted (Kirch 1988:152). Vessel forms from the site include small bowls or cups, two or possibly three variants of large jars and a water jar (Kirch 1988:Table 23). Rims are primarily everted and flat-rounded (Kirch 1988:Table 24).

The density of sherds in the site as a whole is 125.5 sherds/m^2 (1988: Table 15). The density of sherds in three 20cm levels in Layer IB and in Layer IA is listed for one excavation trench (Kirch 1988:101). The densities decrease from the bottom of Layer IB to the top. Kirch (1988:101) considers this to reflect a gradual decline in the manufacture and use of ceramics between 2500 and 1500 BP.

Kirch (1988:149–52) discusses paste and temper types found in the Niuatoputapu ceramics. He found that the paste most commonly found in NT-100 ceramics is indicative of a local clay source, although the paste of a small number of ceramics suggests their importation from Tafahi. Both these paste types are associated with ferromagnesium and, to a lesser extent, pumiceous tempers. One of the 95 sherds analysed has calcareous sand temper and paste type common at NT-90 and associated with dentate stamped ceramics. The sources for all clays and tempers appear local.

The NT-100 ceramics exhibit characteristics of both transitional Late Eastern Lapita and Polynesian plainware assemblages. There is an absence of calcareous temper, and a reduced variability in rim morphology and vessel form. (Kirch 1988:189). Kirch (1988:189) considers that, with the exception of the small cups or bowls, the assemblage resembles that of site FU-11 on Futuna, and differs from Samoan plainware assemblages (in which the vessel forms are restricted only to bowls). No explanation is given for the variability within the assemblage.

Adze component

Two adze fragments are reported from the NT-100 site, one of which is a surface find. The stratigraphic context of the excavated adze fragment is not discussed.

The excavated adze is well polished with a rounded cross-section, but did not fit Green and Davidson's (1969; Green 1971, 1974b) adze typology. The surface find was classified as a Type IX/X. Raw materials for all Niuatoputapu adzes are discussed in the summary of NT-90 assemblages. For interpretation of the NT-100 adze assemblage see NT-90 adze component.

Twenty-two basalt or andesite flakes were recovered. These do not show evidence of grinding, but some may have been used as scrapers (Kirch 1988:217).

Other artefact component

Non-ceramic artefacts from NT-100 are listed according to descriptive or functional type in Table 5.1. The stratigraphic context of the artefacts is not reported by Kirch (1988). At least 558 artefacts were recovered (the precise number is not reported) and of these, 548 are volcanic glass flakes. The remainder of the reported assemblage consists of only ten artefacts, including three shell adzes, a fishhook and fishhook blank, three hammerstones and a shell scraper. A single imported chert flake was recovered.

No behavioural explanation for the presence of particular artefact types in the site is given and no change through time in the assemblage variability can be ascertained from the reported evidence.

Faunal assemblage

A marine and terrestrial faunal assemblage was excavated from the site, although the stratigraphic provenances of the taxa are not reported.

Marine fauna component

The fish taxa identified in the site are similar to those found in NT-90; however, the number of individual specimens is much lower and all species can be caught by spearing, netting or poisoning (Kirch 1988:222–5).

Two-thirds of the molluscan assemblage are gastropods, with the other one-third being bivalves. The overall concentration index was 8.32 kg/m^3. The diversity of shellfish species in NT-100 is less than that in NT-90 (Kirch 1988:227–8).

Terrestrial fauna component

The terrestrial vertebrate component of NT-100 consists of 141 bones, of which 20 are human, 76 are identified as medium vertebrate and a further three are identified as medium mammal (Kirch 1988:Table 38). Indigenous terrestrial fauna consists of marine turtle, a single lizard bone (genus *Brachyophylus*) and possibly birds. Small amounts of pig (five bones) and chicken (seven bones) were recovered. *Rattus exulans* and humanly transported terrestrial gastropods are also present.

For interpretation of the faunal assemblage, see the discussion of the NT-90 faunal assemblage.

NT-93, Pome'e-Nahau

Stratigraphy

The stratigraphy of the NT-93 site was more complex than that of either of the previously described Niuatoputapu sites. In addition to Layer IA (a cultural deposit thoroughly reworked by gardening activities) and Layer IB (less disturbed cultural deposit), a lower cultural deposit, Layer IC, occurred at NT-93. This is described as being earlier than Layer IB (Kirch 1988:104). This is underlain by Layer IIA (calcareous sand with a small amount of cultural deposit), equivalent to Layers IIA in NT-90 and NT-100.

Analytical units

Kirch (1988:104) summarises the depositional sequence at NT-93 as comprising two major cultural layers, Layer IC, representing initial settlement, and Layer IB. However, the stratigraphic context of the cultural material is not reported and the site must therefore be considered as a single chronological unit. The only acceptable date for the site, Beta-8683 (1302–1053 cal BP 2σ range), is from a shell sample excavated from Layer IC and the site has an associated calibrated ^{14}C age range similar to that of NT-100.

Ceramic component

Ceramics were excavated from all stratigraphic units but are analysed as a single unit. The assemblage spans the Late Eastern Lapita to Polynesian plainware periods (Kirch 1988:228). The ^{14}C age range for the site spans the aceramic period of the established cultural sequence. A total of 5635 sherds were recovered from the site. All 124 diagnostic sherds were analysed, but only a small percentage (the exact number is not reported) of the plain body sherds were analysed.

A single decorated sherd (0.02% of the assemblage) is listed as coming from the site (Kirch 1988:Table 15), but the form and location of the decoration on the vessel is not discussed. Sherd thickness was measured and plotted as a histogram, which was unimodal. No significant inter-site or stratigraphic differences in sherd thickness was noted (Kirch 1988:152). Vessel forms from the site are the same as those from NT-100: small bowls or cups, two or possibly three variants of large jars and a water jar (Kirch 1988:Table 23). Rims are primarily everted and flat-rounded (Kirch 1988:Table 24). The density of sherds in the site as a whole is 256.1 sherds/m^2 (Kirch 1988:Table 15).

The paste most commonly found in NT-93 sherds is the same as that for NT-100 ceramics and suggests a local clay source (Kirch 1988:149–52). The paste of a small number of ceramics suggests their import from Tafahi. Both these paste types are associated with ferromagnesium and, to a lesser extent, pumiceous tempers. Two of the 175 sherds analysed have calcareous sand temper and paste type common at NT-90 and associated with dentate stamped ceramics.

For interpretation of the ceramic assemblage, see NT-100 ceramic component.

Adze component

A single adze is listed as excavated from the NT-93 site (Kirch 1988:Tables 31 and 32), although its stratigraphic context is not reported.

According to Green and Davidson's (1969; Green 1971, 1974b) typology, the adze is a Type VI (Kirch 1988:192). Adze raw materials for all Niuatoputapu sites are discussed in the summary of NT-90 assemblages.

Nine basalt or andesite flakes were recovered, none of which show evidence of grinding, although some may have been used as scrapers (Kirch 1988:217).

For interpretation of the assemblage, see discussion of the NT-90 adze component.

Other artefact component

The other artefact component of the NT-93 assemblage is listed according to descriptive or functional type in Table 5.1. The stratigraphic context of the artefacts is not reported. At least 801 artefacts were recovered (the precise number is not reported). Of these, 784 are volcanic glass flakes. The remainder of the reported assemblage consists of only 17 artefacts, of which three shell adzes are surface finds. The other finds include two *Turbo* sp. fishhooks, three abraders, a net weight, two shell ring fragments, four shell scrapers and two pieces of worked bone.

No behavioural explanation for the presence of particular artefact types in the site is given and no change through time in assemblage variability can be ascertained from the reported evidence.

Faunal assemblage

As for NT-100, a marine and terrestrial faunal assemblage was excavated from the site, but the stratigraphic provenances of the taxa are not reported.

Marine fauna component

Five fish taxa were identified at NT-93, all of which can be caught by spearing, netting or poisoning (Kirch 1988:222–5).

Again, two-thirds of the molluscan assemblage are gastropods and one-third bivalves. The overall concentration index for molluscan fauna was 4.76 kg/m^3, which is half of that for NT-100 and a quarter of that for NT-90. The diversity of shellfish species in NT-93 is slightly less than in NT-90 and slightly greater than in NT-100 (Kirch 1988:227–8).

Terrestrial fauna component

The terrestrial vertebrate component consists of 64 bones, of which 48 are identified only as medium vertebrate (Kirch 1988:Table 38). Indigenous terrestrial fauna consists of marine turtle and a single medium bird bone. Pig (three bones) and chicken (six bones) were recovered in small amounts. Terrestrial gastropods are also present.

For interpretation of the faunal assemblage, see NT-90 faunal assemblage.

Change through time in the Niuatoputapu assemblages

In the chronological framework created by Kirch (1998), NT-90 is considered the earliest of the sites based on the presence of dentate stamped ceramics and the associated radiocarbon determinations. However, the recent dates from the site and the disturbed stratigraphy mean the cultural material cannot be assumed to date to the period of initial colonisation of the island. Kirch (1988:90) argues that:

> Comparing the NT-90 assemblage with those from [the] latter sites, it is possible to argue that materials found only at NT-90 were associated with the earliest occupation phases.

In the assessments of change through time in various aspects of the cultural assemblages in the following chapters, Kirch's (1988:Fig. 133) chronological framework has been used as a basis for the analytical units for the Niuatoputapu sites. Accepting the above argument, evidence found exclusively in the NT-90 assemblage is considered as early, that is, associated with the radiocarbon determinations in the range of ca. 3800–3200 cal BP (I-10632, I-10633) and with the initial Lapita use of the site. NT-93 and NT-100 have a contemporary radiocarbon chronology and the sites have been combined as a more recent analytical unit with an associated radiocarbon chronology of ca. 1300–800 cal BP (I-9937, I-10634, Beta-8684 and Beta-8683). This is contemporary with recent dates from NT-90. Therefore, cultural material recovered from NT-90 which is also recovered from the two more recent sites cannot be assumed to be associated with the early NT-90 dates and, for the purposes of investigating change through time in the cultural material, is considered recent.

While no details of the volume of the excavated deposit are provided, approximately 51 m^2, 22 m^2 and 19 m^2 were excavated at NT-90, NT-93 and NT-100, respectively (Kirch 1988:Table 15). Analysis of material from NT-93 and NT-100 as a single unit helps to balance the different sample sizes from the various sites.

Northern Ha'apai sites

The seven Ha'apai sites with acceptable and/or questionable radiocarbon determinations (Tongoleleka, Fakatafenga, Faleloa, Pukotala, Vaipuna, Mele Havea and Holopeka) are all beach sites (see Fig. 5.3). All sites contain dense concentrations of ceramics and all except Holopeka contain dentate stamped Lapita sherds. However, the Faleloa, Pukotala, Vaipuna, Mele Havea and Holopeka sites have not been fully published and only limited descriptions of the excavated assemblages are available (Burley n.d.; Burley et al. 1995, 1999; Shutler et al. 1994).

Tongoleleka

Stratigraphy

The Tongoleleka site on Lifuka Island is located in a long sand dune found inland of the present beach line. Initial excavation of the site (Dye 1987:124) described the stratigraphy as follows. At the base of all excavation units is Layer IV, comprising a sterile fine white sand, probably of aeolian deposition. Lying atop this basal deposit is Cultural Unit III, a dark sand described as being without structure, containing some artefacts and faunal remains. Cultural Unit II overlies Unit III in all but one of the nine excavated test pits, where it rests on the sterile sand. The colour and texture of Unit II varied considerably. It is identified as a single unit on the inland portion of the dune, but on the top and front face has been divided into Units IIa and IIb. IIa contains large Lapitoid potsherds and abundant midden remains, while IIb contains in situ deposits of ceramics and shellfish associated with living surfaces of hard-packed ashy soil. Unit I, which overlies Unit II in all excavation units, is a dark brown sandy loam with sparse cultural remains including some sherds.

In the 1995 and 1997 excavations Burley (n.d.) identified a similar stratigraphy, with some exceptions. Burley's (n.d.) Stratum III appears to correlate with Dye's (1987a) Cultural Unit III, the basal cultural deposit. Burley (n.d.) divides Stratum II into three sub-layers: IIa, IIb and IIc. Stratum IIc is considered a stabilised land surface, overlying Stratum III, and is found in only some parts of the site. This appears similar to Dye's (1987a) description of Cultural Unit IIb, although it is unclear whether Burley's (n.d.) Stratum IIc includes the cultural deposit siting on the stabilised land surface. If so, then Strata IIc and IIb would equate with Dye's (1987a) Cultural Unit IIb. It follows that Burley's (n.d.) Stratum IIa would then equate with Dye's (1987a) Cultural Unit IIa. Burley's Strata IIa and IIb appear to be differentiated on the basis of sediment colour and sand content, and the boundary is diffuse.

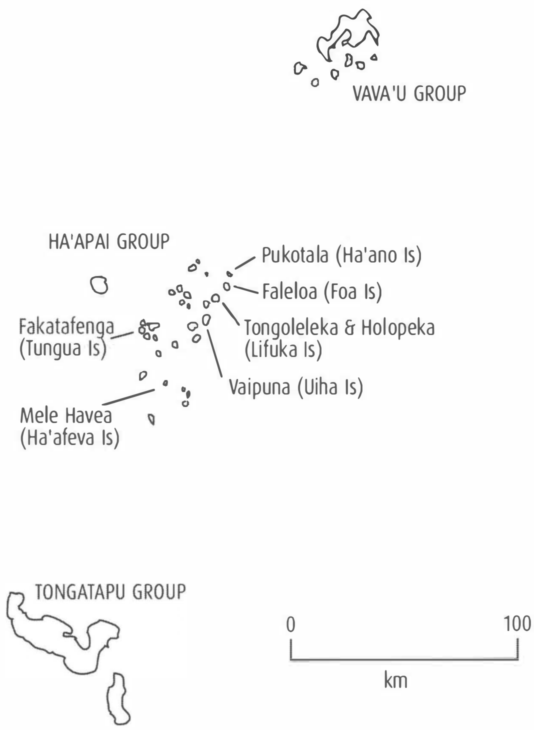

Figure 5.3 Ha'apai sites discussed in the text

Analytical units

The probability distributions of the Tongoleleka dates are illustrated in Figure 5.4. Beta-14171 (2702–2156 cal BP 2σ range) is from a sample described as charcoal rich sand obtained from 'a living surface' toward the top of Cultural Unit III (Dye 1987:129). The dates AA-1921 (2932–2331 cal BP 2σ range) and AA-1923 (2788–2474 cal BP 2σ range) are from turtle bone samples from excavation Layer IV, which is equivalent to Cultural Layer III (Dye 1987:124–6). The age range of AA-1923 is encompassed by that of AA-1921 (Dye 1990).

The samples for CAMS-34560 (2730–2370 cal BP 2σ range), CAMS-34561 (2920–2560 cal BP 2σ range) and CAMS-41514 (2850–2530 cal BP 2σ range) are described by Burley (n.d.:27) as coming from the basal Lapita deposit, Stratum III, the same context as the turtle bone samples for AA-1972 and AA-1923, and fall within their calibrated ranges.

The remaining Tongoleleka dates (CAMS-34558, CAMS-34559, CAMS-41512 and CAMS-41513) are all from Stratum II and are all virtually identical, with a calibrated 2σ range of ca. 2750–2350 cal BP — a similar age range to the underlying Stratum III. On the available description of the stratigraphy the basis of the distinction between Strata IIa and IIb is unclear. Given this, plus the disturbance noted in the site [especially by Dye (1987)] and that the correlations drawn between Dye's (1987a) and Burley's (n.d.) stratigraphy are not definite, it seems appropriate to consider Stratum II and Cultural Unit II as a single analytical unit. Further, the stratigraphic context of the assemblages excavated by Burley et al. (1999) has not yet been published, so analysis of the cultural assemblages is restricted to Dye's (1987a) data.

The stratigraphic units have been retained as the analytical units for the site. The earliest unit on stratigraphic evidence, Stratum or Cultural Unit III, is, on radiocarbon evidence, contemporary with the overlying Stratum II. The chronology of the surface (Stratum I) is unclear.

Although the stratigraphic units have been correlated across the site, Dye (1987:130) feels that complex stratigraphy in some excavation units has resulted in a variable degree of accuracy in equating the cultural material with stratigraphic units. He states that the test pits 0N10E, 0N20E, 45N1W and 126N0W have the highest level of integrity (Dye 1987:130). However, in the reporting of results of the ceramic analysis, no distinction is made between ceramics from these squares and the rest of the assemblages. Non-ceramic cultural material is reported only to stratigraphic layer, not test pit.

Ceramic component

In the excavations undertaken by Dye (1987), 9155 sherds were recovered[1], with all cultural units reportedly containing ceramics. Dye (1987) characterised the assemblage as Lapitoid, that is, in the Lapita tradition including Early and Late Eastern Lapita, and plainware. The ^{14}C age range of Cultural Unit III spans the periods of Early and Late Eastern Lapita and the plainware periods.

A total of 289 (3.2%) sherds are decorated. Dye (1987:173) describes decoration consisting of dentate stamping, incising, carved-paddle impressing, applied relief and notching of rims. Dentate stamped decoration is found in all cultural units, but the percentage of sherds with dentate stamping decreases from Units III to I (Dye 1987:174). In Cultural Unit III, approximately 8% of sherds have dentate stamping, decreasing to 2.5% in Units II and IIb, and 1.6% in Unit IIa. Only a few sherds represent the other forms of decoration. Carved-paddle impressed sherds are quite plentiful in Units II, IIa and IIb, but are absent from Unit III. Incised decoration is restricted to the earliest cultural units. Applied relief is relatively common throughout the sequence, but usually in association with dentate stamping (Dye 1987:176). Decoration is most commonly found on the exterior of the vessel (Dye 1987:181).

There is no difference between cultural units in the thickness of vessel walls, although thickened rims are more frequent in Unit II than Unit III (Dye 1987:205). Vessel forms identified include carinated shoulder, simple bowls and sub-globular pots. Two handles and four lugs were also reported.

Tempers are identified primarily as local sand, with a vitreous igneous component derived from tephra (probably from nearby volcanic islands) and drift pumice. A small number of sherds from one test pit contained exotic feldspathic temper, probably from Fiji. The stratigraphy in the test pits is disturbed and Dye (1987:246) doesn't consider the exotic sherds to be securely associated with the Lapitoid sherds.

Dye's (1987a) interpretation of the ceramic assemblage includes that of the Fakatafenga site and is summarised later in the description of the Fakatafenga assemblage.

Adze component

One stone adze (from Cultural Unit IIb) and 19 volcanic rock fragments (some from each cultural unit) were excavated from Tongoleleka.

The adze has not been assigned to a specific adze type. The cross-section is described as plano-convex with a flattened front and rounded sides, and is broken across the mid-section (Dye 1987:135–6). The raw material is described as coarse-grained, blue-green rock exotic to Tonga.

Seven volcanic stone fragments or flakes from the site are polished, suggesting removal from an adze blade (Dye 1987:138). One is large enough to indicate the shape of the adze blade section, which Dye (1987:139) describes as circular.

No behavioural interpretation of the adze or stone fragments has been made.

No adzes were recovered in the 1997 excavations (Burley n.d.).

Other artefact component

The other artefact types from the 1987 excavation are listed in Table 5.2. The cultural unit from which they were obtained is given, but not the test pit from which they were excavated.

Dye (1987:131–9) describes each of the artefact types, but does not discuss any behavioural implications of the artefacts. No change through time is reported in the other artefact assemblage.

[1] The 1997 excavations yielded a further 5418 sherds, of which 104 are decorated (Burley n.d.). The stratigraphic provenance for the 1997 assemblage has not been reported and no further description of this assemblage is available and these ceramics are not discussed further.

The stratigraphic context of other artefacts from the 1997 excavation has not yet been reported. A total of 44 artefacts were recovered and these include several types not reported by Dye (1987) — shell bead, chisel and scraper — as well as a stone abrader, flake and worked cobble (Burley n.d.).

Table 5.2 Tongoleleka other artefact assemblage (from Dye 1987:Table 8).

ARTEFACT TYPE	RAW MATERIAL	CULTURAL LAYER			TOTAL
		I	II	III	
shell adze	*Tridacna* sp.	1			1
	Conus sp.		1		1
abrader	coral	1	2	1	4
	echinoid		3	2	5
point	stone		1		1
flake/fragment	siliceous rock		2	1	3
octopus lure	*Cypraea* sp.	1	5		6
hammer	stone		2		2
shell ornaments	*Tridacna* sp. ring fragment	2			2
	Trochus sp. ring fragment		10		10
	other ring fragments	2	10	4	16
	Conus sp. disks		3		3
	pearl shell pendant		1		1
	bi-perforated units		3	3	6
Total		7	43	11	61

Faunal assemblage

The species present in the 1987 excavations and their frequencies are reported for each stratigraphic unit, but not for each test pit. The faunal assemblage from the 1997 excavations has not been reported.

Marine fauna

Eight families of shellfish are reported from the site. Concentration indices of gm/m^3 of each family in each cultural unit do not indicate marked differences through time in the species represented, except for *Turbo* sp., which is present in much higher concentrations in Cultural Unit III. Dye (1987:140) considers the diversity of shellfish species to reflect the local marine environment of Lifuka Island.

Fish bone was recovered from all cultural units and has been grouped into seven taxa. No trend is identified in the concentration indices for total fish bone in each cultural unit.

Terrestrial fauna

Dye (1987:141–4) reports the indigenous terrestrial fauna as including turtle [considered terrestrial because the marine turtles nest on the northern Ha'apai Islands]; a giant lizard (genus *Brachylophus*), now extinct; four bird species and three bird families including a megapode, also extinct.

Concentration indices (gm/m^3) (Dye 1987:Table 10) indicate far more turtle bone present in Cultural Unit III than in the upper units. Lizard is also more common in Cultural Unit III. The bones of a megapode and two extinct pigeons are only found in Cultural Unit III and a third extinct pigeon is found only in Units III and IIb.

Chicken (*Gallus gallus*) and pig (*Sus scrofa*) are both reported from the site. Pig was only recovered from the disturbed surface layer, Cultural Unit I, as were sheep and goat. Bird bone quantities are not reported to family or species level, making it impossible to know which cultural units contain chicken. Rat (*Rattus exulans*) was recovered from Cultural Units III and I.

Dye (1987:143) considers the decline in the representation of turtle bone in the site and the apparent extinction of the lizard and bird species evident in the earliest cultural units to reflect the enormous impact of humans on the pristine island fauna. Over time the invertebrate and vertebrate faunal remains become less diverse, with many taxa showing a decline in concentration.

Fakatafenga

Stratigraphy

The Fakatafenga site on Tungua Island occurs in sandy soils located approximately 85 m from the present beach line. Four stratigraphic units were identified in the 14 units excavated at the site (Dye 1987:103). The basal sterile deposit, stratigraphic Unit IV, is yellowish sand lacking structure that has some artefactual material pushed into the surface. This is overlain by the main cultural deposit, stratigraphic Unit III, a dark greyish brown loamy sand with numerous cultural features. Stratigraphic Unit II is similar to Unit III, but has no identifiable features. Stratigraphic Unit I is the surface layer of dark loamy sand. These stratigraphic units were not consistent across the site (Dye 1987:105).

Analytical units

Dye (1987:106) groups the stratigraphic units from the various test pits into seven cultural units according to 'the presence of their position in the stratigraphic column, the presence or absence of cultural features and ceramic artefact content'. Stratigraphic profiles are not illustrated or described for individual test pits, making the construction of these cultural units difficult to understand. Dye's (1987a) cultural units have been retained as analytical units, but in the absence of more detailed description about the nature of the deposits and the basis for their differentiation, only limited interpretation of the distribution of the cultural material is possible. The cultural units are numbered from the surface layer, Cultural Unit I, down and, similarly to the Tongoleleka site, the main ceramic deposit is Cultural Unit III.

Two ^{14}C dates are available from Cultural Unit III (Fig. 5.4), both of which were found to be questionable. The charcoal and ash sample for Beta-14170 (5919–5603 cal BP 2σ range) was collected from the base of Cultural Unit III from a 5cm thick band of charcoal rich soil interpreted as a living surface (Dye 1987:107). Beta-11244 (1992–1412 cal BP 2σ range) is from a sample of charcoal and ash mixed with calcareous sand from an earth oven (Dye 1987:107). Dye (1987:120) rejects the determinations as being too early and too recent, respectively, to date Lapita ceramics, but offers no explanation for the association of the dated samples with the ceramics. The dates give a ^{14}C age range for Cultural Unit III of ca. 5700 to 1400 cal BP.

Ceramic component

Ceramics were excavated from all cultural units identified in the site. The assemblage contains dentate stamped sherds and is characterised by Dye (1987) as Lapita. The age range of ^{14}C dates associated with the ceramics covers the Early Lapita, Lapita and plainware periods in the established sequence. Data are provided on the number and density of sherds for each cultural unit in the site. In total 8551 sherds were excavated from the site which represents 437 sherds/m^3 of deposit.

281 decorated sherds were excavated from Fakatafenga, equivalent to 3.3% of the total assemblage. Dye (1987:173) describes decoration consisting of dentate stamping, incising, carved-paddle impressing, applied relief and notching of rims. Dentate stamped sherds are found in all cultural units, but the percentage decreases from Units IV to I (Dye 1987:174). In Cultural Unit IV, approximately 8% of sherds have dentate stamping, with the successive units showing a consistent decline in the presence of this form of decoration. Only a few sherds represent the other forms of decoration. Carved-paddle impressed sherds are present throughout the sequence, while incised decoration is restricted to the earliest cultural units. Applied relief is relatively common throughout the sequence, but usually in association with dentate stamping (Dye 1987:176). Decoration is most commonly found on the exterior of the vessel (Dye 1987:181).

There is no difference between cultural units in the thickness of the vessel wall, although thickened rims are more frequent in Unit II than Unit III (Dye 1987:205). Vessel forms identified are carinated shoulder, simple bowls and sub-globular pots.

Tempers are primarily sand, which has been locally collected and contains a vitreous igneous component derived from tephra (probably from nearby volcanic islands) and drift pumice. A small number of sherds from one Fakatafenga test pit contained exotic feldspathic temper, probably derived from Fiji. However, the stratigraphy in the test pits is disturbed and Dye (1987:246) doesn't consider the exotic sherds to be securely associated with Lapitoid sherds.

Dye (1987) notes the overall similarity of the ceramic assemblages from Tongoleleka and Fakatafenga and similar change through time in the characteristics of both assemblages. Change through time in the assemblages is inferred from differences apparent between stratigraphic units within each site. The percentage of dentate stamped sherds is greatest in the lower stratigraphic units of both sites. The dentate stamped motifs from both sites are firmly in the Early Eastern Lapita tradition, with some motifs shared with those from Fijian sites and some with those of Tongatapu sites (Dye 1987:217).

Differences in the vessel forms represented in the stratigraphic units are also reported. In Tongoleleka, rounded lips on rim sherds dominate in the early levels, then flat lips become common. Unfortunately, the low number of rim sherds recovered from the Fakatafenga site prohibits any interpretation of change through time at this site (Dye 1987:193–4). Dye (1987:206) identifies vessel form on the basis of rim characteristics. A decline in carinated sherds and everted concave rims, associated with complex vessel forms, is noted in Tongoleleka; however, the increase in convex everted rims expected from the established ceramic sequence was not observed (Dye 1987:206). Convex inverted rims associated with sub-globular pots do not show any trends in the sequence from either site. A rise in inverted concave rim sherds from closed-mouth pots with upturned rims is also seen at Tongoleleka, but not Fakatafenga.

Dye (1987:254) interprets the presence of local tempers with dentate stamped sherds to suggest that either the strandlooper phase [see Groube (1971)] was of short duration, or that the Lapita potters were quickly able to adapt to local raw materials. The latter would have meant dealing with the refractory nature of the clays derived from older andesitic tephras by the addition of vitreous pumice, or by using younger andesitic tephras. The very large volume of ceramics estimated for each site suggests that any raw material constraints must have been mild (Dye 1987:256).

Some ceramic features, especially from the Tongoleleka site, are consistent with changes seen elsewhere in the Ancestral Polynesian homeland, such as a decrease in dentate stamping, the presence of carinated sherds and sharply everted rim sherds. However, in other characteristics the changes in the ceramic assemblages are not consistent with those observed elsewhere (Dye 1987:217).

Adze component

No stone adzes were recovered from the site, although 16 volcanic rock fragments were recovered. Fourteen of these were from Cultural Unit III, three of which were partially polished but of insufficient size to permit inferences about the tools from which they derive (Dye 1987:110).

Other artefact component

The other artefact component of the Fakatafenga site is listed in Table 5.3.

Each artefact class in Table 5.3 is described by Dye (1987:110–14). A behavioural interpretation is implied by the functional categories of the artefacts such as octopus lure and hammerstone, but no further interpretations are offered. The hammerstones are described as showing battering at either end as evidence in support of their inferred function. No change through time in the non-ceramic artefacts is inferred from the assemblage.

Faunal assemblage

The vertebrate and invertebrate faunal assemblage composition is reported at the level of stratigraphic unit. Data on families of invertebrates are reported, data are only general for invertebrate groups. Vertebrate assemblages were excavated from nine of the 14 excavation units.

Table 5.3 Fakatafenga other artefact assemblage (from Dye 1987:Table 5).

ARTEFACT TYPE	RAW MATERIAL	CULTURAL LAYER			TOTAL
		I	II	III	
adze	*Tridacna* sp.		1		1
flake/fragment	siliceous rock	1			1
octopus lure	*Cypraea* sp.		6	6	12
hammerstone	volcanic rock		2	2	4
possible hammerstone	volcanic rock		4		4
shell ornament	ring fragment			1	1
Total		1	13	9	23

Marine fauna component

Sixteen genera of shellfish are identified in the Fakatafenga assemblage; however, amounts are reported only for the eight major families. Concentration indices (gm/m^3) for each family indicate a marked concentration of all shellfish families in Unit III, with slightly lower concentrations in Unit II. Dye (1987:140) considers the diversity of shellfish species to reflect the local marine environment of Tungua Island. The high concentration of shellfish in Cultural Unit III is argued to provide evidence that this unit is the primary habitation component of the site (Dye 1987:116).

Fishbone was recovered from all cultural units except the most recent (Unit I). Four genera (*Scarus* sp., *Diodon* sp., Acanthuridae and Serranidae) have been identified. The highest concentration of fishbone is in Cultural Unit IV.

Terrestrial fauna component

Indigenous terrestrial fauna include turtle, which is found in the earliest two units and probably represents a number of species found in local waters (Dye 1987:117); and bird, found only in Unit III, but not identified to species, possibly including chicken and fruit bat (Pteropidae) from Unit IVS. With the exception of chicken, no domesticates are identified in the assemblage. Some bone has been identified as medium and medium to large mammal. Bones in these categories were excavated from Cultural Units III and II.

Dye (1987:118) considers the presence of high concentrations of turtle bone in the earliest cultural units to be a common feature of early settlement sites (cf. Best 1984; Green 1979:37; Kirch and Yen 1982:280).

Faleloa

Stratigraphy

Shutler et al. (1994:61) describe the stratigraphy of the Faleloa site as being similar to that of Tongoleleka, with four stratigraphic zones identified in each site. The surface, Zone I, is a disturbed deposit containing highly degraded ceramic sherds and modern artefacts. Zone II is dark brown loam in which some sediment is considered by the excavators to be slope-washed clays or silts. Zone III is a sandy clay/loam and contains the majority of the cultural assemblage, including dentate stamped Lapita ceramics. Zone IV is a basal deposit of unconsolidated beach sand underlain by coral bedrock. Zones II and III are subdivided by the excavators into three substrata based on variation in the matrix structure and inclusions; however, these substrata are not discussed further and the cultural material is not provenanced to substrata. A total of 12 1m x 1m test pits were excavated at Faleloa. These included a single trench of eight test pits across which the stratigraphy appeared uniform, although disrupted by occasional pit features (Shutler et al. 1994:61). In 1997, Burley et al. (1999) excavated an additional four 1 m x 1 m test pits, confirming the stratigraphy identified by Shutler et al. (1994), but using the term stratum rather than zone to delineate stratigraphic layers.

Analytical units

The radiocarbon dates from the initial excavations at the site are from charcoal samples, all from Zone III (see Fig. 5.4). CAMS-7145 (3192–2962 cal BP 2σ range) is the earliest of the dates. CAMS-7146 (2778–2359 cal BP 2σ range) and CAMS-8074 (2771–2362 cal BP 2σ range) are slightly more recent. Burley et al. (1999) obtained a further date from Stratum III, CAMS-41530 (2750–2380 cal BP 2σ range), which falls within the same range. The dates give an associated ^{14}C age range for the Stratum/Zone III deposit of up to 900 years, with initial occupation of the site occurring around 3000 cal BP. Stratum II has one associated radiocarbon date, CAMS-41529 (2730–2370 cal BP 2σ range), which is similar to that of Stratum III, although stratigraphically more recent. Stratum/Zone IV has not been ^{14}C dated, but is stratigraphically earlier than Zone III.

Ceramic component

Ceramics were recovered from all stratigraphic units at Faleloa (Shutler et al. 1994). The ceramic assemblage from Zone III is described as Lapita. The assemblage from Zone II is described as plainware with an aceramic component, although decorated sherds were also recovered from this deposit (Shutler et al. 1994:61). The ^{14}C determinations for Zone III span the established chronology of the Early and Late Eastern Lapita periods.

Only the ceramic assemblages from Zones II and III are described; no information is presented concerning the assemblages from Zones I and IV. The Zone III assemblage contains 58% of all sherds and 82% of all decorated sherds. No further differences between the assemblages are discussed. A total of 20,443 sherds from the were excavated in 1992, 231 of which are decorated[2].

Decoration in the assemblage includes dentate stamping, incising, notching, applique modelling, punctuation and perforation. Red slip is also noted on a few sherds. Only 1.1% of the assemblage is decorated, with decoration being located on rims and body sherds. Sherd thickness is not discussed. Vessel forms present include rounded bottom bowls (some with carination), smaller cups and large jars with constricted necks, some with handles (Shutler et al. 1994:61). No estimate of the volume of excavated deposit is reported and the density of sherds cannot be calculated. Temper types or sources are not discussed.

The only differences between the Zone II and III assemblages are that the former has a lower percentage of decorated sherds and a lower overall number of sherds than Zone III. The assemblages from Zones II and III are considered to belong to different phases in the ceramic sequence: plainware/aceramic and Lapita, respectively (Shutler et al. 1994:61), although the criteria for this assessment are not made explicit. The kinds of decoration present are not discussed with reference to zones and it is unclear whether dentate stamped decoration is found in the stratigraphically more recent Zone II.

Adze component

A single stone adze and some fragments (the exact number is not reported) were excavated from the site; however, their stratigraphic context is not reported. Similarly, the type of adze, raw material and morphology are not discussed, and no interpretation of the adze has been presented.

No adzes were recovered in the 1997 excavations.

Other artefact component

The stratigraphic associations of the non-ceramic artefact component, listed in Table 5.4, have not yet been reported.

No behavioural explanations are offered for the presence of specific artefacts in the site, however, non-ceramic artefacts are described as 'surprisingly rare' (Shutler et al. 1994:61). This was confirmed by the recovery of only a further 40 non-ceramic artefacts in the 1997 excavations.

Table 5.4 Faleloa other artefact assemblage (from Burley n.d.; Shutler et al. 1994).

FUNCTIONAL/DESCRIPTIVE TYPE	TOTAL
shell bracelet fragments	9
shell beads	4
shell scraper	6
coral abraders	14
shell chisel	1
pearl shell fishhook blank	1
Cypraea dorsum	2
Turbo tab	6
worked shell	8
pumice	>1
sea urchin spine	>2
modified lithic pieces	>6
TOTAL	>60

Faunal assemblage

A 'profuse collection' (Shutler et al. 1994:61) of vertebrate and invertebrate faunal remains was excavated from Faleloa, but no data are yet available relating to the composition of the faunal assemblage.

Likewise, the faunal assemblage recovered during the 1997 excavation has not yet been reported.

2 The 1997 excavations yielded a further 6696 sherds, of which 207 are decorated (Burley n.d.:21). The stratigraphic provenance for the 1997 ceramics has not been reported and no further description of this assemblage is available. These ceramics are not discussed further here.

Pukotala

Stratigraphy

The initial excavation of a mound at the Pukotala site yielded ceramics, including dentate stamped sherds, as well as other artefactual and faunal material. It was subsequently established that cultural material in the mound represented fill from elsewhere (Shutler et al. 1994:63). Shutler et al. (1994) excavated a further 1m × 1m test pit at a surface scatter of sherds located some distance from the mound site. The following stratigraphy was identified: Stratum I, a surface deposit of dark silty loam; Stratum II, a brown silty loam with burnt coral rock and shell; Stratum III, a grey brown silty sand; and Stratum IV, a yellow to white coral sand. Cultural material was excavated from all strata.

In 1997, Burley et al. (1999) excavated 9.5m^2 at the site, finding a stratigraphy similar to that identified by Shutler et al. (1994).

Burley (n.d.) also found Stratum IV to be the basal, original beach deposit. Stratum II is the main cultural deposit containing Lapita ceramics. There is no clear stratigraphic break between Strata III and II and Stratum II is described as disturbed by postholes and large pits (Burley n.d.:10) Decorated Lapita ceramics appear only toward the base of Stratum II.

Analytical units

Two initial radiocarbon dates were obtained by Shutler et al. (1994): CAMS-7148 (3190–2784 cal BP) from Stratum IV and CAMS-7147 (2847–2400 cal BP) from Stratum III (Fig. 5.4). The sample for CAMS-7148 is considered by the excavators to originate from Stratum III (Shutler et al. 1994:64), although no evidence for this is provided.

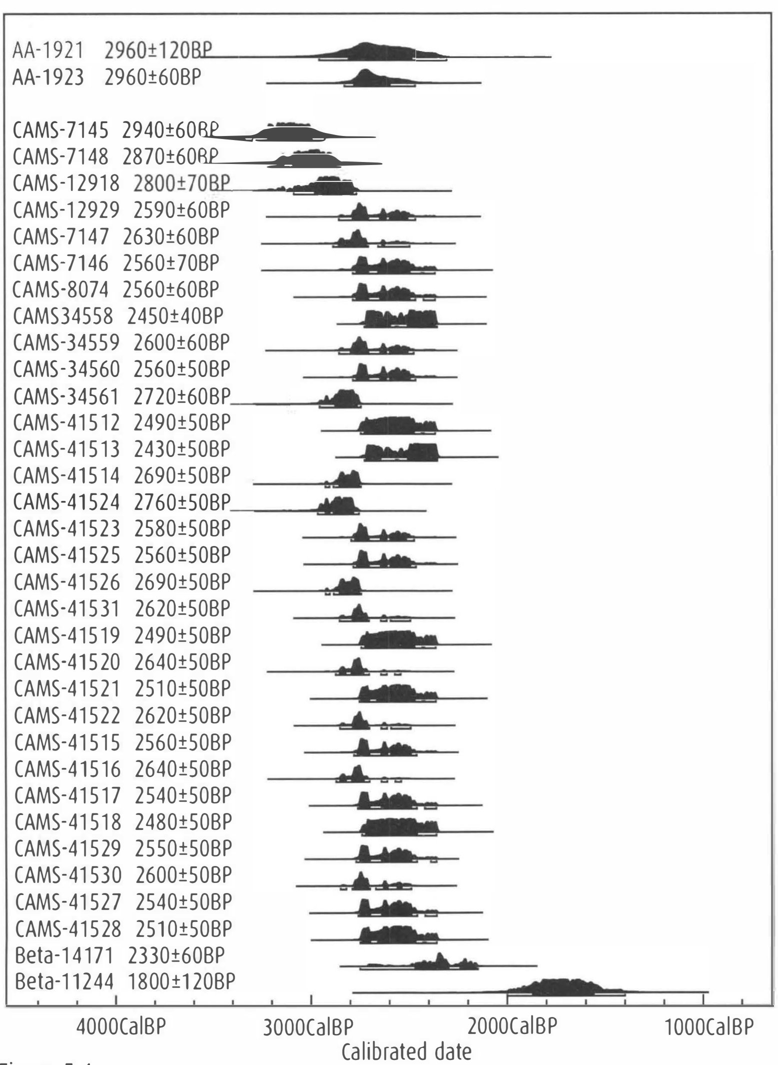

Figure 5.4

Burley et al. (1999) obtained a further four similar dates from the same or adjacent excavation units. CAMS-41515 (2730–2370 cal BP 2σ range) and CAMS-41517 (2730–2370 cal BP 2σ range) are samples from Stratum II. CAMS-41516 (2780–2400 cal BP 2σ range) and CAMS-41518 (2710–2360 cal BP 2σ range) are samples from Stratum III. On the basis of the radiocarbon evidence the two strata can not be distinguished.

Given the radiocarbon determinations, the disturbance to Stratum II and lack of clear boundary between Strata II and III noted above, Strata II and III are considered a single analytical unit with a radiocarbon chronology pene-contemporaneous with Stratum III of the Faleloa site. Stratum IV is stratigraphically earlier.

Ceramic component

All stratigraphic and analytical units from Pukotala contain ceramics and the assemblage has been characterised as plainware (Burley et al. 1995). The ^{14}C

determinations from Zones III and IV span the chronological period of Eastern and Late Eastern Lapita. A total of 105 sherds were excavated, 80% deriving from Stratum II, although the assemblage from each stratigraphic unit is not discussed further.

The 1997 excavations yielded a further 9771 sherds, of which 556 are decorated (Burley n.d.:12). Burley (n.d.:12) notes that the proportion of decorated sherds is unusually high in the site and this may be due in part to the removal of upper deposits containing plainware assemblages for mound fill. However, in Unit 14, undisturbed by mound building activities, a high proportion was also found. The stratigraphic provenance for the 1997 assemblage has not been reported and no further description of this assemblage is available and hence these ceramics are not discussed further below.

Prior to the 1997 excavations only a single decorated sherd had been excavated from a secure context, from Zone III (Burley et al. 1995). No description of the decoration is available. Sherd thickness, vessel forms and temper are not discussed. The volume of excavated deposit is not mentioned and no sherd density can be calculated.

No differences in the assemblages from each stratigraphic unit are discussed. Shutler et al. (1994:64) suggest that the test pit may have been on the periphery of a Lapita occupation and this may account for the lack of decorated sherds. This was later revised to plainware by Burley et al. (1995) following excavation of the Holopeka site in which deposits contemporary with those of Pukotala yielded only plainware ceramics. However, the 1997 excavations demonstrated that the site initially represented a Lapita occupation.

Adze component

A single adze was recovered in the 1997 excavations, but no description or stratigraphic context is available.

Other artefact component

A total of 125 other artefacts were recovered during the 1997 excavation, although the stratigraphic contexts of these items have not been reported. They are listed in Table 5.5.

Table 5.5 Pukotala other artefact assemblage (from Burley n.d.:Table 2).

FUNCTIONAL/DESCRIPTIVE TYPE	TOTAL
shell bracelet fragments	21
shell beads	10
shell long unit	2
shell pendant	4
shell scraper	17
coral abraders	5
shell chisel	3
fishhook	1
Cypraea dorsum	6
Turbo tab	16
worked shell	20
bird bone needle	2
shark tooth	12
pumice abrader	3
sea urchin spine	5
modified lithic pieces (including flakes)	7
TOTAL	134

Faunal assemblage

The faunal assemblage is described as including the remains of an extinct large-bodied iguana and quantities of *Turbo* and other large shells, including *Tridacna* sp. (Burley n.d.:13). The context is not discussed.

Holopeka

Stratigraphy

At the Holopeka site, 13 1m × 1m test pits have been excavated. The stratigraphy of the site has not been fully reported, but is described as similar to the Faleloa and Pukotala sites (Burley et al. 1995:132). Plainware ceramics were recovered from Strata III and II.

Analytical units

Charcoal dates are available for Strata III and II. CAMS-12918 (3157–2755 cal BP) and CAMS-12919 (2780–2382 cal BP), both from Stratum III (Burley et al. 1995), indicate a similar chronology for Stratum III to that of Pukotala (Strata III and IV) and Faleloa (Stratum III) (see Fig. 5.4). Burley et al. (1999) report two dates from Stratum II, CAMS-41527 (2730–2370 cal BP 2σ range) and CAMS-41528 (2710–2360 cal BP 2σ range). These two dates are almost identical to CAMS-12919 from Stratum III.

Ceramic component

Over 8000 sherds were excavated from the Holopeka assemblage, which is characterised as plainware (Burley et al. 1995). The stratigraphic units from which ceramics were excavated are not reported. The ^{14}C age of the dated deposits spans the Early and Late Eastern Lapita periods.

No 'decorated sherd of a Early or Late Eastern Lapita style' (Burley et al. 1995:132) was recovered. Sherd thickness, vessel form and temper are not discussed. The volume of deposit is not reported, and sherd density cannot be calculated.

The association of a plainware assemblage with ^{14}C dates in the range expected from Lapita assemblages is interpreted by Burley et al. (1995:133) as evidence that Lapita ceramics disappeared much more rapidly following colonisation than previously considered, perhaps within two centuries.

Adze component

No adzes are reported.

Other artefact component

While Burley et al. (1995:132) report that 'a small number of other artefacts' were excavated, no details are provided.

Faunal assemblage

The faunal assemblage includes bones of extinct bird species but these are not specified. Fewer extinct bird species were found in the deposit than is usual in Early Eastern Lapita sites. This is interpreted as indicating that, along with the absence of decorated ceramics, the deposit does not represent initial colonisation but is slightly later, with the 'initial ecological impact of Lapita colonisation' having already taken place (Burley et al. 1995:132).

Mele Havea

Stratigraphy

The Mele Havea site on Ha'afeva Island was excavated in 1997 (Burley n.d.) and details of the site have not been fully published. Burley et al. (1995) excavated 11 1m × 1m test pits and found a stratigraphy and ceramics similar to that of the other Ha'apai sites. The basal Stratum IV is a yellow coral sand. Stratum III, the Lapita zone (Burley n.d.:44), is described as stained sand. Stratum II is dark brown loam containing plainware deposits and some Lapita sherds. Stratum I is the surface layer, containing a mixture of late prehistoric and historic artefacts (Burley n.d.:42).

Analytical units

The stratigraphy was clear and easily defined and the strata (as identified above) equate with the analytical units. CAMS-41519 (2710–2360 cal BP 2σ range) and CAMS-41521 (2710–2360 cal BP 2σ range) are charcoal samples from Stratum II. CAMS-41520 (2780–2400 cal BP 2σ range) and CAMS-41522 (2740 –2390 cal BP 2σ range), also charcoal samples, date Stratum III. The dates from both strata fully overlap, but on stratigraphic evidence are considered separate analytical units. However, only a preliminary report of the site is available and this does not provide a stratigraphic context for reported cultural material.

Ceramic component

A total of 13,378 sherds were excavated and of these, 471 are decorated (Burley n.d.).

Adze component

Two adzes have been recovered from the site, but no further information regarding them is available.

Other artefact component

A range of shell and lithic artefacts are reported from the site (Table 5.6), but their stratigraphic contexts have not been reported.

Table 5.6 Mele Havea other artefact assemblage (from Burley n.d.:Table 11).

FUNCTIONAL/DESCRIPTIVE TYPE	TOTAL
shell bracelet fragments	11
shell beads	2
shell ring	6
shell scraper	18
coral abraders	15
Cypraea dorsum	9
Turbo tab	1
worked shell	19
shark tooth	1
pumice abrader	1
sea urchin spine	14
modified lithic pieces (including flakes)	35
TOTAL	132

Faunal assemblage

The Mele Havea faunal assemblage has not been reported.

Vaipuna

Stratigraphy

The Vaipuna site on 'Uiha Island has cultural deposits to 1 m in depth and a stratigraphic profile similar to that of the other Ha'apai sites (Burley n.d.:31). The basal Stratum IV is original beach deposit on which Stratum III, a sandy loam, rests. Burley (n.d.) considers Stratum III to represent the original Lapita deposit. Stratum II is a grey brown silty loam with an abundant faunal assemblage and plainware ceramics (Burley n.d.:34). The excavators found the boundary between Strata III and II difficult to define. Stratum I is the surface deposit containing degraded ceramics argued to originate in Stratum II.

Analytical units

Five radiocarbon determinations are available for the site, all from charcoal samples. CAMS-41524 (2940–2750 cal BP 2σ range), CAMS-41526 (2850–2530 cal BP 2σ range) and CAMS-41531 (2760–2390 cal BP 2σ range) date Stratum III. CAMS-41524 is slightly early than, but overlaps with the other dates, giving a radiocarbon age range of ca. 2900–2300 cal BP for Stratum III. Two dates with similar ranges, CAMS-41523 (2740–2380 cal BP 2σ range) and CAMS-41525 (2730–2370 cal BP 2σ range) date Stratum II. The stratigraphic context of the cultural assemblages from the site has not yet been published.

Table 5.7 Vaipuna other artefact assemblage (from Burley n.d.:Table 9).

FUNCTIONAL/DESCRIPTIVE TYPE	TOTAL
shell bracelet fragments	26
shell beads	55
shell ring	3
shell long unit	9
shell pendant	1
shell scraper	17
coral abraders	11
shell chisel	4
Cypraea dorsum	8
Turbo tab	11
worked shell	50
bird bone needle	2
shark tooth	12
pumice abrader	3
sea urchin spine	5
modified lithic pieces (including flakes)	32
TOTAL	249

Ceramic component

A total of 12,654 sherds have been recovered from the site (Burley n.d.). Of these, 509 are decorated, although the decoration is not described.

Adze component

Four adzes have been recovered from the site, but these are not described in any detail.

Other artefact component

235 other artefacts including lithics, shell valuables and worked shell have been recovered from the site (Table 5.7). These have not been reported in terms of their stratigraphic context.

Faunal assemblage

The faunal assemblage from Vaipuna has not been reported.

Change through time in the Northern Ha'apai assemblages

Six of the sites from the Ha'apai group contain Lapita ceramics, while one has a plainware assemblage. All the sites are from similar preservational environments, being beach contexts on small upraised coral islands. Unfortunately, published data from Holopeka, Pukotala, Mele Havea and Vaipuna do not permit assessment of intra-site change though time in the assemblages. Although Burley (n.d.) argues that the sites of Mele Havea, Vaipuna, Pukotala and Faleloa have a main Lapita deposit with an overlying plainware deposit, decorated ceramics were also recovered from the plainware strata in Mele Havea and Faleloa. Additionally, plainware assemblages are said to be mixed with Lapita deposits in Vaipuna. These mixed assemblages may, as Burley et al. (1999) argue, represent a very short time span for Lapita in the Ha'apai. In the present analysis they do not permit any comparison of the cultural assemblages associated with Lapita and plainware.

Dye (1987) reports disturbance to the deposits in both Fakatafenga and Tongoleleka, thereby making the stratigraphic association of cultural material from both sites questionable. An exception to this are a number of test pits from the Tongoleleka site which Dye (1987) found to be undisturbed; however, for these pits only the ceramic provenance is reported.

Stratigraphic or cultural units identified by Dye (1987) have been used as the analytical or chronological units in the present analysis. These permit some investigation of change through time in the Fakatafenga and Tongoleleka assemblages. However, as noted above, the acknowledgment of the disturbed nature of some of the deposit limits the usefulness of findings.

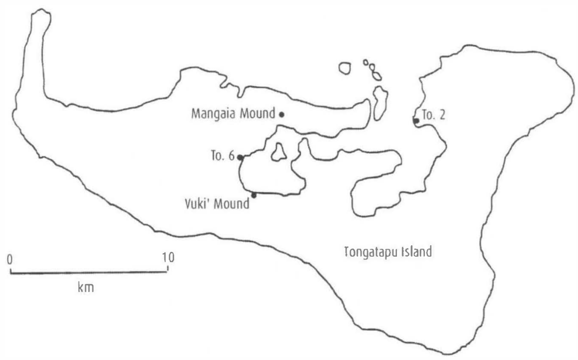

Figure 5.5 Tongatapu sites discussed in the text

Tongatapu sites

The Tongatapu sites are all mound sites concentrated around the palaeoshoreline of Fanga 'Uta Lagoon (Fig. 5.5). All contain shell midden and ceramic deposits, including dentate stamped sherds. To.2 and To.6 are two of six sites excavated by Poulsen (1967, 1968, 1987) that have been fully published. The Mangaia and Vuki's Mound sites are only partially published.

Vuki's Mound

Stratigraphy

Vuki's Mound lies at the edge of a relatively steep slope on the edge of Fanga 'Uta Lagoon. Groube's (1971:299) overview of the mound describes a thin lens at the base containing a few Lapita ceramics, which appear to be in a secondary context, and is argued to be unrelated to the mound construction. Groube (1971:300) describes the mound itself as composed of a series of successive house floors, all containing plainware ceramics. Postholes, pits and ovens have been dug into the house floors disturbing the deposit in some parts of the mound. No detail about the sediments or relationship of stratigraphic layers has been published.

Analytical units

Although a number of radiocarbon dates are available for the site, most have been rejected under the protocol described in Chapter 4. The available ^{14}C dates (illustrated in Fig. 5.6) are on charcoal samples taken from sealed fireplaces in the house floors. ANU-429 (2710–1838 cal BP 2σ range), which dates Layer 4, overlaps with ANU-441 (2758–2159 cal BP 2σ range) from towards the base of the mound in Layer 14. The stratigraphic context for the cultural material has not been published and cultural material from the site may only be considered as two chronological units: the plainware deposits of the mound itself, associated with a radiocarbon age range of ca. 2750–900 cal BP; and the stratigraphically earlier, undated sub-mound Lapita deposit.

Ceramic component

More than 22,000 ceramic sherds were excavated from Vuki's Mound and they occur in all stratigraphic units. The ceramic assemblage from the mound is plainware, while the deposit beneath the mound

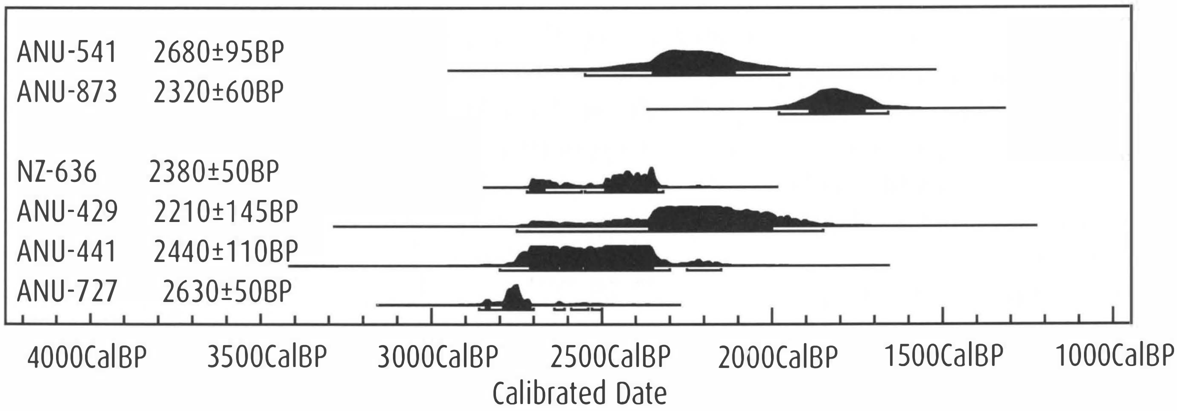

Figure 5.6

contains Lapita ceramics. The ^{14}C age range for the site falls within the Late Lapita and plainware periods of the established cultural chronology. Sherds were analysed as a single unit, although the percentage analysed is not reported. While a few sherds with 'typical Lapita decoration' (Groube 1971:300), presumably dentate stamped decoration, were recovered from beneath the mound, no further decoration is reported. Vessel forms in the mound assemblage are described as globular pots with flat or slightly everted rims on larger pots, and a simple bowl or small cup (Groube 1971:299). Temper type, sherd thickness and the density of the sherds is not reported, but the density is stated to be consistent throughout the mound (Groube 1971:297)

Groube (1971:301) interprets the conventional radiocarbon dates from Vuki's Mound as indicative of a continuous occupation of the site for a short time between 2550 and 2250 BP. On the basis of similar sherd density throughout the site he concludes that there is no evidence in the site for a decline in the use of ceramics during the period of occupation.

Adze component

Adzes described as polished fine-grained rock were excavated from Vuki's Mound, but their stratigraphic context and number is not reported.

The adzes have not been categorised according to Green and Davidson's (1969; Green 1971, 1974b) adze typology; however, Groube (1971:300) says that '[s]ix adzes show closest parallels to the widespread lenticular Melanesian adzes with a curved cutting edge and a base flattened oval cross-section'. A small rectangular section adze was also recovered from an early context in the site. No basalt flakes or debitage are reported.

Groube (1971:300) interprets the lenticular adzes as similar to those reported by Suggs, his Hatiheu type, from the earliest levels in the Marquesas sites.

Other artefact component

Groube (1971:300) reports that the site was rich in shell and stone artefacts, but with the exception of shell 'long units' drilled at either end, these are not described. Similarly, stratigraphic contexts are not provided.

Groube (1971:300) considers the range of artefacts to be similar to those recovered by Poulsen from Tongatapu mound sites (see below).

Faunal assemblage

The mound deposit is described as a shellfish midden, but no further description of a faunal assemblage is provided.

Mangaia Mound

Stratigraphy

Mangaia Mound, like Vuki's Mound, consists of a number of layers containing ceramics and has not been fully published. The mound proper is underlain by a deposit containing decorated, Lapita ceramics. No detailed description of the mound stratigraphy or contents is available.

Analytical units

All radiocarbon determinations from the site, with the exception of NZ-727 (see Fig. 5.6), were rejected under the protocol of Chapter 4. NZ-727 (2790–2603 cal BP 2σ range) is a shell sample taken from Layer 3, beneath the mound proper. The deposit is described as a mixed soil and midden deposit, which contained decorated pottery (Groube 1971:302).

Ceramic component

The stratigraphic context of the Mangaia Mound ceramic assemblage is not described. Although the assemblage from Layer 3 is characterised as Lapita and presumably dentate stamped, no description of the ceramics is given. The ^{14}C age range for Layer 3 is Late Lapita in the established cultural chronology.

Adze component

No adze assemblage is reported.

Other artefact component

No other artefact component is reported.

Faunal assemblage

While the site is described as shell midden, no further description of the faunal component is available.

To.2

Stratigraphy

To.2 is a mound site located approximately 200 m from the present shoreline on the eastern side of the Fanga 'Uta Lagoon entrance (Fig. 5.5). Poulsen (1987:24) identified two stratigraphic divisions in the site, the Midden and Mound Horizons, the latter interpreted as the mound building episode proper. The boundary between the two was easily distinguishable. Poulsen (1987:24) considers the deposit of the Mound Horizon to be made up in part from the Midden Horizon deposit, with the cultural material it contains being in a secondary context. A pre-midden horizon is also represented at the site by three depressions, interpreted as ovens and postholes, all sealed by the Midden Horizon.

Analytical units

The deposit of the Midden Horizon is described as a typically 'dark-coloured shell midden, made up of earth mixed with much shell' (Poulsen 1987:24). The illustrated stratigraphic profile of the site (Poulsen 1987:Fig. 11) shows the Midden Horizon as a single homogenous deposit; however, for analytical purposes, Poulsen (1987:24) divided it into arbitrary units, Zones I-III, based on excavation spit numbers. The shell sample for ANU-541 (2471–1987 cal BP 2σ range) (Fig. 5.6) was taken from a context described as the very bottom of Zone I, the lowest unit, of the Midden Horizon (Poulsen 1987:26). There is no evidence presented to suggest that Zones I–III should be considered separate chronological units. Poulsen (1987:26) found the ceramic assemblage from the Midden Horizon to be homogeneous in character, which lends support to analysing this layer as a single chronological unit. A small number of conjoining sherds demonstrates some vertical displacement of material within the Midden Horizon

(Poulsen 1987:51), indicating some mixing within the deposit. The Midden Horizon is discussed below as a single chronological unit with an associated ^{14}C age range of 2471–1987 cal BP. Cultural material from the disturbed Mound Horizon is not considered further in the present analysis.

Ceramic component

The results of Poulsen's (1967, 1987) analysis of the ceramic assemblages from the Tongatapu mounds are difficult to interpret for a number of reasons, including the absence of data on the overall numbers and provenance of sherds, and the amount of deposit excavated at each site. Results are variously reported according to chronological periods, the whole site, the horizon, arbitrary zones and excavation spits. The data presented for the To.2 and To.6 mounds in the following section are gleaned primarily from the tables in Poulsen (1987).

Ceramics were excavated from all deposits in To.2. The assemblage contains dentate stamp Lapita ceramics and is characterised by Poulsen (1987:78) as early in the ceramic sequence. The ^{14}C age range for the Midden Horizon falls within the plainware period of the established ceramic sequence.

Analyses included all rim and decorated sherds, but no plain body sherds (Poulsen 1987:54). Rims and decorated body sherds from the whole site totalled 2690 sherds, but the percentage from the Midden Horizon is not reported.

There are decorated rim and body sherds in the assemblage. Dentate stamped and incised surface decoration, and notched and applied decoration are present. The percentage of sherds decorated is not possible to ascertain, however Poulsen (1987:Table 13) states that 31.6% of the rims are decorated. Decoration was located on the inside and outside of the rim and on the body below the rim (Poulsen 1987:Table 70). Sherd thickness is not specifically discussed, although the presence of some very thick walled pots is reported. The density of sherds is not reported.

Poulsen (1987:Table 35) identified vessel forms through the relationship of rim orientation to body-rim inclination. These consisted of a number of types of bowls: deep pots with a hemispherical outline below the rim; jars; deep pots of more or less globular shape; and dishes or plates which are shallow with less than a hemispherical outline below the rim. The most common form is the bowl. Flat bases are very rare; all 12 from the Midden Horizon are decorated. Carinated vessels are also present.

Two types of temper were identified: pyroxene and felspar probably from 'Eua or another volcanic island (Poulsen 1987:137). Several sherds of different clay from To.2 may be foreign, possibly from Fiji, as the decoration is similar to Sigatoka sherds (Poulsen 1987:135).

Poulsen (1987) interprets the ceramic assemblage from To.2 as representing an early phase of Tongan ceramics on the basis of the range and percentage of decorated sherds and the range of vessel forms present.

There is no discussion of change through time within the site, but this is considered when the assemblage is compared to that from other sites, in particular To.6. This is discussed below following description of the To.6 site and ceramic assemblage.

Adze component

Six classifiable adzes/adze fragments, and eight unclassifiable fragments were recovered from the site. Of these, only four classifiable adzes and one unclassifiable fragment were excavated from the Midden Horizon (Poulsen 1987:Table 84).

The adze types present, according to Poulsen's (1987:163–5) typology, are single examples each of Types 1a, 2b and 3. Poulsen's adze typology is discussed in relation to that of Green and Davidson (1969) in Chapter 8. The raw material of the adzes from To.2 has not been identified. No basalt debitage is reported from the site.

Poulsen (1987) interprets the To.2 adze assemblage as belonging to an early period and reports only inter-site change through time. This is discussed following reporting of the To.6 adze assemblage.

Other artefact component

Other artefacts excavated from To.2 are listed under Poulsen's (1987) functional type classes in Table 5.8. Poulsen (1987:179–225) describes in detail each functional type and the distribution of these types in other Pacific sites. This is discussed in Chapter 8.

No debitage from shell or bone working is reported, although Poulsen (1987:213) argues that evidence of *Tridacna* sp. and *Conus* sp. working was present at all sites. Pieces of siliceous stone were found in some sites, but these were not collected or quantified (Poulsen 1987:214).

Poulsen (1987) discusses the artefact assemblage from the Tongatapu sites as a whole and makes several broad conclusions. He considers there to be a 'poverty' of bone working in comparison to the richness of the shell working. He interprets manufacturing tools such as abraders, grinders and hammerstones, along with shell debitage, as evidence for shell working at all sites. Although many of the shell artefacts have holes, no artefactual evidence of a drilling tool was recovered. However, the siliceous rock excavated but not analysed may have been used for drill points (Poulsen 1987:214). All stone on the island was imported. Red ochre pieces have shiny facets where they have been rubbed and Poulsen (1987:214) argues they may have been used to decorate ceramics.

Table 5.8 To.2 and To.6 other artefact assemblages (from Poulsen 1987:Tables 84-92).

FUNCTIONAL TYPE	RAW MATERIAL	TO.2		TO.6	
		MIDDEN HORIZON	HORIZON I	HORIZON II	HORIZON III
shell adze	*Tridacna* sp.	1			2
shell chisel	*Terebra* sp.		1		
shell gouge	*Conus* sp.	1			
scraper/peeler	*Tonna* sp.		2		
paring knife	*Anadara* sp.				2
	Strombus sp.		1	1	
fishhook			1		
octopus lure	*Cypraea* sp.	1	20	7	2
net sinker	*Anadara* sp.	51	6	10	3
	stone				1
needle/awl	bone		2	1	
narrow bracelet	*Tridacna* sp.	5			
	Conus sp.	27	1	1	
broad bracelet		1		3	
small ring			2		
long unit			5	1	1
squat unit		1			
circular unit		2	1	1	1
pendant	trumpet shell		1		
bead	shell	2			1
	bone				1
	stone		1	1	
bowling stone	stone		4	1	
hammerstone		3		2	
hammer/file		1	1		
file	coral	30	3	2	4
	sea urchin		2		
grinder	coral		8	6	
	pumice		3	2	3
	stone		7	2	
worked shell	*Conus* sp.	12	2	2	2
	other	3	4	2	2
red ochre		8	3		1
unique artefact			1		
TOTAL		149	82	45	26

Poulsen (1987:214–15) notes that unlike the ceramic assemblage, the non-ceramic artefacts:

> occur in such low numbers that it is uncertain whether their absence from a particular period is real or not, while few are present in sufficient quantities for us to talk about trends over time.

Using the Early, Middle and Late period chronology developed from the ceramics, Poulsen (1987:162–214) investigates all functional artefact types which are represented by more than five artefacts to identify change through time. He concludes there is a decline in shell adzes, *Anadara* sp. net sinkers, bone awls, narrow shell bracelets, branch coral files and *Conus* sp. debitage. Conversely, there is an increase in the number of stone adzes, octopus lure caps and coral grinders (Poulsen 1987:216). However, the Early/Middle periods are represented by much greater volumes of excavated deposit than the Late period.

Poulsen (1987:216) claims that within each site a decrease in the overall number of non-ceramic artefacts is evident. Although this may be the case if arbitrary zones in the sites are assumed to represent distinct time periods, it is not apparent in To.2 when the Midden Horizon is taken as a single analytical and chronological unit.

Faunal assemblage

The faunal assemblage is reported by Poulsen (1987) as numbers of individual specimens from a range of fauna, but is not fully detailed. Furthermore, it is unclear what percentage of the vertebrate assemblage has been analysed. Further, Poulsen (1987:239) states that the retrieval methods used during excavation would not have been conducive to the recovery of small and fragmentary bone. The assemblage is interpreted in light of the assemblages from other Tongatapu sites.

Marine fauna component

Shellfish including *Anadara* sp. and *Gafrarium* sp., marine turtle, crustaceans, rays and fish were recovered. Only 94 non-molluscan marine fauna specimens (from all sites) were identified, from an analysed assemblage of 335 specimens (Poulsen 1987:239). A further unknown quantity of marine fauna has not been identified. The number and weight of *Gafrarium* sp. and *Anadara* sp. as a percentage of the total shell weight from the Midden Horizon indicates a dominance of the latter over the former (Poulsen 1987:Table 96).

The amount of marine turtle excavated from To.2 is far greater than from the other Tongatapu sites. This is explained by Poulsen (1987:234) as being related to the location of the site at the entrance to the lagoon from the open sea.

Crustacea are found only in very low numbers. Those species represented are found in the littoral zone and on coral reefs (Poulsen 1987:235).

A number of fish families are identified, although the NISP is less than nine in all families. These include what Poulsen identifies as trigger fish, perch-like fish including wrasses, Lethrinidae, parrotfish and groupers. Poulsen (1987:240) considers that the paucity of fishing gear in the site and the range of fish represented indicates that netting, spearing and perhaps poisoning were the common fishing techniques.

Terrestrial fauna component

No indigenous terrestrial fauna has been reported from To.2, although 59 unidentified bird bones were recovered from the Midden Horizon (1987: Table 107)[3]. *Rattus exulans* was identified in small amounts in the Midden Horizon (Poulsen 1987:Table 109). The only domesticate reported is chicken, represented by five bones in the Midden Horizon (Poulsen 1987:Table 107). A small number of human bones were also recovered from the Midden Horizon.

Change through time in the To.2 faunal assemblage is not discussed. Poulsen (1987) uses his ceramic sequence as the chronological framework for inter-site comparison of the fauna. This is discussed under the faunal component of site To.6 below.

3 A large number of iguanid lizard bones were excavated from site To.5, but were not identified in any other site (Poulsen 1987:240).

To.6

Stratigraphy

The To.6 mound is located on a palaeoshoreline approximately 200m from the present shoreline of the Fanga 'Uta Lagoon (Fig. 5.5). Poulsen (1987:38) describes the stratigraphy as underlying sterile subsoil of compacted clay into which several oven features have been cut. These are sealed by the overlying midden, which consists of three horizons. Horizon I is ca. 20cm thick, although not continuous across the site, and rests on the subsoil. Several hearths or ovens are associated with it. Both Horizons I and III are a homogeneous compact mixture of earth and shells with cooking stones. The deposit of Horizon II is distinguished from that of Horizons I and III by a low concentration of shell and the soft medium grey to brown soil of which it is composed. Horizon II averages 10cm in thickness, although this varies, and Poulsen (1987:39) considers that the surface of the deposit may have been deliberately levelled. Horizon III varies from 20 to 50cm thick and is more extensive than the lower two horizons.

Analytical units

The two acceptable ^{14}C determinations from the site, ANU-873 (1949–1660 cal BP 2σ range) and NZ-636 (2708–2212 cal BP 2σ range) date Horizon I (see Fig. 5.6). The shell samples for ANU-873 are described by Poulsen (1987:46) as coming from the middle levels of Horizon I and the charcoal for NZ-636 was excavated from an oven feature, Oven K, dug into the clay subsoil at the base of Horizon I. The dates suggest that a considerable time length, perhaps 1000 years is represented by the deposit. A small number of conjoining ceramic sherds excavated from different horizons (Poulsen 1987:52) indicate some vertical displacement or disturbance between the horizons and there is some evidence that postholes were dug from the upper horizons through to the lower (Poulsen 1987:Fig. 24). Poulsen (1987:48) states that there is 'much evidence of the disruption of stratigraphy by pit and posthole digging' and disturbance to the upper deposit by agricultural activities in all Tongatapu mound sites excavated.

Poulsen (1987:59) further divides Horizon I into Zone IB (bottom) and Zone IT (top) on the basis of variation in the artefactual material in the lower horizon, although he considered the sediment and midden matrix to be homogeneous. Poulsen (1987:59) acknowledges that the procedure is 'somewhat arbitrary'. In the present analysis, stratigraphic evidence, rather than variability in material culture is used to delineate chronological units in the sites. Therefore, Horizon I is considered to represent a single analytical unit, rather than two zones. Although some disturbance to the site is reported, the three horizons were clearly identifiable and serve as the chronological units proposed for the site. Horizon I is associated with a ^{14}C determination of ca. 2700–1700 cal BP. Horizons II and III are stratigraphically more recent.

Ceramic component

Ceramics were recovered from deposits through the site, and include dentate stamped Lapita ceramics. Poulsen (1987) characterises Horizons II, III and the upper portion of Horizon I as occurring late in the ceramic sequence. The lower part of Horizon I is characterised as representing the middle ceramic period (Poulsen 1987:79-80). The ^{14}C determinations from Horizon I (ca. 2700 cal BP –ca. 1700 cal BP 2σ range) cover the Late Eastern Lapita and plainware periods of the established ceramic sequence.

All rim and decorated sherds were analysed, but plain body sherds were not. The rims and decorated sherds totalled 1392, but the percentages of these from the various horizons is not reported.

Dentate stamped and incised surface decoration, and notched and applied decoration are present. The stratigraphic contexts of rim and decorated sherds are detailed in Table 5.9.

The overall percentage of decorated sherds is not reported, but 1.6% of rims are decorated (Poulsen 1987:Table 13). Decoration occurs mostly on the upper part of the vessel and the rim. The entire To.6 assemblage is considered to represent the late period, in which decoration is found only on the outside of the pot and on the lip (Poulsen 1987:Table 70).

Table 5.9 Provenance of To.6 rim and decorated sherds (from Poulsen 1987:Table 27).

HORIZON	NO. RIM SHERDS	NO. DECORATED SHERDS
III	358	12
II	356	20
I	280	37

The thickness of the body wall immediately below the rim ranged between 5 and 10 mm (average 6–7 mm), which led Poulsen (1987:133) to characterise Tongan Lapita ware as a thin ware. Poulsen identified vessel forms through the relationship of rim orientation to body-rim inclination (1987:Table 35). In the To.6 site a number of types of bowls (deep pots with a hemispherical outline below the rim, jars, more or less globular deep pots, and shallow dishes or plates, of less than hemispherical outline below the rim) were identified. The most common form is the jar, followed by the bowl. A small number of carinated sherds are reported for each horizon (Poulsen 1987:Table 47).

The weight of sherds/spit in Horizon I is 135.7 g, Horizon II is 137.9 g and Horizon III is 42.9 g (Poulsen 1987:Table 79). The volume of deposit per spit is not reported. Two types of temper were identified, pyroxene and felspar, probably from 'Eua or another volcanic island (Poulsen 1987:137).

The recovery of most of the decorated sherds from the lower part of Horizon I (Horizon IB) led Poulsen (1987:80) to characterise this material as belonging to the middle ceramic period and the deposit is interpreted as 'including material from an ephemeral occupation preceding the main site formation'. He considers this layer to be similar to Layer 3 of the Mangaia site on Tongatapu (Poulsen 1987:80).

Poulsen (1987:123) argues that the presence of decorated sherds in Horizons II and III, which in his chronology is a late assemblage, cannot be simply attributed to displacement from the base of the deposit, which he characterises as Middle period. Rather, he considers that decorated ceramics were known and used in the Late period.

Using the To.2 ceramic assemblage to characterise the Early period, and the To.6 assemblage (minus Horizon I) to characterise the Late (or most recent) period, Poulsen (1987:72) identifies a number of differences between the assemblages which are interpreted as temporal change. The percentage of decorated rim sherds is much greater in the earlier assemblage, as is the number of carinated sherds. In the Late period, decoration is restricted to the outside and lip of vessels. There is a greater variety in the Early period in the combination of various features recorded for each sherd, from which Poulsen (1987) concludes a trend towards simplicity in the ceramic sequence. Collar and flange vessels are more common in the Early period and rim thickenings more common in the Late period (Poulsen 1987:102–4). Decorated sherds are rare in the Late period and the number of decorative motifs represented appears less (Poulsen 1987:Table 72), although this may be due to the smaller decorated sample size. Poulsen argues that:

> The general pottery development was one of simplification, in terms not so much of elements dropping entirely out of the repertoire, but rather decreasing frequencies dominated over increasing frequencies, something which applies equally to individual and combined features. (1987:108)

Poulsen reports differences in the overall weight of sherds and in the number of decorated and rim sherds from the various horizons, but does not report the volume of excavated deposit from each horizon.

Adze component

Twenty classifiable adzes and adze fragments and 16 unclassifiable fragments were excavated from To.6. The stratigraphic provenance of the classifiable specimens is given in Table 5.10.

The adzes are classified according to Poulsen's (1987:163–5) typology [the relationship of Poulsen's typology to that of Green and Davidson (1969) and Green (1971) is discussed in Chapter 8]. The raw material of seven of the 23 excavated adzes from the Tongatapu sites has been identified (Poulsen 1987:163), five of which are from To.6. A Type 1c adze from Horizon III and an adze from To.5 are described as pale grey tholeiitic basalts found in the volcanic islands of the Ha'apai group. A Type 2b adze from To.6, Horizon II, is described as trachyandesite and a Type 2d adze, also from Horizon II, is a green dacitic welded tuff. Both these raw materials may have come from 'Eua (Poulsen 1987:170). A Type 1a and Type 2d adze, both from To.6, Horizon I, were identified as hawaiite (olivine basalt), found

Table 5.10 Classification of To.6 adze assemblage (from Poulsen 1987:162-79).

	ADZE TYPE								TOTAL
	1A	1B	1A/B	1C	2A	2B	2D	3	
Horizon III		2		1					3
Horizon II				1	1	1			3
Horizon I or II	1		1			1	1		4
Horizon I	3					2	1	2	8
provenance unknown					2				2
TOTAL	4	2	1	2	3	4	2	2	20

beyond the andesite line and therefore foreign to Tonga. A Samoan, Uvean or Vanuatu origin for the stone is suggested (Poulsen 1987:163).

Poulsen (1987:172) uses his ceramic chronology of Early, Middle and Late periods to create a chronology for the adze typology and to discuss the chronology for the entire Tongatapu assemblage. In this chronology, the To.2 assemblage belongs to the Early period and the To.6 assemblage to the Late period. Type 1a adzes are found throughout the ceramic sequence, while Types 1b, 1a/b and 1c are from the Late period, although 1c may also be Early. Types 2a and 2b are found throughout the sequence. Type 2d is probably Late (Poulsen 1987:172–3).

Poulsen (1987:173) considers that some ceramics from the bottom of Horizon I represent a Middle period occupation; however, he considers that the five adzes from the bottom of Horizon I (Horizon IB) are associated with the Late period midden of Horizon I in general. The two To.6 adzes of foreign raw material were recovered from his Late period ceramic context (Poulsen 1987:177). Poulsen (1987:177) reiterates Green's (1974:143) interpretation that the source is from other Polynesian islands such as Samoa or Uvea, and therefore that these islands were settled at this time.

In the present analysis Horizons I, II and III are considered as separate, single analytical units with Horizons II and III being stratigraphically more recent than Horizon I. The sample of adzes is small and there is confusion in the provenance of some of the assemblage. This makes an interpretation of differences in the adzes represented in the units difficult. Types 1a, 2d and the miscellaneous Type 3 are found only in Horizon I; Type 2a only in Horizon II; and Type 1b only in Horizon III. Type 2b is found in Horizons I and II, and Type 1c in Horizons II and III.

No basalt flakes or debitage are reported from the site.

Other artefact component

The provenance and quantity of each functional type represented in To.6 are listed in Table 5.5. No debitage from shell or bone working is reported, although Poulsen (1987:213) claimed that evidence of *Tridacna* sp. and *Conus* sp. working was present.

Pieces of siliceous stone were found in some Tongatapu sites, but these were not collected or quantified (1987:214).

The other artefact component of To.6 is discussed above with that of To.2. Poulsen (1987:216) claims that within each site, a decrease in the overall number of non-ceramic artefacts is seen. The total number of artefacts from each horizon (see Table 5.8) does suggest a decline from Horizon I to III; however, no weights or volumes for the deposit excavated from the three horizons are reported and the density of artefacts from each horizon is unknown.

Faunal assemblage

The faunal assemblage is reported from each horizon as NISPs (No. of Individual Specimens) for a range of fauna, but the assemblage is not fully detailed. It is unclear how much of the vertebrate assemblage has been analysed. Poulsen (1987:239) states that the retrieval methods used during excavation would not have been conducive to the recovery of small and fragmentary bone.

Marine fauna component

With the omission of rays, a similar range of marine fauna to To.2 was recovered from To.6. The number and weight of *Gafrarium* sp. and *Anadara* sp. as a percentage of the total shell weight for each horizon (Poulsen 1987:Table 99) indicates a dominance of the former in each of the horizons. A further unknown quantity of marine fauna has not been identified. Crustacea were recovered from Horizon II, but only in very low numbers. Species represented are found in the littoral zone and on coral reefs.

A decline through time in the size of *Gafrarium* sp. shells was noted (Poulsen 1987:Table 100), which is attributed to their constant exploitation. From column samples taken in each midden, an apparent change through time in the proportional representation of *Gafrarium* sp. to *Anadara* sp. was observed, which was argued to be related to the location of the sites in relation to the lagoon and changes in the lagoon itself which may have affected the growth of shellfish species (Poulsen 1987:253–4).

A number of fish families are identified, although the NISP is less than eight in all families in all horizons. Identified families include trigger fish (all horizons), wrasses (Horizons II and III), and Lethrinidae, parrot fish and gropers (all from Horizon II). As for To.2, Poulsen (1987:240) considers that the paucity of fishing gear in the site and the range of fish represented indicates that netting, spearing and perhaps poisoning were the common fishing techniques.

Terrestrial fauna component

The indigenous terrestrial fauna consists of a single bone each of purple swamphen and moorhen from Horizons II and I, respectively. There are a further 122 unidentified bird bones from the site (Poulsen 1987:Table 107). *Rattus exulans* was identified as occurring throughout the site (Poulsen 1987:Table 109).

Chicken was found in small numbers in all horizons (Poulsen 1987:Table 107). A large number of pig bones were found in a pit feature[4], which was dug into the mound in the post-ceramic period. In the remainder of the site 14 bones were found: two from dubious stratigraphic contexts, three from Horizon I, two from Horizon II and four from Horizon III. Two bones, one each from Horizons I and II have been tentatively identified as dog, but this is inconclusive, as is the evidence for dog in other Tongatapu ceramic sites (Poulsen 1987:246–7).

A large number of human bones were recovered from Horizons II and III. These may be burials, but the body part representation and cut marks on the bones suggest cannibalism (Poulsen 1987:250).

Poulsen interprets the presence of domesticates as evidence for agriculture (1987:254). He considers chicken to be present in Tonga from initial human settlement, but the evidence for dog at any stage is equivocal (1987:251). Poulsen considers pig to be present in his Middle ceramic period and probably earlier (1987:251), offering the best evidence for agriculture in the absence of plant remains.

Poulsen (1987:252–3) characterises the Lapita economy in Tonga as twin-based, with the practice of both agriculture and exploitation of natural indigenous resources, especially those of the lagoon and reef.

Discussion of change through time in the Tongatapu assemblages

Investigating intra-site change through time in the Tongatapu assemblages is possible only for the To.6 site. Published data for the Vuki's Mound and Mangaia Mound sites are insufficient to permit analysis, beyond noting the presence of plainware ceramics and a stratigraphically earlier assemblage containing dentate stamped sherds in each site.

Poulsen (1987) constructs an inter-site chronology based on the presence or proportion of ceramic features in the various assemblages from the Tongatapu sites he excavated. The evidence for this is discussed in detail in Chapter 7. In his chronology, the To.2 assemblage is considered Early. The To.6 assemblage is argued to be Late or recent (Poulsen 1987:64), with the exception of sherds from the

4 Pig was also recovered from To.1 which Poulsen (1987:246) considers to be early in the ceramic sequence; however the site is severely disturbed.

bottom of Horizon I (Zone IB) that Poulsen considers to represent the Middle period or possibly Early period (1987:77). However, the radiocarbon chronology for the site does not suggest that To.2 is necessarily earlier than the To.6 assemblage. The early ^{14}C date from To.6 (NZ-636, 2708–2212 cal BP 2σ range) has an earlier, but overlapping, range with ANU-541 (2471–1987 cal BP 2σ range) from the To.2 site. While the charcoal sample for NZ-636 was taken from the base of Horizon I in To.6 and may pre-date the cultural deposit, this cannot be assumed on present evidence. A further date from Horizon I, ANU-873 (1949–1660 cal BP 2σ range) gives an associated radiocarbon age range for this horizon of ca. 2700–1700 cal BP.

Poulsen (1967, 1987) does not consistently report the stratigraphic context for excavated cultural material, but discusses artefactual material as belonging to an Early, Middle or Late period based on association with certain types of ceramics. In the chapters to follow, Poulsen's analysis of change through time based on his ceramic sequence are discussed for the various components of the cultural assemblages in light of the radiocarbon chronology and any effect this has on his interpretations.

Futuna/Alofi sites

Tavai

Stratigraphy

The stratigraphy of the Tavai beach site on Futuna (FU-11) was visible in a stream bank prior to excavation. Ten stratigraphic layers identified by Kirch (1981) were excavated in layers numbered I-X from the surface. Layer X is the basal sterile deposit of compacted coarse sand beach sand. Layer IX contains cultural material, including ceramic sherds in a dark brown, charcoal flecked deposit averaging 1m thick. The contact between the upper and lower layers is gradational. Overlying cultural Layer IX is approximately 2 m of culturally sterile deposit, representing Layers I-VIII.

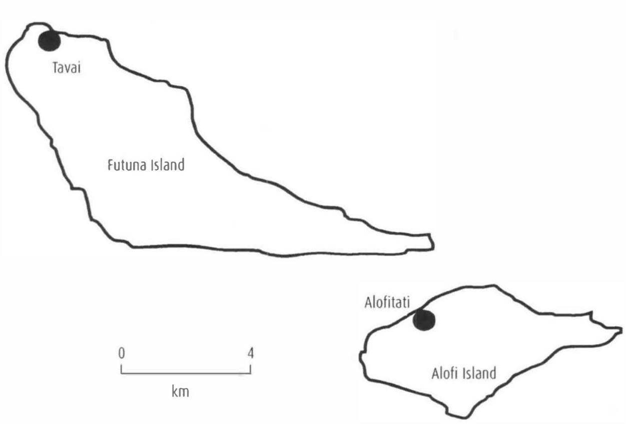

Figure 5.7 Futunan sites discussed in the text

Analytical units

All cultural material from the Tavai site, except surface items, was recovered from Layer IX. Layer IX is dated by a single ^{14}C determination, I-8355 (2329–1890 cal BP 2σ range), illustrated in Figure 5.7. Kirch (1981:Fig. 4) describes variation in the densities of artefactual material in arbitrary excavation levels within Layer IX, but the description of the deposit as a homogeneous layer suggests that variation within the layer is not necessarily temporal. The position of the dated charcoal sample within the layer in relation to the excavation levels is not discussed and the material culture from the site is analysed as a single unit. Layer IX is the only chronological and analytical unit of interest in the site.

Ceramic component

Ceramics were recovered from Layer IX, although some are described as surface finds eroded from the deposit (Kirch 1981:131). Kirch (1981:138) describes the assemblage as Lapitoid; however, he claims it defies classification according to Green's tripartite division for Western Samoa because, although the absence of decoration suggests plainware, the vessel forms are indicative of Late Eastern Lapita. The ^{14}C range for the ceramic assemblages falls in the plainware period. Of the 7306 sherds excavated, 6903 are plain body sherds, while 403 are diagnostic sherds. All the diagnostic sherds were analysed. The percentage of body sherds analysed is not reported. A total of 238 sherds were used in the discriminant components analysis, but this included sherds from four sites.

Only 1% of the assemblage is decorated, consisting of 62 paddle impressed sherds and a single rim sherd with a notched lip. The paddle impressing appears restricted to the upper half of the vessel (Kirch 1981:136). The mean sherd thickness is 5.8 mm with a range of 3–11 mm. No distinction is made between thick or thin sherds, although variation in the thickness of rims in the assemblage is attributed to a change through time towards predominantly non-thickened rims (Kirch 1981:136).

Vessel forms identified include one or more varieties of pots or jars with restricted orifices; globular forms with rounded thickened bases and no flat bases; pots or jars with carinated shoulders; and a globular handled-jar with handles attached both at the rim and at the upper part of the vessel body. No simple bowls were present. The density of sherds in the deposit is not reported.

Both volcanic sand (97.5% of sherds) and calcareous reef detritus (2.5% of sherds) tempers are represented in the assemblage. The volcanic sand tempers are feldspathic, lithic and ferromagnesium, and all are considered to have a local source.

The ceramic (and non-ceramic artefact) assemblage from Tavai is analysed and interpreted by Kirch (1981) in association with smaller assemblages from three undated Futunan sites. Kirch (1987:133–7) noted significant differences between the Futunan ceramic assemblages, which he considers may reflect temporal variation, although only the Tavai site is ^{14}C dated. He considers three of the assemblages, including Tavai, are likely to be contemporary and on the basis of the presence of calcareous sand temper in nearly half the sherds from the FU-13 site, that this assemblage is earlier than the other three (Kirch 1981:137).

Kirch considers the paddle impressed decoration to be identical to that reported from Samoa (Green and Davidson 1969) and by Hunt (1980:133) for Fiji.

To identify where in the established West Polynesian ceramic sequence the Tavai assemblages should fall, Kirch (1981:138) notes the number of attributes or characteristics represented in the assemblages previously characterised as Late Eastern Lapita in the Sigatoka and To.6 sites and Polynesian plainware at Vuki's Mound and SUVa1. The Tavai assemblage shares attributes with both these assemblage types and Kirch (1981:138) considered this to point out the:

> difficulties in reducing a complex set of phenomena — here the course of ceramic change in several contiguous island groups over 1500 years or so — to a simplified schema.

On the basis of the attribute analysis, Kirch (1981:138) considers the Futunan assemblages to be transitional between Late Eastern Lapita and plainware, but to demonstrate the 'difficulty in arbitrarily slicing up a continuous sequence of ceramic change into typological entities'. He considers Green's tripartite sequence should be seen as a general model which holds in many instances, but which may mask complex variability.

Adze component

Three whole and one partial adze, as well as a single adze chip were collected from the site. One of the adzes was collected from Layer IX; the remainder are surface collections. It is unclear whether they derive from the cultural deposit. In the description of the adzes it is unclear which one is the excavated specimen (Kirch 1981:139).

The three complete adzes have plano-convex cross-sections. Two are identified as Type Va and the third as Type Vb according to Green and Davidson's (1969; Green 1971, 1974b) adze typology. All three were manufactured by flaking followed by grinding, leaving some flake scars still evident. Three different raw materials were identified. Two adzes and the chip are light grey basalt or andesite; one adze is dark blue-black basalt; and the fourth is rhyolite. The source of the raw materials is not discussed. Additionally, two basalt flakes were recovered.

Kirch (1981:139) states that '[t]he association of … plano-convex adzes with Lapitoid ceramics…reinforces Green's interpretation of Type V as a significant marker of Lapita and Early Polynesian assemblages'.

Change through time in the adze assemblage is not discussed.

Other artefact component

A range of other stone artefacts was recovered from the site, but no shell or bone artefacts (Table 5.11). It is unclear whether the artefacts described as surface (Kirch 1981:Table 1) were collected from the ground surface or from the streambed after having been eroded from the cultural deposit.

The chert artefacts were manufactured from stream-worn pebbles and cobbles, some of which are included as the manuports recovered from the cultural deposit (Kirch 1981:140). The source of the chert is local and the chert flakes are produced using a simple bi-polar percussion technology. There are no core tools and no retouch is evident.

Table 5.11 Tavai other artefact assemblage (from Kirch 1981:Table 1).

ARTEFACT TYPE	SURFACE	EXCAVATED
chert flake	7	56
chert core	4	8
nut-cracking stone	4	3
grindstone		1
stone manuport		24
TOTAL	15	92

Manuports from Layer IX included rhyolite, basalt and chert cobbles or nodules, which may have served as burnishing stones, or anvils in ceramic manufacture (Kirch 1981:141). 'Nut-cracking' stones are water-worn cobbles with pecked finger grips (Kirch 1981:141) and traces of battering on the ends and are identified as possible hammers for cracking hard-shelled nuts such as *Barringtonia* or *Terminalia*. The 'nut-cracking' stones suggest the practice of arboriculture (Kirch 1981:142). No change through time is argued for the other artefact component.

Faunal assemblage

According to Kirch (1981:141), the water logging and alkaline pH of Layer IX was not conducive to the preservation of faunal remains. Despite this, a human molar, a dog premolar and a fragment of fish vertebra were recovered (presumably from Layer IX although this is not specified). The dog premolar is considered notable because the association of dog with Lapita assemblages is questionable (Kirch 1981:142).

Alofitai

Stratigraphy

Sand (1990) excavated and dated a number of ceramic sites on Futuna and Alofi, including Asi Pani, which contained Lapita ceramics. Although several of the sites have been ^{14}C dated, only a single radiocarbon determination from the Alofitai site was acceptable under the analysis protocol presented in Chapter 4. Unfortunately, the Alofitai site is not fully published. A limited amount of information is available about the context of the site and the ceramic assemblages from the dated deposits.

The stratigraphy of the Alofitai site is described only as having a Lower and Upper ceramic horizon, separated by an aceramic layer or layers. The cultural content of the aceramic layer(s) is not discussed. The Upper ceramic horizon is just below the present ground surface (Sand 1990:124).

Analytical units

A charcoal date from the Upper ceramic horizon, Gif-7484, gave a calibrated 2σ range of 1540–1263 cal BP (see Fig. 5.7). The Lower ceramic horizon may be considered a separate analytical unit, stratigraphically earlier than the Upper horizon; however, the cultural material is reported only from the site as a whole and therefore in the present analysis the site is considered a single analytical unit.

Ceramic component

Ceramics were excavated from two horizons in the site separated by an aceramic layer. Sand (1990) does not use the established ceramic sequence, but identified his own ceramic phases in the Futuna/Alofi assemblages. The ^{14}C age range for the site falls in the very recent end of the plainware period and the early aceramic period of the established ceramic sequence. The ceramic assemblage from the site is not specifically described, but the ceramic assemblages from Futuna / Alofi are described collectively (Sand 1990). The number of sherds excavated from the site is not reported, neither is the percentage analysed.

Decorated sherds were recovered, but, with the exception of a single perforated rim sherd, the type of decoration is not discussed (Sand 1990:129). The percentage of sherds decorated is not reported. Decoration was found on vessel parts other than just the rim (Sand 1990:128). No thick or thin wares are described. The upper stratigraphic horizon contained a sherd of probable Fijian origin of the 'Kulo' type.

Three types of jars and four types of open bowls have been identified in the Futuna/Alofi assemblages. Handle fragments from jars were recovered from Alofitai. A single shouldered bowl from Alofitai is the only one in the Futuna/Alofi assemblages and has a unique temper and is possibly of exotic origin (Sand 1990:128). Sherd density is not reported.

Sand (1990:126) reports that calcareous temper was found in a small number of sherds from the lowest levels in some sites, but does not discuss Alofitai specifically. All other ceramics have one of three temper types (lithic, plagioclase or ferromagnesium) which are identical to those described from the Tavaii site by Kirch (1981) (Sand 1990:126).

Differences between the ceramic assemblages from the Lower and Upper horizons are not reported. However, for the Futuna/Alofi assemblages as a whole, Sand (1990:128) identifies a change through time in vessel form. Sand (1990:132) considers the late ceramic phase of Futuna/Alofi to be distinguished by the absence of open bowls in the upper ceramic levels, in contrast to the late Samoan phase.

Similarly to Kirch's (1981) claim for the Tavai ceramic assemblage, Sand (1990:132) considers the absence of open bowls and the presence of handles in plainware assemblages from other Futunan sites to distinguish these assemblages from the characteristics of the established tripartite ceramic sequence.

Adze component
No adzes have been reported from the site.

Other artefact component
An other artefact assemblage is not reported.

Faunal assemblage
No faunal assemblage is reported.

Discussion of change through time in Futuna and Alofi assemblages
Both the Tavaii and Alofitai sites have cultural material reported only as a single analytical unit. The radiocarbon date for the Tavaii site suggests the deposit may be earlier than that from Alofitai; however, cultural material reported from the Alofitai site consists of two stratigraphic units, the lower of which is undated. A more recent chronology for the Alofitai assemblage cannot be assumed.

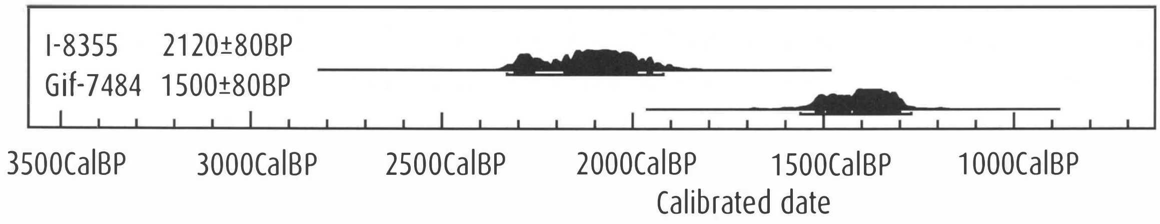

Figure 5.8

6

Samoan site stratigraphy and data

THIS CHAPTER presents the data from Samoan sites found to have acceptable or questionable radiocarbon determinations (see Chapter 4). As with Chapter 5, discussion of the stratigraphy and chronological units for each site precedes description of the cultural material. The sites are discussed according to the subregions of American Samoa and Western Samoa.

American Samoan sites

To'aga

Stratigraphy

The To'aga site on Ofu Island in American Samoa (Fig. 6.1) consists of a stratified beach deposit with surface features. Due to progradation of the beach over the last 3000 years, the stratigraphy at the site is considered by Kirch and Hunt (1993:47) to be the result of two main actions: the deposition of colluvial clay deposit from the steep talus at the rear of the beach site; and the deposition of calcareous sand, mixed with darker volcanic fragments in some layers. These fragments represent periods where a volcanic headland has been exposed and eroding. The composition of the sediments varies across the site principally as a result of spatial variation in the proportion of colluvial to beach deposit and in the presence of cultural material, particularly charcoal. Charcoal is present as flecking in colluvial deposits, suggesting burning of vegetation on the slopes behind the site prior to, and possibly aiding, erosion. Periods of stabilisation in the depositional regime are represented by palaeosols, seen in a number of test pits. The main cultural deposits lie towards the colluvial slope at the back of the beach while the seaward portion of the beach is primarily culturally sterile coral sand and reef detritus (Kirch and Hunt 1993:47).

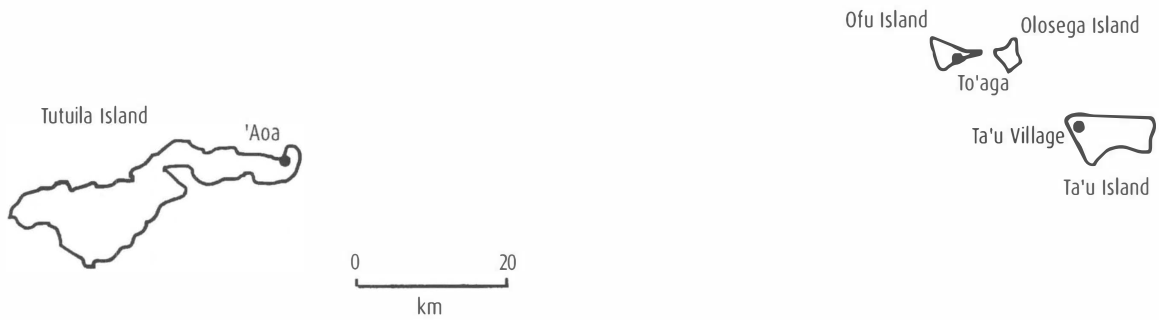

Figure 6.1 American Samoan sites discussed in the text.

Although 31 1m × 1m test pits were excavated, the site extends at least 2km along the beach making it difficult to assess the overall stratigraphy (Kirch and Hunt 1993:82). The excavations were undertaken over three field seasons. A ceramic deposit was identified in a single test pit in 1986 which prompted subsequent excavation at the site. Fourteen test pits were excavated in 1987, concentrated in an area situated between the 1986 test pit and the talus slope. In 1989 a further 16 test pits were excavated along transects running across the beach from the talus to the shoreline, designed to explore the spatial extent of the site (Kirch and Hunt 1993:43).

Excavations were carried out according to stratigraphic layers, Layer I being the surface layer. The layers were distinguished on sedimentological criteria. Sedimentological or lithological units identified as having been deposited as a single event, or as several events of resulting same mode of deposition, were designated as individual layers (Kirch and Hunt 1993:44). A number of excavation units were located so as to investigate the remains of structures, mounds or house floors visible on the surface. These are located further toward the present shoreline than the excavation units yielding ceramics, and represent more recent activity at the site. Excavation was concentrated toward the rear of the site at the base of the talus where ceramics were first excavated in 1986.

The stratigraphy in each excavation unit consists of calcareous sand deposits alternating with colluvial deposits, with varying degrees of mixing of the two. At the base of some excavation units, coral and coarse white sand indicate original beach deposit.

Analytical units

In the To'aga site report, Kirch and Hunt (1993) do not provide a correlated radiocarbon and lithostratigraphy for all test pits. In the descriptions of the stratigraphy of individual excavation units and summarised depositional sequences for adjacent excavation units, they correlate some stratigraphic layers; however, overall chronological units for the site are not discussed and the relative age of the various cultural deposits is difficult to interpret. Identifying appropriate analytical units for the site was central to looking at change through time in the assemblage and I have synthesised the evidence presented by Kirch and Hunt (1993). A summary of the chronostratigraphic and lithostratigraphic association of deposits in the excavation units is presented below and used to identify three chronological or analytical units.

Table 6.1 lists the To'aga radiocarbon determinations discussed in the text and Figure 6.2 illustrates their probability distributions.

In the following discussion of the stratigraphy and chronological units, only those excavation units for which data about the excavated assemblages are available are discussed. No artefacts are reported to come from excavation Units 18, 19, 26, 24 or 25 and the stratigraphic context of the faunal assemblages from these units is not reported. Hence, these excavation units are not considered further.

Table 6.1 To'aga acceptable and questionable radiocarbon determinations (from Kirch 1993a:87–9).

LABORATORY NUMBER	DATE YEARS BP	CALIBRATED RANGE YEARS BP (2σ)	PROVENANCE
Beta-35601	2900±110	3356–2761	Unit 28, Layer II
Beta-35602	2630±100	2947–2361	Unit 23, Layer IIIA
Beta-26464	2620±140	3023–2344	Unit 10, Layer IIB
Beta-35604	2770±80	2649–2133	Unit 23, Layer IIIB
Beta-25033	2640±80	2354–1975	Unit 6, Layer IIA-1
Beta-25034	2570±80	2306–1916	Unit 6, Layer IIB
Beta-19742	2350±50	1962–1705	1986 test pit, Layer D, Level 10
Beta-35924	2100±70	1716–1368	Unit 15, Layer II
Beta-35600	1190±70	1275–935	Unit 17, 53 cm bs

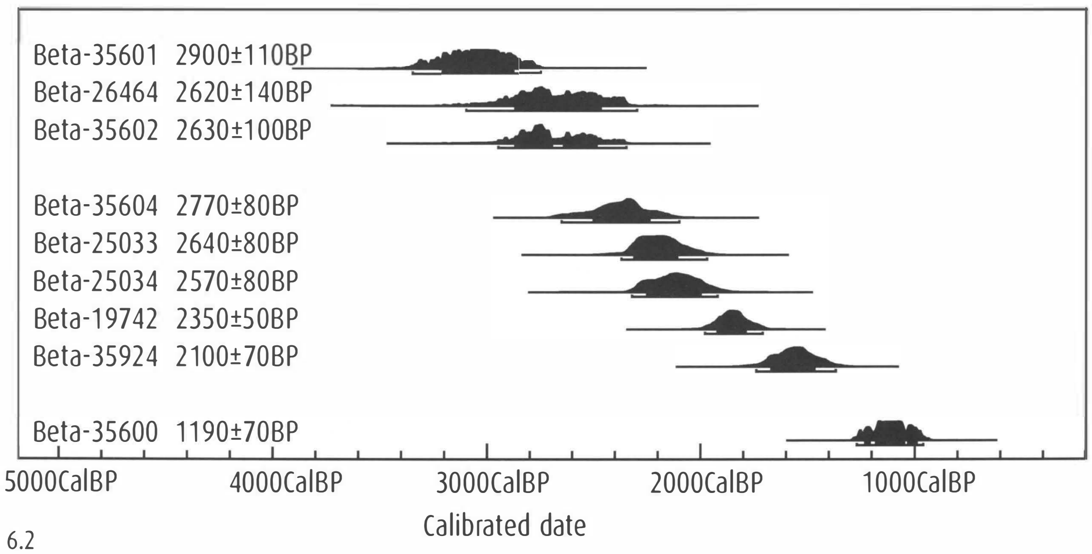

Figure 6.2

Some difficulties were encountered in synthesising the evidence due to the large number of excavation units, some located a great distance apart, and confusion in the numbering of stratigraphic layers in some units. Kirch and Hunt (1993) used lithological criteria to initially divide the excavated deposits into stratigraphic layers. However, these layers have occasionally been subdivided. For example, Layer II was divided into Layers IIA, IIB and IIC. The criteria upon which these subdivisions have been made are not always clear, apparently relating in some instances to the presence or density of cultural material, whilst in others to the provenance of radiocarbon dated samples.

It has been assumed that where a layer in one unit (for example Layer II) is said to equate with a subdivided layer in another unit (for example Layer IIIA) and the reason for the subdivision (for example into Layers IIIA, IIIB and IIIC) is not lithological, Layer II in the first unit is considered to equate chronologically with all three Layers IIIA, IIIB and IIIC.

The relationships between the stratigraphic layers of the various excavation units are illustrated in Figures 6.3 to 6.7. In these diagrammatic representations of the To'aga stratigraphy, layers considered by the excavators to be contemporaneous, either on radiocarbon evidence or due to similarity in the deposits, are shown on the same row of the table. Where I interpret (on the basis of the evidence presented) that deposits may be contemporaneous but such a relationship is not stated by the excavators, the stratigraphic layers are highlighted with italics and the rationale for this interpretation is discussed in the accompanying text.

Units 1, 4 to 9, 10, 11 and 14 (Fig. 6.3)

In the 1987 field season, 14 units were excavated (see Fig. 6.3). Of these, Units 1, 4, 5, 6, 7, 8 and 9 were adjacent and formed the main trench. The stratigraphy in the trench is said to also be reflected in Unit 10 and two adjacent units, 11 and 14 (Kirch and Hunt 1993:49–55).

Figure 6.3 Stratigraphic relationship of excavation Units 1 to 14 at the To'aga site (Code: * = deposits containing ceramics).

UNITS 1, 4 TO 9	UNIT 10	UNITS 11, 14	UNIT 12	UNITS 2, 3	UNIT 13
					Layer I
					Layer IB
					Layer II
				Layer I	
				Layer II	
Layer IA	Layer IA	Layer IA	_Layer IA_		
Layer IB	Layer IB	Layer IB	_Layer IB_		
Layer IC*	Layer IC	Layer IC*	_Layer IC_		
Layer IIA-1 (palaeosol)*	Layer IIA-1 (palaeosol)	Layer II*			
Layer IIA*	Layer IIA*				
Layer IIB (Beta-25033)*	Layer IIB (Beta-26464)*				
	Layer IIC				
Layer IIC*		Layer III*			
Layer III*	Layer III	Layer IV			
			Layer IC-1		
			(?Layer III)*		
Layer IV					
_Layer V_*	_Layer IV_				

Figure 6.4 Stratigraphic relationship of excavation Units 15 to 17 and 28 to 30 at the To'aga site (Code: * = deposits containing ceramics).

UNIT 28	UNITS 15, 29, 30	UNIT 16	UNIT 17
			Layer I
			Layer II
			Layer III (Beta-35600)
	Layer IA	_Layer IA ?_*	
	Layer IB		
Layer I			
	Layer II (Beta-35924)*	Layer IB*	
			Layer IVA
	Layer IIIA-1 (palaeosol)	Layer IC (palaeosol)	Layer IVB (palaeosol)
	_Layer IIIA_*	_Layer II_*	_Layer V_
	Layer IIIB*	Layer III*	
		Layer IV	_Layer VI_
			Layer VII
	Layer IIIC		
Layer IIA*			
Layer IIB (Beta-35601)*			
Layer IIC*	Layer IIID*		
	Layer IV		
Layer III			

Figure 6.5 Stratigraphic relationship of excavation Units 20 to 23 at the To'aga site (Code: * = deposits containing ceramics).

UNITS 20, 23	UNIT 21	UNIT 22
		Layer I
		Layer II
Layer IA		
Layer IB	*Layer IA*	
Layer IC		
	Layer IB	
Layer IIA (palaeosol)		
Layer IIB*	Layer IIA*	Layer III
Layer IIIA (Beta-35602)*		
Layer IIIB (Beta-35604)*	Layer IIB*	
Layer IIIC*		
Layer IV	*Layer IIC*	

Figure 6.6 Stratigraphic relationship of excavation Unit 27 at the To'aga site (Code: * = deposits containing ceramics).

UNITS 20, 23
Layer I
Layer II*
Layer IIIA ?*
Layer IIIB ?3000 BP*

Figure 6.7 Stratigraphic relationship of the 1986 test pit at the To'aga site (Code: * = deposits containing ceramics).

1986 TEST PIT
Layer I
Layer II (Beta-19742)*
Layer III

Layer IC in the main trench is considered to be contemporaneous with Layer IC in Units 11 and 14. In Units 11 and 14, Layer II is not subdivided (as it is in the main trench) into IIA, IIB and IIC. Layer IIC in the main trench is argued to correlate with Layer III in Units 11 and 14 (Kirch and Hunt 1993:54). No mention is made of the relationship of Layer IIC in Unit 10, to Layer III in Units 11 and 14. Description of the deposits by Kirch and Hunt (1993:53–4) suggests that Layer IIC in Unit 10 is comparable with the base of Layer II in Units 11 and 14, while Layer III in Unit 10 is comparable with Layer III in the main trench and Layer IV in Units 11 and 14. Therefore, Layer II in Units 11 and 14 is considered to equate with Layers IIA-1, IIA, IIB in the main trench and Layers IIA-1, IIA, IIB and IIC in Unit 10. As a result, the ^{14}C determinations Beta-25033, Beta-25034 and Beta-26464 date material from Layer II in Units 11, 14 and 10 and Layers IIA-1, IIA and IIB in the main trench. Their calibrated 2σ ranges are 2354–1975 BP (Beta-25033), 2306–1916 BP (Beta-25034) and 3023–2344 BP (Beta-26464). The dates from Layer II of the main trench almost fully overlap, and furthermore, just overlap with Beta-26464 from Unit 10. Layer IIB in Unit 10 may be earlier than IIB in the main trench; however, on the present chronostratigraphic and lithostratigraphic evidence this cannot be assumed.

Units 2, 3, 12 and 13 (Fig. 6.3)

Also excavated during the 1987 field season were Units 2, 3, 12 and 13. Units 2 and 3 are located toward the shoreline from the main trench and have a similar stratigraphy in Layers I and II. Layer I is a silty clay, calcareous sand mix and is under cultivation. Layer II is a culturally sterile, calcareous sand deposit. These deposits are likely to be more recent than those further from the shoreline and are thought by the excavators to result from the prograding of the beach after about 1900 BP (Kirch and Hunt 1993:56). Unit 12 is at the base of the talus slope at the rear of the beach and has a stratigraphy comprised almost entirely of colluvium. Description of the sediment suggests Layers IA, IB and IC are comparable to those in the main trench and Units 10, 11 and 14, but those in Unit 12 are far deeper. The relationship of the basal layer (IC-1) to any other stratigraphic unit is unclear. The unit consists of thoroughly mixed clay-loam and sand which is very similar to the overlying Layer IC, but distinguished by the excavators by a greater calcareous sand content and the presence of ceramics (Kirch and Hunt 1993:55). No radiocarbon determinations are available for the unit and the relative stratigraphic age of the Layer IC-1 deposit is unknown. There is some confusion about the provenance of ceramics from this unit. Ceramics are listed as coming from Layer III in Unit 12 (Kirch and Hunt 1993:126); however, no Layer III is discussed in the description of the stratigraphy. Twenty-five sherds are said to come from the basal deposit (Layer IC-1) (Kirch and Hunt 1993:55) and 20 sherds are listed as coming from Layer III (Kirch and Hunt 1993:126).

Unit 13 was located so as to enable excavation of a house mound situated approximately 20m toward the shoreline from Unit 12. The stratigraphic Layers I and IB consist of house floors of water-worn coral gravel and a burial in Layer IB. Historic artefacts were excavated from Layer I. Layer II is a culturally sterile, calcareous sand which may equate to Layer II in Units 2 and 3, but there is insufficient information available to confirm this.

In the excavation units of the main trench and Unit 10, a palaeosol or evidence of a period of stabilisation of the land surface was noted in Layer IIA-1. A palaeosol was noted in several other excavation units and may provide a chronological marker in the units. This is discussed further below.

Units 15 to 17, 28, 29 and 30 (Fig. 6.4)

Six excavation units were placed along a transect (Transect 5), located approximately 100m north of the main trench (Kirch and Hunt 1993:Fig. 5.8), toward the rear of the beach plain. Unit 17 is closest to the water, followed by Unit 16. Units 15, 29 and 30 form a small trench located 10m behind Unit 16. Unit 28 is situated a further 10m toward the rear of the beach, at the base of the talus.

In their summary of the Transect 5 depositional sequence, Kirch and Hunt (1993:67) discuss several chronological phases and the stratigraphic units which reflect them, connecting some of the stratigraphy of the various units.

Layer II in Unit 28 is divided into Layers IIA, IIB and IIC, which are distinguished by colour and minor variations in the sediment content of the primarily calcareous deposit, but there are no identifiable boundaries (Kirch and Hunt 1993:66). The density of cultural material is greatest in IIC, which is considered equivalent to Layer IIID in Units 15, 29 and 30, although the rationale for this is not stated. Beta-35601 (3356–2761 cal BP 2σ range) is a charcoal sample variously reported to come from the base of Layer II (Kirch and Hunt 1993:88), Layer IIB (Kirch and Hunt 1993:67) and the interface between Layers II and III (Kirch and Hunt 1993:67) of Unit 28. Given the disparity in the reported provenance of the radiocarbon sample and the lack of lithological evidence for distinguishing Layers IIA, IIB and IIC, Beta-25601 is considered herein to date all of Layer II in Unit 28, and Layer IIID in Units 15, 29 and 30.

A period of shoreline progradation is said to account for the basal calcareous sand deposits of Unit 16 (Layers III and IV), Unit 17 (Layers VI and VII) and the deposit of Layer IIIB (Units 15, 29 and 30) (Kirch and Hunt 1993:67).

A palaeosol is evident in Units 15, 29 and 30 (Layer IIIA-1), Unit 16 (Layer IC) and Unit 17 (Layer IVB).

Layer IIIA in Units 15, 29 and 30, Layer II in Unit 16 and Layer V in Unit 17 are all described as a structureless deposit of white calcareous sand (Kirch and Hunt 1993:62–4), which in each case lies directly below the palaeosol. For these reasons the layers are considered contemporaneous.

Layer II in Units 15, 29 and 30 contains midden, charcoal ash and cooking stones and is interpreted by Kirch and Hunt (1993:68) as a cookhouse activity area, which they consider to be contemporaneous with Layer IB of Unit 16. Beta-35924 (1716–1368 cal BP 2σ range) is a shell sample from Unit 15, Layer II, and also provides a date for Layer IB, Unit 16. Overlying both these units is a deposit of colluvium with a surface lens of garden soil. Layer I of Unit 28 is described as a massive colluvium deposit (Kirch and Hunt 1993:66).

Layer IIIB in Units 15, 29 and 30, and Layer III in Unit 16 are calcareous sand deposits, both described as very pale brown and containing non-concentrated midden or occupation deposit (Kirch and Hunt 1993:63–4). The excavators consider Unit 16, Layer III to be a seaward expression of Unit 15, Layer IIB or IID; however, there is no Layer IIB or IID described for Unit 15 and the corresponding layer appears to be either IIIB or IIID.

Unit 17 has a series of three successive house floors or pavements that make up Layer III. Charcoal, interpreted as hearth rake-outs from within the floors, provided the sample for Beta-35600 (1275–975 cal BP 2σ range) (Kirch 1993a:88). Midden deposit was excavated from Layers I and II (Kirch and Hunt 1993:61).

Units 20 to 23 (Fig. 6.5)

Units 20 and 23 form a trench and have a uniform stratigraphy. Units 21 and 22 are located 10m and 20m respectively seaward of Units 20 and 23 along Transect 9, which is about 500m north of the main trench (Kirch and Hunt 1993:Fig. 5.8). Units 20, 21 and 23 have deep stratified cultural deposits, but Unit 22 has a much simpler and apparently more recent stratigraphy.

The basal deposit of Units 20, 21 and 23 is a culturally sterile, calcareous beach sand (Kirch and Hunt 1993:73, 76). Layers IIIA, IIIB and IIIC of Units 20 and 23 are all described as calcareous sand, distinguished primarily by varying concentrations of midden and organic staining (Kirch and Hunt 1993:47, 73). Kirch and Hunt (1993:77) consider that the thick ceramic bearing Layer IIIB of Units 20 and 23 indicates the occupation of a narrow coastal terrace and that Layer IIB of Unit 21 is the seaward extent of this deposit. The ^{14}C determinations Beta-35602 (2947–2361 cal BP 2σ range) and Beta-35604 (2649–2133 cal BP 2σ range) from Unit 23 (Layers IIIA and IIIB, respectively) also date Unit 21, Layer IIB. Given the lack of lithological evidence for distinguishing Layers IIIA, IIIB and IIIC in Units 20 and 23, Beta-35602 and Beta-35604 are also considered to date Layer IIIC in Units 20 and 23.

Rapid progradation of the beach is said to account for the sterile, calcareous sand deposit of Layer IIB (Units 20 and 23), Layer IIA (Unit 21) and Layer III (Unit 22) which seals the ceramic bearing layer found in these units (Kirch and Hunt 1993:78).

A palaeosol in Units 20 and 23 in Layer IIA indicates a period of stabilisation in this part of the beach. Layers IB in Units 20 and 23, and IA in Unit 21, are both described as massive colluvial deposit including volcanic cobbles and dispersed chalky midden. For the purposes of this analysis I have assumed these are chronologically equivalent deposits.

Layers I and II in Unit 22 are primarily calcareous beach sand with some clay, dispersed house floor gravel and midden. Layer II is distinguished from Layer I by its darker colour and higher concentration of house floor gravel (Kirch and Hunt 1993:77).

Unit 27 (Fig. 6.6)

Unit 27 is on Transect 3, ca. 200m south of the main trench, located towards the rear of the beach. A variety of artefacts, including ceramics, was excavated from Layers II and III. Layer II is a calcareous sand with coral and basalt pebbles and cobbles in the lower part, suggesting a high-energy depositional event (Kirch and Hunt 1993:58). No specific comparisons between the stratigraphy of Unit 27 and other units are reported. Kirch and Hunt (1993:58) consider that the ceramic assemblage excavated from Layer IIIB may be chronologically equivalent to ceramics found elsewhere in the site dated to ca. 3000 BP. The boundary between the primarily calcareous sand Layers IIIA and IIIB is diffuse, although IIIB has a higher clay content. Kirch and Hunt (1993:59) consider Layers IIIA and IIIB to represent a single occupation phase.

1986 test excavation (Fig. 6.7)

The stratigraphy of the 1986 excavation unit has not been correlated with the results from subsequent field seasons. The test pit is located approximately 250m seaward of the 1987 main trench. A shell sample from the main cultural deposit (Layer II) yielded Beta-19742 (1962–1705 cal BP 2σ range).

Summary

Table 6.2 summarises the association of radiocarbon determinations with stratigraphic layers based on the synthesis presented above. Radiocarbon determinations from the To'aga site come from a restricted number of test pits clustered in the vicinity of the main excavation trench. Correlation of the stratigraphy has permitted association of the radiocarbon determinations with deposits from a larger number of excavation units.

Synthesis of the stratigraphy points to the palaeosol as a chronological marker in the site. The palaeosol is seen in the excavation units in or near the main trench (Units 1, 4-9, 10, 15, 29, 30, 17, 20 and

Table 6.2 To'aga analytical units and associated radiocarbon determinations.

ANALYTICAL UNIT	LABORATORY NUMBER	COMBINED 2σ CALIBRATED RANGE YEARS BP	ASSOCIATED DEPOSITS
	Beta-35600	1275-935	Unit 17, Layer II
	Beta-35924	1716-1368	Units 15, 29,30 Layer II
Unit 3			Unit 16, Layer IB
	Beta-19742	1962-1705	1986 test pit, Layer II
		PALAEOSOL	
	Beta-35602	ca. 2900-2200	Units 20/23, Layers IIIA, IIIB, IIIC
	Beta-35604		Unit 21, Layer IIB
Unit 2	Beta-25033	ca. 3000-1900	Units 1, 4-9, Layers IIA-1, IIA, IIB
	Beta-25034		Unit 10, Layers IIA-1, IIA, IIB, IIC
	Beta-26464		Units 11/14, Layer II
	Beta-35601	3356-2761	Unit 28, Layers IIA, IIB, IIC, III
Unit 1			Units 15 and 30, Layer III
			Unit 16, Layer III
			?Unit 27, Layer III

23), suggesting a stable land surface existed for a period of time towards the rear of the present beach. The deposit associated with the palaeosol contained anthropophyllic snails and root casts extending into the underlying layer, suggestive of vegetation cover and gardening (Kirch and Hunt 1993:51, 64).

Deposits associated with Beta-35601, Beta-25033, Beta-25034, Beta-26464, Beta-35602 and Beta-35604 are all earlier than the palaeosol formation, while deposits associated with Beta-35924 and Beta-35600 post-date the palaeosol. The position of the deposit associated with Beta-19742 (1986 test excavation) in relation to the palaeosol is not clear. The 1986 test pit is seaward of the excavation units in which the palaeosol was identified. In Kirch and Hunt's (1993) proposed model of geomorphological change on the beach plain, the excavation units closer to the present shoreline are more recent. This would suggest that the area of the 1986 test pit was still an active beach at the time of palaeosol formation and Beta-19742 and the cultural material of Layer II in the 1986 test pit post-date the palaeosol formation (see Kirch and Hunt 1993:Fig. 5.2). Kirch and Hunt (1993:79) date the stabilisation of the beach and formation of the palaeosol at around 1900 cal BP, which approximates the recent end of the 2σ calibrated range for ^{14}C determinations from deposits immediately below the palaeosol. Only a single radiocarbon determination, Beta-35924, occurs in association with deposits directly overlying the palaeosol. The early end of the 2σ calibrated range of Beta-35924, ca. 1700 cal BP, suggests a minimum of 200 years for the stable surface prior to further deposit being laid down, represented by Layer II in Units 15, 29 and 30, and Layer IB in Unit 16. The chronology of other stratigraphic layers that directly overly the palaeosol is less clear. These can only be said to post-date ca. 1900 cal BP. Beta-35600 from a house floor in Unit 17 has a calibrated 2σ range of 1275–935 cal BP, indicating stabilisation of the beach ridge shoreward of the ceramic deposits by at least 1300 BP.

The analytical units for the To'aga site need to take account of the position of the deposit in relation to the palaeosol and the stratigraphic relationships indicated by Figures 6.3–6.7. They need also to take account of the reporting of data from the site. The provenance of cultural material is not fully reported. Ceramics have been selected for analysis from a limited number of contexts, all of which occur below the palaeosol. The non-ceramic artefacts come from a large number of test pits, but the stratigraphic provenance of the artefacts is not commonly reported. The stratigraphic provenance is reported for faunal remains from 12 test pits and includes some assemblages from deposits that post-date the palaeosol. It is not possible to assess the overall distribution of cultural material in the site because it is unclear whether material is absent from the other test pits or stratigraphic units, or simply not reported.

The palaeosol has been used to divide the assemblage into pre- and post-palaeosol or ca. 1900 BP components (Table 6.2), creating Analytical Units 2 and 3. A further division has been made in the pre-palaeosol deposits between those associated with the earlier Beta-35601 and the more recent Beta-25033, Beta-25034, Beta-26464, Beta-35602 and Beta-35604 dates, Analytical Units 1 and 2. Although there is some overlap in the 2σ ranges of these two groups of dates, stratigraphic evidence indicates that the cultural deposits associated with Beta-35601 are the earliest in the site. Excavation Unit 27 is undated, but on the basis of ceramics the excavators consider Layer III to be chronologically equivalent to Beta-35601. The inclusion of the ceramic assemblage from Unit 27 in Analytical Unit 1 is discussed in Chapter 7.

Ceramic component

Hunt and Erkelens (1993) characterise the To'aga ceramic assemblage as representing three phases: Early, Middle and Late. The chronology and associated deposits are listed in Table 6.3. The stratigraphic layers from which ceramics were excavated are illustrated in Figures 6.3–6.7. There are some disparities between the layers described as having ceramic assemblages in the description of the stratigraphy of individual excavation units (Kirch and Hunt 1993:43–83), and the layers listed as containing ceramic assemblages in the report of the ceramic analysis (Hunt and Erkelens 1993:Tables 9.1 and 9.2). These are discussed where relevant in Chapter 7.

Table 6.3 To'aga site ceramic periods (from Hunt and Erkelens 1993:124).

Period	Age Range	Units and Stratigraphic Layers
Early	3250–2350 BP	Units 1, 5 to 7, 9 and 28, Layer III
Middle	2500–2000 BP	Units 1, 4 to 7, 9, 27 and 28, Layers IIB and IIC
Late	2000–1700 BP	Units 4 to 9 and 27, Layer IIA

The two ^{14}C dates available for Layer II in Units 1, 4 to 7 and 9 are contemporary, and the entire layer is considered to be a single chronological unit. This conflates the Middle and Late ceramic periods into a single unit which is stratigraphically more recent that those of the early period, except for Layer III in Unit 28 which should be included in the conflated Early/Middle unit. Layer IIA of Unit 27, included in the Early period and listed in Hunt and Erkelens (1993) Table 9.2, is not mentioned in the description of stratigraphy. Unit 27 is not radiocarbon dated nor are the stratigraphic relationships to other units reported. The ceramics from Unit 27 Layer IIIB were said on stylistic grounds to equate with assemblages from other units dated ca. 3000 BP, but this is speculative.

The assemblage is characterised as plainware. The ^{14}C determinations in association with ceramics include Early Lapita, Late Lapita and plainware phases of the established sequence.

While a total of 2434 sherds were recovered (Hunt and Erkelens 1993:123), only 1663 sherds are listed in their Tables 9.1 and 9.2. Eroded sherds appear to have been excluded. Sherds for analysis were selected from excavation units with large samples and across the entire ceramic sequence. A total of 737 sherds were selected for analysis (Hunt and Erkelens 1993:124).

Decoration includes red-slipped ware, carved paddle-impressed ware, incised ware, and notched, impressed and crenellated rims (Hunt and Erkelens 1993:124). Thirty sherds are slipped and 11 others are decorated. This represents 1.7% of the total assemblage. Decoration was identified on both rim and body sherds.

The thickness and variance in thickness was measured for each non-eroded sherd in the analysed assemblage. The mean, median and mode of sherd thickness are less in the Early than the Late group, but the range is slightly greater in the Early period (Hunt and Erkelens 1993:Table 9.14). The implications of the data are not discussed by Hunt and Erkelens (1993).

Hunt and Erkelens (1993:Tables 9.1 and 9.2) list ceramics on the basis of being thick ware (>7.5mm) or thin ware (<7.5mm), although the significance of the 7.5mm value is not discussed. They state that thick wares were present in all deposits and the abundance of thick ware is stable over time. Thin ware is never dominant, but occurs in roughly equivalent numbers to thick ware in the early deposits. Thin ware declines in real and relative values over time, but persists throughout the assemblage. A single vessel shape, an open, round-based bowl was identified (Hunt and Erkelens 1993:123). 7.3% of analysed sherds are rim sherds, 80% of which have a squared lip cross section, while the remainder are rounded.

The volume of excavated deposit is not reported and the density of sherds cannot be calculated.

The temper of 29 sherds has been examined petrographically, although the provenance of these sherds is not reported. Dickinson (1993) found all sherds to contain basaltic tempers, with four variants of the temper present. All appear indigenous to the Manu'a group. The tempers are similar to, but not the same as, those from Upolu, Western Samoa (Dickinson 1993:156). A local colluvial source has been identified for most of the clay of the To'aga assemblage except some red slipped ware which does not match known local sources (Hunt and Erkelens 1993:146).

Change through time in the assemblage has been assessed using the tripartite Early/ Middle/Late framework. Decorated rims were only found in Early contexts. Measured thickness of the sherds indicated those from the Early period were, on average, thinner than those of the Middle period, which were in turn found to be thinner on average than those of the Late period (Hunt and Erkelens 1993:131). Pottery declines in abundance after 2000 BP and then disappears altogether (Hunt and Erkelens 1993:147).

No explanation is offered for these changes, although Hunt and Erkelens (1993:146–7) identify a decreasing diversity in clays used over time and suggest that the colluvial clays with 'inbuilt' basaltic tempers may have resulted in a poorer quality of ceramic, contributing to the demise of ceramic manufacture.

The analytical units of the present analysis do not accord with Hunt and Erkelens (1993) tripartite framework. It is difficult to see how the dates provided by Hunt and Erkelens (1993) for their three phases (see Table 6.3) match the assemblages they have chosen as characteristic of those phases. The present analytical units create a substantially different chronological framework for the assemblages. This is discussed in full in Chapter 7.

Adze component

Six classifiable adzes/adze fragments were excavated from To'aga (Kirch 1993b:157). The stratigraphic context of each is listed in Table 6.4.

Table 6.4 To'aga adze assemblage (from Kirch 1993b:157–8).

ADZE PROVENANCE	ADZE TYPE	RAW MATERIAL	ANALYTICAL UNIT
Unit 9, Layer IIA-1	V	basalt/andesite	2
Unit 20, Layer IIIB	V (fragment)	basalt	2
Unit 23, Layer IIIB	V (fragment)	basalt	2
1986 test pit	VI or V	basalt	3
Unit 27, Layer IIIA	possible V or another with quadrangular cross-section (fragment)	basalt	?1
Unit 3, aceramic deposit	probably IV	basalt/andesite	3

Three of the adzes (from Units 9, 20 and 23) are from Analytical Unit 2, immediately below, or, in the case of the Unit 9 adze, associated with the palaeosol, dated from ca. 2500–1950 cal BP. The radiocarbon determination associated with Unit 3 (the aceramic deposit) was rejected in the analysis reported in Chapter 4. Hence, both remaining adzes are derived from contexts that are not securely dated. The adze from Unit 27, Layer IIIA is associated with an undated ceramic deposit that has been tentatively assigned to Analytical Unit 1.

The classification of the adzes according to Green and Davidson's (1969; Green 1971, 1974b) typology and adze raw material description is listed in Table 6.4. According to Weisler (1993), a local basalt source is likely for all adzes except the probable Type IV adze, which he assigns to the Tatagamatau quarry on Tutuila Island.

A flaked tabular piece of basalt, possibly a trimming flake from adze manufacture was recovered from Unit 27, Layer IIIA. Basalt flakes were 'surprisingly uncommon' (Kirch 1993b:165) in the excavated material. Eighteen flakes were recovered: 11 from Unit 23, Layer III; three from Unit 28; and four from Unit 29.

The adzes found in association with ceramics are all plano-convex Type V which are 'widespread and common throughout the Ancestral Polynesian region', but disappear early in the first millennium AD (Kirch and Hunt 1993:239). No change through time is noted in the excavated To'aga assemblage; however, Kirch and Hunt (1993:239) conclude that differences between the excavated adzes and surface collection from Manu'a in general indicate change through time. The Type V adze is considered to disappear between 2000 and 1000 BP, and quadrangular or trapezoidal forms dominate more recent (surface) assemblages. In the chronological units used in the present analysis, four Type V adzes are from securely dated contexts equivalent to, or earlier than ca. 1900 cal BP. Two adzes from post-ca. 1900 BP contexts are Types V or VI and Type IV.

Other artefact component

The To'aga other artefact assemblage is listed in Tables 6.5 and 6.6. Each functional type is described by Kirch (1993b:159–66).

Table 6.5 To'aga other artefact assemblage (from Kirch 1993b:158-66). (Code: ? = stratigraphic provenance unknown or uncertain).

FUNCTIONAL TYPE	RAW MATERIAL	NO.	PROVENANCE	ANALYTICAL UNIT
shell adze	?*Cassis* sp.	1	1986 test pit, ceramic context	3
hammerstone	igneous rock	1	Unit 9, Layer IIA-1	2
	basalt	1	Unit 9, Layer IIA-1	2
fishhooks and tabs	*Turbo* sp.	-	(see Table 6.11)	
octopus lure cap	*Cypraea* sp.	3	Unit 28, Layer III	1
shell bead abrader	coral (*Porites* sp.)	1	Unit 11, Layer III	?2
abrader	echinoid	2	main trench, Layer IIA-1	2
		1	Unit 15, Layer II	3
		1	Unit 23, Layer IIIC (?drill point)	2
		1	Unit 20, Layer II (?drill point)	2
		2	Unit 28, Layer IIB	1
bead	Conus sp.	2	main trench, Layer IIB	2
		1	Unit 20, Layer IIIC	2
	Nerita sp.	2	main trench, Layer IIB	2
		1	Unit 21	?
	gastropod	1	Unit 30, Layer II	1
	echinoid spine	1	Unit 20, Layer IIIC	2
shell ring	Conus sp.	2	main trench, Layer IIB (fragments)	2
		1	Unit 16, Layer III	2
		1	Unit 29, Layer IIIB	2
	Conus or *Tridacna* sp.	1	Unit 11, Layer II	?2
	Tridacna sp.	1	Unit 23, Layer IIIC	2
drilled tooth	shark	1	Unit 21, Layer IIB	2
bone point	?dog or ?pig	1	Unit 27, Layer IIIB	?1
worked shell	*Turbo* sp.	-	(see Table 6.6)	
	Pinctada sp.	5	1 each in Units 11, 22, 23, 29, 30	?
		1	Unit 23, Layer IIIB	2
lithic core	obsidian	1	Unit 23, Layer IIIC	2
Total (excluding fishhooks and manufacturing debitage)		33		

With the exception of the fishhooks and abraders, behavioural implications of the functional categories of artefacts are not discussed by Kirch (1993b). Finished fishhooks, fishhook tabs and worked shell of *Turbo* sp. provide evidence of the manufacture of fishhooks at the site. Kirch (1993b:162) identifies two of the echinoid spine abraders as possible drill points used in fishhook manufacture and suggest the other abraders recovered could also have been used in the manufacturing process. Kirch and Hunt (1993:240) argue that the presence of a fishhook assemblage at To'aga, when almost no

Table 6.6 To'aga fishhook and fishhook manufacturing debitage assemblage (from Kirch 1993b:160–2) (Code: ? = stratigraphic provenance unknown or uncertain).

ARTEFACT TYPE UNIT	NO.	PROVENANCE	ANALYTICAL
fishhook	22	not reported	?
(whole, broken and unfinished)	1	Unit 15, Layer II	3
	1	Unit 27, Layer IIIA	?1
	1	Unit 23, Layer IIIB	2
	1	Unit 20, Layer IIIB	2
	2	1986 test pit	2
Total	28		
fishhook tab	1	Unit 21, Layer IIB	2
(1989 field season only)	1	Unit 23 Layer IIIB	2
	1	Unit 30, Layer II	3
	8	Unit 23	?
	10	Unit 21	?
	7	Unit 20	?
	1	Unit 16	?
	2	Unit 15	?
Total	31		
worked Turbo sp. shell			
(1989 field season only)	44	Units 15 to 17, 20 to 23, 25, 26, 28, 30	?
Total number of artefacts	103		

fishhooks have been recovered from West Polynesian sites, reflects the absence of a lagoonal environment which would permit fishing using nets and spears.

The coral abrader recovered from Unit 23, Layer IIB has a cupule on the ground surface, and has been identified as a shell bead abrader seen in eastern Melanesian sites, but not otherwise known in West Polynesia (Kirch 1993b:162).

No change through time in the other artefact component is reported, although Kirch (1993b:164) states that *Conus* shell rings do not appear to have been part of the Samoan material culture in historic times. Kirch and Hunt (1993:240) identify the morphology of some To'aga fishhooks as similar to early East Polynesian forms and consider these fishhooks to be prototypes from which the diversity of East Polynesian fishhooks developed.

The stratigraphic (and chronological) relationships of the deposits outlined above indicate the entire other artefact component comes from ceramic contexts. Of these, only five artefacts (two fishhook fragments, one fishhook tab, one shell bead and one echinoid abrader) were recovered from deposits which post-date the palaeosol (1986 test pit and Layer IIB in Units 15 and 30).

The provenance of only six whole or broken fishhooks and three tabs is reported (see Kirch 1993b:160–2; Kirch et al. 1990). These are listed in Table 6.6. Two hooks and two tabs come from the same stratigraphic context (Units 23, Layer IIIB, Unit 20, Layer IIIB and Unit 21 Layer IIB) dated ca. 2900–2100 cal BP. One fishhook and one tab come from the same stratigraphic context, above the palaeosol (Units 15 and 30, Layer II) with an age range of ca. 1700–1368 cal BP. The fishhook from Unit 27 is from an undated ceramic context and the two fishhook fragments from the 1986 test pit are from a context dated ca. 1950–1700 cal BP.

Faunal assemblage

Nagaoka (1993:189) states that sieving was not carried out on the colluvial deposits in the site because of difficulties screening the sediment and the low density and poor preservation of material. While data from the main trench (Units 20/23 and 15/19/30) are reported to stratigraphic layer, only the excavation unit is reported for the remainder of the assemblage. The fully reported units were chosen for detailed analysis by Nagaoka (1993:190) because they have a larger sample than individual units; however, they do not represent the chronology for the entire site.

Marine fauna component

Marine fauna includes shellfish, fish, marine turtle, sea urchin and Crustacea. Twenty taxa were identified in the fish bone, which averaged a density of 73 bones/excavation unit. Most of the taxa are inshore fish, although some (including Serranidae, Lutjanidae and Carangidae) cover a wide range of habitats (Nagaoka 1993:194). Several families can be caught with fishhooks (Serranidae, Lutjanidae and Holocentridae), but the commonly represented Scaridae and Acanthuridae are more likely to be caught by netting or spearing.

A high density of shellfish was found in deposits dated 2500–1900 cal BP and a similar density was recovered from Units 15/29/30, Layer III, dated ca. 1700–1400 cal BP. The stratigraphically contemporary Layer IB, Unit 16 contained the greatest concentration of shellfish. This was in association with house floor gravel. Over 76% of the identified shell consisted of Turbinidae, Trochidae and Tridacnidae. No difference in the composition of the shellfish assemblage has been noted temporally or spatially.

Fifty-six marine turtle bone fragments were recovered, about half of these coming from Unit 20, Layer IIIB (Nagaoka 1993:195), dated ca. 2650–2150 cal BP.

Terrestrial fauna component

Steadman (1993) identified 15 taxa of indigenous birds in To'aga, including ten species of seabirds and five of land birds. Of these, one megapode species and six sea birds are now extirpated on Ofu Island. The extirpated bird species make up 85% of the 74 bones examined. The megapode bone comes from Unit 15, Layer IIID, the earliest dated context which Kirch and Hunt (1993:241) interpret as evidence for their over-exploitation by early colonisers.

The non-fish vertebrate assemblage totalled 687 bones, of which half are *Rattus exulans* and half of these come from Layer II of the main trench. Fifteen chicken (*Gallus gallus*) bones were identified. Most of these came from Layer IIIB, Units 20 and 23. Only a single pig bone was recovered from the site, from a recent context in Unit 17. Pig and dog may be represented in 44 unidentified 'other mammal' bones. Seven of these are from pre-ca. 1900 cal BP contexts and eight from Layer II, Units 15/29/30, dated ca. 1700–1400 cal BP (Nagaoka 1993:195–6 and Table 13.9). Nagaoka (1993:207) found the To'aga faunal assemblage showed little change over time and no apparent shift in resource base from indigenous to domesticated fauna. The bird bones appear primarily in the early levels.

'Aoa

Stratigraphy

The 'Aoa Valley is situated on the north coast of eastern Tutuila Island (Fig. 6.1). The 'Aoa site is about 700 m from the present coastline at the edge of the prehistoric shoreline of an infilled bay. The site was excavated after stratified cultural deposits were noted in the bank of an adjacent river. The sediments excavated from the site are colluvial and alluvial deposits from the surrounding mountains (Clark and Michlovic 1996:5). Eight excavation units totalling 13.5 m^2 were excavated.

Clark and Michlovic (1996:7) characterise the stratigraphy of the site as consisting of eight soil layers (I-VIII) of various thickness and variously represented in the excavation units. The deepest soil layers (VII and VIII) were reached in only four excavation units. The sediment is described as stony silty clay that varied in texture and particle size in the profile, from clay and silty loams in the lower four layers to gravelly and sandy loam in the upper four layers. Clark and Michlovic (1996) divide the stratigraphic layers into A- and B-Horizons. A-Horizons represent periods of landform stability when the surface was exposed for a period long enough for a weathering profile to appear.

The site consists of two main stratigraphic units. Layer VI, a developed A-Horizon, divides the more recent stratigraphic Layers I–V from the lower cultural deposit in Layers VI–VIII. Clark and Michlovic (1996:11) include Layer VI and associated cultural material with the lower, earlier stratigraphic unit. Several features were identified in the profile and riverbank including fireplaces, pits and a boulder alignment in Layer V.

Analytical units

The excavators divide the site into two cultural components distinguishable on the basis of radiocarbon dates (Fig. 6.8), stratigraphy and the associated artefact assemblages (Clark and Michlovic 1996:13). Beta-48049 (3382– 2742 cal BP 2σ range) and Beta-48911 (2764–2164 cal BP 2σ range) are from charcoal

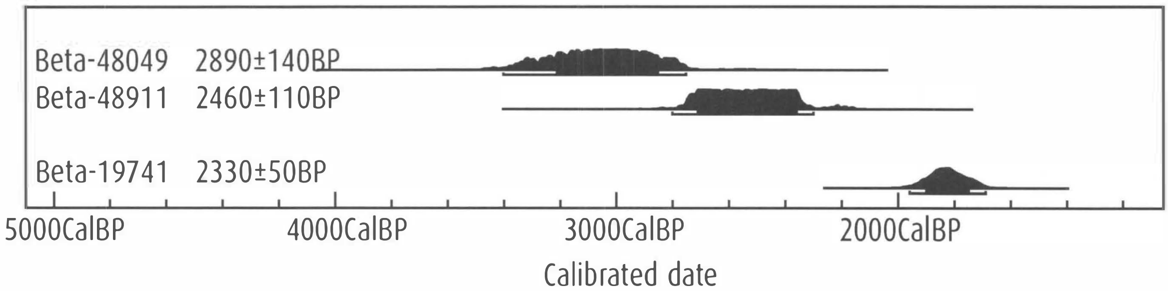

Figure 6.8 Probability distributions of the 'Aoa and Ta'u radiocarbon determinations discussed in the text

samples from Layer VII in adjacent excavation units which give a combined calibrated range for Layer VII of ca. 3300–2200 BP. There are six other dates from the site from Layers II and V, which range from ca. 650 cal BP to the historic period. The upper Layers I to V (Analytical Unit 2) are indistinguishable chronologically and may indicate a period of rapid sediment accumulation on the palaeosol of Layer V. Stratigraphic Layers VI, VII and VIII form the early Analytical Unit 1 in the lower half of the site. Layers VI to VIII are considered as a single analytical unit, as published data from the site are insufficient to enable any variability between these stratigraphic layers to be investigated.

Ceramic component

Ceramics were excavated from all stratigraphic layers except Layer I; however, apart from the number of sherds recovered from each layer, characteristics are described for the assemblage as a whole. The assemblage is classified as plainware and the ^{14}C dates for the site range from the Early Eastern Lapita to the plainware and mound-building period of the established cultural sequence. A total of 878 sherds were recovered, including several surface finds (Clark and Michlovic 1996:11). A total of 134 (15%) sherds were recovered from Layers I–V and 744 (85%) from Layers VI–VII. Of these, 568 (65%) sherds are from Layer VII.

No decorated sherds were recovered. Ceramics classed as thick and thin wares were both present, but the basis for the distinction is not reported. The only vessel form identified is a globular bowl. The reported 31 rim sherds are of two types, flat to rounded, and bevelled. All except one are from Layers VI to VIII. The density of sherds/stratigraphic unit is not reported.

Two types of temper are identified: crushed basaltic rock (associated with the thick walled sherds) and sand (associated with thin walled sherds). Two types of pastes were also identified, Types A and B. Type A sherds are commonly thicker than Type B. Sherds from Layers VI to VIII were generally smaller and, on average, slightly thinner than those from the upper layers. Type B paste is more common throughout the assemblage, but Type A is better represented in the upper portion although the sample size is small. No explanation is given for these differences.

Clark and Michlovic (1996:14) consider the 'Aoa assemblage to be similar to that of To'aga in the presence of thick and thin ware throughout the deposit and the globular bowl being the only vessel form identified, although no bevelled rims were found at To'aga. They consider the upper stratigraphic units indicate the manufacture of ceramics until ca. 350 BP.

Adze component

Eleven adze/adze fragments and 11 adze preforms were excavated from the site, with one adze and one adze preform recovered from the surface. Two adzes were excavated from Layer II, five from Layer V, three from Layer VII and one from Layer VIII. One preform was excavated from each of Layers I, II, III and VIII. Two preforms came from Layer V and four from Layer VII.

Three adzes could be definitely typed according to Green and Davidson's (1969; Green 1971, 1974b) adze typology, these being three Type V adzes from Layers VII and VIII. Based on a number of morphological traits, other possible adze types present include Types I, III, IV and VI. The adze preforms are likely to be Types I, III, VI and possibly VIII. The stratigraphic associations of the adze types are not reported, although Type V adzes are said to occur only in the lower layers (Clark and Michlovic 1996:13).

The adzes are of a basaltic rock known as hawaiite, thought to come from a known local quarry source (Clark and Michlovic 1996:15). A total of 3559 basalt flakes were recovered; 68% from Layer V and 12% from Layer VII (or a total of 80% from the lower cultural layers comprising Analytical Unit 1). Very few flakes had ground surfaces. Eighty-five percent are described as reduction flakes, while 13% have cortex present and are classified as secondary decortication flakes.

The type V adzes are considered the most interesting find because they have been considered markers of early occupation in Samoa. The presence of flaking debris and adze preforms is considered indicative of intensive late-stage local production of adzes (Clark and Michlovic 1996:15). Preforms are rare in other West Polynesian sites. Some variation between layers in the presence of basalt flake characteristics is noted (Clark and Michlovic 1996:9), but no explanation is offered for this.

Basalt tools were also recovered and are discussed below.

Other artefact component

The other artefact component at 'Aoa is restricted to lithic artefacts (Table 6.7). A grinding facet is also mentioned, but the stratigraphic context of this is not reported.

The category of basalt tool is not defined. The likely use of the artefacts is probably as scrapers and, less commonly, gravers (Clark and Michlovic 1996:9).

The volcanic glass assemblage is described as the largest from a single site anywhere in Samoa and one of the largest from the central Pacific (Clark and Michlovic 1996:14). Edge damage indicating tool use was found on 24 of the volcanic glass flakes, hence their description as tools. According to Clark and Michlovic (1996:11) the flakes are small, commonly <1cm in 'diameter' and bipolar flaking is inferred from crushing at the distal ends. Comparison of volcanic glass samples with those collected from sites on Upolu suggest they are from the same island, probably Tutuila (Clark and Michlovic 1996:11). Most of the volcanic glass artefacts are from the lower cultural deposit of Layers VI, VII and VIII.

A single chert flake is comprised of a pink siliceous material. Small amounts of chert have been found in the Upolu sites SUSa3 and SULe12 (Clark and Michlovic 1996:12). There are no known chert sources in Samoa and the source of the chert is possibly to the west in Fiji, perhaps Futuna (Clark and Michlovic 1996:12).

Basalt tools are more common, by number, in the upper layers.

Table 6.7 'Aoa lithic assemblage (not including adzes or adze preforms) (from Clark and Michlovic 1996:Table 2).

ARTEFACT TYPE	ANALYTICAL UNIT 1				ANALYTICAL UNIT 2			TOTAL
	I	II	III	V	VI	VII	VIII	
basalt tool		8		3		3		14
volcanic glass tool				4	4	18		24
volcanic glass core				16	8	61	13	98
volcanic glass flake		1		19	16	104	14	153
chert flake						1		
basalt hammerstone							1	
TOTAL		9		42	28	197	28	287

Faunal assemblage

A very limited faunal assemblage (Table 6.8) was recovered, a feature attributed by Clark and Michlovic (1996:12) to poor preservation in the acidic soils.

Marine fauna component

Marine fauna is represented by a single piece of turtle shell.

Table 6.8 'Aoa faunal assemblage (from Clark and Michlovic 1996:12).

BODY PART	TAXA	LAYER			TOTAL
		II	V	VI	
tooth	pig	3	2	1	6
	unidentified		1		1
bone fragments	unidentified	1			1
	unidentified mammal		2		2
	burnt bone		2		2
	turtle shell		1		1

Terrestrial fauna component

No indigenous terrestrial fauna is identified. The only evidence of domesticates are pig teeth from Layers II, V and VI.

No interpretation of the fauna is offered.

Ta'u Village

Stratigraphy

Ta'u Village is on the narrow coastal plain of Ta'u Island (Fig. 6.1). Excavations in the village revealed a plainware ceramic deposit in a single test pit on the inland slope of a calcareous dune ridge (Hunt and Kirch 1988:167). The stratigraphy of the site has not been published.

Analytical units

A single ^{14}C determination for the site (Fig. 6.8), Beta-19741 (1939–1690 cal BP 2σ range) dates the ceramic deposit. Cultural material (with the exception of the faunal component) is reported only from the occupation deposit containing ceramics. No intra-site change through time in cultural material can be assessed.

Ceramic component

Ceramics were recovered from a single occupation deposit (Hunt and Kirch 1988:167). The assemblage is characterised as Polynesian plainware within the Lapitoid series of West Polynesia. The ^{14}C date associated with the ceramic assemblage spans the later half of the plainware period in the established cultural chronology.

A total of 115 sherds were recovered. These have been analysed in association with 32 sherds from the initial test pit at the To'aga site, excavated in the same season of fieldwork (1986). No distinction between the two sites is made in the discussion of the results. It is unclear whether all or a portion of the assemblage was analysed.

There are no decorated sherds. The vessel wall thickness (measured on 49 sherds) ranges from 7.5 to 14.6mm, with a mean thickness of 10.62mm, variance of 3.46mm and a standard deviation of 1.86mm. These data are identified as similar to the sherd thickness data for thick ware sherds described by Green (1969:112; 1974b) from Western Samoa, and in particular the Vailele sites (Hunt and Kirch 1988:169-70). Only a large open bowl form was identified. The density of sherds is not reported. Ceramic temper is described as angular sand grains, probably ferromagnesium basaltic in origin.

No behavioural interpretation of the assemblage has been published.

Adze component

No adzes were recovered from the site.

Other artefact component

Artefacts recovered in association with the ceramic assemblage include a basalt scraper made from a flake which has been unifacially retouched, and two tabular-shaped coral pebbles, one with roughly parallel grooves cut into one surface, the other both surfaces. These are interpreted as possible net weights and evidence of early fishing strategies (Hunt and Kirch 1988:175).

Faunal assemblage

The Ta'u Village faunal assemblage is discussed in conjunction with that from the initial excavation at To'aga site (Hunt and Kirch 1988:177). No distinction is made between the fauna from the two sites. The taxa present are reported, but not the quantity or density of material.

Marine fauna component
Shellfish (Turbinidae, Cypraeidae, Trochidae and *Tridacna* sp.) and fishbone (including a lutjanid fish) were recovered.

Terrestrial fauna component
No indigenous terrestrial fauna are reported. Pig and an unidentified medium mammal were recovered in association with ceramics (Hunt and Kirch 1988:177)[1]. In post-ceramic stratigraphic contexts, abundant pig, rat, medium bird, possibly chicken, medium mammal, human and fish remains were recovered (Hunt and Kirch 1988:177). The dominance of pig in post-ceramic sites 'suggests a temporal trend towards development of terrestrial resources' (Hunt and Kirch 1988:177).

Discussion of change through time in American Samoan assemblages
In both the 'Aoa and To'aga sites, a major chronological break is apparent in a palaeosol (Kirch and Hunt 1993) or A-Horizon (Clark and Michlovic 1996), a stable ground surface which seals earlier deposits. In the case of the 'Aoa site, the excavated cultural material has been reported in relation to this chronological marker, but this is not the case in the To'aga site report. The analytical units created in the discussion above permit some change through time to be investigated in the two pre-palaeosol chronological units. The usefulness of the post-palaeosol unit is limited because data from these deposits are not fully reported. The earlier analytical units from both these sites have a similar chronology and ceramic assemblage.

The single analytical unit from the Ta'u village site has an associated radiocarbon date similar to that of the 1986 To'aga test pit, and equivalent to the post-palaeosol analytical unit at To'aga.

Western Samoan site

Jane's Camp

Stratigraphy
Five 1m x 1m test pits were excavated at the Jane's Camp midden site on the north coast of Upolu (Fig. 6.9). The site is a low mound, approximately 60m by 30m, located ca. 20m from the present high tide mark. Test Pits I and II were located parallel to the shoreline ca. 20m apart, while Test Pits II to V lie on a

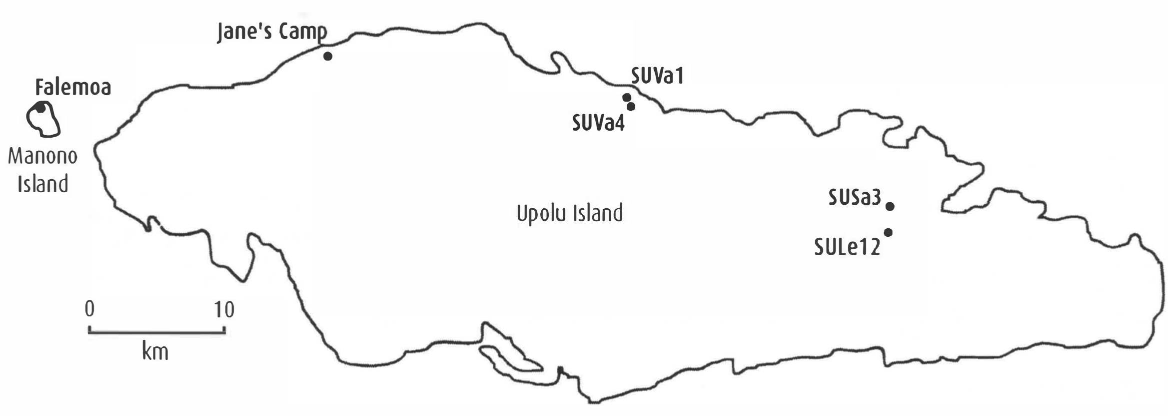

Figure 6.9 Western Samoan sites discussed in the text

1 The faunal remains reported from To'aga (Kirch et al. 1990) do not mention pig in association with ceramics. It is assumed that the evidence identified as pig comes from the Ta'u village site.

transect perpendicular to the shoreline, ca. 20m apart. Five stratigraphic units (Strata I to V) were identified in the site, although the basal deposits (Strata I and II) were only seen in Test Pit I. The stratigraphic profiles of the test pits (Smith 1976a:66, Fig. 15) indicate that the cultural deposits are deepest on the seaward, northern edge of the mound, and decrease in depth southward along the transect, across the mound. Test Pit V contains only Stratum V deposit.

Strata I and II at the base of Test Pit I are described as greenish-brown silty sand (Smith 1976a:62). There is no clear boundary between Strata I and II; however, Smith (1976a:62) differentiates Stratum II from Stratum I on differences in the texture of the sediment (no further description is provided), and Stratum II having less charcoal and ash than Stratum I.

Analytical units

The available ^{14}C dates, illustrated in Figure 6.10, are from Strata I and II: NZ-2726/7/8B (the pooled mean of NZ-2726, NZ-2727, NZ-2728 all from a single *Tridacna* valve) and RL-479 are from different test pits and are stratigraphically inverted. That is, RL-479 (3705 cal BP–3077 cal BP) is from Stratum II and NZ-2726/7/8B (2370–2265 cal BP) is from Stratum I, suggesting the possibility of post-depositional disturbance of the deposit. This may also be indicated by the absence of any stratigraphic boundary between the strata and the similarity of their sediment. Due to the lack of any clear stratigraphic boundary between Strata I and II the cultural material is conflated to a single analytical unit with an age range of ca. 3700–2300 cal BP.

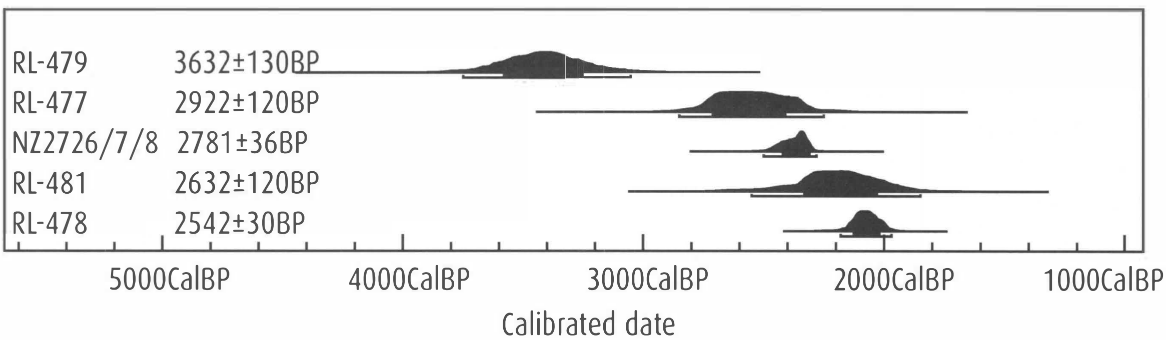

Figure 6.10 Probability distributions of Jane's Camp radiocarbon determinations discussed in the text

As with Strata I and II, no clear boundary between Strata III and IV is described by Smith (1976a:64). Both are a dark sand with concentrated midden deposit, but the strata are delineated by the presence of a number of discontinuous lenses of white sand at approximately the same depth in only one test pit (Test Pit I). The shell samples for dating of Strata III [RL-478 (2150–963 cal BP)] and IV (RL-481, RL-477) were taken from Test Pits I and II, respectively. Smith (1976a:64) does not discuss the provenance of the samples in Test Pit II in relation to the white sand lenses used to divide Stratum IV from Stratum III in Test Pit I. Given this, there is no way to determine whether they date Stratum III or IV. RL-481 (2472–1875 cal BP) and RL-477 (2150–1963 cal BP) are best considered as dating the combined Strata III and IV. The calibrated 2σ ranges of the dates fully overlap, giving a potential age range of ca. 2800–1900 cal BP for Strata III and IV. This gives two analytical units for the Jane's Camp site, thereby permitting investigation of change through time in the cultural assemblage (although it should be noted that there is significant overlap in the age ranges of the two units).

Stratum V, the disturbed surface layer, contained numerous historic artefacts and is not considered further.

Ceramic component

Ceramics were excavated from all stratigraphic units. The sequence is characterised as a Samoan Brown Ware (Holmer 1980a:108). The age range of the earlier Analytical Unit 1 spans the Early and Late Lapita periods and early plainware. The more recent Analytical Unit 2 spans the Late Lapita and plainware periods of the established ceramic sequence. A total of 1642 sherds were recovered, although only 938 have a known stratigraphic context. Two analyses of the ceramic assemblage have been carried out. Smith (1976b) analysed a total of 705 sherds from three sites including Jane's Camp, but does not specify the number from Jane's Camp or their provenance. Holmer (1980a) also analysed ceramics from several sites, but states that these were of known provenance with 769 being from Jane's Camp.

Three or four sherds from the total assemblage (0.2%) have some decoration, but this is restricted to incision and modelling (Smith 1976b:84). The stratum from which the decorated sherds were recovered is not reported, and neither is the part of the vessel decorated. Nearly 3% of the total assemblage has a bright orange wash: over half of these came from Stratum III.

Smith (1976b:84) categorises sherds over 10mm as thick ware, although the basis for this decision is not discussed. It does not appear to have been used in his principal components analysis of the ceramics. Smith (1976b:Table 4) lists the number of thick ware sherds from each strata. They make up 4.5% of Stratum I; 3.6% of Stratum II; 6.2 % of Stratum III; and 5.5% of Stratum IV. Holmer (1980a) measures sherd thickness as a variable and gives an average thickness for each ceramic type he identifies. Holmer (1980a) does not use a particular measurement to divide the assemblage.

Smith (1976b:94) used rim sherds to identify the vessel forms of a jar, possibly a shouldered jar or bowl, and the more common open bowl. The rims are either parallel or slightly expanded or incurved, flat-lipped. Holmer (1980a) identifies wide-mouthed bowls and possibly jars with generally flat rim.

The volume of excavated deposit is not reported and no estimate of sherd density can be made.

Dickinson (1974) identifies four different classes of temper in Samoan assemblages, including Jane's Camp. He found that all four classes were present in all the assemblages and concluded that either trade was prevalent in the region, or each pottery centre was using a wide variety of temper sources. Holmer (1980a) identifies two main temper types (ferromagnesium basalt and coral sand) in the assemblages he analysed, both of which were found in ceramics from Jane's Camp. No source of the tempers is described.

In both the analyses discussed above, the aim was primarily to identify regional similarities and differences between a number of West Samoan assemblages. As a consequence, detailed discussion of any differences within the Jane's Camp assemblage is lacking. Smith (1976b:92) concluded on the basis of a principal components analysis of ceramics from three Western Samoan sites, including Lapita ceramics from the Ferry Berth site, that the homogenous nature of the sample reflects the common tradition that connects the Lapita ceramics to later plainware. Smith (1976b:94) describes two types of Samoan plainware — varieties A and B. Variety B is said to represent the final stage of ceramic manufacture in Samoa. He does not, however, discuss the presence of these two varieties in the Jane's Camp strata.

Holmer (1980a:111–14) identifies seven classes of ceramics in the assemblages from five Western Samoan sites: Jane's Camp, Potusa, Falemoa, Paradise and the Ferry Berth site. The types are named according to the site in which they are most common and whether they are fine, coarse, slipped or 'Lapitan'. All seven classes are represented in the Jane's Camp assemblage. A diagrammatic representation of the percentages of each type per stratum indicates that all seven types are present in all strata (Holmer 1980a:Fig. 42) and no clear trend is apparent in presence of fine or coarse ware. No behavioural interpretation is offered for the variability in the representation of the ceramic classes in the strata.

If the percentages of class representation in each stratum are combined into the two analytical units proposed for Jane's Camp, the differences in the proportional representation of the classes in between the Early and Late units are negligible. Insufficient data are available to investigate what other variability there may be within and between the analytical units.

Adze component

Twelve complete or partial adzes were collected during the course of excavations, but seven of these are surface finds or of uncertain provenance, leaving five from excavated contexts. There is some difference in the reporting of the provenance of the adzes by Smith (1976a) and Hewitt (1980a). Smith (1976a:68) states initially that four adzes were excavated from Stratum IV and one from Stratum V, but subsequently discusses an adze from Stratum III. Hewitt (1980a:138) lists only four adzes from known contexts, two from Stratum III, and one each from Strata IV and V, plus one from an unknown context.

In the present analysis, these contradictions of stratigraphic context are of no consequence as both Strata III and IV are included in a single analytical unit. However, the discrepancy in the overall number of adzes excavated remains. The types of adze reported by Smith (1976a) and Hewitt (1980a) are the same. I have used Smith's (1976a) data for adze type, number and provenance (Table 6.9).

Smith (1976a:70) describes two adze blanks from the site, one 'diamond-shaped' in cross-section from Stratum II and a surface find of oval cross-section.

Positive identification of the adze type according to Green and Davidson's (1969; Green 1971, 1974b) typology was not possible for all adzes because most are fragmentary (Hewitt 1980a). Ten adzes were identified to type or blank, but only four of these are from excavated contexts (Table 6.9).

Table 6.9 Jane's Camp adzes of known type (according to Green and Davidson 1969, 1974b) (from Smith 1976a:70).

ANALYTICAL UNIT	CONTEXT	TYPE			BLANK	TOTAL
	III	IV	V			
1	Stratum I					
	Stratum II				1	1
2	Stratum III			1		1
	Stratum IV	1		1		2
Historic	Stratum V	1	1	3	1	6
TOTAL	2	1	5	2	10	

Five of the adzes (whose provenance and adze type are not reported) are a fine-grained black basalt unlike other basalt observed from Upolu excavations, but subsequently shown to be of local origin (Smith 1976a:70). Three adzes and two fragments are a dark grey, fine-grained basalt similar to the previously mentioned material, one adze and both adze blanks are porphyritic basalt. The adze has an incipient tang considered similar to an adze discussed by Green (1974a) from the SUSa3 site. The final adze is dark-grey green, very fine-grained basalt (Smith 1976a:70).

Smith (1976a:68) states that the most common adze from Jane's Camp is Type V, supporting Green's (1974b:258) identification of Type V as an early form in Samoa. Although he concedes that the assemblage is too small to make meaningful statistical inferences, the frequency of Type V at Jane's Camp is greater than in inland West Samoan ceramic contexts and may be associated with coastal activities.

The analytical units used in the present analysis do not affect previous interpretations of the assemblage. However, the ^{14}C age range associated with Analytical Unit 2 suggests that not only Type V, but also Type III, could be considered an early, pre-2000 BP adze form. No change through time in the assemblage has been noted.

The presence of basalt fragments or flakes in the site is not reported.

Other artefact component

Janetski (1976a:71–4) describes a range of non-ceramic artefacts from the site according to raw material and morphology and/or function. The stratigraphic context is not given for all artefacts.

A function for some of the artefacts is implied by their descriptive categories (e.g. scraper, hammerstone, abrader and octopus lure). One of the *Conus sp.* shell scrapers is bevelled outside of the cutting edge. The *Cypraea* sp. scraper has been heavily abraded along both lateral edges. The three pieces of worked bone have been abraded with a rough scraping tool to form a point.

Sea urchin abraders were found throughout the assemblage. Some have a tapering point, others a diagonal flattening and others are blunt. Janetski (1980a:131) considers that many of the sea urchin abraders or files were wrongly identified in the Jane's Camp assemblage and their shape is likely to be from non-cultural causes.

Janetski (1976a:71) notes the scarcity of artefacts in the assemblage. He interprets the relative abundance of sea urchin files as implying the working of shell, but more likely bone as has been seen elsewhere in the Pacific. Coral files or abraders he associates with the working of shell (Janetski

1976a:74). He points out that both these artefact types are used in the manufacture of fishhooks which are not seen in Samoan sites. In the case of Jane's Camp, he argues this absence cannot be attributed to lack of preservation as other organic material is well preserved. He concludes that, together with the low occurrence of fish bone, this is evidence that fish did not play an important subsistence role (Janetski 1976a:74).

The analytical units of the present analysis do not significantly affect the distribution of the artefacts. Sea urchin abraders are the only artefact in the other category from Analytical Unit 1.

Faunal assemblage

A marine and terrestrial faunal assemblage was excavated from the site. The density of shellfish is given for each stratigraphic unit except Stratum I. Shellfish were present in Stratum I as indicated by Janetski (1976b:Fig. 20) which illustrates the relative representation of five genera of shellfish in each stratum. Stratigraphic contexts are not reported for all vertebrate classes.

Table 6.10 Jane's Camp other artefact assemblage (from Janetski 1976a:71–4) (Code: P = present; AU = Analytical Unit).

FUNCTIONAL/ DESCRIPTIVE TYPE	RAW MATERIAL	AU 1	AU 2	HISTORIC	CONTEXT UNREPORTED	TOTAL
balls	basalt				2	2
hammerstone	basalt				1	1
flake/fragment	?				1	1
shell scraper	*Conus* sp.		1	1		2
	Cypraea sp.			1		1
	?*Turbo* sp.		1			1
	?whelk				1	1
octopus lure	*Cypraea* sp.		1			1
shell ring fragment	unknown		1			1
cut shell	*Conus* sp.		1		2	3
worked bone	flying fox		3			3
abrader	sea urchin	P	>34	P	52	>86
	coral				1	1
TOTAL			>42	2	60	>104

Marine fauna component

Shellfish, sea urchins, turtle and fish are all represented in the marine faunal assemblage (Janetski 1976b).

Densities of shellfish are similar in Strata II, III and IV, but much less in Stratum V (Janetski 1976b:Fig. 19). Over 50 shellfish families or species have been identified in the site and all are available within the lagoon adjacent to the site. Percentages of the six main families of shellfish differ in the five strata. In particular, Cypraeidae comprise over 50% of the assemblage from Stratum I and decrease to 20% in Stratum IV. This trend is reversed for both Bivalvia and Turbinidae, which are more common in Strata IV and V, respectively.

A total of 87 fish bones was recovered from the site, mostly unidentified apart from parrot fish (which is common in the lagoon) and porcupine fish (Janetski 1976b:80). 'Slate-pencil' sea urchins were found in high concentration in Stratum III, Test Pit I. Other smaller sea urchin species were also present. The slate-pencil urchins were unknown in the area at the time of excavation and Janetski (1976b:80) suggests that, given the large quantities in the site, they may have been extirpated from the area. Twenty-five turtle carapace bones were excavated, but their contexts are not reported. Fifty-one other bones were excavated but are unidentified further (Janetski 1976b:81).

Terrestrial fauna component

A small amount of bird bone was recovered from Jane's Camp. Some in Stratum II are identified as chicken (*Gallus gallus*) (Janetski 1976b:80), which is the only domesticate identified in the site.

Janetski (1976b:81) suggests the absence of pig bones from the site indicates that this animal may not have been introduced to Samoa at the time the site was created. Hence, its absence may imply less dependence on horticulture and a greater reliance on intensive reef exploitation. Reef exploitation persists and expands through time to Strata III and IV, and decreases markedly in Stratum V (Janetski 1976b:82).

Combining the available data into the two stratigraphic units in the present analysis does not alter the pattern of data, although the differences reported in shellfish family representation in the strata are exaggerated. Insufficient data are available to assess any impact on the remainder of the assemblage.

Falemoa

Stratigraphy

Falemoa is a coastal site on the small island of Manono (Fig. 6.9) with a complex stratigraphy that includes many features. The site is about 30m x 20m in dimensions and only about 10m from the present high tide mark. A large areal excavation of the site was carried out over two field seasons. The site plan indicates that at least 50m^2 were excavated (Lohse 1980:Fig. 7); however, the volume of deposit excavated is not reported.

Lohse (1980:25) identifies seven strata (I to VII) in the site. Stratum I is composed of Stratum Ia, a non-cultural basaltic subsoil, and Stratum Ib, a sterile fossil beach sand containing large amounts of shell debris. Stratum II is described as the top 15–20cm of the fossil beach sand, differentiated from Stratum Ib below by staining from organic material in the overlying Stratum III and by the presence of cultural material.

Stratum III is a charcoal stained sand with clumps of lightly cemented shell and bone debris, possibly the result of fires and/or inundation (Lohse 1980:29). Stratum III was visible across most of the site. Stratum IV is described as a sandy midden that occurred uniformly throughout the site (Lohse 1980:29), resting on Stratum III, or Stratum II where Stratum III was lacking. None of the agglutination of shell and sand in Stratum III was seen in Stratum IV, but a platform structure was found in the upper portion of Stratum IV in part of the site. This consisted of a layer of large unshaped basalt boulders overlain with a pavement of small pebbles and stones.

Stratum V is clearly delineated from Stratum IV and is white beach sand with a feature that may be a sea wall of water-worn basalt boulders along the seaward edge of the site. Historic artefacts were recovered from this layer. The white sand is uniform and extends across the site and may be the result of a single storm event (Lohse 1980:31). Stratum VI contains some cultural material, but is considered to be a zone of down slope wash, while Stratum VII is the modern forest soil containing historic cultural material and numerous potsherds.

Analytical units

There was no evidence of disturbance between the strata at Falemoa. Strata VI and VII include sediment (and cultural material) washed down from the slope behind; however, there is little or no vertical displacement of deposit and the interfaces between the strata are clearly identifiable (Lohse 1980:31). Therefore, the stratigraphic units from the site which contain cultural deposit have been used as analytical units, with the exception of Strata VI and VII which are in a secondary depositional context and contain historic artefacts. These are not considered further.

Three acceptable or questionable ^{14}C dates are available from the site (Fig. 6.11). NZ-4343B (2678–2332 cal BP 2σ range) dates the basal cultural deposit, Stratum II. The calibrated ranges of UGa-2208 (1679–1378 cal BP 2σ range) from Stratum III and UGa-2211 (1686–1365 cal BP 2σ range) from Stratum IV (Jennings and Holmer 1980:Table 2) overlap completely. This suggests a relatively short time span may be represented by Strata III and IV. Stratum V is stratigraphically more recent than Stratum IV.

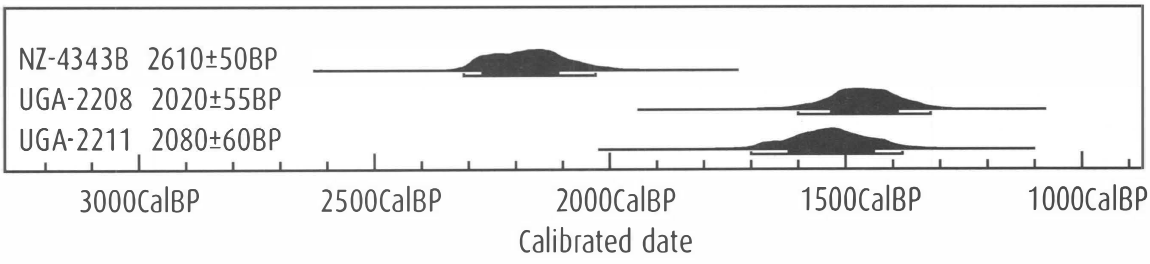

Figure 6.11

Ceramic component

Ceramics were excavated from Strata II, III, IV, VI and VII, although those from VI and VII are associated with down slope wash from behind the site. The assemblage is characterised as plainware or 'Samoan Brown Ware' by Holmer (1980a:108). The ^{14}C dates from the site span the plainware period in the established ceramic chronology.

The ceramic assemblage was analysed by Holmer (1980a) (see Section 6.3.1); however, the Falemoa assemblage is not individually described. Only sherds with a known provenance were analysed, the total from Falemoa being 754 sherds. Of these, 524 sherds were recovered from Stratum II, III and IV (Holmer 1980a:105). From Stratum II, 129 sherds were recovered; Stratum III, 26 sherds; and Stratum IV, 369 sherds.

A single decorated rim sherd was recovered from Stratum IV, but the form of decoration has not been described. Less than 1% of the assemblage is decorated. Two different coarse and fine wares (Falemoa coarse and fine wares and Jane's Camp coarse and fine wares) are identified in the Falemoa assemblage, although the basis for distinguishing between the types is not clear.

The only vessel form identified is a wide-mouthed bowl with a generally flat rim (Holmer 1980a:112–14).

Neither the density of ceramics nor the volume of deposit excavated is reported.

With the exception of the Jane's Camp fine ware, which has a coral sand temper, all the ceramics have a temper described as ferromagnesium basalt. No source of the tempers is described and clay sources are unknown (Holmer 1980a).

The aim of Holmer's (1980a) analysis was primarily to identify regional similarities and differences between a number of West Samoan assemblages. As a consequence detailed discussion of any differences between the Falemoa strata is lacking.

Holmer (1980a:111–14) identifies seven classes of ceramics in the assemblages from five Western Samoan sites. All of the types are represented in the Falemoa assemblage. In the diagrammatic representation of the percentages of each type per stratum, no estimate for Stratum III is shown, possibly because of the low number of sherds from the unit. In Strata II and IV all seven types are present (Holmer 1980a:Fig. 42) and no clear trend is apparent in presence of fine or coarse ware. No behavioural interpretation is offered for the variability in the representation of the ceramic classes in the strata.

Adze component

The stratigraphic context of the Falemoa adzes is listed along with their type by Hewitt (1980a) and given in Table 6.11.

Table 6.11 Falemoa adze assemblage (from Hewitt 1980a:Table 17).

CONTEXT	TYPE			UNIDENTIFIED	TOTAL
	I	III	X		
Stratum III	1	1			2
Stratum IV	1			2	3
Stratum V			1		1
TOTAL	2	1	1	2	6

Adze raw material is not described. A total of 160 basalt flakes was recovered from the site, but 102 of these are from Strata VI and VII, the modern forest floor (Hewitt 1980a:139). Hewitt (1980a:139) divides the assemblage into adze flakes (presumably those with grinding) and plain flakes. Stratum II has three plain flakes; Stratum III has four adze and ten plain flakes; Stratum IV has nine adze and 24 plain flakes; and Stratum V has five plain flakes[2].

Hewitt (1980a) does not offer an interpretation of the variability in the adze assemblage, although she refers to Green's (1974b:258–60) chronology for the ceramic sequence. This suggests that Type I adzes are the most common type post-2000 BP, Type III is known from early Tongan contexts and from coarse ware contexts in Samoa, and Type X is associated with early Samoan ceramic contexts and continues throughout the sequence (Hewitt 1980a:136–7). The context of the adze types at Falemoa agrees with these associations. Change through time in the adze assemblage has not been discussed.

2 The figures presented by Hewitt (1980a) total only 157 flakes.

Table 6.12 Falemoa other artefact assemblage (from Janetski 1980a:Table 15).

ARTEFACT TYPE	RAW MATERIAL	STRATUM						TOTAL
		II	III	IV	V	HISTORIC	UNKNOWN	
fishhook	*Turbo* sp.			1				1
	Pearl shell	1			1	1		3
	unknown			1				1
octopus lure	*Cypraea* sp.	3	1			2		6
peeler	*Cypraea* sp.		1	2				3
	Turbo sp.		1					1
scraper	*Cypraea* sp.		2					2
	Conus sp.		1			1		2
bead	bone	2						2
armband	*Conus* sp.				1	2		3
	Tectus sp.		10	1	1			12
disc	*Cypraea* sp.			1			1	2
	Coral				1			1
file	sea urchin	1	2	5		1		9
adze	*Tridacna* sp.			1				1
worked	shell	2	4	7	4	6	2	25
	bone		1					1
	coral		1	1				2
chisel (?)	stone	1						1
hammerstone	basalt			1				1
flake	obsidian	1	1				1	3
TOTAL		11	25	21	8	13	4	82

Other artefact component

Janetski (1980a:Table 15) reports a range of non-ceramic artefacts from the Falemoa site (Table 6.12). The raw material is discussed and a morphological description of the artefact provided, but there is little discussion of why functional types are attributed to particular artefacts. Wear and sharpening is noted on some of the shell artefacts (Janetski 1980a:125).

The worked shell is described as five *Pinctada* sp. fragments which appear to be smoothed along one or two edges. Janetski (1980a:129) considers that one may be a broken lure: the provenance of this artefact is not reported. Four pieces of smoothed *Tridacna* shell were also recovered, one from Stratum III and three from Stratum IV. One may be an adze fragment, another, an armband fragment.

Janetski (1980a:130) could not identify the lure types using Buck's (1930) description of Samoan lures or Green's (1974b:273) review of Samoan material culture. One-piece fishhooks such as those from Strata II, IV, V and VII were not discussed by Buck (1930). Janetski (1980a:130) considers them similar to fishhooks from Niuatoputapu (Kirch 1978), but different to those from Tongatapu. He makes the following comparisons: *Turbo* sp. fishhook (Stratum IV) is similar to *Turbo* sp. fishhooks from Anuta described by Kirch and Rosendahl (1973); rounded pearl shell fishhooks (Strata II, V and VII) are similar to early Marquesan forms reported by Suggs (1961) and Sinoto (1967).

No change through time in the presence and/or function of artefacts is noted by Janetski (1980a).

Shell beads were recovered only from Stratum II. Shell peelers and scrapers and armbands are absent from Stratum II, but relatively common in Strata III and IV. The range of non-ceramic artefacts from Strata III and IV is very similar, although far fewer ceramic sherds were recovered from Stratum III.

Faunal assemblage

The faunal assemblage is discussed by Janetski (1980b); however, the provenance of bone is not fully reported and no details of the shellfish assemblage from Stratum II are available.

Marine fauna component

Shellfish, fishbone, crab, turtle carapace and sea urchin (*Heterocentrotus* sp.) were all recovered from Falemoa. Only the shellfish assemblage is described in detail (except for Stratum II). The overall density of shellfish (gm/m^3) is greatest in Strata III and IV, although the relative proportion of the species represented is similar in Strata III, IV and VII (Janetski 1980b:Table 14). The taxa present reflect the reef environment adjacent to the site, the most common being Cypraeidae, Trochidae, Neritidae and Strombidae (Janetski 1980b:119). Fishbone identified at the site was mostly parrot fish from the adjacent reef (Janetski 1980b:119). Turtle bone was recovered from the basal Stratum I and from Stratum II.

Terrestrial fauna component

Flying fox bones and a few bird bones (possibly sea birds) are reported, but no provenance is given (Janetski 1980b:119–20). Pig bone was recovered from the historic level and two bone fragments, possibly rodent, were recovered from Stratum III.

Shell and bone densities both decrease through time as represented by the strata, and this is considered to reflect a general decrease in dependency on reef collecting through time (Janetski 1980b:118). Janetski (1980b:120) speculates that what he identifies as a gradual decrease in marine exploitation might equate with an increased reliance on horticulture. He (1980b:121) notes that the Falemoa and Jane's Camp faunal assemblages show similarities because of the local reef exploitation, but differences in the shellfish species preferences.

SUVa1

Stratigraphy

The complex stratigraphy of SUVa1 mound site (Fig. 6.9) is characterised by Green (1969e:116) as six layers (I–VI), the surface being Layer I. At the base of the mound, several features are cut into the underlying subsoil. These are Layer VI, filled with Layer V deposit, suggesting Layer VI is an occupation phase earlier than Layer V (Green 1969e:120–1). Layer V is interpreted as a refuse deposit rather than an occupation area, and contains the main ceramic assemblage (Green 1969e:117). No features or concentrations of ceramics, other artefacts or charcoal were visible, but Green (1974b:247) does not question the association of ^{14}C dated charcoal samples from this layer with the ceramic assemblage (see below). The upper portion of Layer V is considered by Green (1969e:119) to be a palaeosol, which marks the boundary between Layer V and mound building activities proper, as represented by Layers I to IV (Golson 1969:110). Some post-depositional disturbance to Layer V is indicated by postholes and other features, these having been cut into the layer from above. Layer IV contains few artefacts and Green (1969e:119) considers the deposit to represent fill from the surrounding subsoil. Layer III is a series of gravel beds interpreted as house floors (Green 1969e:119). Layer II is a thick layer of sterile clay. Layer I is a the surface of the mound and contains a number of features and artefacts, some of historic age (Green 1969e:120).

Analytical units

The stratigraphy suggests three different phases of the behaviour at the site (Green 1969e:120). The earliest is represented by features cut into the subsoil (Layer VI) and Layer V; the second by the house floors of Layer III; and the third by various activities represented by Layer I. Each of these is separated by a culturally sterile or near culturally sterile layer. Probability distributions of the dates are illustrated in Figure 6.12. The ^{14}C determinations from Layer V, NZ-361 (1946–1627 cal BP 2σ range), NZ-362 (1917–1615 cal BP 2σ range) and NZ-363 (2296–1570 cal BP 2σ range) give a ^{14}C age range of ca. 2300–1600 cal BP (Fig. 6.12). Two further radiocarbon determinations are available from the site which are too recent to be considered in the analysis presented in Chapter 4: a date from Layer IV of 680±80 BP (Gak-500) and a date from Layer 1 (Gak-501) in the historic range. Cultural material from Layer I is not considered further. Cultural material associated with Layers V, IV and III is discussed below as coming from separate analytical units.

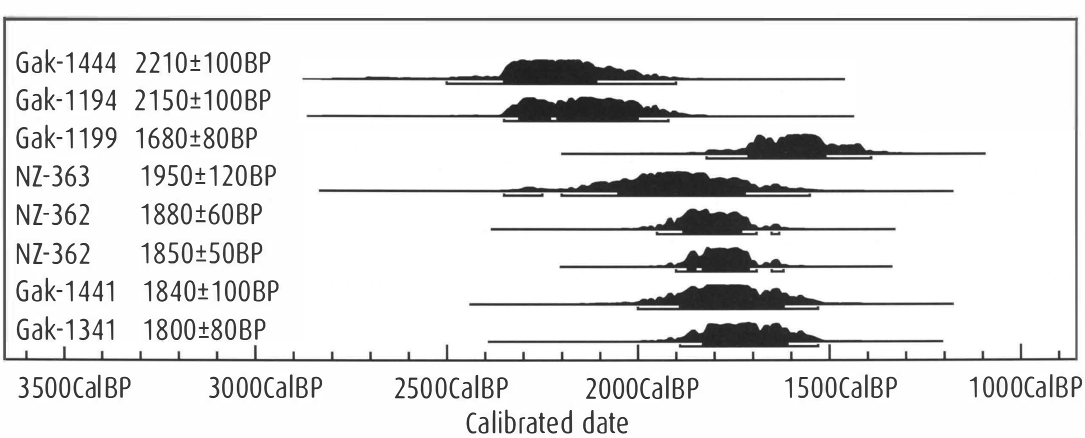

Figure 6.12

Ceramic component

A total of 401 sherds were recovered from SUVa1. The majority come from Layer V (365 sherds), 31 sherds from Layer IV and a total of five sherds from the other layers (Green 1969e:Table 6). The assemblage is characterised as plainware. The ^{14}C dates from Layer V lie within the range of plainware in the established sequence. The ^{14}C date from Layer IV falls within the aceramic, mound building period. All sherds were analysed.

There are no decorated sherds. The assemblage is characterised as thick ware, with the exception of two sherds from Layer V which have thin walls and fairly fine temper (Green 1969e:128). Two types of low open bowls were identified having rims with parallel or expanded sides. The density of sherds is not reported.

The temper of 27 sherds from SUVa1, SUVa4 and SUSa3 were analysed by Dickinson (1969). Three types of temper sands were identified, all locally available on Upolu (Dickinson 1969:273). The temper types varied with the typology of the ceramics. Ferromagnesium basaltic tempers are associated with thin, fine ware sherds from SUVa4 and Layer 5 of SUSa3. Feldspathic basaltic temper was found in thick, coarse ware from Layer 4, SUSa3, and the basal layers of SUVa1 and SUVa4. Feldspathic tempers were found in thick, coarse sherds from SUVa1, Layer 5 and SUSa3, Layer 4.

Green (1969e:128) interprets the presence of ceramics in Layer IV and above, as resulting from upward movement of ceramics from below (Layer V). He considers the two thin ware sherds from Layer V may reflect the survival of an earlier Samoan ware.

Adze component

Five whole adzes and 13 fragments were recovered (Green 1969e:130). Their stratigraphic contexts are listed in Table 6.13.

Table 6.13 lists the adzes in the assemblage according to Green and Davidson's (1969; Green 1971, 1974b) adze typology. The adze raw material(s) are not discussed.

Four basalt flakes with polished surfaces and 42 other flakes, including seven which show signs of use or further modification, were recovered from Layer V (Green 1969e:133; 1974a:146). The flakes, like the ceramic sherds, are dispersed throughout the deposit, suggesting that the deposit as a whole represents refuse or was dumped at the site (Green 1974a:146).

The Type III quadrangular adze from Layer V is a type associated with later Polynesian assemblages, but its presence in Layer V indicates the early presence of the form in Samoa (Green 1969e:133). The dominant adze is Type V, which is generally rare in Samoan surface collections. The assemblage establishes the association of Types II, III, V, VI and VII with ceramics dated to ca. 2000–1800 BP (Green 1969e:133). No change through time in the adze assemblage is noted.

Table 6.13 SUVa1 adze assemblage (from Green 1969e:Table 8).

CONTEXT	TYPE									TOTAL
	I	II	III	IVA	V	VI	VII	X	UNCLASSIFIED	
Layer IV	1									1
Layer V	2	1	1	1	6	1	1	1	1	15
Unreported					1	1				2
TOTAL	3	1	1	1	7	2	1	1	1	18

Other artefact component

The other artefact component consists of 16 stone artefacts. The Layer V assemblage consists of three pebble chopping tools made on water-worn cobbles with one flaked side; two hammerstones with pitting on one end; a discoidal anvil stone of very fine-grained basalt; two stone sinkers for octopus lures; a net sinker of vesicular basalt; a basalt file with one edge sharpened and polished; a large flat grindstone; a miscellaneous stone hemisphere, possibly a pottery anvil stone; an abrading tool of fine white stone; and a modified piece of pumice. The Layer IV assemblage comprises an anchor stone with a hole in one end and a smoothed, probably ground pebble.

No interpretation has been made beyond the function attributed in the categorisation of some artefacts.

Faunal assemblage

No faunal assemblage is reported from the site, although Green (1969e:118) described Layer V as containing 'traces of former midden debris'. The acidic volcanic soils are not conducive to preservation of organic material.

SUVa4

Stratigraphy

As with SUVa1, excavations at the SUVa4 site (Fig. 6.9) revealed a ceramic deposit at the base of a mound. This deposit also appeared to result from activities unrelated to the overlying mound. Terrell (1969:160) describes the stratigraphy of the mound as uniform across the site. Stratigraphic layers are designated Layers A to F, from the surface. Layer F is the deposit underlying the mound proper and is further divided into two zones, F-1 and the underlying F-2. Terrell (1969:164) considers Layer F-1 to be the weathered surface of a palaeosol, which he further divides into Layers F-1a and F-1b. Layer F-1a is a dark brown zone at the top of Layer F-1 containing few cultural finds. Layer F-1b, underlying F-1a, is the primary ceramic deposit. It was not possible to distinguish between these layers in all parts of the site. The stratigraphy is further complicated by the presence of what Terrell (1969:161) describes as a Hearth Horizon, which, in some parts of the site, overlies Layer F-2 where Layer F-1 is absent. The Hearth Horizon is stratigraphically contemporaneous with Layer F-1.

Analytical units

Cultural material was excavated from the surface layer of the mound, containing historic artefacts, and from Layer F-1. Only two sherds and five stone flakes were recovered from the entire mound deposit (Green 1969a:166).

The acceptable radiocarbon determinations, from SUVa4 come from the pre-mound deposit. Both ^{14}C dates are from Hearth Horizon, Gak-1199 (2347–1885 cal BP 2σ range) and Gak-1194 (1778–1374 cal BP 2σ range) (Fig. 6.12). These dates suggest that the Hearth Horizon may represent a relatively long period of time, up to 1000 radiocarbon years. No ceramics were recovered from the Hearth Horizon. All cultural material from the base of the mound is reported only as coming from Layer F1, making assessment of the cultural material in relation to the radiocarbon chronology difficult. Given that Layer F1 and the Hearth Horizon are covered by the palaeosol, Analytical Unit 1 comprises all deposit below the palaeosol (Layer F1 and the Hearth Horizon). Cultural material from the mound itself comprises Analytical Unit 2 (Layers A to E).

Ceramic component

A total of 229 ceramic sherds were recovered from Layer F1 and a single sherd was recovered from each of Layers A and E (see Green 1969a:Table 11). The assemblage is characterised as plainware. The ^{14}C age range of the ceramic assemblage includes the plainware and early aceramic periods of the established sequence. All sherds were analysed.

Five paddle-impressed decorated sherds were recovered, all deriving from a single broken pot. These represent 2.1% of the total sherds. Thick coarse ware and thin fine ware sherds were recovered; however, the specific characteristics identifying sherds as thin or thick ware are not discussed. Thin fine ware makes up 86% of the assemblage (by sherd numbers) and thick ware, 14% (Green 1969a:Table 11). Thick and thin ware were found in both Layers F1-a and F1-b. Nearly half of the thick ware sherds were from a single excavation square.

Thick ware sherds have almost all simple flat rims characteristic of bowls. There is more variety in the thin ware sherds, indicating a greater diversity in vessel forms, which include a large open bowl and an open-mouthed jar form (Green 1969a:174).

The average concentration of sherds is 2.2/m^2 (Green 1969a:172), although this is variable. The density of sherds is much higher in Layer F1-b than in Layer F1-a (Green 1969a:172). Temper analysis was carried out on a small number of sherds (see above).

Terrell (1969) interprets the presence of more sherds in F-1b than F-1a as a result of ceramics in the latter being in a secondary context, having originated from the F1-b Layer. Green (1969a) considers the SUVa4 assemblage to be earlier than that of SUVa1, and that the low overall concentration of ceramics reflects either or both a brief time interval or low intensity use of a restricted area.

Adze component

Four adzes and one adze blank were found in pre-mound building contexts at SUVa4, and an additional four adzes were recovered from the mound itself (Table 6.14).

Table 6.14 SUVa4 adze assemblage (Green 1969a:167).

CONTEXT		TYPE			
		I	V	VIA	UNCLASSIFIED
mound	Layer A or C	1		1	
	Layer A			1	
	Layer C	1			
sub-mound	Layer F1		1		1
	Hearth Layer	1			
	Layer F1-b	1			1
TOTAL		4	1	2	2

The SUVa4 adze classification is listed in Table 6.14. No adze raw materials are discussed. A further 56 flakes of fine-grained basalt were recovered from Layer F1. Green (1969a) considers the flakes to be the result of adze use, rather than adze manufacture or the desired end product. Twelve flakes with polished surfaces and 11 plain were recovered from the mound layers.

Green (1969a) notes that adze Types I and VIa are found in the more recent levels of the mound and that this is a pattern seen in other mound sites. The Type I adze from the Hearth Horizon indicates the presence of this type as early as 1700–1600 BP (Green 1969a:167).

Other artefact component

The other artefact component of the assemblage consists of obsidian flakes and cores (described below), a ground piece of white travertine rock (function unknown), four basalt grindstone fragments (two from the F1 layer and two from the mound deposit) and a pounding stone from the mound deposit.

The obsidian artefacts were found in Layer F1 and consist of 50 flakes, 23 cores and a pebble. All artefacts, including the cores, are small, suggesting the raw material source was also of small size (Green 1969a:168). Green (1969a:169) likens the assemblage to those of Hawaii and Easter Island that also consist of unretouched flakes. The source of the obsidian is unknown. Occurrence of obsidian in Samoan sites appears restricted to early, ceramic contexts (Green 1969a:168).

No behavioural explanation is offered for the presence of specific artefacts.

Faunal assemblage

Shell and bone were uncommon due to the acidic nature of the soil and because the deposits were not refuse dumps (Green 1969a:170).

A single fragment of *Tridacna* shell and a single calcined bone fragment were recovered from Layer F1.

SUSa3

Stratigraphy

The inland site of SUSa3 (Fig. 6.9) was excavated as five stratigraphic units (Layers 1 to 5) which are relatively uniform and distinctive across the site (Green 1974a:109). Layer 5 is the basal cultural layer of compact charcoal-stained brown to black gravelly clay that rests on the natural clay underlying the entire area. Several features were identified on the surface of this basal non-cultural clay deposit which were sealed by Layer 5 deposit and considered to predate Layer 5. These are designated Occupation A (Green 1974a:111).

Occupation B consists of the lower part of Layer 5, including the fill of the features identified as Occupation A, and a pavement of small boulders and gravel associated with this layer in one part of the site. No features were identified in the diffuse boundary between Layers 4 and 5, but a group of features were noted on the surface of Layer 4, a compact dark-brown gravelly clay lacking obvious internal bedding (Green 1974a:111). These features were identified as Occupation C (Green 1974a:115). Many of these features were filled with river gravels brought to the site as floors in the overlying more recent Layer 3. Layers 3 and 2 are aceramic deposit and Layer 1 is of historic age (Green 1974a:117).

Analytical units

The two radiocarbon determinations from the site (Fig. 6.12) are Gak-1441 (1992–1529 cal BP 2σ range) from Layer 5 and Gak-1341 (1918–1528 cal BP 2σ range) from Layer 4. Gak-1341 lies within the range of Gak-1441, suggesting to Green (1974a:115) that 'no great interval of time is indicated for the accumulation of both layers [Layers 4 and 5], despite some differences in the pottery they contain' and Layer 4 was laid down rapidly with no break between it and Layer 5. Hence, although Layer 5 is stratigraphically earlier than Layer 4, on radiocarbon evidence the layers are contemporary. Unlike the boundary between Layer 5 and the features cut into the underlying subsoil and that between Layers 4 and 3, only a diffuse boundary exists between Layers 4 and 5. Conjoining grindstone fragments were recovered from Layers 4 and 5 (Green 1974a:150) and the deposits of Layers 4 and 5 are both described as brown-grey gravelly clay, although Layer 5 is described as darker than Layer 4 (Green 1974a:Fig. 54). On sedimentary and radiocarbon evidence the two layers appear to be identical. Although differences in the cultural material from the two layers may be due to change through time, this is not demonstrable on the present evidence. The layers are considered as a single analytical unit with a combined age range of ca. 1990–1530 cal BP. Layers 3 and 2 are undated, but are stratigraphically more recent than Layers 4 and 5 and are considered as separate analytical units. No cultural material has been reported from Layer 2.

Ceramic component

Ceramics were excavated from Layers 4 (1479 sherds) and 5 (4446 sherds including those of Occupation A) (Table 6.15). A total of 5925 sherds were excavated from the analytical unit comprising Layers 4 and 5, and 39 sherds from the stratigraphically more recent Layer 3. The assemblage is characterised as plainware. The ^{14}C dates from the site fall within the later half of the plainware period of the established ceramic sequence. The ceramic assemblage from each stratigraphic unit is described and the entire assemblage appears to have been analysed.

Table 6.15 Provenance of thick coarse ware and thin fine ware sherds from SUSa3 (from Green 1974a:Tables 9 and 10).

	THIN FINE WARE	THICK COARSE WARE	TOTAL
Layer 4	308	1171	1479
Layer 5	4061	385	4446

Decoration consisting of notching was found on 140 thin fine ware rim sherds. This represents 25% of thin ware rim sherds and 1.9% of the total sherd assemblage (Green 1974a:128). Two rim sherds have suspension holes beneath the lip. A thick coarse ware (1556 sherds from Layers 4 and 5) and a thin fine ware (4369 sherds from Layers 4 and 5) have been identified (Green 1974a:Table 9). The provenance of the wares is given in Table 6.15. The basis of the thick coarse and thin fine ware distinction appears to be sherd thickness and temper size, but the method is not reported. Vessel forms consist of a few varieties of restricted-mouth bowls, many open bowls of varying sizes and, rarely, a shouldered bowl (Green 1974a:118). Thick ware sherd density is 32 sherds/m^2 and thin ware sherd density is 48 sherds/m^2. This phenomenon is only partially explained by greater breakage of the thin sherds (Green 1974a:126).

Two temper types are common among the thick ware sherds: felspathic trachytic and feldspathic basaltic (Green 1974a:121). All thin ware sherds have a sand-sized temper of ferromagnesium basaltic type. All tempers present could have local sources (Green 1974a:128).

The presence of fire-blackened areas on sherds suggests some use of the ceramics for cooking or heating (Green 1974a:129). Another function for medium to large containers may be as kava bowls

(Green 1974a:129). The ceramics recovered from Layer 3 are considered by Green (1974a:152) to be in a secondary context, originating from Layer 4.

Green (1974a:130) explains the different proportions of ceramic types in Layers 5 and 4 as indicative of a change through time from thin fine ware to thick coarse ware. Thick coarse wares replace the thin fine wares and the large thick coarse ware bowls continue to be used for the same function as the large thin ware bowls (Green 1974a:129). Green (1974a:130) considers the changes in cultural material in the short space of time reflected by Layers 4 and 5 are 'of a minor nature within a unified complex'.

In the present analysis, Layers 4 and 5 are considered as a single analytical unit and therefore variability in the ceramic assemblage cannot automatically be explained to be change through time.

Adze component

A total of 35 whole or broken adzes were excavated from Layers 4 and 5 (Green 1974a:Table 12). The number and type of adzes is listed in Table 6.16. The adzes are all oceanic olivine basalt. Some of the darker adzes are silica rich olivine basalts known as hawaiites (Green 1974a:141). All raw materials present are of local origin, but the raw material source(s) are unknown (Green 1974a:141).

Table 6.16 SUSa3 adze assemblage (from Green 1974a:Table 12).

	TYPE													TOTAL
	IA	IB	IC	ID	II	I/II	IVA	IVB	IVA/B	VA	VB	VIB	UNIQUE	
Layer 3						1								1
Layer 4	1			2	2					2	2	3	1	13
Layer 5	4	1	1	2			1	1	1	5	4		1	21
TOTAL	5	1	1	4	2	1	1	1	1	7	6	3	2	35

A total of 89 basalt flakes (with polished surfaces), plain flakes and cores were present in Layers 4 and 5. Four plain flakes were recovered from Layer 3. Of the 11 cores, five may also be called unclassified adze fragments. The remainder (n=6) are small and have a number of flakes removed without any indication of their being a stage in adze manufacture (Green 1974b:145).

Green (1974a:137) interprets the adzes, especially those from Layer 5, as coming from a domestic context. The adzes are generally lightweight and a wide range of types that Green (1974a:137) considers to reflect the diverse activities that may be associated with a dwelling, but not the bush or garden. The larger adzes, especially Type V, are more likely associated with larger tasks, especially woodworking (Green 1974a:137).

Green does not discuss change through time in the assemblage. The analytical units used in the present analysis do not affect Green's (1974a:137) interpretation of the assemblage.

Other artefact component

The other artefact component of SUSa3 is listed in Table 6.17.

Green (1974a:149) suggests that the frequency of grindstone fragments in Layers 4 and 5 is related to the large number of adzes present. The grindstones would presumably have been used to polish and resharpen the adzes, especially after woodworking activities, likely to have taken place around the house. The discoidal stone from Layer 5 looks like a 'crude Polynesian bowling stone' or grinding stone for crushing nuts (Green 1974a:150). Green (1974a:153) considers the small number of artefacts from Layer 3 to be typical of many later Samoan sites. He suggests that Layer 3 represents an ordinary household, but Layers 4 and 5 have a more specialised domestic status (Green 1974a:153).

Green (1974a:153) argues that although direct evidence of economic activity was lacking, the site's location and the assemblage of portable artefacts suggest a household dependent on agriculture and food products similar to those used by Samoans in the early nineteenth century.

The analytical units used in the present analysis conflate the artefacts from Layers 4 and 5 into a single unit, further highlighting the differences between the lower and upper analytical units in terms of the amount of cultural material recovered.

Faunal assemblage

No faunal assemblage from the SuSa3 site is reported.

Table 6.17 SUSa3 other artefact assemblage (from Green 1974a:149) (Code: P = present).

FUNCTIONAL TYPE	RAW MATERIAL	STRATIGRAPHIC CONTEXT		
		LAYER 3	LAYER 4	LAYER 5
flake/core	obsidian	3	4	18
flake	chert			1
grindstone fragment	basalt	P	P	P
	quartz - trachyte	P	P	P
hammerstone	pebble (vesicular basalt)			3
chopping tool	pebble		1	
discoidal stone	basalt			1
manuport	stone		1	3
ochre			P	P
miscellaneous	ground basalt			1
	ground quartz-trachyte			1
?net float	vesicular basalt		1	
TOTAL		>3	>7	>28

SULe12

Stratigraphy

SULe12 is an inland house site (Fig. 6.9) which includes surface features, kerbstones and the remains of several other platforms (Davidson and Fagan 1974:74).

The stratigraphy of the site is described as seven layers (1 to 7) overlying natural or sterile subsoil. The stratigraphy is complex, layers are sometimes indistinguishable, and there are many postholes and pits throughout the site (Davidson and Fagan 1974:74). Davidson and Fagan (1974:77) interpret the stratigraphy as representing three major phases. The earliest is Phase 1, which includes cultural remains associated with initial occupation of the site represented by the basal Layer 7. Phase 2 consists of the overlying yellow brown clay platform represented by Layer 6, and deposit from its initial use represented by Layers 6, 5 and 4. Layer 5 is a similar deposit to Layer 7 and appears to be fill deposited to provide a level surface for the overlying occupation. It is found in only a small art of the site and includes Layers 5b, the fill of a pit feature with a greater concentration of charcoal, and 5a. Layer 4 is an artificial fill of clay also found in only a small part of the site. This deposit extends the original Layer 6 platform. Phase 3, the most recent phase of the site, is a series of occupations on the surface of the levelled platform during which houses were built, identifiable through postholes and other features in Layers 3, 2 and 1.

Analytical units

Ten radiocarbon dates are available from the site (Fig. 6.12). While four of these fall in the time period considered in the analysis presented in Chapter 4, only one, Gak-1444 (2359–1933 cal BP 2σ range), was not rejected under the analysis protocol. Gak-1444 is from a charcoal sample obtained from the base of a pit feature in Layer 5b cut into Layer 7. There is a possibility that the sample is derived from Layer 7 sediment, which is similar to that of Layer 5 (Davidson and Fagan 1974:84). The disturbance to the site and the lack of a secure radiocarbon chronology makes identification of analytical units difficult and the most appropriate procedure is to use Davidson and Fagan's (1974) division of the site into three phases. Phase 2, a combined unit of Layers 6, 5 and 4, has an associated ^{14}C date of ca. 2350–1950 cal BP. The most recent, with a probable age of no earlier than 500 BP, is represented by Layers 1, 2, and 3.

Ceramic component

A total of 31 ceramic sherds were excavated from Layers 7 (nine sherds), 6 (one sherd) and 5 (ten sherds) and either 2 or 3 (nine sherds), with a further two sherds unprovenanced (Davidson and Fagan 1974:Table 6). A small number of ceramics were recovered from each phase or analytical unit. The assemblage is characterised as plainware. The ^{14}C age range for Phase 2 (Layers 6, 5 and 4) falls within the plainware period.

A single decorated rim with incising on the inner edge of the lip was recovered (Davidson and Fagan 1974:86). Fine and coarse wares are described. All the sherds except one are categorised as fine. Thick coarse and thin fine wares are defined according to Green (1974a), and Davidson and Fagan (1974:Table 6) indicate that the thick coarse ware sherds have a thickness greater than 10mm.

No vessel forms are discussed, although one of the rims resembles the rim of a bowl from SUSa3 (Davidson and Fagan 1974:86). The density of sherds in the deposit is not reported and temper types are not discussed.

No differences between the ceramics in the various stratigraphic units are discussed. Ceramics and other artefacts found in the upper layers are considered to have originated in the lower, earlier levels (Davidson and Fagan 1974:90).

Adze component

Fourteen whole and fragmented adzes were recovered (Table 6.18). A single adze was recovered from the earliest analytical unit, four from the unit with a radiocarbon date of ca. 2350–1950 cal BP and nine from the most recent unit.

Table 6.18 SULe12 adze assemblage (from Davidson and Fagan 1974:86-7).

CONTEXT	TYPE					
	I	II OR IX	V	VII	IX	UNKNOWN
Layer 1				1	1	2
Layer 2	2					
Layer 3	1	1				1
Layer 5						3
Layer 6			1			
Layer 7	1					
Total	4	1	1	1	1	6

Adzes types represented according to Green and Davidson's (1969; Green 1971, 1974b) adze typology are listed in Table 6.18. Six of the adzes were fragments that could not be identified to type. Adze raw material is not discussed.

Basalt flakes with polished surfaces were recovered from Layers 6 (one flake), 3 (one flake) and 1 (three flakes). An assemblage of stone flakes were also recovered; however, their raw material is not discussed although it is presumed to be basalt. Many of the 93 flakes are weathered and questionably artefactual (Davidson and Fagan 1974:87). Nineteen are considered struck flakes, with a further 55 as probable flakes. Three cores were also recovered (Davidson and Fagan 1974:Table 8).

Davidson and Fagan (1974:87) consider the evidence of weathering on some adzes and fragments from all layers to indicate that they are in a secondary context. They have either been incorporated into house floor gravel as in Layers 1 to 3, or incorporated into the site as part of the fill for platform construction (Layers 5 and 6 adzes) and are therefore of greater antiquity than their excavated context would suggest. No change through time is noted in the adze assemblage. The analytical units of the present analysis do not alter this interpretation.

Other artefact component

The other artefact component is listed in Table 6.19.

No behavioural interpretation of the artefacts is made nor any change through time is discussed. Use of the analytical units of the present analysis concentrates the artefacts into the three units, but the small number of artefacts present limits interpretation of differences between the units.

Table 6.19 SULe12 other artefact assemblage (from Davidson and Fagan 1974:88).

FUNCTIONAL TYPE	RAW MATERIAL	LAYER				
		1	2	5	6	7
grindstone fragment	not reported	3	1	1		
file	stone			1	2	
flake	chert			1		
flake/chip/?core	obsidian	1		2		2

Faunal assemblage

No faunal remains were recovered from the site.

Discussion of change through time in the Western Samoan assemblages

The Western Samoan sites included in the analysis represent a greater range of site types than any other subregion. The two Western Samoan beach sites both have stratified deposits that permit change through time in the assemblages to be investigated. Stratum II from the Falemoa site is contemporary with the Jane's Camp analytical units, but Strata III and IV are more recent. The Vailele mound sites, SUVa1 and SUVa4, have a comparable stratigraphy, but only SUVa1 has a sequence of deposits that will permit change through time to be investigated. The basal ceramic unit from SUVa1 is contemporary with the single analytical unit of SUVa4.

Two inland stratified house sites, SUSa3 and SULe12, are included in the analysis. The available ^{14}C date from the SULe12 site is associated with the second of three stratigraphic units and is earlier than the SUSa3 deposits. Associated radiocarbon dates indicate the most recent analytical unit of the SULe12 site is less than ca. 500 years old, much more recent than radiocarbon dated deposits from the SUSa3 site. The most recent SUSa3 deposit contains historic artefacts from the nineteenth century.

7

Assessment of the ceramic sequence

THE WEST POLYNESIAN ceramic sequence has two essential features. The first is ceramic phases, constructed on the basis of similarities in particular ceramic characteristics in contemporary assemblages and considered to reflect a cultural link across space between the makers of the ceramics. The second is that ceramic phases are points within a sequence of change through time in a ceramic tradition (see Green 1974b:250–1). The characteristic style of ceramics in each phase is derivative of, or 'evolved' from, the assemblages of the previous phase, reflecting the cultural evolution of the ceramic producing society. As such, the ceramic sequence acts as an archaeological correlate for a regional culture or society and as an indicator of regional cultural change. Although plainware assemblages have been associated with an Ancestral Polynesian Society, it is specifically the evolution of these assemblages from those characterised as Lapita that underlies their use as the primary material correlate for cultural and linguistic change in West Polynesia. In this chapter, the assessment of whether this is an appropriate use of the archaeological evidence addresses two main questions in relation to the West Polynesian ceramics assemblages:

1. Does Green's (1974b) ceramic sequence still provide an appropriate framework, given the now greatly expanded corpus of data from ceramic sites and the results of the assessment of the radiocarbon and stratigraphic evidence presented in Chapters 4 to 6?
2. Does an explanation of social or cultural change best explain temporal variability evident in the West Polynesian ceramic assemblages?

In addressing the first question stated above, it is necessary to look both at the assemblages characterised as belonging to a particular phase, and whether a transition between the phases is apparent in the archaeological evidence. It is reasonable to expect, in accordance with the concept of a sequence, that some directional change in the characteristics of the assemblages will be evident in sites with more than one stratigraphic or chronological unit containing ceramics. A further expectation is that where the chronological sequence of the site spans more than one of Green's ceramic phases, the transition from one phase to the next will be apparent.

In Chapter 3, the main characteristics of Green's (1974b) ceramic sequence were summarised as change through time in four sets of characteristics — decoration, vessel form, sherd thickness and temper type, and prevalence of ceramics. Green used variability in these sets of characteristics, and the radiocarbon dates associated with sites in which the differences were first noted, to define the phases of the regional ceramic sequence: Early Eastern Lapita, Late Eastern Lapita and Polynesian plainware. The sequence provided an explanation of the limited data then available. As discussed in Chapter 2, although some regional differences have subsequently been identified, the original ceramic sequence has, until very recently, continued to be used as the interpretative framework for West Polynesian assemblages. The recent excavation of plainware sites contemporary with Lapita deposits challenges the sequence, but to date there has been no substantial reassessment of the regional evidence.

The ceramic assemblages from sites with more than one chronological unit are discussed below and the evidence for change through time in the assemblages assessed. Although not central to Green's original sequence, ceramic temper type has also been argued to be a temporal marker by several researchers. Hence, change through time in the tempers of the analysed assemblages is also discussed.

Following this, the evidence for a regional ceramic sequence is assessed. The chronologies of the analytical units for the ceramic deposits (discussed in Chapters 5 and 6) are used as a regional comparative framework to investigate similarities and differences in contemporary assemblages and the chronology for regional change in various assemblage attributes. The strength of current explanations of the patterned variability in the ceramic assemblages is critically assessed and some alternative explanations offered.

Two kinds of difficulties were encountered in comparing ceramic data from the various sites. The first stemmed from the general lack of description about the process of selection of sherds for detailed analysis, what proportions of the assemblages were analysed and why various attributes were considered important. Although a similar range of attributes including type and position of decoration, vessel form, sherd thickness, temper type, and rim shape and thickness have been used in all analyses, the method(s) by which they are categorised and quantified is not commonly specified (cf. Clark n.d.). The second difficulty stems from a lack of investigation of causes other than change through time that may account for, or at least contribute to, variability within and between assemblages. These may include spatial factors such as site function or taphonomic processes.

Change through time in the West Polynesian Ceramic assemblage characteristics

Eighteen sites or groups of sites discussed in Chapters 5 and 6 were found to contain more than one analytical unit. These are listed in Table 7.1, along with the phases of the ceramic sequence represented in the sites as identified by the excavators or subsequent researchers.

Early to Late Eastern Lapita

The transition from Early to Late Eastern Lapita is characterised by:

- a decrease in the overall percentage of decorated sherds;
- a decrease both in the amount of decoration and the areas of the vessel on which decoration is found; and
- a decrease in the range of vessel forms (Green 1974b:249; Kirch 1984:51).

Poulsen (1967, 1987) constructed his chronology for the Tongatapu sites using ceramic assemblage characteristics, rather than associated radiocarbon dates. In this framework, To.2 was considered earlier than To.6 (see Chapter 5). To assess Poulsen's claims for change through time in the ceramic assemblages, it has been necessary to review the To.2 evidence with that of To.6, even though

To.2 has only a single analytical unit. These sites provided the basis for Green's (1974b) description of the characteristic changes from Early to Late Eastern Lapita assemblages.

Fakatafenga, Tongoleleka, Faleloa, Mele Havea, Vaipuna and Pukotala sites in the Ha'apai group have more than one analytical unit containing dentate stamped ceramics and may be used to investigate change through time in Lapita assemblages.

Table 7.1 Classification of ceramic assemblage sites with more than one analytical unit.

SITE	EARLY LAPITA	LATE LAPITA	PLAINWARE	ACERAMIC
Tongoleleka	✔			
Fakatafenga	✔			
Faleloa	✔			
Mele Havea	✔			
Vaipuna	✔			
Pukotala	✔			
To.6		✔		
Mangaia Mound	✔		✔	
Vuki's Mound	✔		✔	
NT-90, NT-93/NT-100	✔		✔	
To'aga			✔	✔
'Aoa			✔	
Jane's Camp			✔	
Falemoa			✔	
SUVa1			✔	✔
SUVa4			✔	✔
SULe12			✔	✔
SUSa3			✔	✔

To.2 and To.6

Poulsen (1987) developed a tripartite, relative chronology for the Tongatapu assemblages based on trends in rim sherd characteristics of shape and orientation. He considered these to be the most important features for establishing variability in vessel shape. According to his chronology, the To.2 assemblage represented the Early Period; ceramics from the bottom half of Horizon I in To.6 represent an ephemeral occupation in the Middle Period; and ceramics from the upper portion of Horizon I, and Horizons II and III belong to the Late Period. Poulsen (1987) divided the Horizon I assemblage into Middle and Late components based purely on ceramic characteristics. There is no stratigraphic evidence to support this division and Horizon I is considered here a single chronological unit. The ceramics from the three horizons of To.6 were argued to show clear trends, confirming for Poulsen (1987:62) the idea that they represented different phases of occupation. However, what these trends are were not discussed.

The acceptable radiocarbon determinations for the sites do not support the interpretation that To.6, Horizon I is a more recent deposit than To.2. The calibrated age range for To.6, Horizon I (ca. 2700 –1200 cal BP) fully incorporates the range for To.2 (2470–1987 cal BP) and would indicate these deposits are contemporary. This age range for To.2 is more recent than the commonly accepted chronology for Lapita. The very early end of the To.6 age range falls within the Late Lapita period.

The rim and decorated body sherds from both sites were analysed according to over 200 separate attributes (Poulsen 1987:Table 14). Trends in ceramic attributes were measured using relative percentages of sherds exhibiting a particular attribute in each horizon of To.6 and the To.2 midden deposit. Plain body sherds were simply weighed.

A total of 1629 decorated rim and body sherds were excavated from To.2, but only 76 from all three horizons in To.6 (Poulsen 1987:Table 13). Although the sample sizes differ greatly, Poulsen (1987:70) noted:

> how generally uniform the decorated pottery is throughout the period represented by the excavated material. The majority of analysed features are found in all horizons of all sites where decorated pottery occurs. Their relative frequency does not change at all or, where it does, the consistent or conflicting trends are mostly of no statistical significance.

Despite this, Poulsen (1987:128-9) also concluded that by his Late ceramic phase, represented by the To.6 assemblage, with the exception of sherds from the base of Horizon I:

> lip decoration had become much more common … inside decoration had probably been totally abandoned … Surface decoration and applied decoration had both declined … but notched decoration was as popular as always. [Decoration is] practically confined to the lip and is very simple … In many cases the execution of the decoration gives an impression of carelessness.

Throughout the assemblages, decoration is primarily found on the upper part of the vessel and on the rim except on the rare flat-based vessels. On the latter the decoration runs to the base corner (Poulsen 1987:117).

Poulsen (1987:71) found the most significant difference in decorated sherds between the sites to be their quantities relative to plainware. Although Poulsen (1987:71) recognised that a decrease in the proportion of decorated rims over time does not necessarily mean a decline in the number of decorated vessels, he divided the number of decorated rim sherds by the total number of rim sherds to estimate the proportion of decorated pottery from each horizon. The estimated percentage of decorated pots from To.2 is 32% (Poulsen 1987:Table 13), higher than any other reported West Polynesian assemblage. However, using the percentage of the total weight of decorated to plain sherds, the figure was only 12%. Poulsen (1987:114) considered the real value to lie somewhere in between. In To.6, 6.8% of the rim sherds are decorated (Poulsen 1987:Table 27). Twenty-seven decorated sherds came from Horizon I, 20 from Horizon II and 12 from Horizon III. Poulsen (1987:71) concluded that, in absolute numbers, decorated sherds decline through time as represented by To.2 to To.6, as well as through the three horizons of To.6.

Using rim, lip and body-rim transition attributes, Poulsen (1987:86-7) identified four groups of vessel types in the Tongatapu assemblages: bowls, dishes, plates and jars. A further analytical distinction was made between carinated and uncarinated vessels. Two trends were identified in vessel form. Flat-based vessels and carinated pots are almost exclusively found in To.2. Twenty-two decorated and three plain flat-based sherds were recovered from To.2, while only a single plain flat-based sherd was recovered from the base of To.6 (Poulsen 1987:Table 33). Poulsen (1987:101) interpreted this to mean that complex vessel forms belong only to his Early and Middle periods. Most flat-based and all carinated sherds are decorated. Bowls and jars show some change through time, principally in rim shape, but Poulsen (1987:110–12) considered this to be minor.

In summary, the most significant difference between the assemblages is in the proportion of decorated sherds. Within To.6, the very low numbers of decorated sherds makes interpretation of the differences between the analytical units difficult. Poulsen's (1987) findings concerning the nature of decoration in the two assemblages appear contradictory. On the one hand little, if any, difference was noted; on the other, the location and type of decoration differs. The other major difference between the sites appears to be in vessel form, primarily the absence of carinated sherds from To.6. However, although complex vessel forms represented by carinated and flat-based sherds decline in absolute numbers, on the above figures the decline in the percentage of these sherds in the total analysed assemblage from each site is minimal (1.5% in To.2 and 1.3% in To.6).

With the available radiocarbon chronology it is not possible to argue that the comparative absence of decorated sherds from To.6 provides evidence of change through time. The definition of To.6 as either Lapita or Late Lapita is perhaps questionable, given the very small numbers of dentate stamped sherds recovered. However, assemblages characterised as Lapita from elsewhere in West Polynesia have an equivalently low proportion of decorated sherds (see below).

If we accept that To.2 is earlier than To.6, then the data as summarised are equivocal on whether there is a decrease in the overall percentage of decorated sherds; suggest a decrease in decorated vessel area; and may show some decrease (carinated bowls) in the range of vessel forms.

The differences identified by Poulsen (1967) between the decorated components of To.2 and To.6 were codified by Green (1974b) as differences between Early and Late Lapita ceramic phases, but these progressive changes have not been recognised in any other site.

Tongoleleka and Fakatafenga

The Tongoleleka and Fakatafenga assemblages were excavated and analysed by Dye (1987a) and the Tongoleleka site has been subsequently excavated and re-dated by Burley et al. (1999). The cultural assemblages recovered in the more recent excavations have not yet been fully reported and therefore the following discussion refers only to the data collected by Dye (1987).

In both sites there is an ephemeral basal deposit which represents initial occupation. This is overlain by the main, at least partially undisturbed, cultural deposit, Cultural Unit III in Tongoleleka and Unit IV in Fakatafenga. The overlying Cultural Unit II in Tongoleleka, and Units III and II in Fakatafenga, are generally disturbed deposit, although some specific *in situ* deposits were noted. The surface layer (Unit I in both sites) is disturbed and contains historic material. Dye's (1987a) interpretation of the cultural units as representing separate chronological phases was questioned in Chapter 5 because of the disturbance reported in both sites. However, on the available evidence it was not possible to assess the extent of the disturbance and Dye's (1987a) cultural units were retained as analytical units. Radiocarbon determinations from both sites come from Cultural Unit III (Dye 1987) or Stratum III (Burley n.d.) and Stratum II (Burley n.d.) in Tongoleleka and Unit III in Fakatafenga. The available dates suggest that the ceramic deposits may span the Lapita and Early plainware phases of the established ceramic chronology. The age range for Unit/Stratum III and Stratum II in Tongoleleka is ca. 2900–2300 cal BP and 2750–2350 cal BP, respectively and for Cultural Unit III in Fakatafenga is ca. 5700–1400 cal BP.

Dye's (1987a) ceramic analysis was similar to that of Poulsen (1987), focussing on rim attributes and decoration to identify trends through time. Only decorated and rim sherds were fully analysed. These represent 5.6% of sherds from Tongoleleka and 5% from Fakatafenga (Dye 1987:163). Dye (1987a:170) notes that the assemblages are comparable because they contain sherds of similar size and condition. In both sites Dye (1987a: Tables 16 and 17) found the number and the percentage of dentate stamped sherds decreases from the main cultural units to the overlying units, but the percentage of decorated sherds in the upper Units II and I is similar. Dye (1987a:175) considers it likely the sherds in Unit I of both sites have become incorporated into the aceramic deposit from the underlying Unit II. Combining the data for the percentage of decorated sherds from Units I and II in each site, a decrease in decorated sherds from 8.4% in the main cultural deposit to 2% in Tongoleleka, and from 4.4% to 1.2% in Fakatafenga is still evident (Dye 1987:Tables 16 and 17).

Differences were noted in the presence of minor decorative techniques (incising, carved-paddle impressing and applied relief) in the various cultural units. Of these, only the presence of incised decoration appeared to change through time, being found only in the earliest deposits from each site. The overall percentages of sherds exhibiting these minor decorative techniques is low and Dye (1987:176) considers their distribution may be a consequence of limited sampling.

The position of decoration on the vessel could be assigned in approximately 50–70% of decorated sherds from each unit, categorised as exterior, interior or lip decoration. The relative frequency of decoration in these three positions varied between cultural units, but no trends through time are apparent (Dye 1987:181–2). Decoration primarily occurs on the outside of the vessel (although it is also found on the inside) throughout the sequence. Decoration on the lip of the vessel was evident in all units of the Fakatafenga sequence, but was uncommon throughout the Tongoleleka assemblage (Dye 1987:181-2). Since the Tongoleleka assemblage is chronologically contained with the Fakatafenga sequence, this is a clear difference between the sites.

Dye (1987a:206) uses rim course and orientation to identify vessel types present in the assemblages. Of the vessel forms, he argues that:

> given the accepted sequence for changes in Lapitoid vessel form in the ancestral Polynesian homeland, the popularity of everted concave rims might be expected to decline, while convex rims, in particular the everted convex rim sherds yielded by simple bowls might be expected to increase. (Dye 1987:207).

Dye (1987) found concave everted rims, associated with complex vessel forms, to show the expected decrease in frequency throughout the Tongoleleka sequence and from Units III to II in Fakatafenga. However, the concurrent increase in everted convex rims, associated with simple bowls, was not apparent, these sherds declining in frequency through both sequences. Rim characteristics also show an increase in inverted concave rims associated with a close-mouthed pot in the upper cultural units of Tongoleleka (Dye 1987:210). A similar trend was not evident in Fakatafenga. A trend towards flat lip vessels and expanded rims was noted in both assemblages (Dye 1987:Table 24), but is not discussed in relation to vessel form.

Carinated sherds, representing less than 2% of the total number of sherds from each site, are most common in the main cultural unit in both sites and their decline in Units II and I 'closely parallels the decline of decorated sherds' (Dye 1987:193). Flat-based sherds are also infrequent: six were recovered from Tongoleleka (five from Unit II and one from Unit III) and two from Fakatafenga (one each from Units III and II). Although Dye (1987a), like Poulsen (1987a), associates flat bases with dentate stamped decoration, their distribution does not suggest a decline over time, although it is acknowledged their numbers are small.

Dye (1987a:174) considered the assemblages to conform to the established sequence because of the apparent decrease through time in dentate sherds at both sites; however, this is not clearly supported by stratigraphic evidence. Dye (1987:124, 130) noted disturbance to Units II and I in both sites. Ceramics from only a limited number of excavation squares in Tongoleleka could be considered to be from *in situ* cultural deposits. Unfortunately, the data from excavation squares are not reported separately to those from the disturbed contexts. The consistency in the nature of decoration throughout the assemblages may support a conclusion that at least a portion of the decorated component of the upper units originated from the main cultural deposit.

The expected decline in complex vessel forms is apparent in a decline in carinated sherds in both sites, but not in flat-based sherds, nor in the expected increase in simple bowl forms. There are clear differences between the assemblages in the location of decoration on pots and in vessel forms present. These differences cannot, on radiocarbon evidence, be argued to suggest change through time as the Tongoleleka assemblage is chronologically contained within the Fakatafenga sequence.

Faleloa, Vaipuna, Mele Havea and Pukotala

Very little data are available concerning the assemblages from these sites. In each case, a plainware and earlier Lapita assemblage are considered to be present in the site, but these are mixed, with decorated sherds being found in plainware contexts and vice versa (Burley n.d.). In each case, on radiocarbon evidence the Lapita and plainware deposits appear contemporaneous, although, as Burley et al. (1999) argue, the calibration curve intercept dispersions and interquartile ranges of the radiocarbon dates indicate the stratigraphically earlier Lapita deposits date marginally earlier than the stratigraphically more recent plainware.

In Falemoa there is a reported decrease in the percentage of decorated sherds from the basal cultural deposit, Zone III (described as a Lapita deposit) to the overlying Zone II. Zone II is described as plainware with an aceramic component (Shutler et al. 1994:61), although decorated sherds were also recovered from this deposit suggesting the deposit may be reworked and the decorated sherds originate from the underlying Zone III. However, the available evidence appears to support the finding that the percentage of decorated sherds decreases over time as represented by the stratigraphic units.

Discussion

In each of the sites discussed above, a decline in the proportion of decorated sherds and an associated decline in complex vessel forms over time have been noted by the excavator, which appears to support a transition from Lapita to Late Lapita. However, this evidence has been shown to be equivocal in To.2 and To.6, where the radiocarbon evidence does not support differences between the sites being interpreted as change through time, and in Tongoleleka and Fakatafenga, due to the disturbance to the deposits noted by Dye (1987). Only the main cultural deposit in these sites has been dated, limiting any inference about the time period that may be reflected in the stratigraphic units.

In each case other trends expected in the transition from Lapita to Late Lapita assemblages are only partially realised and contradictory trends are also apparent. In both cases the excavators have noted a consistency in the decoration [although Poulsen's (1987) description is somewhat contradictory]. At least some of differences between To.2 and To.6, and between Tongoleleka and Fakatafenga, can be argued to be spatial, rather than temporal.

The argument of Green (1974b) and others (Kirch 1981, 1984) for a distinctly Late Eastern Lapita phase, transitional between Early Eastern Lapita and Plainware is not clearly supported by the assemblages discussed in the present analysis. The differences observed in the assemblages do not present a picture of an assemblage that has a particular set of characteristics that differentiate it from both Early Lapita and plainware, whilst being transitional between the two.

Lapita to Plainware

The transition from Lapita to fully plainware assemblages is characterised by:

- the disappearance of dentate stamped decoration and most other decorative techniques; and
- the simplification of vessel forms, to an assemblage almost entirely of simple bowls and/or globular pots.

Only two sites in the present analysis, Vuki's Mound and Mangaia Mound, both on Tongatapu, contain deposits identified as Lapita and plainware. At the base of the sites is a deposit containing dentate stamped sherds. The deposits of the overlying mound structures contain only plainware ceramics. Neither site has been fully published and no description of the assemblage containing dentate stamped ceramics is available for either site. A comparison of the plainware and decorated assemblages is not possible given the available data.

Like Vuki's and Mangaia Mounds, the Niuatoputapu sites (NT-90, NT-93 and NT-100) do not demonstrate a transition from Lapita to plainware. However, the Niuatoputapu sites, viewed as a sequence, have chronological units characterised as Lapita or as plainware. These are the focus of the discussion to follow.

Niuatoputapu assemblages

Change through time in the Niuatoputapu cultural material is argued by Kirch (1988) to be evident when comparing NT-90 with the more recent combined NT-93/NT-100 assemblage. The NT-90 site is disturbed deposit with a radiocarbon age range of ca. 3800–800 cal BP and may include both Lapita and more recent plainware assemblages. The two early, pre-3000 BP dates from NT-90 were found to be questionable (see Appendix 1). The two more recent dates from the same site are contemporary with the range of ca. 1300–600 cal BP for the combined NT-93/NT-100 assemblages.

Kirch's (1988:146, Table 15) analysis of the Niuatoputapu ceramics was restricted to 1106 diagnostic sherds and less than 1% of plain body sherds from a total of 43,131 excavated and surface collected sherds. Of the diagnostic sherds, 131 (12%) are decorated. Only 16% of the analysed sherds come from the more recent NT-93/NT-100 deposit, although a similar percentage of sherds from each site are classified as diagnostic. The density of ceramics from the more recent assemblages is less than half that of the NT-90 site. As discussed in Chapter 5, the dates from NT-90 suggest either more than one, or a very long, continuous occupation of the site, whereas the NT-93 and NT-100 occupations are relatively short. This may account for the greater density of sherds at the site.

Dentate stamped decoration was found only in the NT-90 assemblage. A relatively low 0.4% of sherds have this type of decoration (Kirch 1988:Table 15), possibly reflecting the inclusion of more recent plainware in the deposit. The more recent NT-93/NT-100 assemblages are described as plainware, but include five rim sherds (0.2% of the assemblage) with incised decoration (Kirch 1988:171). Incising and notching are also found in the NT-90 assemblage.

Kirch (1988:Table 23) identifies six classes of vessel amongst the diagnostic sherds, some of which have several variants. All classes and variants are present in the NT-90 assemblage. Their relative proportions in each assemblage are not reported, but variants are described as common, present or absent (Kirch 1988:Table 23). The range of variants in the NT-93 and NT-100 assemblages is similar, but they contain only five, possibly six, of the 18 identified in NT-90. Decorated small bowls and cups, large decorated and undecorated bowls, a decorated carinated bowl, decorated collar bowl, decorated carinated jar, large undecorated carinated jar and large undecorated jar with constricted neck are present in NT-90, but appear to be missing from the more recent assemblages. All carinated sherds except one derive from NT-90. Two variants of large globular plainware jars are common in all assemblages, although a third variant is found only in NT-90 (Kirch 1988:163). A handled water jar is present in all sites. Also common in all sites are plainware bowls or cups.

The NT-90 assemblage appears to differ from the Lapita assemblages discussed previously in the large range of vessel forms identified. However, in the Tongatapu and Ha'apai sites the high fragmentation of sherds made identification of vessel form difficult and, in the Niuatoputapu analysis, the large range of vessels is, in part, a product of the way in which the vessel forms and variants have been defined. Two variants of cups found only in NT-90 appear to be distinguished from a third variant found also in NT-93 and NT-100, primarily on the presence of decoration. This is also true of one variant of large bowl found in NT-90. Furthermore, size, assumed function of the vessel and sherd thickness are also used by Kirch (1988) to distinguish variants such as large bowls (vessel Form 2) from small bowls (vessel Form 1), and large thick bowls (vessel Form 3) from large thin bowls (vessel Form 2). In the previously discussed assemblages, the definition of vessel form was limited to attributes of rim course and orientation and carinated sherds were not subdivided into vessel types. Kirch (1988:160–2) identifies four carinated vessel forms from NT-90, three of which are consistently decorated. The subdivision of vessel form, especially on the basis of decoration, size or sherd thickness, tends to exaggerate differences between the NT-90 and NT-93/NT-100 assemblages. Taking out variants identified on decoration, function or sherd thickness, the difference between the NT-90 and NT-93/NT-100 assemblages is primarily the absence of carinated vessels and dentate stamped decoration from the more recent assemblages. This accords with the findings in the previous section of a correlation between the presence of complex vessel forms and dentate stamped decoration.

The NT-93/NT-100 assemblage consists of small bowls and large jars, described as a large globular jar with constricted neck, flaring toward the rim, and a handled water jar. With the exception of the handled water jar, this conforms to the simple forms generally associated with plainware assemblages. All three forms are also common in the NT-90 site, suggesting a continuity between the plainware component of Lapita and more recent plainware assemblages. However, the mixing of more recent plainware with earlier Lapita material in the NT-90 deposit cannot be ruled out. The chronology for the disappearance of dentate stamped decoration and complex vessel forms cannot be determined.

Discussion

The differences between Lapita and fully plainware assemblages in the established sequence are characterised as the absence of features which identify an assemblage as Lapita (primarily dentate stamped decoration, but also complex vessel forms) — in plainware assemblages. Although the presence of these characteristics may delineate one ceramic phase from another, a definition reliant simply on the presence or absence of particular characteristics does not permit a transition between one phase and the next to be identified or investigated. Plainware assemblages cannot be argued to evolve from Lapita assemblages in the absence of evidence for the transition. The Northern Ha'apai Lapita sites are argued by Burley et al. (1999) to show this transition, but until their assemblages are fully published this cannot be assessed. The plainware component of Lapita may better demonstrate a transition between the assemblage types. However, the evidence from NT-90 suggests a continuity between the plainware component of Lapita assemblages and the fully plainware assemblages in undecorated vessel forms. Green (1979:43--44) noted that undecorated or frequently undecorated vessel forms found in Eastern Lapita assemblages are bowls of simple shapes and sub-globular pots like those of plainware, although the specific evidence to support this statement is not reported. The limited data available concerning the plainware component of Lapita assemblages in general does not permit further investigation, but the noted similarity in the plainware of both ceramic phases does not suggest a change through time or evolution.

The recovery of plainware deposits in American Samoa and the Ha'apai Group that are contemporary with Lapita deposits does not support the sequence of change through time in the ceramic assemblage types. However, Burley et al. (1999) argue that dentate stamped decoration and complex vessel forms may have disappeared within a couple of hundred years of colonisation in the Ha'apai group and therefore the transition from Lapita to plainware is not immediately visible in the associated radiocarbon chronology.

The importance of the current lack of evidence for the evolution of plainware from Lapita lies in the use of this transition as the major archaeological correlate for the appearance of an Ancestral Polynesian Society from the society reflected by Lapita archaeology. The definition of Lapita *versus* plainware assemblages, notably the absence of dentate stamped decoration and complex vessel forms from the plainware sites, suggests difference, rather than evolution from one assemblage type to another. If the majority of the Lapita assemblage, the plainware component is considered, the Lapita and plainware do not, on the limited evidence available, appear to demonstrate a change through time. Although the cessation of the manufacture of decorated Lapita ware signals some sort of social change, a continuity in the majority of the ceramic assemblage does not provide a satisfactory correlate for the appearance of a distinctly different society. As will be discussed in Chapter 10, a similar interpretation has not been made of parallel changes evident in the Melanesian archaeological record.

Change through time in plainware assemblages

Temporal variability in West Polynesian plainware was initially identified by Green (1974b) in the West Samoan assemblages and was subsequently extrapolated to other West Polynesian assemblages. Change through time in plainware assemblages is characterised as:

- a decrease in the relative amount of thin fine sherds to thick coarse sherds; and
- an overall decrease in the amount of ceramics towards the cessation of ceramic manufacture (Green 1974b:250).

SUVa1, SUVa4 and SUSa3

Green (1974b) created his sequence for plainware assemblages using the data from SUVa1, SUVa4 and SUSa3. He interpreted variation in ceramic characteristics, radiocarbon dates and stratigraphy of the sites, as a chronological sequence in which the SUVa4, Layer F1 and SUSa3, Layer 5 ceramic assemblages represented an earlier phase of plainware than the ceramics of SUVa1, Layer V and SUSa3, Layer 4 (Green 1969a:171).

Green's (1969a, 1969e, 1974a, 1974b) analyses of the assemblages were based on sherd numbers and the proportional representation of two distinct types of sherds he identified in the assemblages; thin fine ware and thick coarse ware. The two sherd types were distinguished on the basis of sherd thickness and coarseness of temper (Green 1969a:170), although these differences were not quantified.

Differences in rim characteristics were also noted, such as that thick coarse ware is almost always associated with a simple flat rim of an open bowl. Several varieties of rim are found on thin fine ware, suggesting several vessel shapes, although the most common is the open bowl (Green 1969a:173). Using the relative proportions of sherd types in each site (Table 7.2), Green (1974b:250) concluded that the plainware tradition in Western Samoa:

> showed an internal stylistic development... from a predominantly thin fine ware variety of pottery with minimal decoration to a thick coarse ware pottery with almost no decoration.

Table 7.2 Numbers and relative percentages of thick and thin ware sherds at sites SUSa3 (Layers 4 and 5), SUVa1 (Layer V) and SUVa4 (Layer F1) (after Green 1969b:Table 6, 1969e:Table 11, 1974a:Table 9).

	SUSA3, LAYER 5		SUSA3, LAYER 4		SUVA1, LAYER 5		SUVA4, LAYER F1	
	NO.	%	NO.	%	NO.	%	NO.	%
Thick coarse ware	385	7	1171	75	329	90	31	13
Thin fine ware	4061	93	308	25	36	10	198	87

The radiocarbon dates associated with the West Samoan deposits suggested that this change was rapid, taking place over only a few hundred years. Green (1974a:131) considered thick coarse ware to be the final stage of ceramic manufacture in Western Samoa.

Assessment of the radiocarbon chronologies and stratigraphy in Chapters 4 and 6 found the ceramic deposit at the base of the SUVa1 mound (Layer V) has a radiocarbon age range of ca. 2300–1700 cal BP. This is completely contained within the radiocarbon chronology of the main ceramic deposit (Layer F1) of SUVa4 (ca. 2400–1400 cal BP). Calibration of the radiocarbon dates from SUSa3, Layers 4 and 5 indicates that the ceramic deposits are contemporary on radiocarbon evidence. Layers 4 and 5 were conflated to a single analytical unit with a radiocarbon age range of ca. 1990–1530 cal BP, fully within the range of the above deposits. On radiocarbon evidence, the variability observed by Green (1974b) in ceramic assemblages from the three sites cannot be said to be a consequence of change through time. This does not necessarily refute Green's findings, because the resolution of the radiocarbon chronology does not permit temporal change at the scale he considers to be visible archaeologically in Layers 4 and 5 of SUSa3. However, it does suggest that the variability within the assemblages may be equally explained as a result of spatial rather than temporal factors, given the proximity of the sites SUVa1 and SUVa4, and the higher percentage of sherds identified as thin fine ware in SUVa4 than in SUVa1 (Green 1969a). The two ceramic types may reflect functional differences given their association with different vessel forms and/or technological constraints on manufacture given the difference in the coarseness of temper.

Jane's Camp and Falemoa

Ceramics were recovered from each stratigraphic unit in both the Jane's Camp and Falemoa midden sites. A sample from Jane's Camp was initially analysed by Smith (1976b) in association with sherds from the undated Paradise plainware deposit and the Ferry Berth Lapita deposit, also from Western Samoa. Subsequently, Holmer (1980a) re-analysed these assemblages, together with samples from Falemoa and the Potusa site (see Appendix 1). In both cases, the results are discussed in terms of a regional sequence and little specific information is available concerning either.

Smith's (1976b) analysis consisted of 555 sherds from Jane's Camp, 72 from Paradise and 77 from Ferry Berth. No description is given of sherd size or fragmentation. Sherds from the Ferry Berth site are described as Lapita (Smith 1976b:86), but the percentage of decorated sherds is not reported. The assemblage was initially divided into three classes on the basis of thickness and texture, sherds ≥ 10 mm thick being classified as thick ware. Sherds from the more recent, upper Strata III and IV of Jane's Camp, Test Pit I, were found to be mainly 'thick and coarse textured', while those of the stratigraphically earlier Strata I and II were predominantly a 'thinner finer textured ware' (Smith 1976b:86). However, this is not the case if sherds from Strata III and IV in all test pits are included. Only 54 sherds were excavated from these strata in Test Pit 1, but 336 were recovered from Strata I and II (Smith 1976b:Table 4). If the sherds from Strata III and IV in all four test pits are included (Strata I and II were found in only Test Pit 1), then the difference in the proportion of thick to thin ware is minimal. Of a total of 587 sherds from Strata III and IV, 6% are classified as thick ware, whereas 4% of the stratigraphically earlier Strata I and II are thick ware.

By undertaking a principal components analysis of the ceramics using a range of variables including surface condition, surface finish, hue, texture and wall thickness, Smith (1976b:83) wished to provide an independent test of Green's ceramic sequence using technological rather than stylistic variables. Absolute numbers of sherds were used to investigate the changing frequency of attributes, under the assumption that the Ferry Berth assemblage is earlier than the plainware assemblages. Smith (1976b:92) found that 'the initial impression [is] one of absence of differentiation in the sample', although there is a tendency for the Ferry Berth sample to cluster together, separate from the other two assemblages. He concluded that 'the homogeneous nature of the sample...reflects the common tradition which connects the Lapita ceramics of about 3000 BP and the later plain ware' (Smith 1976b:92)

The analysis identified two distinct types of plainware in the assemblages, varieties A and B. However, there is no patterning in their distribution within or between sites that could be inferred as spatial or temporal variation (Smith 1976b:92). Despite this, Smith (1976b:96) describes plainware Variety B as the final stage in the production of Samoan pottery, consisting of an open bowl form with a coarse feldspathic temper. Variety A consists of an open bowl and a shouldered jar form with occasional incising on the rim and a finer paste and ferromagnesium temper. No reference is made to sherd thickness in the two varieties (Smith1976b:94–95).

Holmer's (1980a) analysis of sherds from the Jane's Camp, Paradise, Ferry Berth, Falemoa and Potusa sites also identified a number of ceramic types. Like Smith (1976b), he does not report their provenance. Initially, Holmer (1980a) analysed 2000 sherds from the five sites, including 754 from Falemoa and 769 from Jane's Camp, using a principal components analysis with a wider range of attributes than that of Smith (1976b). No covariance was found between any of the attributes (Holmer 1980b:105). As an alternative, morphological attributes were used to divide a portion of the sherds into seven types (their number and provenance is not reported). A total of 141 sherds considered to exemplify the seven types were then analysed using a discriminant analysis program. The results confirmed the original seven types as 'statistically defensible' groups (Holmer 1980a:106) which were then used to classify the rest of the assemblage.

The seven types comprise coarse and fine wares, slipped-ware and a Lapitan ware consisting of an earlier Lapita Brown Ware and a later Samoan Brown Ware. There is considerable overlap in the variables characterising these types (Holmer 1980a:111–14) and all types are represented in all sites (Holmer 1980a:Fig. 42). Holmer (1980a:115) argued that there are similar trends in the representation of the various types in Jane's Camp and Falemoa, although the relative percentages of the various types differ. However, this issue was not discussed further. Under the assumption that Jane's Camp and Falemoa are fully contemporary, Holmer (1980a:115) suggested that differences between these assemblages may reflect regional variation and might indicate a temporal significance for his typology, but that the radiocarbon dates are insufficient to confirm this.

Two of his seven types are described as coarse ware and two as fine ware. The average sherd thickness of the coarse ware varieties is greater than that of the fine ware (Holmer 1980a:111–14). It appears from the graph of percentages of each type in stratigraphic units of Jane's Camp and Falemoa, there are some trends in the representation of coarse and fine ware over time in the Jane's Camp site. The Faleasi'u fine ware declines from Strata I to IV, but the percentage of this type is actually greatest in the most recent Stratum IV (Holmer 1980a:Fig. 42). The proportional representation of Falemoa coarse ware increases from Strata I to IV. No directional change in type representation through time is evident in the Falemoa assemblage. The relative percentage of fine to coarse wares in both sites (as shown in Table 7.3) has been recalculated from Holmer's (1980a:Table 8) original data.

There are only slight variations in the proportion of coarse to fine wares in both sites and no discernible trends through time in either site.

Table 7.3 Percentages of fine and coarse wares in the analytical units of the Jane's Camp and Falemoa sites (from Holmer 1980b:Table 8).

SITE	ANALYTICAL UNIT	STRATUM	TOTAL NO. SHERDS FROM ANALYTICAL UNIT	FALEASI'U AND FALEMOA FINE WARE		FALEASI'U AND FALEMOA COARSE WARE	
				NO. SHERDS	% OF TOTAL	NO. SHERDS	% OF TOTAL
Jane's Camp	2	III and IV	509	219	43	63	12
	1	I and II	245	112	45	38	15
Falemoa	3	4	369	138	37	166	45
	2	3	26	14	53	11	42
	1	2	129	47	36	55	42

Neither Smith's (1976b) nor Holmer's (1980a) analyses demonstrate variation in the Jane's Camp or Falemoa assemblages that can be attributed to change through time. Using technological attributes, Smith and Holmer found little difference within or between the assemblages they analysed, including that from the Ferry Berth Lapita deposit.

Holmer (1980a) did not analyse all the ceramics from Falemoa and Jane's Camp. However, in the analysed samples from both sites (Holmer 1980a:Table 8), there is a greater number of sherds from the more recent analytical units. Nevertheless, given the absence of measures of sherd density this phenomenon is difficult to interpret. Should this reflect the actual numbers of ceramics, then the expected proportional decline in ceramics over time is not evident in either site.

'Aoa and To'aga

The 'Aoa site contains two distinct chronological units, separated by a hiatus of up to 1500 years. Both chronological units contain ceramics, although 85% of these are from the earlier unit. Clark and Michlovic (1996) have identified two types of ceramics in the assemblage, a thick ware with a temper of crushed basaltic rock and a thin ware associated with a sand temper. The sherds in the earlier unit were found, on average, to be slightly thinner than in the recent unit, although the criterion for assigning sherds to the thick or thin categories is not reported. The assemblage is also divided into two types, A and B, on the basis of paste. Type A sherds, with a basaltic temper, were more commonly found in the recent analytical unit and were generally thicker than Type B sherds.

Clark and Michlovic (1996:14) recognised that the disparity in the number of sherds from the two units may account for the observed differences in the assemblages. No other assemblages of an age comparable to that of the recent analytical unit have been identified in Western Polynesia.

Analysis of ceramics from the To'aga site was designed to assess variability in raw materials, technology, style and function (Hunt and Erkelens 1993:124). A total of 2434 sherds were excavated from the To'aga site, of which 737 were individually analysed according to a number of attributes (Hunt and Erkelens 1993:124–25). However, only 538 sherds in the sample retained their interior and exterior surface and could be used for analysis of surface traits. The analysed sherds were selected from excavation units which have larger samples and which Hunt and Erkelens (1993:124) consider to represent the 'full sequence of pottery manufacture at To'aga'.

The sample was divided into three temporal periods for comparative purposes (Table 7.4). According to Hunt and Erkelens (1993:124), these are 'not ceramic periods or phases, but simply represent a three-part division devised to analyse change in the sample'. However, the results of the analysis are discussed according to this temporal framework.

Table 7.4 To'aga site temporal divisions (from Hunt and Erkelens 1993:124).

PERIOD	AGE RANGE	UNITS AND STRATIGRAPHIC LAYERS
Early	3250–2500 BP	Layer III in Units 1, 5 to 7, 9 and 28
Middle	2500–2000 BP	Layers IIB and IIC in Units 1, 4 to 7, 9, 27 and 28
Late	2000–1700 BP	Layer IIA in Units 4 to 9 and 27

The only vessel form identified in the To'aga assemblage is described as a bowl with an unrestricted orifice. A small number of rim sherds, all from the Early period, are decorated with impressing and notching on the lip (Hunt and Erkelens 1993:131). Two body sherds have incised decoration and one, from an Early context, is paddle-impressed (Hunt and Erkelens 1993:137). A red slip was identified on 30 sherds from both Early and Middle period contexts (Hunt and Erkelens 1993:Table 9.1).

Thin and thick ware were defined as <7.5mm and >7.5mm, respectively (Hunt and Erkelens 1993:147), although no rationale is offered for this distinction. Hunt and Erkelens (1993:147) found that:

> thin ware is never dominant in the assemblage but occurs in roughly equal percentages with thick ware in the early deposits... but declines in real and relative values over time.

There are two major flaws in Hunt and Erkelens' (1993) analysis. Firstly, the sherds selected for analysis do not cover the entire sequence as Hunt and Erkelens (1993:124) maintain. Secondly, the chronology of the Middle and Late periods (Table 7.1) does not accord with radiocarbon evidence from the site. No rationale in terms of stratigraphy or radiocarbon evidence is provided for their assigning ceramics to a particular period.

A synthesis of the stratigraphy and radiocarbon chronology for the To'aga site was presented in Chapter 6. On the basis of this, the following radiocarbon chronology is associated with the three temporal periods of Hunt and Erkelens (1993):

- In the deposits associated with the Early period (3250–2500 BP), Layer III in To'aga excavation Units 1, 5 to 7 and 9 is not radiocarbon dated, but stratigraphically predates layers with an associated radiocarbon chronology of 3000–1900 cal BP (Beta-25033, Beta-25034 and Beta-26464). Layer III in Unit 28 stratigraphically predates the earliest radiocarbon date from the site, Beta-35601 (3356–2761 cal BP). Deposits in the Early period therefore have a possible associated radiocarbon age range of ca. 3300–2700 cal BP, similar to that given by Hunt and Erkelens (1993).
- Deposits included in the Middle period (2500–2000 BP) come from Layer IIB and IIC in Units 1, 4 to 7 and 9. Layer IIB is associated with, and Layer IIC stratigraphically pre-dates, a radiocarbon chronology of ca. 3000–1900 cal BP (Beta-25033, Beta-25034 and Beta-26464). Unit 27 has not been radiocarbon dated and the stratigraphy has not been correlated with that of radiocarbon dated deposits. Layers IIB and IIC in Unit 28 are associated with the earliest date in the site, Beta-35601 (3356–2761 cal BP). The radiocarbon age range for the Middle period spans ca. 3300–1900 cal BP, overlapping with the Early and Late periods.
- Deposits in the Late period (2000–1700 BP) from Units 4 to 9, Layer IIA are associated with a radiocarbon chronology ca. 3000–1900 BP (Beta-25033, Beta-25034 and Beta-26464). Unit 27 has not been radiocarbon dated and no Layer IIA is reported in the description of the unit's stratigraphy, although a variety of artefacts are listed as coming from Layer IIA (Kirch and Hunt 1993:58). Ceramics in the Late period are associated with radiocarbon age range of ca. 3000 –1900 cal BP, overlapping with all three periods.

The stratigraphic layers of Units 1, 4 to 7 and 9, which make up the Early, Middle and Late periods, are in stratigraphic sequence and differences in the ceramics from these deposits may be due to temporal differences. However, the radiocarbon chronology does not permit confirmation of this and the associated dates do not accord with those given for the three periods. The deposits from Unit 28 are also in stratigraphic sequence; however, the stratigraphy from Unit 28 and the main trench has not been securely correlated.

All ceramics included in Hunt and Erkelens' (1993) analysis come from deposits which pre-date the formation of the palaeosol evident in the To'aga site, dated to ca. 1900 BP (see Chapter 6), and therefore do not cover the full sequence. Ceramics are reported as having been recovered from the following stratigraphic units that post-date the palaeosol formation:

- Layer II in Units 15 and 30, and Layer IB of Unit 16, associated with a radiocarbon date of 1716–1368 cal BP (Beta-35924) (Hunt and Erkelens 1993:Table 9.2).
- Layer IC, Units 1, 4 to 9, 11 and 14 (Kirch and Hunt 1993:51, 54).

The stratigraphic units from which ceramics were recovered, and whether they are classed as thick or thin ware and decorated, are listed by Hunt and Erkelens (1993:Tables 9.1 and 9.2). These data suggest that in To'aga Analytical Unit 1 (the earliest unit in the present analysis), 41% of 196 sherds are classed as thin ware. This decreases to only 12% of 1077 sherds in Analytical Unit 2. In the most recent, post-1900 BP Analytical Unit 3, 5% of 65 sherds are thin ware. Although the sample sizes vary markedly, this appears to confirm the observation that the relative proportion of thin ware decreases through time.

Decorated and red-slipped sherds are found only in the earlier two analytical units pre-dating 1900 BP. Again, this may be a factor of sample size, as only 5% of the listed sherds come from post-1900 BP deposits.

No further change through time in ceramic characteristics can be ascertained from the available evidence, although Kirch and Hunt (1993:238) note a decline in the diversity of raw materials for ceramic manufacture over time.

Discussion

West Polynesian plainware sites present the best opportunity for the study of change through time in ceramic assemblages, at least in Samoan sites. No Tongan plainware sites with more than one chronological unit were included in the present analysis. Unfortunately, with the exception of the To'aga assemblage and the preliminary findings from the 'Aoa site, little detailed intra-site analysis has been undertaken, researchers preferring to look at variation within a region rather than the site.

Green (1974b) identified two distinct patterns of change through time in plainware assemblages, a decrease in the relative amount of thin fine to thick coarse sherds, and a decrease in the overall amount or density of ceramics. In all plainware sites considered, two distinct kinds of ceramics were identified on the basis of either, or both, the coarseness of temper or sherd thickness, creating two categories: thin fine or thick coarse wares. Temporal variation in the representation of the two types has been identified in all sites, such as that thin fine ware sherds occur more frequently in the earlier deposits. Although the reassessment of radiocarbon and stratigraphic evidence makes this data equivocal in the case of SUSa3, SUVa1 and SUVa4, the evidence from the 'Aoa and To'aga sites appears to concur with Green's (1974b) original interpretation of the Western Samoan assemblages. However, this does not appear to be the case in the Jane's Camp and Falemoa assemblages. On radiocarbon evidence, the To'aga and 'Aoa deposits represent the longest time spans of any of the sites investigated, although occupation may not have been continuous. The scale of change through time in the representation of thin fine to thick coarse ware in these sites is far greater than that originally argued by Green (1974b) for SUSa3 (Layers 5 and 4), representing only a couple of hundred years.

Assessing whether the overall amount of ceramics from plainware sites decreases over time is difficult given the available evidence. The density of sherds is not reported for any fully plainware site; however, the numbers of sherds excavated from each stratigraphic unit is reported for SUSa3, SUVa1, SUVa4, To'aga and 'Aoa. In each case, relatively few sherds were recovered from the stratigraphically more recent deposits. The sherd quantities reported for the Jane's Camp and Falemoa site contradict this trend.

Change through time in plainware sites has not been directly associated with cultural change in the same way as the transition from Lapita to plainware because of the association of plainware assemblages with Ancestral Polynesians and a Proto-Polynesian language. In the established cultural sequence, Ancestral Polynesians were argued to appear in West Polynesia by 2500 BP, lasting as a region-wide society until ca. 1700 BP when locally differentiated archaeological signatures become apparent. The excavation of early and very recent plainware deposits, and results of the assessment of the radiocarbon chronology in Chapter 4, indicate that plainware assemblages may have been manufactured for at least 2000 years, with, as the above evidence suggests, little change through time in their characteristics. Given this, are plainware assemblages an appropriate correlate for the proto-language and associated society? If so, then it must be argued that the Ancestral Polynesian Society appears with or shortly after initial colonisation and does not undergo any archaeologically visible evolution over the ensuing 2000 years. This seems unlikely, suggesting that plainware assemblages may not be satisfactory evidence with which to locate the speakers of a Proto-Polynesian language in time and space.

Change through time from plainware to aceramic deposits

The established chronology for the disappearance of ceramics from Samoan sites was based on the most recent radiocarbon dates associated with ceramics and the earliest radiocarbon dates associated with aceramic deposits. The disappearance was estimated by Green (1974b) to have occurred ca. 1700 BP. Of the sites included in the present analysis, several (SUVa1, SUVa4, SUSa3, SULe12 and To'aga) are considered to have both plainware and aceramic deposits. In the mound sites (SUVa1 and SUVa4) and house sites (SUSa3 and SULe12) aceramic layers overly the basal ceramic deposits. In each case, a small number of sherds was recovered from the aceramic layers. These ceramics have been argued by Green (1974b:245–47) to be in a secondary context, having originated from the main ceramic deposit or having entered the site in fill from elsewhere. The supporting evidence includes:

- the associated radiocarbon dates, especially in SUVa1 where there is a gap of 1000 radiocarbon years between the main ceramic deposit and the overlying mound layer containing only a few sherds.
- stratigraphic evidence, especially where there is evidence of disturbance, such as posthole digging in SUSa3.
- the presence of an earlier ceramic deposit adjacent to a house site, such as at SULe12, where the ceramic deposit may have been used as fill for the house floors in which a small number of ceramics have been identified.

Clarke (n.d.) considers that dates as recent as ca. 300 BP from ceramic deposits in the 'Aoa site question Green's (1974b) explanation of ceramics in late Samoan contexts and the chronology for the cessation of ceramic manufacture in general. Clarke (n.d.) presents a critique of Green's interpretation of the sites discussed above, as well as several other West Samoan sites. He argues that in each case where sherds from deposits more recent than ca. 1700 BP are argued to be in a secondary contexts, an equally plausible argument can be made that these ceramics indicate the continuation of pottery manufacture more recently than the established chronology suggests. Further, he suggests that abandonment of ceramics may not have been uniform throughout Samoa or West Polynesia in general, as is suggested by dates of ca. 1000 BP from ceramic deposits on Niuatoputapu.

Nine excavation units in the To'aga site contained aceramic deposits. Two further units (Units 10 and 24) yielded small numbers of sherds (n=5 and n=53, respectively) (Hunt and Erkelens 1993:Tables 9.1 and 9.2). All were located to the seaward side of the ceramic deposits (Kirch and Hunt 1993:Fig. 15.1). The geomorphological evidence suggests the aceramic deposits accumulated during a period of rapid beach progradation ca.1900–1000 BP, post-dating the palaeosol formation (Kirch and Hunt 1993:83). Three To'aga radiocarbon determinations date aceramic deposits; however, only one of these (Beta-35600) was found to be acceptable under the assessment protocol outlined in Chapter 4 (see Appendix 1). Beta-35600 has a 2σ age range of 1275–935 cal BP. The most recent acceptable radiocarbon determination from a ceramic deposit, Beta-35924, has a 2σ range of 1716–1368 cal BP. These dates suggest the cessation of ceramic manufacture at To'aga perhaps as early as ca. 1700 BP, but possibly as recently as ca. 1200 BP. Further dates from recent ceramic and aceramic deposits at To'aga are needed to refine this chronology further.

Change through time in tempers used in West Polynesian ceramics

Green (1974b) identified a change through time in the coarseness of temper in the West Samoan ceramic plainware sequence. Although the type of temper was not included as a formal characteristic of the ceramic sequence, several researchers have subsequently identified temper types, in particular calcareous or coral sand, as a temporal marker.

Kirch (1981, 1988) found calcareous sand tempers to be associated with early sites on Futuna and Niuatoputapu. On Futuna, Kirch excavated the FU-11 site (Tavai) and collected surface sherds from several other sites. At one, FU-13, calcareous sand temper was found in a significant number of sherds. Kirch (1981:133) attributed a temporal significance to this difference on the basis that the early West Polynesian sites (Ferry Berth site, NT-90 and Jane's Camp) also contain significant percentage of sherds with calcareous sand temper. The near absence of calcareous sand temper in ceramics excavated from FU-11, dated ca. 2300–1900 cal BP, and the presence of two decorated sherds in FU-13, led Kirch (1981) to conclude that the FU-13 assemblage represented Early Eastern Lapita. Sand (1990:126) also noted calcareous sand temper in ceramics from several sites on Futuna/Alofi, including the Asi Pani Lapita site. Although these were always few in number, they suggested to Sand (1990:131) colonisation of the islands in the Early Eastern Lapita period.

Calcareous sand tempers were common in the examined sample of plain body sherds from NT-90, but were absent from the more recent Niuatoputapu sites of NT-93 and NT-100 (Kirch 1988:148). No association of calcareous sand temper with either the decorated sherds or plain sherds from NT-90 was discussed. Coral sand temper was found only occasionally in Western Samoan sherds classified by

Holmer (1980a:111–12) as Mulifanuan Lapita, but found exclusively in the fine ware component of the Jane's Camp assemblage, comprising about 20% of sherds. In the contemporary Falemoa assemblage, a small amount of coral sand temper is present, but the dominant temper type is ferromagnesium basalt.

Hunt and Erkelens (1993:Fig. 9.4) identify an association of sherd thickness with temper similar to that of Green (1974b), such that the coarser the temper, the thicker the sherd. All 29 examined sherds from the To'aga site contain volcanic sand temper of local stream or beach origin, although in a few this is mixed with calcareous grains derived from reef sources (Dickinson 1993:151). Dickinson (1993:151–12) identified four categories of temper, two of which, feldspathic basaltic and profuse basaltic, were found only in thick ware sherds. The remaining two, sparse basaltic temper and mixed sand temper containing calcareous sand, were found in thick and thin sherds. Of six sherds containing calcareous sand grains, five are from contexts designated Early by Hunt and Erkelens (1993:Table 9.15). However, Hunt and Erkelens (1993) consider differences in temper and clay classes in their three ceramic periods to reflect the limited sample of sherds examined, rather than any change through time.

Calcareous sand temper appears to be associated almost exclusively with the earlier part of the ceramic sequence, in particular with decorated Lapita ceramics and in the fine ware component of some early plainware assemblages. Ambrose (1997:528) has suggested that calcareous sand tempers may be a feature of early classic Lapita ware — highly decorated complex vessel forms with fine sandy fillers possibly preferred for drawing elaborate designs, like a 'prepared canvas'. Variability in temper appears in general to correlate with sherd thickness, and to have a technological role in the manufacture of pots of particular form and/or function. Change through time in the choice of temper may also reflect changing availability of temper sources, as Hunt and Erkelens (1993) suggest for the To'aga site.

A regional West Polynesian ceramic sequence?

It was argued in Chapter 3 that assessment of the ceramic sequence through the investigation of intra-site variability was more appropriate than looking at regional change through time, because this approach takes account of local environmental and taphonomic processes that may influence assemblage variability. In the sites investigated in the present analysis, and in West Polynesian sites in general, it is uncommon for ceramics to have been recovered from more than one stratigraphic context. In sites where ceramics have been recovered from more than one stratigraphic unit, insufficient radiocarbon dating restricts understanding of the temporal relationships of the stratigraphic units. Despite these limitations, the following points can be made in regard to change through time in the ceramic assemblages:

- The difference between Lapita and plainware assemblages described in the established sequence as the loss of dentate stamped decoration and complex vessel forms takes into account only a very minor percentage of the assemblage. The lack of data concerning the plainware component of Lapita assemblages, and published sites containing Lapita and later plainware deposits, does not permit comparison of the plainware component of Lapita assemblages and fully plainware assemblages. In the interpretation of the assemblages this may falsely exaggerate differences between Lapita and plainware assemblages. Characterising the nature of the similarities and differences between these assemblages is important for understanding the behavioural implication of the disappearance of dentate stamped decoration and the relationship of early plainware deposits to contemporary Lapita deposits. In the absence of such data, and in particular the absence of any securely dated site which demonstrates a transition from Lapita to full plainware, it is difficult to envisage the assemblage types as a sequence in the evolutionary sense, and therefore as an archaeological correlate for social evolution.
- There is no secure radiocarbon or ceramic evidence to support differentiation of assemblages containing dentate stamped ceramics into Early or Late Lapita. This appears to support the

recent findings of Burley et al. (1999) that, at least in the Ha'apai sites, dentate stamped decoration disappears shortly following colonisation. This, along with only a small percentage of Lapita assemblages being decorated, may explain the absence of sites that could be classed as transitional between Lapita and plainware.

- Plainware assemblages, represented almost exclusively by Samoan plainware in the present analysis, appear remarkably uniform across time and space. With the exception of the handled jars reported from Tavai and NT-93/NT-100, and a possible shouldered jar or bowl from Jane's Camp, plainware assemblages (including those from Vuki's Mound, Ta'u Village and Alofitai) consist of simple open bowls or globular pots. Some change through time in sherd thickness is suggested by the American Samoan assemblages. These contain ceramic deposits that appear to span more than 1000 years and the changes observed are relatively minor. What they may mean in a behavioural sense is unclear, especially given the uniformity of vessel forms throughout this period and plainware assemblages in general. It is possible that it may simply reflect the availability or choice of different temper types. The lack of data concerning the plainware component of Lapita sites makes the overall spatial and temporal continuity in West Polynesian ceramic assemblages difficult to assess. If plainware has a similar simple range of vessels throughout the ceramic sequence as Groube (1971) and Green (1979) have suggested, then change through time throughout the region would be marked only by the disappearance of a very small percentage of the early assemblages comprising the complex vessel forms with dentate stamped decoration.

The radiocarbon chronology of West Polynesian ceramic assemblages

The radiocarbon chronology for the various analytical units of the present analysis are presented in Figure 7.1. Of the eight sites containing Lapita ceramics, seven have radiocarbon determinations dating

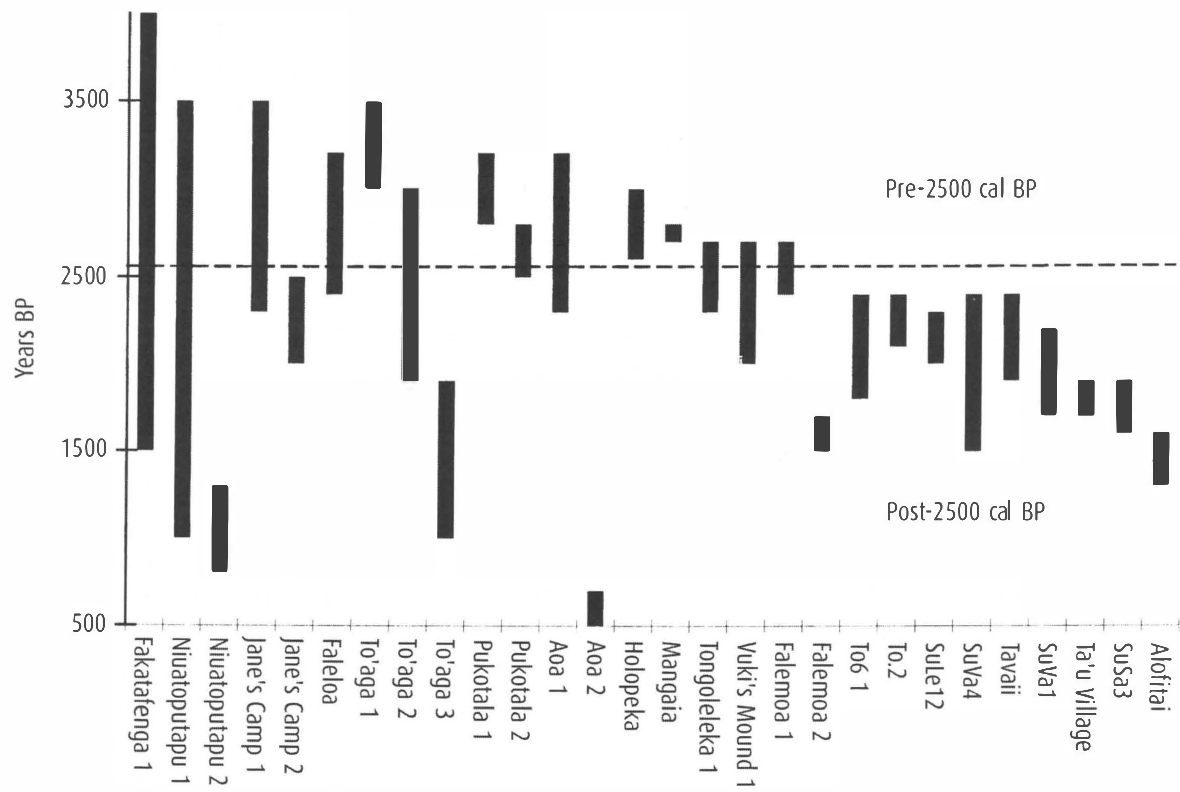

Figure 7.1 Radiocarbon chronology assoicated with analytical units of West Polynesian sites for which the stratigraphic context of the cultural assemblages is reported.

the stratigraphic unit containing dentate stamped ceramics. Vuki's Mound has Lapita ceramics in the undated basal layer, stratigraphically earlier than overlying plainware deposits dated 2758–2159 cal BP (ANU-441). The radiocarbon determinations in association with Lapita deposits range from nearly 6000 cal BP (Beta-14170) in Fakatafenga and ca. 3800–3200 cal BP (I-10632 and I-10633) in NT-90 to 1992 cal BP–1412 cal BP (Beta-11244) in Fakatafenga and ca. 1100 cal BP (I-9934 and I-10481) in NT-90. All six dates are outside the accepted range of Lapita in the West Polynesian chronology. All were found to be questionable either because they come from deposits which may be disturbed, or mixed, or, in the case of I-10632 and I-10633, they may date fossilised or non-cultural shell. Anderson and Clark (1999) have noted a similarly wide distribution of radiocarbon dates associated with Fijian deposits containing dentate stamped ceramics. They suggest that recent dates associated with Lapita may be due to dated charcoal being intrusive in the deposit. Charcoal is much lighter than other midden components and more easily transported by ground water, land crabs and other natural agencies to below its original point of deposit, or introduced to lower levels through posthole or oven digging, or other kinds of disturbance. Complicating the situation ever further is the possibility that charcoal associated with the earliest ceramics may not have preserved due to progressive fragmentation of charcoal over time.

On present evidence it is not possible to suggest a regional estimate for the chronology of the disappearance of dentate stamped decoration. It is no longer appropriate to estimate the disappearance of dentate stamping using early dates from exclusively plainware sites, owing to the presence of plainware assemblages contemporary with Lapita assemblages. The estimated date of 2500 BP for the end of Lapita is not evident in the deposits of the present analysis.

Plainware assemblages appear to be present throughout early West Polynesian prehistory and may continue until as recently as ca. 600 (Beta-8682) on Niuatoputapu and ca. 500 cal BP on Tutuila (Clark and Michlovic 1996). A regional chronology for the cessation of ceramic manufacture cannot be estimated on the current data.

The near absence of aceramic cultural deposits in the present analysis may be due to inadequate radiocarbon dating and/or lack of research interest in these sites. The radiocarbon chronology associated with plainware sites suggests that an aceramic period prior to the beginning of the mound building period, ca. 1000 BP, may not exist (cf. Burley 1994:393). Although, as Clarke (n.d.) suggests, the manufacture of ceramics post ca. 1500 BP may not necessarily be a regional phenomenon. If this is the case, then in the West Polynesian cultural chronology the change from ceramic to mound building phases represents, in a culture historical sense, the major temporal change.

Explaining variability in West Polynesian ceramic assemblages

The analysis of the West Polynesian ceramic assemblages suggests that the only major, possibly regional variability in the assemblages may be the presence or absence of dentate stamped decoration and associated complex vessel forms. The available radiocarbon evidence indicates that this variability is not solely a consequence of change through time, although assemblages containing dentate stamped ceramics do appear only in the earlier part of the sequence. This pattern may be explained in three ways:

1. Burley et al. (1999) argue that the loss of dentate stamped decoration in the first few hundred years following colonisation will not be evident in the radiocarbon evidence unless the distribution of a large number of dates from stratified ceramic deposits is investigated. The current radiocarbon sequence does not permit such an investigation. Kirch and Hunt (1993:231) and Kirch (1997:148) have argued that the early dates in association with plainware ceramics in the To'aga site may also suggest the loss of dentate stamped decoration either immediately following, or prior to, colonisation of American Samoa. If dentate stamped decoration disappears early from all of West Polynesia then the dates associated with Lapita ceramics from To.2, possibly To.6 and Fakatafenga are likely to be incorrect. The early disappearance of dentate stamped decoration would explain the regional differences

apparent in the distribution of Lapita and early plainware sites Lapita having disappeared prior to colonisation of most of Samoa (cf. Kirch 1997:148).

2. Decorated Lapita and plainware are different spatial components of the same sites. Due to generally very low percentages of decorated sherds in Lapita assemblages, the differences can be accounted for by sampling error in the recovery of cultural material. This explanation was originally put forward to explain the association of plainware assemblages with early dates in the Pukotala site. Here, Lapita and fully plainware assemblages were found in close proximity (Shutler et al. 1994). The Pukotala evidence has since been reinterpreted in support of the early disappearance of dentate stamped decoration (Burley et al. 1999). Sand (1996:49-50) has argued that the presence of two contemporary ceramic assemblages in the earliest sites from New Caledonia, containing either dentate stamped Lapita ceramics or paddled impressed ceramics known as Podtanean, may be a product of the way in which the sites have been defined. New Caledonian sites and, he (Sand 1996:50) argues West Polynesian sites, are defined as Lapita on the presence of only a few dentate stamped sherds. In two early New Caledonian sites, Lapita and Podtanean sherds have been found to be concentrated in different areas of the sites, the implication being that limited aerial excavation may result in a site being characterised as having only one type of pottery. Some support for this explanation comes from the Melanesian Lapita sites of Nenumbo in the Solomon Islands (Sheppard and Green 1991) and Talapakamalai in the Mussau Islands (Kirch 1997:172–73). In both sites, aerial excavation revealed spatial patterning in the distribution of ceramic types, suggesting different activity areas. Sampling error may account for some of the associations of plainware assemblages with early dates, although this is unlikely to account for the absence of Lapita ceramics from Samoa. Extensive aerial excavation of the Jane's Camp and Falemoa sites, both of which have dates within the accepted Lapita range, recovered only plainware.
3. Lapita and plainware are two different kinds of sites. This was conjectured by Burley et al. (1995) to explain early dates associated with plainware assemblages in the Ha'apai group. A similar explanation has been offered for the early New Caledonian evidence. According to Sand (1996), the presence of Lapita and Podtanean ceramics has been explained as reflecting two separate cultural groups initially colonising New Caledonia (Galipaud 1992). Sand is critical of this interpretation for several reasons. He argues that the radiocarbon chronology associated with the early Podtanean sites should be viewed with caution, since, as with the West Polynesia evidence, there are sampling and contextual difficulties associated with the earliest dates and a lack of integration with other dates (Sand 1996:48). Looking only at the earliest securely dated deposits, Lapita and Podtanean are contemporary; however, Sand (1996) also notes that many of the sites have only a single published date, making interpretation of their chronology difficult. Sand (1996) and others (Galipaud 1990; but see Green and Mitchell 1983) consider that the two ceramic types have different purposes. The presence of Lapita decoration, complex vessel shapes and their porous nature, suggest use as an object of prestige or value, while the thicker, stronger walls and simpler shapes of Podtanean suggest a utilitarian function (Sand 1996:49). If Lapita and plainware sites in West Polynesia similarly represent different kinds of sites, then the near absence of Lapita sites in Samoa must suggest that the activities represented by Lapita ceramics were not practised in Samoa, or were enacted through other kinds of social practice or material culture.

The second and third explanations do not contradict the first. The specialised function of Lapita and/or specialised sites containing Lapita may not have lasted beyond the initial colonisation period. Systematic collection of a large number of dates from Lapita and plainware sites throughout Tonga is required to establish whether the pattern now argued to explain the Ha'apai evidence can be considered regional.

Conclusion

The question remains as to whether the variability present in West Polynesian ceramic assemblages can be considered a sequence — that is, as a series of evolutionary stages in the development of assemblage characteristics which can be argued to reflect social change toward becoming Polynesian. Intrinsic to arguments for the development of an Ancestral Polynesian Society from Lapita in West Polynesia has been the interpretation of the variability in ceramics as a sequence of change through time, from Early to Late Eastern Lapita to Polynesian plainware assemblages. As yet, no single published and securely dated site in West Polynesia shows a transition between the various phases of this sequence.

A number of researchers (e.g. Green 1974b; Groube 1971; Poulsen 1987) have stressed that it is likely that only the decorated component of Lapita disappears. However, rather than investigate this through comparison of the plainware component of Lapita and fully plainware assemblages, research has focussed largely on the decorated ceramics, emphasising differences between Lapita and more recent plainware assemblages.

The evidence presented in this chapter points to a regional signature and continuity in ceramic assemblages that continues throughout most of West Polynesian prehistory prior to 1000 BP, rather than any change through time in the greater part of the ceramic assemblages. Green (1974b:251) identified the transition from Late Eastern Lapita to the distinctive style of Polynesian plainware as a major development, but then states this was 'accomplished largely by focussing on the plain ware component of the Lapita ceramic series'. Golson's (1971) use of a single term, Lapitoid, to describe all West Polynesian assemblages may be a more accurate reflection of ceramic variability in this region. While the social implications of the disappearance of dentate stamped ceramics should not be underestimated, in light of the continuity evident in the majority of the assemblage it is difficult to see this as reflecting social change leading to a distinctly new kind of society. Although we can assume that the disappearance of dentate stamping and complex vessel forms represents some social change, what the nature of that change is not immediately apparent. It may signal the cessation of the behaviour that led to colonisation, but as Anderson and Clarke (1999) point out, if the American Samoan plainware deposits are evidence of initial colonisation, eastward colonisation appears to continue in the plainware period. Further, similar changes from Lapita to post-Lapita ceramics assemblages have been noted in Melanesia and yet these have not been interpreted as the appearance of a distinctly different kind of society.

Although ceramics have been used as the primary material culture correlate for cultural change in West Polynesia, they are perhaps least suited to identifying Ancestral Polynesians in the archaeological record. Ceramics were not manufactured by Polynesian societies at the time of European contact, nor, on current evidence, at any time in East Polynesian prehistory. Hence, looking for patterns in ceramic evidence which suggest an ancestral form of later Polynesian societies is, to an extent, illogical. Other kinds of evidence, especially of a kind recovered from East and later West Polynesian sites, may be more appropriate. This is explored in the subsequent chapters, through investigation of change through time in the non-ceramic component of early West Polynesian assemblages.

8

Non-ceramic artefacts in West Polynesian assemblages

Comparative framework for non-ceramic cultural material

Similarly to the assessment of ceramic assemblages presented in the preceding chapter, sites containing more than one analytical unit are used in this chapter to investigate change through time in non-ceramic artefacts.

In the previous chapter it was established that the major source of variability in West Polynesian ceramic assemblages is the presence or absence of dentate stamped decoration and the associated complex vessel forms identified as Lapita. The local and regional chronology for the disappearance of the former, and any associated behavioural significance, is unclear based on the present evidence. However, as the presence of dentate stamped decoration appears to be the most significant measure of difference in the ceramic assemblages, it provides an important initial framework for investigating variation in the non-ceramic artefact assemblages. The division of the sites into Lapita and plainware assemblages (Table 8.1) is also a division of the region into sub-regions. The Lapita assemblages are all Tongan, while, with the exception of the Niuatoputapu sites, all plainware sites are Samoan or Futunan. Unfortunately, the plainware assemblages from Vuki's Mound, Mangaia Mound and the Northern Ha'apai Lapita Sites have not been fully published.

The assessment of the ceramic sequence did not indicate regional change in ceramic assemblages at ca. 2500 BP as expected from the consensus cultural chronology. However, it does not necessarily follow that temporal variability implied by the phylogenetic model of an Ancestral Polynesian Society will not be evident in other kinds of evidence. To investigate this issue, the radiocarbon chronology has been used to divide the assemblages according to whether they are early or late in the sequence. Where a majority of the radiocarbon age range falls either pre- or post-2500 cal BP

Table 8.1 Lapita and plainware deposits.

LAPITA	PLAINWARE
To.2	To'aga
To.6	Ta'u Village
Tongoleleka	'Aoa
Fakatafenga	Jane's Camp
Faleloa	Falemoa
NT-90	NT-93/NT-100
Mangaia Mound (sub-mound)	Mangaia Mound (mound deposit)
Vuki's Mound (sub-mound)	Vuki's Mound (mound deposit)
Pukotala	Holopeka
Vaipuna	SUVa1
Mele Havea	SUVa4
	SULe12
	SUSa3
	Tavai
	Alofitai

Table 8.2 Analytical units with a radiocarbon chronology dating pre- and post-2500 cal BP.

PRE-2500 CAL BP	POST-2500 CAL BP
Niuatoputapu (NT-90)	Niuatoputapu (NT-93/NT-100)
Jane's Camp (Analytical Unit 1)	Jane's Camp (Analytical Unit 2)
To'aga (Analytical Unit 1)	To'aga (Analytical Unit 3)
Faleloa	Vuki's Mound
Pukotala	Falemoa (Strata III, IV and V)
'Aoa (Analytical Unit 1)	To.6 (Horizons I, II and III)
Holopeka	To.2 (midden)
Mangaia Mound (sub-mound)	SULe12
Vaipuna (Stratum III)	SUVa4
	Tavai
	SUVa1
	Ta'u Village
	SUSa3
	Alofitai

this has dictated the part of the sequence into which it has been placed (Table 8.2).

However, Fakatafenga Cultural Unit IV, NT-90, the middle chronological unit from To'aga, Tongoleleka Cultural Unit III, Unit 1 of Falemoa, Mele Havea, Pukotala and Vaipuna (Stratum II) all have radiocarbon age ranges which span 2500 cal BP and cannot reasonably be assigned to either part of the sequence. The probability distributions of the associated dates (see Chapters 5 and 6) also did not indicate whether each deposit was more likely to date earlier or later in the age range. With the exception of NT-90, these sites have been excluded from the investigation of variability between early and more recent assemblages, but they have been included in analyses of intra-site variability and comparison of Lapita and plainware assemblages. By excluding the listed sites from the first analysis, any distinctions between the early and late assemblages in terms of non-ceramic artefacts should be more clearly defined.

Cultural material present in the disturbed NT-90 assemblage, but absent from the recent NT-93/NT-100 assemblage, may be argued to be associated with the earlier Lapita deposit at NT-90. Material common to NT-90 and NT-93/NT-100 may be associated with the recent NT-90 dates, contemporary with NT-93/NT-100. Therefore, only material exclusively found at NT-90 has been classified as a pre-2500 BP assemblage.

Non-ceramic artefacts from West Polynesian sites are reported and analysed as functional or morphological types. These provide the basis for investigating variability in the assemblages. Table 8.3 lists the number of ceramic and non-ceramic artefacts from each site and the aerial extent of the excavations. While the volume of excavated deposit would provide a more accurate reflection of the extent of the excavation and the density of artefacts, this information was available for only two sites.

Disregarding the flaked stone artefact assemblages (recovered from seven sites) and the worked shell (from five sites), fewer than 100 non-ceramic artefacts were recovered from each site, except To.6 and Vaipuna. When classified according to their various functional and morphological types, the number of artefacts in each category from each site is generally very low, commonly fewer than 10. Coupled with the absence of an accurate measure of artefact density from most sites, this precludes the use of quantitative analysis to compare non-ceramic artefact assemblages within or between sites. In the following discussion, the presence or absence of artefact types is the primary method for assessing inter-site variability and any regional change through time in artefact type and/or morphology. This limits interpretation of the data, but this limitation equally applies to current use of the data to argue for the appearance of an Ancestral Polynesian Society.

Table 8.3 Aerial extent of excavation and quantity of artefacts excavated from securely dated West Polynesian sites.

SITE	AERIAL EXTENT OF EXCAVATION	NUMBER OF SHERDS	NUMBER OF NON-CERAMIC ARTEFACTS (ADZES AND OTHER ARTEFACTS)
NT-90	49.5 m^2	31,405	8866 (8778 pieces volcanic glass)
NT-93/NT-100	39 m^2	8020	1359 (1332 pieces volcanic glass)
Tongoleleka	20 m^2	14,573	105 (22 flakes and miscellaneous lithics)
Fakatafenga	14 m^2	8551	23
Faleloa	16 m^2	27,139	>57
Pukotala	11 m^2	9876	127
Vaipuna	17.5 m^2	15,654	242 (61 miscellaneous worked shell)
Mele Havea	11 m^2	13,378	134
Holopeka	13 m^2	>8000	not reported
To.2	ca. 16 m^2	2690 (rim and dec. sherds)	149 (51 shell net sinkers, 30 coral files)
To.6	73 m^2	1392 (rim and dec. sherds)	154 (29 Cypraea sp. dorsa)
Vuki's Mound	20 m^2	>22,000	not reported
Mangaia Mound	not reported	not reported	not reported
Tavai	6 m^2	7306	92 (56 chert flakes, 24 manuports)
Alofitai	not reported	not reported	not reported
To'aga	39 m^2	2434	136 (31 fish hook tabs, 44 worked shell fragments)
'Aoa	13.5 m^2	878	287 (271 flake stone artefacts)
Jane's Camp	ca. 14 m^2	1642	104 (86 echinoid abraders)
Falemoa	80 m^2	754	84 (25 worked shell fragments)
SUVa1	ca. 121 m^2	401	16
SUVa4	ca. 15 m^2	229	80 (74 obsidian artefacts)
SULe12	ca. 40 m^2	31	14
SUSa3	17 m^2	7460	>37

Assessment of the West Polynesian Adze sequence

The development of the West Polynesian adze sequence was discussed in Chapter 3 and the adze typology summarised in Table 3.5. Green and Davidson (1969) initially delineated a range of Western Samoan adze types, subsequently given regional and chronological dimensions for the whole of West Polynesia by Green (1971). The West Polynesian adze types have been argued to be an intermittent stage in the development of the East Polynesian adze kit from earlier Lapita forms and, through the appearance of new adze types, to reflect the appearance of an Ancestral Polynesian Society in West Polynesia. In the present analysis the adze sequence is assessed only on its internal logic, that is, on whether the context of the excavated adze type conforms to the expectations of the adze sequence and not whether the typology is a useful or valid means to classify variability.

The main characteristics of the sequence are:

- A typology consisting of ten formal adze types designated I to X and a number of sub-types. The ten types have temporal and spatial dimensions considered to reflect cultural difference and change. Green (1971:29) explains the sub-types as 'experimentation with [the] form in the course of modifying the adze kit', but he does not attribute a temporal significance to them. The presence/absence of the various adze types is used as a chronological marker for West Polynesian assemblages.
- All adze types (except Type VIII and possibly Type VII) are found in early Samoan contexts (i.e. in ceramic contexts).
- Type V is the most common adze type found in association with ceramic assemblages. It is consistently used as a chronological marker of early West Polynesian assemblages and may disappear from the sequence with ceramics. The Type V has been described as an innovation of the Ancestral Polynesian Society (Kirch and Hunt 1993:239). The plano-convex cross-

section, which characterises the Type V adze, is considered by Green (1971) to be derivative of earlier Melanesian Lapita adzes and a forerunner of the early Marquesan Hatiheu or plano-convex type adze. As such, it provides a material correlate for the process of Polynesian colonisation and social evolution from Melanesia to East Polynesia.

- Type I, along with Type V, is considered by Green (1974b) to be an early West Polynesian innovation from earlier Melanesian Lapita forms but unlike Type V, was manufactured throughout Samoan prehistory.
- According to Green (1971), Types I, III and IX are found in West and early East Polynesian contexts; Types IVa and V are found in Fijian Lapita, West Polynesia and early East Polynesian contexts; Types IVb, VI and VII are found in Samoan and early East Polynesian deposits; and Type VIII is found in later West Polynesian and early East Polynesian sites.

Adze type representation in the analysed West Polynesian sites

Table 8.4 lists adze types according to the analytical units from which they were excavated. With the exception of adzes from To.2 and To.6, the adze types are those reported by the excavators. The adzes from To.2 and To.6 were originally classified by Poulsen (1967, 1987) and then reclassified by Green (1971) according to his expanded Samoan typology. Green's (1971) classification of the Tongatapu adzes is provided in Table 8.4. For a few sites, the adze type has not been reported. These adzes have been included in the category 'unclassified' (UC), along with those which could not be classified according Green and Davidson's (1969) typology, either because they did not fit a morphological type or because the adze is incomplete. The stratigraphic context of adzes from Faleloa, Vaipuna, Mele Havea and 'Aoa is not fully reported, although all Type V adzes from the 'Aoa site were recovered from the earlier analytical unit (Clark and Michlovic 1996:Table 2). The adze assemblages from Mangaia Mound, Holopeka, Pukotala, Faleloa, Vaipuna, Mele Havea, Alofitai or Ta'u Village, and Vuki's Mound are not fully detailed.

Adzes from some sites were classified into the sub-types defined by Green and Davidson (1969). However, this was not consistent in the published reports, and only the classification Type I to X is given in Table 8.4.

Table 8.4 does not include surface collected adzes, although these were included in the analysis of the adze assemblages from the Niuatoputapu sites (Kirch 1988), Tavai (Kirch 1981) and Jane's Camp (Smith 1976a). Kirch (1988) argues that the surface adzes from the NT-90 site have been recently exposed from underlying cultural horizons, but this is not conclusive and hence only those adzes from secure stratigraphic contexts have been included.

A total of 147 adzes have been recovered from securely dated West Polynesian contexts. Of these, 37% (n=55) are from the Western Samoan sites of SUSa3 and SUVa1, the assemblages which formed the basis of Green and Davidson's (1969) and Green's (1974b) typologies. The remaining 92 adzes were excavated from 16 other sites. Overall, the quantity of adzes from each site is very small and the number excavated from individual sites appears unrelated to the spatial extent of the excavation or the amount or density of other cultural material recovered from the deposits (see Table 8.3). Given the importance assigned to adzes in the development of the West Polynesian cultural chronology, the small size of the assemblages is surprising.

In summary, Table 8.4 indicates that Type V adzes are by far the most commonly represented adze type, followed by Types I and VI. Type V adzes are most common in all sub-regions, but Types I and VI are almost always recovered only from Western Samoan contexts.

The remaining adze types (II, III, IV, VII, IX/X and X) are each represented by fewer than ten specimens. Types II, possibly VII, and IX/X and X were only recovered from Western Samoan contexts, although this pattern may be due to the much greater sample size from the Western Samoan sites than either Tongan or American Samoan contexts.

No Type VIII adzes were recovered from the West Polynesian assemblages. Green (1974b:262) considered this type to be rare and perhaps a more recent Western Samoan form. They have been recovered from early East Polynesian assemblages (Green 1971).

Table 8.4 Adze number and type, according to Green and Davidson (1969), recovered from analysed West Polynesian sites (Code ? = tentative classification by the excavator; UC = unclassified).

SUB-REGION	SITE	ANALYTICAL UNIT	I	II	III	IV	V	VI	VII	IX/X	X	UC	TOTAL
Tonga	Niuatoputapu	NT-90										1	1
		NT-93/NT-100						1				1	2
	Faleloa	not reported										1	1
	Tongoleleka	Unit 2										1	1
	Pukotala	not reported										1	1
	Vaipuna	not reported										4	4
	Mele Havea	not reported										2	2
	Vuki's Mound	mound					?6					p	6
	To.2	midden					2					2	4
	To.6	1					2					6	8
		2				1	1					1	3
		3			2	1							3
		unknown	1				1					5	7
		Total	1		2	2	12	1				25	43
Futuna	Tavai	excavated					?1						1
Western	Jane's Camp	1										1	1
Samoa		2			1		2						3
	Falemoa	Stratum V									1		1
		Stratum IV	1									2	3
		Stratum III	1		1								2
	SULe12	1	1										1
		2					1					3	4
		3	3	?1					1	1		3	9
	SUVa4	sub-mound	2				1					2	5
		mound	2					2					4
	SUVa1	Layer V	2	1	1	1	6	1	1		1	1	15
		Layer IV	1									1	2
	SUSa3	Layers 4 and 5	11	2		3	13	6				2	37
		Layer 3		?1									1
		Sub-total	24	5	3	4	23	9	2	1	2	15	88
American	To'aga	1					?1						1
Samoa		2					3						3
		3				?1	?1						2
	Aoa	1 and 2	?1		?1		3		?1			4	10
		Sub-total	1		1	1	8		1			4	16
Total			26	5	6	7	43	10	3	1	2	44	147

The representation of adze types in assemblages listed in Table 8.4 supports the adze sequence summarised above and in Chapter 3. Type V is the most common type and the other types defined by Green and Davidson (1969) are all represented. There is, however, a number of adzes in the unclassified category, a large proportion of which do not fit any of Green and Davidson's (1969) types. Unclassified adzes represent 30% of the excavated adzes, suggesting that the established typology does not account for all morphological variability in the regional adze assemblage. Although only 25% of the total number of adzes come from Tongan sites, 50% of the unclassified adzes are Tongan. Green and Davidson's (1969) typology was initially developed to classify adzes from Western Samoan contexts. The large number of unclassifiable Tongan adzes may suggest regional differences in the adze assemblages, although this may also reflect differences between Lapita and non-Lapita assemblages. This is discussed in the following section.

The temporal and regional distribution of adze types

Intra-site change through time in the adze sequence

Meaningful investigation of intra-site change through time in the adze sequence is not possible for most sites because the quantity of adzes recovered is too low (e.g. To'aga, Niuatoputapu sites, Falemoa, Jane's Camp and SUVa4), or a great majority of the adzes are concentrated in a single chronological unit in the site (e.g. SUSa3, SUVa1 and SULe12). The 21 adzes from To.6 potentially provide some indication of temporal variability, although the time periods represented by the three horizons are unclear. However, the stratigraphic context of seven of the excavated adzes is unknown (Poulsen 1987:162-75) and, of the remaining 14 adzes, seven could not be classified using Green and Davidson's (1969) typology. This leaves only seven adzes (two Type V in Horizon I; Types IV and V in Horizon II, and Types IV and III in Horizon III); an insufficient amount to attribute a temporal significance.

Comparison of Lapita and non-Lapita adze assemblages

Green (1974b) attributed a temporal significance to adze types by their association with Lapita, coarse plainware or fine plainware assemblages. His findings were presented in Table 3.3 (Chapter 3) and may be summarised as follows:

- Types I, IV, V and possibly III are early, associated with Lapita and plainware ceramics.
- Types IX/X and X are probably early, ca. 2500 BP.
- Types II and VI are associated with coarse ware.
- Types VII and VIII are late and probably associated with aceramic sites.

Green (1974b) acknowledged that information regarding the adzes from the early part of the Samoan sequence was missing and that this chronology was based on Lapita sites in Tonga and plainware sites in Western Samoan dated no earlier than ca. 2400 BP.

Table 8.5 lists the adze type representation in Lapita, plainware and aceramic contexts, according to the analytical units of the present analysis. The aceramic contexts are those identified as aceramic by the excavators, but which may contain a small amount of plainware ceramics. As Green (1971, 1974b) argued, there are differences in the adze types found in Lapita and plainware assemblages. Recent research appears to support the association of adze types identified by Green (1974b) and summarised above. Types II, VI, VII and IX are found only in association with plainware. With the exception of Type IX, this supports Green's (1971) finding that Types II, VI and VII are found only in Samoan assemblages. Green (1971) found Type IX to be present early in the Samoan sequence, but it was not recovered from Lapita or early plainware contexts included in the present analysis.

Sample size may account for at least some of the differences between the Lapita and plainware adze assemblages. A total of 92 adzes was recovered from plainware contexts, but only 28 from Lapita contexts. Of the latter, only three adzes were recovered from securely dated Lapita contexts in northern Tonga. Both adzes from NT-90 and Tongoleleka were unclassifiable and the type of adze recovered from Faleloa is not described. No adzes were recovered from Fakatafenga. Although the aerial extent of the To.6 excavation is much greater than that of the other Lapita sites (see Table 8.3), this seems insufficient to account for the large number of adzes recovered from To.6, compared to the other Lapita sites. Twenty-one adzes were recovered from secure stratigraphic contexts in To.6, but a total of only seven from the remaining Lapita sites.

There are also differences in the adze types from Lapita and aceramic sites. Types I, IV and V are found in both contexts, while all the remaining types are found in only one or the other context. The differences may reflect a change through time in adze manufacture, but this too may be explained as regional variation. The near absence of Type V adzes in aceramic deposits appears to support Green's (1971) finding that this type probably disappears from West Polynesian assemblages at the same time as ceramics. However, ceramics from these 'aceramic' contexts, with the exception of To'aga, have been argued by Green (1974b) to be intrusive in the deposit, having originated from an earlier ceramic

Table 8.5 Adze type representation in Lapita, plainware and aceramic contexts. Note that the stratigraphic context and hence ceramic association of adzes from Vaipuna, Mele Havea and Pukotala has not been reported (Code UC = unclassified).

CERAMIC ASSEMBLAGE	SITE	I	II	III	IV	V	VI	VII	IX/X	X	UC	TOTAL
Lapita	NT-90										1	1
	Faleloa										1	1
	Tongoleleka										1	1
	To.2					2					2	4
	To.6	1		2	2	4					12	21
	Total	1		2	2	6					17	28
Plainware	Vuki's Mound					?6						6
	Jane's Camp			1		2					1	4
	NT-93/NT-100						1				1	2
	Falemoa	2		1						1	2	6
	SULe12, Unit 1	1										1
	SUVa4, sub-mound	2				1					2	5
	SUVa1, Layer V	2	1	1	1	6	1	1		1	1	15
	SUSa3, Layers 4 and 5	11	2		3	13	6				2	37
	To'aga				?1	4						5
	Aoa	?1		?1		3		?1			4	10
	Tavai					?1						1
	Total	19	3	4	5	31	8	2		2	13	92
Aceramic	SULe12, Units 2 and 3	3	?1			1		1	1		6	13
	SUVa4, mound	2					2					4
	SUVa1, Layer IV	1									1	2
	SUSa3, Layer 3		?1									1
	To'aga, Unit 3				1							1
	Total	6	2		1	1	2	1	1		7	21

deposit. If this is so, then some proportion of the adzes might equally be argued to be in a secondary context and to be more properly associated with plainware ceramic assemblages.

In summary, there is no clear typological division between Lapita adzes and those in plainware deposits, with all Lapita types found associated with plainware as well. Type V is dominant in both groups. Plainware sites have a number of types which do not occur in Lapita deposits; however, sampling bias cannot be ruled out in these cases. Approximately 77% of the plainware site adzes are types found associated with Lapita.

Regional change through time in the adze assemblages

An association of adze types with Lapita and plainware ceramics can no longer be automatically used to establish their chronology. Variability in the morphology of adzes from Lapita and plainware sites may reflect different site types or regional variation (discussed below). To investigate change through time, the radiocarbon chronologies provide a comparative framework. Table 8.6 shows the presence of adze types from deposits dated pre- and post-2500 BP (the sites are listed in Table 8.2).

Table 8.6 The presence of adze types reported in deposits dated pre- and post-2500 BP. Note that this excludes adzes from To'aga Unit 2, Fakatafenga Unit IV, Tongoleleka Unit III, Falemoa Unit I, Vaipuna, Mele Havea and Pukotala (Code: UC = unclassified).

	ADZE TYPE										TOTAL
	I	II	III	IV	V	VI	VII	IX/X	X	UC	
Pre-2500 BP deposits					4					2	6
Post-2500 BP deposits	25	5	4	7	36	10	2	1	1	29	120

Six adzes, consisting of three Type V ('Aoa, Unit 1), one possible Type V (To'aga , Unit 1) and two unclassified adzes (one each from Niuatoputapu and Tongoleleka, Unit 1), were recovered from contexts which, on radiocarbon evidence, pre-date 2500 cal BP. It is possible that further adzes from the 'Aoa site were recovered from the early analytical unit, but their stratigraphic context has not been reported. A total of 120 adzes of 10 different types were recovered from deposits that, on radiocarbon evidence, post-date 2500 cal BP. To some extent this difference is likely to reflect the greater number of more recent deposits, but it may also reflect a shorter time span represented by the early deposits.

In Chapter 7 it was suggested that one explanation for the current distribution of Lapita and plainware sites is the loss of dentate stamped decoration very early in the sequence, prior to the colonisation of much of Samoa. If so, the available radiocarbon chronologies for To.2 and To.6 deposits are unlikely to date the manufacture of the dentate stamped pottery recovered from both sites.

Table 8.7 shows the distribution of adze types from Lapita and pre-2500 cal BP plainware deposits, and those from post-2500 cal BP plainware deposits. This only slightly increases the range of adze types in early deposits. However, half the early adzes could not be classified according to the Western Samoan typology. Five of the early adzes are from Samoan contexts. In the post-2500 cal BP adzes, 15% could not be classified, but only seven of the 94 adzes come from Tongan contexts. It appears the earlier, predominantly Tongan adzes include a range of types which do not appear in the more recent assemblages and that a number of adze types (II, VI, VII, IX/X) are innovations which appear after ca. 2500 cal BP in Samoa. It should be remembered that the near absence of well documented Tongan plainware assemblages precludes investigation of whether these innovations are West Polynesian or limited to Samoa.

The relatively small number of adzes from pre-2500 cal BP contexts may be explained by the Lapita assemblages representing a relatively short period of time in comparison to the plainware assemblages.

Table 8.7 Adze types found in Lapita and pre-2500 cal BP, and post-2500 cal BP deposits (Code: UC = unclassified).

	ADZE TYPE									TOTAL
	I	II	III	IV	V	VI	VII	IX/X	X	UC	
Lapita and pre-2500 BP plainware deposits	1		2	2	10					17	32
Post-2500 BP deposits	24	5	2	5	30	10	2	1	1	14	94

Sources of variability in adze typology

The investigation of adze type representation in West Polynesian assemblages reinforces many of Green's (1971) findings about the distribution of the adze types and the range of types that seem to appear with late plainware assemblages in Samoa. The explanation of this pattern simply as change through time or as indicative of cultural change is questionable. The adze sequence as outlined in Chapter 3 is not a sequence per se, but a characterisation of variability (cf. Cleghorn 1992:129). There is no sense of the development of new adze types from existing ones, or of change through time within a type. The adze types are static entities, and, with the exception of Type III being a fully ground form of Type I (Green 1974b:258), no continuum between the types has been argued, either on technological or morphological evidence. Given that the examples of each adze type are mostly few, the presence or absence of most types from individual sites can be explained in terms of sample size. Nonetheless, at a regional scale the evidence does suggest some differences in the distribution of adze types and in their chronology.

Variability in adze morphology can be attributed to function and raw material availability, as well as stylistic or cultural preference. As discussed in Chapter 3, although Green (1974b) recognised these factors as influencing adze morphology this issue was never explored in relation to morphological variability in the adze typology.

Excavators refer to the analysed sites variously as middens, mounds, houses or structures. This implies different kinds of activities are likely to have taken place in each site, although this distinction may reflect the structure of the site at the time of excavation, rather than the presence or absence of structures in the past. In Table 8.8 the adze types associated with each site type are listed. The distribution of adze types does not appear to vary markedly between the site types, perhaps reflecting a similar range of uses for adzes at all sites. However, the concentration of adzes do differ markedly. Fifty-two adzes were excavated from only two 'house' sites, whereas 57 were recovered from 14 midden sites.

Green (1974a, 1991) has suggested that once people colonised across the Andesite Line a new and different range of basalts was available for adze manufacture. Although never detailed with reference to specific adzes or technologies of reduction, Green (1974b:144) considered that the oceanic or olivine basalts east of the Tongan archipelago would have affected the process and outcome of adze manufacture:

> when people crossed the Andesite Line to settle in Samoa and the rest of Polynesia, they found it necessary to manufacture their entire adze kit from a restricted range of fine-grained basalts whose flaking properties and strengths differed from those of the materials previously used. This resulted in changes in adze technology and typology. For example it appears to have led to a certain amount of experimentation in Samoa, the results of which are reflected in the early Samoan adze kit.

No specific evidence is offered in support of this; however, such a finding seems plausible given the now large body of literature available concerning the influence of raw material on the technology and outcome of stone artefact manufacture. A similar argument for the variability observed in early East Polynesian assemblages is offered by Anderson et al. (1994:36). Table 8.9 lists the raw materials and sources of the basalt found in sites where this information is reported, along with the presence of basalt debitage suggesting adze manufacture, resharpening or use at the various sites.

Table 8.8 Adze types associated with various West Polynesian site types (Code: ? = typology of the adze has been questioned by the excavator; P = present).

SITE TYPE	SITE	I	II	III	IV	V	VI	VII	IX/X	X	UC	TOTAL
Midden	NT-90										1	1
	NT-93/NT-100						1				1	2
	Faleloa										1	1
	Tongoleleka										1	1
	Pukotala										1	1
	Vaipuna										4	4
	Mele Havea										2	2
	To.2					2					2	4
	To.6	1		2	2	4					12	21
	Jane's Camp			1		2					1	4
	Falemoa	2		1						1	2	6
	Tavai					?1						1
	To'aga				?1	5						6
	Aoa	?1		?1		3		?1			4	10
	Sub-total	4		5	3	17	1	1		1	25	57
Mound	Vuki's Mound					?6					P	6
	SUVa4	4				1	2				2	9
	SUVa1	3	1	1	1	6	1	1		1	2	17
	Sub-total	7	1	1	1	13	3	1		1	4	32
House	SULe12	4	?1			1		1	1		6	14
	SUSa3	11	3		3	13	6				2	38
	Sub-total	15	4		3	14	6	1	1		8	52
	Total	26	5	6	7	43	10	3	1	2	37	147

Table 8.9 Adze raw material type and source and basalt debitage.

SITE	RAW MATERIAL	SOURCE	No. OF BASALT FLAKES	GROUND BASALT FLAKES	REFERENCE
NT-90	andesite or basalt	unidentified, possibly local	75	no	Kirch 1988:192
NT-93/NT-100	andesite or basalt	unidentified, possibly local	31	no	Kirch 1988:192
Tongoleleka	volcanic stone	exotic to Tonga	7	yes	Dye 1987:135
Fakatafenga	volcanic rock	not reported	16	yes	
To.6	?	Ha'apai, 'Eua, Samoa/Uvea	not reported		Poulsen 1987:263
Tavai	basalts (3 types)	not reported	2	no	Kirch 1981
To'aga	basalt	local, except one from Tatagamatau	19	no	Weisler 1993
'Aoa	basalt	local	3559	yes	Clark and Michlovic 1996
Jane's Camp	several types	unidentified	not reported		
Falemoa	?		160	yes (?)	Lohse 1980
SUVa1	basalt	local	46	yes	Green 1969e
SUVa4	fine-grained basalt	local	56	yes (?)	Green 1969a
SUSa3	olivine basalts and hawaiites	local	89	yes (?)	Green 1974a
SULe12	basalt	local	present	yes	Davidson and Fagan 1974

Although this information is available from only a few sites and is limited in detail, it appears that, where a basalt source is reported, in all the Samoan sites except Jane's Camp and Falemoa, the basalt is local, or at least from the Samoan archipelago and presumably olivine basalt or hawaiite (see Best et al. 1992). In the Tongan sites, except those on Niuatoputapu, a non-local source is suggested. This is not surprising given Tongatapu and the Ha'apai Islands are raised coral and have no immediately local basalt sources.

The apparent use of local sources of basalt for adze manufacture in Samoa supports an argument for regional differences in adze morphology if the relationship between raw material, technology of reduction and outcome holds true. The available evidence is insufficient to demonstrate this.

Discussion

Green (1971) has argued that the West Polynesian adzes represent an intermediate stage between Melanesian Lapita and early East Polynesian adze assemblages and therefore provide evidence of a cultural link between the regions and of cultural development from Lapita to Ancestral Polynesian to early East Polynesian society. Variability between the West Polynesian adzes associated with Lapita and plainware assemblages appears, on the basis of the above analysis, to confirm Green's finding that there is some development in the range of adze types over time, at least in Samoa. This is suggested by the present evidence, but is not conclusive because the radiocarbon chronologies associated with Lapita and plainware do not clearly indicate a regional change through time from one assemblage to another. The adze typology itself merely describes variability in measurements of morphological characteristics and adze cross-sections, but does not explain this variability. An explanation for the appearance of new adze forms is suggested through regional differences in raw material availability likely to affect the technology and outcome of adze manufacture, although this remains to be adequately demonstrated. Such an explanation does not imply an accompanying social or cultural change. Social or cultural change may be taking place at the same time, but it has not been theorised as to how this would be reflected in the present evidence.

The other artefact component of West Polynesian assemblages

Other artefacts include all non-ceramic artefactual material, except adzes and adze manufacturing debris, and encompass a large range of artefacts manufactured from stone and organic material.

Analysis and interpretation of these artefacts has largely consisted of associating artefacts with a general descriptive or functional class such as ornament, fishing gear, food preparation tool or stone artefact (see Chapter 3). Within these classes some artefacts are assigned a more specific function, such as vegetable peeler or net sinker. The class or function is assigned to the artefact because it has a morphological similarity to artefacts so classified in ethnographic and/or archaeological literature.

Six assemblages in the present analysis (SUVa1, SUVa4, SUSa3, SULe12, 'Aoa and Tavai) are from depositional contexts which do not preserve organic material. In these sites, only a small number of non-ceramic artefacts, primarily stone, have been recovered. Shell and bone artefacts are absent.

Recovery strategies are rarely specifically discussed by the excavators and probably differ between sites, affecting the range of artefacts recovered. Only Kirch and Hunt (1993) and Janetski (1980a) refer to the presence of worked shell and systematically collected it from at least some of their excavation units in the To'aga and Falemoa sites, respectively. Given the lack of general criteria for recognition of worked shell, it may be premature to assume that when worked shell is not reported, it was not present in the site. The same may be true of reworked shell and bone artefacts, previously unreported artefact forms (Smith 1991) and amorphous flaked stone artefacts.

The extent of the categorisation of artefacts as functional or descriptive types also varies between site reports. Although most general types such as shell ring fragment appear to be commonly used, in some cases this category may be subdivided according to raw material, for example *Trochus* ring fragment; and/or on morphological characteristics, for example 'broad' or 'narrow' shell ring fragment. In the following discussion, the categories as used by the excavators have been retained where possible, but in some cases, to make the assemblages comparable, the range of descriptive categories has been condensed.

The categorising of assemblages as Ancestral Polynesian implies both an internal consistency in their range of artefacts and that the assemblage is in some way distinct from earlier Lapita assemblages of which they are derivative. This is explored below through comparison of the other artefact component of Lapita and plainware assemblages. It can be reasonably expected that some change through time in the other artefact component, unrelated to the associated ceramic assemblage, would be visible in the West Polynesian sites which contain more than one analytical unit and, in particular, those for which the associated radiocarbon chronology suggests a long occupation sequence. The evidence for change through time in the other artefact assemblages from sites with more than one analytical unit is discussed below.

Intra-site change through time in the other artefact component

The range of artefact types and their raw materials from the Niuatoputapu sites, Fakatafenga, Tongoleleka, To.6 and To.2, Jane's Camp, Falemoa and To'aga is presented in Table 8.10, according to general artefact types and broad functional classes. Although this tends to reduce the apparent range of artefacts in some sites, it presents a more standardised picture of the range recovered. For example, perforated shell units are in some sites described either as squat or long units (see Table 5.5), but this is purely descriptive and no behavioural or functional rationale is offered. Similarly, where shell discs or rings are manufactured from a variety of shell species, the relevance of this to their description/explanation as ornaments or shell valuables has not been discussed by the excavators. Further, the overall numbers of artefacts in each category is invariably too low to assign any significance to the presence of *Conus* ring fragments in one analytical unit and *Tridacna* ring fragments in another, for example.

Although Table 8.10 includes only those sites for which an other artefact component is reported from more than one analytical unit, it provides an indication of the quantities of artefacts and the range of types generally recovered from West Polynesian assemblages where organic remains are preserved.

The number of artefacts recovered from each site is small. Poulsen's (1987:214–15) observation regarding the non-ceramic artefacts from the Tongatapu assemblages could apply equally to all the assemblages:

Table 8.10 Other artefacts reported from early West Polynesian sites with more than one analytical unit (Code: P = present).

SITE	ANALYTICAL UNIT	MANUFACTURING TOOLS										FOOD PREPARATION TOOLS		
		SHELL ADZE	HAMMER-STONE	FILE	HAMMER/FILE	ABRADER	NEEDLE/AWL	BONE POINT	STONE CHISEL/POINT	GRINDER	SHELL PEELER	SHELL SCRAPER	SHELL PARING KNIFE	SHELL TOOL
Niuatoputapu	NT-90	1	4			7					1	6		
(see Table 5.1)	NT-93/NT-100	3	3			3						5		
Tongoleleka	Unit III					3								
(see Table 5.2)	Unit II	1	2			5			1					
	Unit I	1				1								
Fakatafenga	Unit III		2											
(see Table 5.3)	Unit II	1	6											
	Unit I													
To.2	Midden		3	30	1									2
To.6	Horizon I			5	1		2			18			3	1
(see Table 5.5)	Horizon II		2	2			1			10			1	
	Horizon III			4						3			2	
Jane's Camp	Unit 1					P								
(see Table 6.10)	Unit 2					>34						2		
Falemoa	Stratum II				1				1					
(see Table 6.12)	Stratum III				2						2	3		
	Stratum IV	1	1		5						2			
	Stratum V													
To'aga	Unit 1	1				3		?1						
(see Table 6.5)	Unit 2		2			4								
	Unit 3					1								

Table 8.10 cont.

SITE	ANALYTICAL UNIT	FISHING GEAR				ORNAMENT/VALUABLE					
		FISH HOOK	FISHHOOK BLANK	NET WEIGHT	OCTOPUS LURE	SHELL RING FRAGMENT	SHELL/CORAL DISK	BEAD	SHELL UNIT	SHELL PENDANT	DRILLED TOOTH
Niuatoputapu	NT-90		7	P		13	2	2	1		
(see Table 5.1)	NT-93/NT-100	3	1	P		2					
Tongoleleka	Unit III					4			3		
(see Table 5.2)	Unit II				5	20	3		3		
	Unit I				1	4				1	
Fakatafenga	Unit III				6	1					
(see Table 5.3)	Unit II				6						
	Unit I										
To.2	Midden			51	1	33		2	3		
To.6	Horizon I			6	20	3		1	7		
(see Table 5.5)	Horizon II			10	7	4		1	2		
	Horizon III			4	2			2	2		
Jane's Camp	Unit 1										
(see Table 6.10)	Unit 2				1	1					
Falemoa	Stratum II	1			3			2			
(see Table 6.12)	Stratum III				1	10	1				
	Stratum IV	2				1					
	Stratum V	1				2	1				
To'aga	Unit 1	?1	?		3			1			
(see Table 6.5)	Unit 2	4	2			6		6			1
	Unit 3	1	1								

Table 8.10 cont.

SITE	ANALYTICAL UNIT	MISCELLANEOUS								
		WORKED SHELL	WORKED BONE	WORKED CORAL	OCHRE/ HEAMATITE	VOLCANIC GLASS/ OBSIDIAN	FLAKED CHERT	FLAKED SILICEOUS STONE	SEA URCHIN FILE	STONE BALL
Niuatoputapu	NT-90	p	2		1	8778	38			
(see Table 5.1)	NT-93/NT-100	p	2			1332	1			
Tongoleleka	Unit III									
(see Table 5.2)	Unit II							2		
	Unit I							1		
Fakatafenga	Unit III									
(see Table 5.3)	Unit II									
	Unit I							1		
To.2	Midden	15			8					
To.6	Horizon I	6			3					4
(see Table 5.5)	Horizon II	4								1
	Horizon III	4			1					
Jane's Camp	Unit 1									
(see Table 6.10)	Unit 2	1	3							
Falemoa	Stratum II	2				1				
(see Table 6.12)	Stratum III	4	1	1		1				
	Stratum IV	7		1						
	Stratum V	4								
To'aga	Unit 1	?								
(see Table 6.5)	Unit 2	1				1				
	Unit 3	?								

[they] occur in such low numbers that it is uncertain whether their absence from a particular period is real or not, while few are present in sufficient quantities for us to talk about trends over time.

The relative absence of non-ceramic artefacts from West Polynesian assemblages is interesting in itself, especially in relation to the relatively high density of artefactual material in Lapita sites to the west and in early East Polynesian sites. This is discussed below.

In a small number of cases, individual artefacts are found in relatively large quantities. With the exception of flaked stone artefacts, these are usually artefacts such as net weights, echinoid spine abraders and octopus lures. There are no established criteria for identifying the intentional modification of these 'artefacts', which may, in their morphology, mimic non-cultural breakage and/or wear patterns (see Smith 1991; Spennemann 1993).

With the exception of food preparation tools, the various functional classes of artefacts are found in all sites. Food preparation tools are rare (or unrecognised) in all sites and absent from the Ha'apai sites of Tongoleleka and Fakatafenga, and from To'aga. The significance of the near absence of such tools from early West Polynesian sites is discussed in Chapter 9.

With regard to evidence for intra-site change through time in the other artefact component, where an artefact type is recovered from a site it is generally recovered from more than one analytical unit and no intra-site change through time in artefact type is suggested. However, there are several exceptions to this. There is a far greater range of manufacturing tools in To.6 than in To.2. The radiocarbon chronology associated with these deposits does not permit an explanation of change through time, but may indicate spatial variability in Lapita assemblages.

Two significant differences are evident in the flaked stone and shell ornaments/valuables from NT-90 and NT-93/NT-100. Although volcanic glass is present in both assemblages, it is found in far greater quantities in NT-90 than the more recent assemblages. Further, with the exception of a single artefact, flaked chert is found only in NT-90. A greater variety and number of shell ornaments is found in NT-90. Kirch (1988:242) found little variability in the Niuatoputapu other artefact assemblages, but noted the differences in flaked stone assemblages and the presence of shell valuables in the earlier phase represented by NT-90. He explained these differences as reflecting 'a major decline in long-distance exchange links with other West Polynesian communities' (Kirch 1988:243) from the Lapita to plainware periods. The shell ornaments/valuables are all finished items and none were recovered in the process of being manufactured (although worked shell is reported but not described). Therefore, according to Kirch (1988:254-5), Niuatoputapu is likely to have been an importing node in the exchange system of Lapita sites in West Polynesia. While this may be the case, the differences between the NT-90 and NT-93/NT-100 assemblages are not necessarily temporal and may suggest spatial variability in contemporary assemblages. Nonetheless, shell ornaments and exotic raw materials do appear to be more frequently recovered from Lapita than plainware deposits (see below).

Non-ceramic artefacts are virtually absent from the earlier analytical unit of Jane's Camp. A behavioural explanation for this is not apparent, although the volume of excavated deposit comprising Analytical Unit 2 (the more recent stratigraphic unit) is far greater than that of Unit 1 (Smith 1976a:Fig. 15).

With the exception of Kirch (1988) discussed above, no change through time in the nature of the other artefact assemblages has been noted by the excavators, although Poulsen (1987:216) identified a decrease over time in the quantity of non-ceramic artefacts in the Tongatapu assemblages. In To.6 the numbers of artefacts from the three horizons, listed in Table 5.5, appear to confirm this, although no information is available concerning the relative volume of deposit in each horizon and consequently the relative density of artefacts is unknown.

In summary, a quantitative analysis of intra-site change through time is not possible for the other artefact assemblages. The presence/absence of artefact types suggests some differences within the sites which may reflect change through time, but this is not evident in all assemblages or in the same range of artefacts, and is inconclusive on present evidence.

Comparison of other artefact component of Lapita and plainware sites

Table 8.11 lists the presence of non-ceramic artefact types in West Polynesian Lapita and plainware sites. Where the species from which a shell artefact was manufactured is reported, it has been listed. Artefacts found in both NT-93/NT-100 and NT-90 have been included as associated with plainware, rather than Lapita. Those recovered from NT-90, but not NT-93/NT-100 have been included with Lapita ceramics.

Fewer Lapita than plainware deposits are included in the present analysis and non-ceramic artefact assemblages from the Ha'apai Lapita sites are very limited in number and range (see Table 8.10 and Chapter 5)[1]. Nonetheless, similar numbers of artefact types have been recovered from Lapita and plainware sites, although there are some differences in the range of artefacts. Several factors need to be taken into account in interpreting these differences:

- Artefacts are not uniformly categorised or collected from the sites. In particular, no flaked stone artefacts were collected by Poulsen (1987), although he notes their presence in the Tongatapu sites.
- Organic remains, and therefore shell and bone artefacts, were preserved in all Lapita sites, but in only a few plainware sites.
- Lapita sites are more commonly found in locations where there are no immediate stone sources which may result in a greater reliance on shell as a raw material. The inland plainware sites of SUSa3 and SULe12, the Samoan mound sites of SUVa1 and SUVa4, and the American Samoan 'Aoa site contain the largest reported range of stone artefacts and this may reflect the

[1] Excavations in the Ha'apai sites have recovered a more extensive range and quantity of other artefacts (Burley n.d.), but the stratigraphic context and association of these artefacts with Lapita, plainware or more recent assemblages has not yet been published.

Table 8.11 Comparison of functional classes of other artefacts recovered from West Polynesian Lapita and plainware sites (Code: 1 = To'aga; 2 = Jane's Camp; 3 = Falemoa; 4 = NT-93/NT-100; 5 = NT-90; 6 = To.2; 7 = To.6; 8 = Tongoleleka; 9 = Fakatafenga; 10 = Faleloa; 11 = Vuki's Mound; 12 = Ta'u Village; 13 = SUVa1; 14 = SUVa4; 15 = SUSa3; 16 = SULe12; 17 = 'Aoa; 18 = Tavai).

FUNCTIONAL CATEGORY	DESCRIPTIVE CATEGORY	LAPITA	PLAINWARE
manufacturing tools	stone adze	6, 7, 8	1, 3
	shell adze	8, 9, 6, 7	1, 3, 4
	abrader (echinoid)	7, 8	1, 2, 3, 4
	abrader (coral)	6, 7, 8, 10	2, 4
	abrader (stone)		13
	shell chisel/gouge	6, 7, 10	
	hammerstone	6, 7, 8, 9	1, 2, 3, 4, 13, 17, 18
	grindstone		13, 14, 15, 18
	stone chisel		3
	stone file		13, 16
	coral grinder	7	
food preparation tools	shell scraper	7	2, 3, 4
	shell peeler	5	3
	shell knife	7	
fishing gear	fishhook	7	1, 3, 4
	fishhook blank	10	1, 4
	net weight	6, 7	4, 13
	octopus lure	6, 7, 8, 9	1, 2, 3
ornaments or valuables	shell bead	5, 6, 7,10	1
	bone bead	7	3
	Conus ring	6, 7	1, 3, 4
	Conus disk	5, 8	1, 3
	Tridacna ring	5, 6, 8	1
	Trochus ring	5, 8	
	drilled tooth		1
	shell ring	7, 8, 9, 10	2
	bi-perforated shell unit	5, 8	
	shell pendant	7, 8	
	shell unit	6, 7	11
miscellaneous	flaked stone	8, 9, 10	1, 2, 12, 13, 17
	flaked siliceous stone	6, 7, 8, 9	4, 15, 16, 17, 18
	obsidian/volcanic glass	5	1, 3, 4, 14, 15, 16, 17
	abraded haematite/ochre	5	15
	stone point	8	
	worked shell	6, 7	1,2, 3
	worked bone	7	2, 3, 4
	worked coral	6, 7	3, 12
	stone ball	7	2

availability of stone. These sites also contained comparatively large assemblages of stone adzes (see earlier discussion).

Given the likely influence of these factors on the distribution of artefact types, Lapita and plainware deposits are not markedly different in their other artefact components. If plainware deposits derive from Lapita, the disappearance of dentate stamped decoration and complex vessel forms does not appear to be reflected in either a range of new artefact types or a marked loss of older types. A possible exception to this is in the presence of a range of shell ornaments in Lapita sites that are not found in the plainware sites where shell has preserved. This may support Kirch's (1988) argument (discussed above) that the shell ornaments recovered from NT-90 are valuables in an exchange network existing during the Lapita period, but subsequently declining or disappearing. However, Groube (1971:300) has described the Vuki's Mound plainware deposit as rich in shell artefacts, similar to those excavated from Lapita deposits by Poulsen (1987). With the exception of shell units, these have not been described.

In general, the available evidence suggests continuity rather than change in the other artefact component. Interpretation of the kinds of behaviour or activities reflected by the non-ceramic artefacts has been limited to that implicit in the functional categories into which they have been placed, initially by the excavators, and retained in the present analysis. Given this, it is not possible to identify specific behaviours reflected by individual artefact types that may be subtly represented in the technology of manufacture of artefacts. The lack of what are commonly described as valuables (i.e. decorated pots and shell ornaments) from plainware sites may indicate some social change or the transference of the social function of these items elsewhere.

Regional change through time in the other artefact assemblages

To investigate whether there is any regional change through time in the other artefact component, not evident in individual sites, and which may be unrelated to the associated ceramic assemblage, the other artefacts are listed in Table 8.12 according to their association with analytical units dated pre- or post-2500 BP. It should be noted that the range of artefacts listed differs marginally to those of Table 8.11 due to several analytical units not being included owing to their associated radiocarbon chronology spanning 2500 BP.

Of the analytical units listed in Table 8.2, eight fully pre-date 2500 cal BP; however, of these, the other artefact components of two, Mangaia and Holopeka, have not been reported. Only a single artefact and a single type of artefact were recovered from Pukotala and Jane's Camp, respectively. There are 14 post-2500 cal BP deposits, but the other artefacts are not fully reported from Vuki's Mound and Alofitai, and organic remains were not preserved in SULe12, SUVa4, SUVa1 or SUSa3. Here, again, the small quantity of artefacts does not permit interpretation based on quantitative analysis, only on the presence of artefact types, although the very limited pre-2500 cal BP deposits may not give an accurate type representation. The three factors listed earlier as influencing the distribution of artefacts (categorisation and recovery strategies, preservation, and raw material availability) equally need to be recognised in the interpretation of Table 8.12.

There appear to be significant differences in the range of artefacts pre- and post-2500 cal BP, suggesting a change through time that is unassociated with variability in ceramic assemblages. Only two artefact types appear in the earlier assemblage which were not recovered from post-2500 cal BP deposits, but 12 artefact types appear in the post-2500 cal BP assemblages and not in the earlier assemblages. However, this may be misleading because of these 12 types, nine are present in the Lapita sites of To.2 and To.6. It is the inclusion of these deposits with the post-2500 cal BP deposits that creates the disparity in artefact type representation, giving an impression of temporal change in the other artefact assemblages, emphasised by the limited sample from pre-2500 cal BP contexts. The question remains whether radiocarbon determinations associated with To.2 and To.6 are an accurate reflection of the chronology of the deposits. If a post-2500 cal BP date is accurate, then the Tongatapu assemblages almost exclusively account for the differences in artefact representation between the early and more recent deposits.

Fishhooks in West Polynesian assemblages

Along with ceramics and adzes, fishhooks are the third artefact class to be used by Pacific archaeologists, in particular those working in East Polynesia, to determine cultural and temporal relationships between excavated assemblages. Fishhook morphology has been employed both as an indicator of variability in fishing strategy (Kirch and Dye 1989) and of social/cultural change (Allen 1996). Until recently, the near absence of fishhooks from excavated deposits in West Polynesia precluded these kinds of analyses being undertaken in the region and associations between early West and East Polynesian assemblages being established using artefacts other than adzes. The recovery of a relatively large assemblage of 28 fishhooks and 31 fishhook tabs from the To'aga site provided the first good evidence for early West Polynesian fishhook manufacture. The excavators argue that the assemblage can be seen as a proto-type stage from

Table 8.12 Comparison of non-ceramic artefact types present in West Polynesian assemblages dating pre- and post-2500 BP [Code: 1 = Niuatoputapu (NT-90); 2 = Jane's Camp (Analytical Unit 1); 3 = Faleloa; 4 = To'aga (Analytical Unit 1); 5 = Pukotala; 6 = 'Aoa (Analytical Unit 1); 7 = Niuatoputapu (NT-93/NT-100); 8 = Jane's Camp (Analytical Unit 2); 9 = To'aga (Analytical Unit 3); 10 = Falemoa (Strata III, IV and V); 11 = To.6 (Horizons I, II and III); 12 = To.2 (midden); 13 = SULe12; 14 = SUVa4; 15 = Tavaii; 16 = SUVa1; 17 = Ta'u Village; 18 = SUSa3; 19 = 'Aoa (Analytical Unit 2); 20 = Vuki's Mound].

FUNCTIONAL CLASS	DESCRIPTIVE TYPE	PRE-2500 CAL BP	POST-2500 CAL BP
manufacturing tools	adze	2, 3, 4, 6	8, 9, 10, 14, 15, 16, 18, 19
	shell adze		7, 9, 11, 12
	abrader (echinoid)	2, 3, 4	7, 8, 9, 10, 11
	abrader (coral)	3	11, 12
	shell chisel	3	12
	shell gouge or knife		11
	bone needle or awl		11
	coral grinder	1	7, 11, 16
	grindstone/abrader	1	11, 13, 15, 16, 18
	hammerstone	1, 6	10, 11, 12, 14, 15, 16, 18
	stone file		11, 12, 13, 16
food preparation	shell scraper		7, 8, 10, 12
	shell peeler	1	10
	shell knife		11
fishing gear	fishhook	?4	7, 9, 10
	fishhook blank	3, ?4	7, 9, 11
	net weight	1	7, 11, 12, 17, ?18
	octopus lure	4	8, 10, 11, 12, 16
ornaments or valuables	shell bead	1, 3	11, 12
	bone bead		11
	Conus ring	4	10
	Conus disk	1	10, 11, 12
	Tridacna ring	1	12
	Trochus ring	1	
	shell ring (sp. no reported)	3, 5	8, 10
	shell pendant		11
	shell unit		11, 12, 20
	flaked stone	1, 3, 6	14, 15, 16, 17, 18
	obsidian/ volcanic glass	1, 6	10, 13, 14, 18,19
	chert	1, 6	15, 18, 19
miscellaneous	bone point	4	
	worked shell	?1, ?4	8, ?9, 10, 11, 12
	worked bone		7, 8, 10
	manuport		15, 18
	worked coral		10

which the diversity of East Polynesian fishhooks developed (Kirch and Hunt 1993:240), reinforcing their interpretation of the To'aga site as Ancestral Polynesian.

The To'aga assemblage of fishhooks tabs, are all manufactured from the body whorls of *Turbo* sp. shells and show a consistency in size, morphology and manufacture (Kirch and Hunt 1993:160). Most of the fishhooks are of a rotating form, but one is a jabbing hook. The provenance of only six of the fishhooks and three of the tabs is reported (Table 6.6). The fishhooks come from contexts included in Analytical Unit 2 and possibly 1 of the present analysis and therefore date pre-ca. 1900 cal BP. It is not possible to infer any temporal significance in the distribution of the provenanced artefacts.

Three of the fishhooks are described by Kirch (Kirch and Hunt 1993:161) as strongly reminiscent of some early Marquesan fishhooks and the manufacturing method apparent in the tabs and incomplete hooks as resembling methods described for the early Marquesan assemblages. However, one-piece fishhooks in the early Marquesan sites show, according to Anderson et al. (1994), great diversity in their forms (Rolett 1993:Table 3 and Fig. 3). While it is true that the majority of early one-piece Marquesan hooks are rotating (Anderson et al. 1994:43) like in the To'aga assemblage, and that experimentation with different raw material, in particular bone, may have resulted in diversity in Marquesan forms, the To'aga fishhooks are characterised by their uniformity. The earliest sites in East Polynesia may not yet be identified, but the earliest assemblages from the Marquesas all include a range of fishing gear unknown from early West Polynesian sites, including two-piece and composite hooks and trolling lures (Anderson et al. 1994; Rolett 1993). Although trolling lure points from early East Polynesian sites were initially considered of West Polynesian type (Suggs 1961), this was based on surface collections of West Polynesian trolling lures. Trolling lures have been excavated from disturbed deposits in Western Samoa (Janetski 1980a), but are yet to be recovered from securely dated West Polynesian deposits.

A small number of one-piece fishhooks and fishhook tabs, again from the body whorls of *Turbo* sp., have also been recovered from the NT-90 and NT-93/100 assemblages (Table 5.1). Kirch (1988:205) considers they have their closest parallels with one piece *Turbo* fishhooks excavated from Melanesian sites and the Polynesian outliers of Tikopia and Anuta, which are roughly contemporary with NT-93/NT-100. Recently, Burley (n.d.:12) has recovered a one piece 'bait' fishhook in association with Lapita ceramics in the Ha'apai site of Pukotala and tabs of *Turbo* sp. similar to those identified by Kirch (1993) as fishhook blanks in the To'aga site. Tabs from the body whorl of *Turbo* sp. have also been identified in pre-Lapita sites in Island Melanesia, although no *Turbo* fishhooks have been recovered (Smith and Allen 1999). Janetski (1980a:130) also considers a single *Turbo* fishhook from the Falemoa site similar to both the Niuatoputapu hooks and those from Anuta. A similarity to these fishhooks from sites to the west of West Polynesia does not necessarily imply cultural ties between the regions, but it does question the cultural association drawn between the diverse one-pieces fishhooks of East Polynesia and those from To'aga.

Three pearl shell fishhooks were also recovered from the Falemoa excavations, two from undisturbed contexts, one each from Strata II and V. Janetski (1980a:130) describes them as similar to those described by Suggs (1961) and Sinoto (1967) from early Marquesan sites. No further detail is provided.

Conclusion

The small size of the non-ceramic artefact assemblages from West Polynesian sites limits both recognition and interpretation of variability in the assemblages. No investigation of intra-site change through time has been possible in the present analysis. Investigation of temporal change in the presence of adze and other artefact types has been restricted to comparison of type representation in Lapita and plainware sites and in archaeological deposits radiocarbon dated pre- or post 2500 cal BP. Several significant findings of variability in the assemblages have been made using these comparative frameworks, although explanations for this variability can only be conjectured on the present evidence.

Assessment of the adze sequence indicates that there are differences between Lapita and plainware assemblages in adze types or their morphology, and quantity. Adzes associated with Lapita ceramics are relatively few in number and less likely to fit the Samoan adze typology of Green and Davidson (1969) and Green (1974b). A similar difference was also suggested through comparison of adze assemblages pre-and post-2500 cal BP. The variable affecting and perhaps creating this pattern is the geographic distribution of site types and their ages. The Lapita deposits are all Tongan, as are the majority of adzes from early contexts. The differences in accessibility and type of raw material in Tonga and Samoa are likely to create such regional differences and need to be taken into account prior to explanations of variability being either temporal or cultural.

The other artefact assemblages also indicate some differences between Lapita and plainware assemblages, in that a greater variety of shell ornaments appears to be associated with Lapita deposits. However, generally the other artefact assemblages show a consistency in their range that appears unrelated to the ceramic assemblage type or their recovery from deposits dated pre- or post-2500 cal BP.

The assessment of the non-ceramic artefactual evidence was designed to investigate the evidence for change through time in the record that has been explained as cultural change with the appearance of an Ancestral Polynesian Society. In particular it provided a means of assessing whether, in light of the findings in Chapter 7, variability in the characteristics of ceramic assemblages was reflected in non-ceramic material culture. The comparatively small quantity of adzes and other artefacts from Lapita sites may reflect the short time frame for dentate stamped ceramics in West Polynesia proposed by Burley et al. (1999), and given some support by the current assessment of the ceramic sequence.

The limits posed on interpretation of the regional ceramic sequence by the lack of detailed publication of Tongan plainware assemblages, with the exception of Niuatoputapu, applies equally to the non-ceramic artefacts. There are insufficient published data from well dated excavated assemblages to permit an explanation of the current patterns of regional variation. In regard to change through time in the assemblages, dentate stamped decoration, complex vessel forms and perhaps a range of shell ornaments appear to belong to the earlier part of the sequence, but the evidence is inconclusive as to a date at which they disappear. Variation in adze morphology appears to reflect a change through time in some types, but the cause of this variation cannot be attributed to cultural change in the absence of a study of the influence of raw material on the outcome of adze manufacture. There does not appear to be any significant change in the range of other artefact types and plainware ceramic characteristics over the period from initial colonisation of the region to ca. 1000 BP as represented in the sites of the present analysis.

9

Archaeological evidence for the early West Polynesian subsistence economy

THE TWO DOMINANT interpretations of the Lapita economy may be characterised as:

- whether Lapita sites in Remote Oceania represent a mobile, intermittent or transient use of the island or region, a 'strandlooper' economy (Groube 1971); or
- whether sedentism and a horticultural subsistence base, including domesticates, were part of the initial colonisation strategy reflected in Lapita sites.

The evidence used in support of these two alternative views of Lapita subsistence has been discussed in detail in Chapter 3. In the context of arguments presented in this monograph, their relevance is that a horticultural subsistence base has been argued to be a feature of Ancestral Polynesian Society, having been brought to West Polynesia by the Lapita colonisers.

In the first half of this chapter, direct evidence for subsistence, in the form of faunal remains, is discussed. Change through time in the faunal assemblages within sites is reviewed and the evidence presented for the presence of domesticates (pig, dog and chicken) and commensals (*Rattus exulans* and synanthropic land snails). In the second half of the chapter, indirect evidence for subsistence, in the form of artefactual evidence and features identified during excavation, is discussed in relation to the faunal evidence and used to investigate any regional trends in subsistence base.

Change through time in the faunal components within sites

The composition of faunal assemblages (especially indigenous fauna), perhaps more than artefactual assemblages, is influenced by local environment, placing an emphasis on intra-site analysis when assessing change through time in subsistence economy. In only nine of the analysed sites with more than one chronological unit has a faunal assemblage been preserved which permits change though time in the species represented, and the relative proportions of species and or classes of fauna, to be assessed.

To.2 and To.6

The To.2 and To.6 faunal assemblages are dominated by shellfish and include fishbone, crustaceans and non-fish vertebrates, including turtle, bird and pig. The analysis of the bone does not appear to have been completed and was undertaken in a number of stages by different researchers. This appears to have limited the identification of taxa and is discussed below. Poulsen (1987:78) discussed change through time in the faunal assemblages within the chronological framework he developed for the ceramics. Hence, To.2 is considered to occur early in the sequence and To.6 to belong to his Middle and Late periods. As discussed previously, the available radiocarbon chronology for the sites does not support such an interpretation. The three horizons of To.6 potentially provide evidence to look at intra-site change through time in the faunal assemblages. However, with the exception of shellfish, the numbers of individual specimens per taxa in the site are insufficient to identify any differences between the horizons.

The shellfish assemblages are dominated by *Gafrarium* sp. Poulsen (1987:231) found, using his chronological framework, that the average size of *Gafrarium* sp. shell decreases over time. The larger average size of shell recovered from To.2 was attributed to its being collected from previously unexploited populations of shellfish, following initial colonisation. The decline in *Gafrarium* sp. shell size from the To.2 to To.6 assemblage he attributed to their continued exploitation. Poulsen's finding was confirmed by Spennemann's comparison of prehistoric and present shell sizes (as cited in Poulsen 1987:231).

Large amounts of marine turtle bone were recovered from To.2 (404 bones), but relatively few specimens from To.6 (eight bones from Horizons II and III). To.2 is located at the entrance to Fanga 'Uta Lagoon, in likely close proximity to turtle nesting areas on the beach, whereas To.6 is located on the edge of the inner lagoon. The differences in site location may account for the differential distribution of turtle bone in the middens (Poulsen 1987:234).

A similar range of fish species is represented in all three horizons of To.6 (Poulsen 1987:Table 105).

The bird bone recovered from To.2 and To.6 has not been fully analysed. Two rail species, each represented by a single bone, have been identified from To.6, Horizons I and II. Chicken bone is present in very small numbers in all horizons of To.6 and seven bones were recovered from the To.2 midden (Poulsen 1987:241). Poulsen (1987:233 and Table 107) lists several species of wild bird as being identified in To.1, another excavated midden deposit containing Lapita ceramics. Apart from the two bones in the To.6 site, wild birds have not been reported from any other of Poulsen's excavations. The To.1 assemblage was analysed by a different researcher and at a different time to the other sites, which may account for this difference (Poulsen 1987:232).

In To.6, 14 pig bones were scattered thinly across the site and through all horizons. Poulsen (1987:245) considered two of the 14 pig bones to be in dubious stratigraphic context. Two long bone fragments and a tooth were recovered from the stratigraphically earliest Horizon I.

No change through time can be inferred on the basis of the To.6 faunal assemblage. The concentration of marine turtle in To.2 may be interpreted as evidence of initial exploitation of a population, but the radiocarbon chronology associated with the site makes this unlikely. To.2 is located on the coast whereas all the other midden sites are on the lagoon edge, offering a spatial rather than temporal explanation for the abundant marine turtle remains.

Tongoleleka and Fakatafenga

The faunal assemblages from the Tongoleleka and Fakatafenga sites reported by Dye (1987) include shellfish and a number of vertebrate species. Shellfish species from both sites were considered by Dye (1987:140) to reflect high levels of local availability of shellfish. The overall concentration of shellfish in Tongoleleka does not vary significantly between cultural units, although *Turbo* sp. are concentrated in the main Cultural Unit III. Dye (1987:116) interpreted the high concentration of shellfish in Fakatafenga Cultural Unit III as evidence of this unit being the primary cultural deposit in the site.

Limited information is available about the vertebrate assemblages. These are divided into fish, turtle, bird, fruit bat, lizard, pig, medium mammal and medium to large vertebrate (Dye 1987:Tables 7 and 10). The final two categories are not discussed in the text. Insufficient information is reported to assess variability in the fish assemblages. Turtle bone is found throughout the sites, but is concentrated in the lower cultural layers. The bones of a large-bodied, now extinct, iguanid lizard (*Brachylophus* sp.) were recovered from the earliest deposits on Tongoleleka (Pregill and Dye 1989). The bones of a megapode and two extinct pigeons were recovered from Cultural Unit III in Tongoleleka (Dye 1987:142). Dye and Steadman (1990:209) report that birds made up a significant proportion of the diet at Tongoleleka, but are insignificant in the Fakatafenga assemblage. Dye (1987:Table 10) lists 39 bird bones from Tongoleleka, including chicken and wild taxa. Only three bird bones were recovered from Fakatafenga.

Dye (1987:118) considered the concentration of turtle bone in the earliest deposits to be a common feature of early settlement sites, and the decline in turtle bone over time and the presence of extinct species in the earliest cultural units to reflect the impact of humans on pristine environments (Dye 1987:143).

Niuatoputapu

Change through time in the Niuatoputapu faunal assemblages is difficult to assess because the NT-90 assemblage spans a period from colonisation to ca. 2000 BP. In the assessment of material culture offered in the previous chapters, artefacts present in NT-90 and NT-93/NT-100 have been considered to date to the recent period represented by NT-93/NT-100. A similar interpretive framework for the faunal material, especially indigenous fauna, would be nonsensical because indigenous fauna may have been available throughout the sequence. However, introduced species represented in the NT-90 assemblage cannot be assumed to have been present from the time of initial use of the site (this is discussed further below).

NT-90 has a higher density and greater diversity of shellfish species than does NT-93 or NT-100 (Kirch 1988:227–28). Kirch (1988:228) interprets this as representing a reduction in the shellfish content of the sites over time, due to continued heavy exploitation of the reef ecosystem and the gradual reduction of the area of the reef caused by tectonic uplift. The high concentration of shellfish at the NT-90 site may also reflect the length of occupation of the site which, on the available radiocarbon chronology, may have spanned 2000 years, although not necessarily continuously. This is far longer than the dates from NT-93 and NT-100 would suggest for occupation of those sites. Significant differences in the percentages of six molluscan families were noted between the sites (Kirch 1988:Fig. 132). This cannot be explained by the prevalence of particular species in the immediate environment of the sites (Kirch 1988:228); however, no further explanation is offered.

The vertebrate assemblages from NT-90 and NT-100 have similar species or families identified, except for the prevalence of wild bird taxa in NT-90. The latter is argued to reflect human exploitation of pristine environments following colonisation (Kirch 1988:Table 38). At least five species have been identified in NT-90 that are missing from NT-100. The NT-93 avian fauna is restricted to chicken and a single unidentified bird bone.

Turtle bone and fishbone are present in all three sites, but both occur in greater density in NT-90 than in either NT-93 or NT-100. Once again this may be due to the length of occupation of the sites, although Kirch (1988:221) interprets this as evidence of an abundance of turtle at initial colonisation which declined with human predation and the declining importance of fishing in subsistence.

Furthermore, Kirch (1988:235) argues that based on density measures, pig increases over time, probably as the island's agricultural support base increases. However, this cannot be substantiated by the radiocarbon chronology for the NT-90 site.

A greater range and quantity of wild taxa are represented in NT-90 than in NT-93/NT-100. This appears to support a general pattern of association between deposits of the colonisation period and easily exploited indigenous terrestrial fauna. Assuming the three sites have similar contexts of preservation, the apparently decreasing density of shellfish and fish over time is difficult to explain in the absence of data concerning the length and intensity of site occupation. It may, as Kirch argues, reflect a decreasing importance of marine fauna in the diet, or be due to a decrease in availability resulting from continued exploitation and/or environmental change.

To'aga

Nagaoka (1993) and Steadman (1993) analysed the faunal assemblage from the To'aga site. The distribution of faunal material in the site was influenced by differential preservation and retrieval procedures used for the sand and colluvial deposits found in different parts of the site (Nagaoka 1993:189). The faunal assemblage from some excavation units is not fully reported. A stratigraphic provenance for the fauna is given only for excavation Units 1, 4 to 9, 20/23 and 15/19/30.

Nagaoka (1993) analysed the shellfish, fish and non-fish vertebrates from these deposits. She found marine turtle bone to be present throughout the deposit, but concentrated in Unit 20, Layer IIIB (Analytical Unit 2) and in Unit 15, Layer IIIC (Analytical Unit 1) (Nagaoka 1993:196). Other wild taxa were also present throughout the site.

Steadman (1993) identified several species of extirpated birds in the To'aga assemblage. Most of these were found in contexts considered early, which also contained the majority of the chicken bones. Based on the quantity and diversity of bird bone seen in early sites elsewhere in Polynesia, Steadman (1993:226) concluded that the To'aga assemblage may not reflect the initial occupation of the region. However, this may be due to the analysis of assemblages primarily from Analytical Unit 2, rather than the earlier Analytical Unit 1 (see below).

Nagaoka (1993:207) concluded that, contrary to expectations of temporal change:

> the composition of the To'aga assemblage changes little over time. The invertebrate assemblage best illustrates this with a few taxa dominating the assemblage across time and space. A similar trend appears to be evident for the fish assemblage as well. At present the cause of this pattern is not evident. Some possible causes include the exploitation of naturally abundant taxa from a temporally stable environment, a lack of change in subsistence practices, or a combination of both factors.

Nagaoka's (1993) findings are, however, based on a sample that is greatly biased towards deposits from a single chronological unit, Analytical Unit 2 of the present analysis. Similarly to the To'aga ceramic analysis, faunal material chosen for detailed analysis came from deposits with a larger faunal assemblage (Nagaoka 1993:190). This included only a very limited sample from the post-1900 BP deposit, Analytical Unit 3, and an equally limited sample from the earliest unit (Analytical Unit 1), represented only by fauna from Unit 15/19/30, Layer IIIB. The chronological units used by Nagaoka (1993) are not reported, but are presumably the stratigraphic layers in the analysed excavation units. On the basis of radiocarbon evidence, most of the material analysed is contemporary or represents an unknown and possibly a very short amount of time. This perhaps explains why no temporal change is evident in the fauna from the site.

Jane's Camp

The Jane's Camp faunal assemblage includes shellfish, sea urchin, fish, turtle and possibly sea bird, with scanty evidence for chicken (Janetski 1976a:82). The provenance and quantity of the vertebrate fauna is not reported.

Janetski (1976a:80) found differences in the proportions of the most common shellfish species in the Jane's Camp strata, although a very small sample size from Stratum 1 may account for these differences. Using the analytical units of the present analysis, Cypraeidae are by far the most commonly represented shellfish in the earlier Analytical Unit 1, with bivalves second and a small amount of Ceritidae, Trochidae and Turbinidae present. In Analytical Unit 2, bivalves are more frequent than the four gastropod species, although Cypraeidae are the most common of these, with a marginally increased frequency of Trochidae and Turbinidae (Janetski 1976a:81). No explanation was offered for these differences. From the increasing density of shell from Stratum I to Stratum IV, Janetski (1976a:82) concluded that extensive exploitation of lagoon fauna increased through time.

Sea urchin spines were recovered in large numbers from the site; however, no data concerning their frequency in the strata (or analytical units) are reported. Nonetheless, Janetski (1976a:80) states that their representation declined through time as represented by the strata in the site and they are not found in the lagoon in the present. He concludes they may have been foraged to extinction.

Falemoa

The stratigraphic layers, Strata II to V, in the Falemoa site have been used as chronological units in the present analysis. The density of shell and bone is greatest in Stratum III and decreases sequentially in Strata IV and V (data are not provided for Stratum II) (Janetski 1980b:Tables 12 and 13). No mammal bone was identified in Strata II to V. A small amount of bone, no provenance reported, was identified as fish and sea bird, and the assemblage also included sea urchin and crab. Janetski (1980b:119) noted that sea turtle was recovered from Stratum II, the earliest cultural deposit.

As with Jane's Camp, Cypraeidae is the most frequent shellfish family present, but the species preference in Falemoa is, according to Janetski (1980b:119), stable through time. However, species representation data are available only for Strata III and IV (Janetski 1980b:Table 14) which have a fully overlapping radiocarbon chronology and may represent a relatively short time period. This may refute Janetski's (1980b:120) conclusion that, based on the density (by weight) of shell per stratum 'analysis of the midden does not document other than a gradual decrease in the collecting pattern, which might be equated with the increased reliance on horticulture'.

Discussion

With the exception of To.6, the expected concentration of indigenous or wild fauna (including turtle, bird and lizard) is apparent in the earliest stratigraphic units from each site. This may also be the case in Jane's Camp, but unfortunately the provenance of vertebrate fauna is not reported and hence this cannot be determined with any certainty. The To.6 deposit does not, on the faunal evidence appear to represent initial occupation of Tongatapu.

Turtle was recovered from all sites but was concentrated in early deposits, with the possible exception of To.2 and Jane's Camp. Dye and Steadman (1990:212) argue that beach nesting turtle populations would have provided an easy target for colonisers, but due to the turtle's long maturation time their abundance would have declined rapidly in a short period of time. The exploitation of these animals may have shifted to open waters, thereby accounting for the continuing presence of turtle in much smaller quantities throughout the sequence. Although most researchers recognise indigenous birds in the assemblages, detailed studies of the avian fauna are available for only the Tongoleleka and To'aga sites (Dye and Steadman 1990; Steadman 1993). These indicate the exploitation of land and sea bird species, at least some of which are now locally extinct. Burley et al. (1995:132) note the presence of extinct birds in the Holopeka plainware site, but conclude these do not show the expected range of species if the site belongs to the initial colonisation period. Insufficient analyses have been done and/or reported to further assess the regional pattern of indigenous bird exploitation.

Temporal variability in marine resources includes change in shellfish species, a decline in their diversity in one site and a decline in their size in another, a change in shellfish density, though not always decreasing through time, and a decrease in fishbone density. Kirch (1988:228) suggests a combination of human exploitation and environmental change to account for apparent temporal variability in the shellfish species in Niuatoputapu sites.

An association between the exploitation of indigenous fauna and island colonisation is well recognised both by people who argue for and against a horticultural subsistence base being associated with Lapita colonisation. The crucial evidence in these arguments has been the chronology for the appearance of domesticates, especially pig in early sites. Insufficient quantities of non-indigenous vertebrates have been reported from the sites to permit any intra-site change through time in their presence or abundance to be investigated. This regional evidence for the introduction of domesticates to West Polynesia is now discussed.

Regional archaelogical evidence for domesticates and commensals

The three domesticates, pig, dog and chicken, were present throughout the Pacific at the time of European contact, having been humanly transported to the various islands from Southeast Asia. Their presence in archaeological deposits has been used as evidence for prehistoric animal husbandry and as indirect evidence in arguments for early West Polynesian subsistence being a forerunner to that of Polynesian societies at contact. In particular, pig bone in archaeological sites has been used to argue for an associated horticultural practice involving the yam-taro complex, because it has been considered that in order to sustain a pig population on small islands, agricultural food scraps are necessary to provide fodder (Kirch 1984:56). The chronology for the introduction of domesticates to Near Oceania is unclear, especially that of pig, which may be present in pre-Lapita sites in Melanesia (Kirch 1997:211).

Table 9.1 lists the provenance of bone identified as domesticates (pig, dog or chicken) and the presence of the commensals [Pacific rat (*Rattus exulans*) and land snails]. Only bone conclusively identified and provenanced is included in the following discussion. The provenance and amount of evidence is discussed below with reference to the radiocarbon chronology of the deposits.

Pig

Pig (*Sus scrofa*) has been identified in eight of the analysed sites (Table 9.1). In these (as well as a number of other sites) it has been suggested that bone identified only as mammal or large vertebrate may include pig bone, but this is not possible to confirm.

Table 9.1 Stratigraphic association of bone identified as a domesticate or commensal species (Code: ? = the stratigraphic association of the bone has not been clearly identified).

SITE	ANALYTICAL UNIT	PIG	DOG	CHICKEN	LAND SNAILS	RAT
Niuatoputapu	NT-90	✔	✔	✔	✔	✔
	NT-93/NT-100	✔		✔	✔	✔
Tongoleleka	Cultural Unit III			?		✔
	Cultural Unit II			?		
	Cultural Unit I (Historic)	✔		?		✔
To.2	midden			✔		✔
To.6	Horizon I	✔		✔		✔
	Horizon II	✔		✔		✔
	Horizon III	✔		✔		✔
To'aga	1					✔
	2			✔	✔	✔
	3	?				✔
'Aoa	1	✔				
	2 (post-650 BP)	✔				
Ta'u Village	ceramic deposit	?				
Jane's Camp	1			✔		
Tavai			✔			

Pre-2500 BP deposits

Two pig bones were recovered from the NT-90 site on Niuatoputapu; however, the radiocarbon chronology for this site spans 3000–1000 BP and the disturbed deposit is likely to contain recent cultural material. The stratigraphic provenance of the recovered pig bones is not reported.

A single pig tooth was recovered from 'Aoa, Layer VI. Layer VI is the uppermost layer of the early analytical unit identified at the site, an A-horizon palaeosol. Layer VI is stratigraphically more recent than Layer VII with associated radiocarbon dates which have a 2σ range of ca. 3400–2200 cal BP. No other faunal material is preserved in the early analytical unit.

Post-2500 BP deposits

Five bones identified as pig were recovered from the NT-100 site and three from the NT-93 site. Similarly to the NT-90 site discussed above, stratigraphic provenance of the bone is not reported and the disturbed surface Layers Ia and Ib may contain recent cultural material.

Poulsen (1987:Table 107) recovered pig bone in small amounts (less than five bones) from each horizon in To.6. A radiocarbon chronology of ca. 2400–1800 cal BP is associated with Horizon I. Horizons II and III are not radiocarbon dated and their age range is unknown[1].

A single pig tooth was recovered from Layer I of the aceramic Unit 17 in the To'aga site (Kirch and Hunt 1993:240). Layer I is the surface layer and may contain recent cultural material (Kirch and Hunt 1993:Fig. 5.12). In their report of the initial excavations at To'aga and the Ta'u village site, Hunt and Kirch (1988:177) note an association of pig bone with ceramics in the excavated deposits, but the site is not specified. Given that no pig has been subsequently reported in association with ceramics from To'aga, it is assumed that the pig bone was recovered from the ceramic deposit of the Ta'u Village site, although the stratigraphic context is unclear and the site has not been fully published. The ceramic deposit from Ta'u Village has an associated radiocarbon date of 1939–1690 cal BP 2σ range (Beta-19741).

In the Tongoleleka site, Dye (1987:Table 10) lists pig bone as recovered from Cultural Unit I, the disturbed surface layer from which goat and sheep were also recovered.

From the 'Aoa site, six pig teeth and four fragments of unidentified bone were recovered from the recent Analytical Unit 2, with associated radiocarbon dates of <650 BP.

Dog

Four bones identified as dog (*Canis familiaris*) were recovered from the NT-90 site. The stratigraphic context of the bones is not reported and, as discussed above, the stratigraphy and associated chronology of the site does not permit an age to be assigned to the bones.

Kirch (1981) recovered a single dog premolar from the cultural Layer IX in the Tavai site on Futuna with an associated radiocarbon date of 2329–1890 cal BP 2σ range (I-8355). Apart from a single fishbone, this tooth is the only faunal material preserved in the Tavai site.

Chicken

Chicken (*Gallus gallus*) has been identified in eight sites. In two sites, To'aga and Jane's Camp, chicken was recovered from deposits that pre-date 2500 cal BP. In To'aga (Analytical Unit 2) and Jane's Camp (Analytical Unit 1) chicken bones are associated with a radiocarbon age range of ca. 3000–1900 cal BP and ca. 3700–2300 cal BP, respectively. In the To'aga site, seven of the total 15 chicken bones were concentrated in Units 20/23, Layer IIIB (Nagaoka 1993:196). Janetski (1976a:80) reports only that a small number of chicken bones were recovered in Stratum II from the Jane's Camp site.

Bird bone was recovered from all cultural units in the Tongoleleka site. Chicken bone is not reported separately from other bird bone and a specific stratigraphic context cannot be assigned to it (Dye 1987:Table 10).

[1] Evidence for pig in other ceramic contexts on Tongatapu comes from site To.1 (Poulsen 1987:243–4), but these are from uncertain stratigraphic contexts (Poulsen 1987:Table 108) and Poulsen (1987:232) describes To.1 as being more disturbed than To.2.

All three Niuatoputapu sites contain chicken (NT-90, 12 bones; NT-100, seven bones; NT-93, six bones), although the stratigraphic provenance is not reported. The chicken bone from NT-90 may be associated with the early, pre-2500 cal BP radiocarbon dates from the site, but this cannot be substantiated.

Five chicken bones were recovered from the To.2 midden and in small numbers from Horizons I, II and III in To.6. Both sites have an associated radiocarbon chronology post-dating 2500 BP.

Commensals

Pacific rat (*Rattus exulans*) has been positively identified in seven West Polynesian sites. Two further bone fragments are described as possibly rodent in Stratum III of the Falemoa site (Janetski 1980b:120). Currently, the only evidence for Pacific rat in the earliest West Polynesian deposits comes from Analytical Unit 1 of the To'aga site, although it is possible that the rat bone collected from NT-90 is also associated with the early dates from the site. The absence of rat bone from the Jane's Camp site may be due to recovery strategies, although it should be noted that fishbone was recovered from the deposit.

The collection and analysis of land snails has only been undertaken for the Niuatoputapu sites NT-90 and NT-93 (Kirch 1988) and the To'aga site (Kirch 1993). At To'aga, a series of sediments from the main excavation trench (excavation Units 1 and 4 to 9) were analysed for land snails. The assemblage was dominated by synanthropic species brought to the To'aga site by the Island colonisers as part of their 'transported landscapes' (Kirch 1993:118, 120). Kirch (1988:235) has similarly argued that the presence of synanthropic snail species in the ceramic sites of Niuatoputapu 'reflect the inter-island transfer of plants and adhering soil during and after human colonisation of the island'.

An association of land snails with initial colonisation of Niuatoputapu is inconclusive on the present stratigraphic and radiocarbon evidence from NT-90. In the To'aga site, synanthropic land snails have been recovered only from Layer II deposit in excavation Units 1 and 4 to 9 (part of Analytical Unit 2 in the present analysis). The earliest deposits at the site were not tested for the presence of land snails (see Kirch 1993c). Layer II comprises the main cultural layer in the site and is capped by a palaeosol, Layer IIA-1. Kirch (1993c:120) considers the synanthropic snail species to 'suggest the establishment of a stable anthropogenic vegetation over the To'aga coastal terrace'. The palaeosol which overlies the main cultural deposit of Layer II in the main excavation trench is such a stable land surface and may reflect the establishment of gardens in the area, although this is by no means certain. The radiocarbon determinations directly associated with the deposits analysed for land snails are 2306–1916 cal BP (Beta-25034) and 2354–1975 cal BP (Beta-25033). However, these deposits have been correlated with other deposits in Analytical Unit 2, with an associated radiocarbon chronology of 3023–2344 cal BP (Beta-26464). This may extend the chronology for the land snails to initial occupation of the site.

Discussion

Unfortunately the faunal assemblages from several of the earliest deposits (Faleloa, Pukotala and Holopeka) have not yet been published, limiting the data available for investigating the introduction of domesticates at the time of initial colonisation. The evidence for all three domesticates in the analysed assemblages is scant, both in the pre-2500 BP and in more recent deposits. The lack of evidence for dog in ceramic deposits has been generally acknowledged (Dye and Steadman 1990; Poulsen 1987:251). However, the evidence for pig in early sites has been considered secure by some (Kirch 1988; Spriggs 1997:85), although this claim has not been universally accepted (see Groube 1971; Janetski 1976a; Poulsen 1987:251). On the present evidence, the strongest argument for pig in pre-2500 BP West Polynesian contexts is a single pig tooth from the uppermost stratigraphic horizon of the lower cultural unit in the 'Aoa site.

If pig was introduced pre-2500 BP to West Polynesia, the evidence does not suggest an economy dependent on agriculture if the association between pig and agricultural or horticultural subsistence is the best line of argument for it. However, the same may be said of the limited evidence in the post-2500 BP record and pig may not have been an important feature in the West Polynesian subsistence until after the period represented in the present analysis, that is after ca. 1000 BP. Kirch (1988:253) suggests a correlation between the social importance of pig in more recent times and the rise of socio-political hierarchy in Fiji and West Polynesia in the last millennium.

Of the three domesticates, chicken is the only one that appears securely represented in early sites. Although chicken has not been recovered from the earliest unit at To'aga, it presents the strongest argument for the introduction of a domesticated animal species at the time of initial colonisation. However, unlike pig, the presence of chicken is not usually considered proxy evidence for horticulture or agriculture.

The presence of the commensals, Pacific rat and synanthropic land snails, in early deposits at To'aga suggests their transport with initial colonists, but present evidence does not allow them to be conclusively associated with the earliest deposits. Synanthropic land snails are securely associated with deposits dated ca. 2000 BP and perhaps earlier. It is not unexpected that Pacific rat would be found in the earliest deposits. This does not imply any association with horticulture.

Indirect for horticulture and arboriculture

Indirect evidence for horticulture and arboriculture is defined here as archaeological evidence considered associated with the cultivation or processing of edible plants, and includes artefacts recovered from excavated deposits and features evident in sites. Kirch (1984:58, 1997:213) discusses this evidence from Lapita sites as including earth oven features, peeling knives and scrapers of cowrie shell, and peelers of pearl shell. From Ancestral Polynesian sites on Niuatoputapu he identifies a number of pits as having been used for the ensilage and fermentation of breadfruit paste, as well as hammerstones with pecked finger grips as being used to open hard shelled nuts such as *Canarium* sp. and *Terminalia* sp. The function of these hammerstones is inferred through ethnographic analogy (Kirch 1984:56).

As discussed in Chapter 3, there is no agreed set of criteria for distinguishing artefacts such as shell scrapers from shell broken during extraction of the shellfish or from non-cultural processes, or for identifying specific functions for tools through use-wear and / or residue studies. Despite this, artefacts described as shell scrapers or peelers have been argued to, in the absence of plant remains, provide substantive evidence of horticulture or agriculture (Kirch 1988). Table 9.2 reports the context of such artefacts from the analysed West Polynesian sites and their description where given.

Table 9.2 Provenance and description of food preparation tools.

SITE	ANALYTICAL UNIT	ARTEFACT TYPE	NO.	DESCRIPTION
NT-90		shell scraper	6	Base of *Cypraea* sp., some evidence of scraping on broken edges, also known as net weights and large bivalves with use-wear on dorsal margins (Kirch 1988:208)
		shell peeler	1	*Cypraea* sp. dorsum, smoothed edges on three sides and fourth shows use-wear from scraping in food preparation and possibly other tasks (Kirch 1988:208)
NT-93/NT-100		shell scraper	5	As for NT-90
To.2		shell tools	2	No description
To.6	Horizon I	shell paring knife	1	*Strombus* sp. with paring perforations due to abrasion (Poulsen 1987:185)
		shell tools	1	No description
	Horizon II	shell paring knife	1	As for Horizon I
	Horizon III	shell paring knife	2	*Anadara* sp. with hole in umbo, similar to net sinker but known ethnographically as vegetable scrapers (Poulsen 1987:184)
Jane's Camp	2	shell scraper	2	*Turbo* sp. questionably artefactual, Conus sp., base removed, bevelled along cutting edge (Janetski 1976b:71)
Falemoa	Stratum III	shell peeler	2	*Cypraea* sp. one with two holes broken at either end in the dorsum (Janetski 1980a:125)
		shell scraper	3	Two *Cypraea* sp. base with much wear on the broken edge, broken Conus shell with smoother edges (Janetski 1980a:125)
	Stratum IV	shell peeler	2	As for Stratum III, one without evidence of wear, doubtful artefact, the other heavily worn on working edges (Janetski 1980a:125)

The number of artefacts with an identified function related to processing of vegetables is very small. In many instances the function and/or artefactual status of the object has been questioned by the excavator. The small number of artefacts may be due to the difficulty in identifying shell tools unless they are highly curated forms (Smith 1991). However, although a large volume of material was excavated from the To'aga site and the midden material was specifically examined for shell artefact manufacturing debitage (Kirch 1993b), no artefacts were identified as food preparation tools. It is possible that other tools, in particular stone artefacts, may have performed a similar function, but this has not been argued by researchers working in West Polynesia. In no instance where a description of the artefact is provided, has a direct relationship been established between features identified as use-wear or modification and the ascribed function of the artefact as a scraper, peeler or knife. If the association between the types of artefacts listed in Table 9.2 and horticulture holds true, then little indirect artefactual evidence for horticulture has been recovered from West Polynesian sites.

Similarly, indirect evidence for agriculture in the form of features visible in excavated deposits is minimal, being limited to a pit feature in the NT-93 site interpreted as a fermentation pit for breadfruit (Kirch 1988:110) and earth ovens containing oven stones at NT-90, although the latter were probably used for cooking meat (Kirch 1988:92). The radiocarbon chronologies and disturbance associated with both these sites suggest the features date to the recent end of the sequence.

Kirch and Hunt (1993:235) found that the deposits of the To'aga site dating from about 2000 BP contain colluvium which has been eroded from the steep slopes at the rear of the beach on which the site is located. This is flecked with charcoal that they interpret as the result of intentional forest clearance associated with shifting cultivation of root and tuber crops.

Discussion

Based on a range of archaeological and linguistic evidence, in 1984 Kirch (1984:54) claimed that:

> direct and indirect evidence [supports] the view of Ancestral Polynesian economy as a broad-based, generalist set of strategies including agriculture, animal husbandry and marine exploitation.

Since then a number of early sites have been excavated in West Polynesia. While contributing substantially to the data base of marine exploitation and the targeting of indigenous terrestrial fauna by initial colonisers of the region, these sites have added little evidence for an agricultural subsistence base in early West Polynesian prehistory. It is, of course, far more difficult to see direct evidence for agriculture or horticulture than it is to see faunal evidence in the archaeological record, but indirect evidence is also lacking and does not support the following discussion by Kirch et al. (1990:12) of the To'aga faunal assemblage:

> While this faunal assemblage might be interpreted as evidence for an economy dominated by marine exploitation and bird hunting (cf. Groube 1971), we believe that such an interpretation would be incorrect, ignoring the wealth of direct and indirect evidence supporting a model of Lapita and later Ancestral Polynesian peoples as horticulturalists. At To'aga such evidence is admittedly slim, but does include the presence in Layer II of anthropophyllic snails and the charcoal flecking in terrigenous erosional deposits suggestive of up-slope firing of vegetation.

The evidence for horticulture cited by Kirch et al. (1990) is likely to date after ca. 2000 BP (see earlier discussion) and they acknowledge that the evidence from To'aga can be argued to support the strandlooper model of Groube (1971) for sites of the colonisation period. A strandlooper economy could also be argued for the Tongoleleka and Fakatafenga assemblages and for To.2 if the deposit is earlier than the associated radiocarbon dates. The exploitation of indigenous food resources by colonising populations is generally acknowledged by advocates of both a horticultural and strandlooper Lapita subsistence base. It is the evidence for domesticates, in particular pig, in early sites which has been used to argue that horticulture or agriculture is a feature of Lapita colonisation and, in West Polynesia, the Ancestral Polynesian Society. As discussed in this monograph, the evidence for pig in sites of the colonising and post-Lapita periods is scant. Based on the presence or increasing density of pig bone in archaeological deposits there is no suggestion of an increasing reliance on horticulture in the period from colonisation to at least 2000 BP.

It should be noted that pig is also absent from early Fijian (Kirch 1984:544), New Caledonian and Southern Vanuatu deposits (Spriggs 1997:146). This, along with other kinds of evidence (discussed in the following chapter) suggests that Lapita sites in Remote Oceania may be different to those in Near Oceania in their non-ceramic evidence, identifying them as sites of initial colonisation. In early East Polynesian sites, pig is present (albeit in small quantities) in the early deposits of the Hane (Anderson et al. 1994) and Hanamiai (Rolett 1992) in the Marquesas. The recent reassessments of the chronologies of these sites suggests that their initial occupation was no earlier than ca. 1500 BP and perhaps as recently as ca. 1000 BP (Rolett and Conte 1995). It is unclear on current evidence at what time pig, and the West Polynesian agricultural base observed at contact, became central to the subsistence economy, but there is insufficient evidence to assume that this was during the early period, at least not before ca. 2000 BP.

Conclusion

The arguments for an early West Polynesian subsistence economy ancestral to that of Polynesian subsistence observed at contact are, like arguments concerning change through time in the West Polynesian adze and ceramic assemblages, not interpretations of the archaeological evidence so much as the expectations of that evidence based on linguistic and ethno-historic evidence.

Given recent evidence for arboriculture (Gosden 1995) and the processing of taro in pre-Lapita sites in Melanesia (Wickler and Spriggs 1988), and arboriculture in Lapita sites (Kirch et al. 1991), one would assume the existence of some form of plant manipulation, including arboriculture, when people first move beyond the Solomon Islands (Gosden 1992). The pre-Lapita Melanesian evidence, dating from as early as 20,000 BP and characterised by Spriggs (1997:84) as 'hunter-horticulturalism', suggests that manipulation and cultivation of plant species, and complex technologies for their processing, were not a late Holocene innovation or exclusively associated with sedentary or socially stratified societies as has been argued for Lapita. Rather, the evidence suggests that various plant species began to be used, manipulated and transported by humans at different times and on different islands over the very long period from the initial colonisation of Island Melanesia.

The manipulation of plant species by the initial colonisers of West Polynesia does not necessarily mean that the plant subsistence base and technology of production mirrored the horticultural or agricultural systems of later Polynesian societies. If this was in fact the case, we might expect to find adjunct evidence, such as pig, in the early sites. The current evidence suggests a later introduction of pig and dog to West Polynesia. Unfortunately, direct macroscopic evidence for plant manipulation by the initial colonisers of West Polynesia is unlikely to be preserved in the archaeological record. In West Polynesia to date, no waterlogged sites equivalent to those of the Arawe and Mussau Islands in Melanesia (Kirch 1997), from which much of the Lapita evidence for arboriculture derives have been located.

The early Melanesian evidence for plant manipulation is important in pointing to the kinds of interpretive restrictions that umbrella categories such as 'agriculture' can place on understanding archaeological evidence, especially when tied to a model of social evolution. The protohistoric agricultural subsistence economy of Polynesia may, like that represented in Lapita sites in Near Oceania, be the amalgam of various kinds of technologies, plants and domesticates being incorporated into the economy at various stages in prehistory, rather than a package arriving in West Polynesia with Lapita colonists. Underlying the idea that an ancestral form of Polynesian economy was brought to West Polynesia by Lapita colonisers is the assumption that West Polynesian communities were increasingly isolated from communities to the west following colonisation. This assumption underpins the linguistic model for the development of Proto-Polynesian in isolation from the languages to the west and dictates that, rather than production systems having been developed over time in interaction with communities to the west, an ancestral Polynesian system arrived with Lapita. The evidence for the interaction of West Polynesian and Melanesian communities in the Lapita and post-Lapita period is discussed in the following chapter.

10

Early West Polynesian archaeology — a southwest Pacific archaeological signature

IS THE PHYLOGENETIC MODEL of an Ancestral Polynesian Society in West Polynesia sustained by the early archaeological evidence of the region? If not, what does this archaeological record tell us about the period following colonisation until ca. 1000 BP, and more generally about models of socio-cultural change and colonisation in the Pacific?

The phylogenetic model of early Polynesian prehistory presupposes:

1. Change through time in early West Polynesian archaeological evidence that reflects the appearance of an Ancestral Polynesian Society.
2. A regional similarity in early West Polynesian archaeological evidence that reflects a regional Polynesian homeland.
3. Change through time in the archaeological record mirroring socio-cultural continuity and development from Lapita to early East Polynesian society.

These assumptions are discussed below in relation to the findings of the assessment of early West Polynesian archaeology.

Change through time in excavated cultural assemblages

Change through time has been investigated in three ways:

1. Using chronological units for individual sites constructed from stratigraphic and radiocarbon evidence.
2. In a regional framework in which assemblages were analysed according to whether they date pre- or post-2500 cal BP.

3. By comparing Lapita and non-Lapita assemblages on the assumption that assemblages containing dentate stamped ceramics may pre-date fully plainware assemblages.

In each case, the findings varied somewhat according to the data included, but overall the picture to emerge is, with the exception of the very early colonisation period, one of continuity through time in most aspects of the excavated cultural assemblages.

Ceramics

The assessment of change through time in the ceramic assemblages found that the only significant source of variability in this component was in the presence of dentate stamping and associated complex vessel forms in assemblages identified as Lapita. In all cases the decorated and complex vessel forms constitute a very minor component of the total ceramic assemblages, but were the focus of the analysis and reporting of results. In contrast to the established ceramic sequence, no evidence was found for a Late Lapita assemblage. No clear decline through time in the amount or type of decoration was found in a single site. Where the density of decorated sherds was considered to decline through time, there was no associated change in the characteristics of the decoration. This feature, along with the presence of apparently contemporary Lapita and plainware sites in Tonga and Samoa, suggests the disappearance of dentate stamped decoration was rapid and occurred very early in the sequence. This is in accordance with the findings of Burley et al. (1999) for Ha'apai sites and Anderson and Clark (1999) for Fiji. If so, the radiocarbon determinations associated with dentate stamped ceramics in Fakatafenga and To.2 are too recent and unlikely to date sherds in the assemblages. This requires confirmation through systematic dating procedures such as those employed by Burley et al. (1999).

Regardless of whether dentate stamped decoration strictly precedes, or is contemporary with, early fully plainware assemblages, dentate stamped decoration and associated complex vessel forms remain the only significant source of temporal variation in the ceramic assemblages. Although there is little available information about characteristics of the plainware component of Lapita assemblages, they appear to consist primarily of simple vessel forms (bowls and pots) of a utilitarian function similar to plainware from Lapita sites elsewhere. The change from Lapita to plainware appears to reflect only the disappearance of dentate stamped decoration and complex vessel forms, rather than significant changes in the plainware component. Lapita and plainware assemblages may, as Golson (1971) and subsequently Kirch (1981) have suggested, be better seen as Lapitoid, emphasising their continuity rather than difference.

Plainware assemblages show little, if any, change through time, from the colonisation period to as recently as ca. 1000 BP in some areas. The vessel shapes are limited almost exclusively to globular pots or bowls and their range is uniform within sites. There may be some temporal variability in the thickness of the vessel wall, but this is limited to only a couple of sites and appears related to temper and clay choice or availability, rather than stylistic change. In sites where the density of plainware has been argued to decrease through time, the characteristics of the assemblages remain constant, regardless of the length of time represented in the site.

Unfortunately, the chronology for the disappearance of ceramics from West Polynesia is not possible to ascertain from the presently available data. This chronology appears not to be consistent throughout the region and ceramics may have been manufactured in some areas until the proto-historic period (Clarke n.d.).

Non-ceramic artefacts

Little change through time can be identified in non-ceramic artefacts, with the exception the appearance of some new adze types. Overall the quantity of non-ceramic artefacts in the assemblages is surprisingly small. The small number of non-ceramic artefacts prohibited use of quantitative analyses to compare assemblage characteristics in non-ceramic artefacts and meant relying instead on the presence or absence of artefact types to assess change through time. This takes little account of factors affecting preservation, site type or function, but does demonstrate that claims for new artefact types or an increase in their density in the post-Lapita, Ancestral Polynesian period, cannot be argued on current archaeological evidence.

Flaked stone artefacts are the most common artefact type found in the West Polynesian assemblages; however, with the exception of adzes, they have received little or no attention until very recently. As reported by various archaeologists, the Type V plano-convex adze of Green and Davidson's (1969) typology is the most commonly recovered adze from West Polynesian assemblages dated from colonisation to ca. 1000 BP, followed by the Type I. Both these adze types are found in Melanesian Lapita and early East Polynesian assemblages. While they may provide a cultural link between these regions, the morphological similarity between Type V adzes from West Polynesian and early East Polynesian assemblages has been questioned (Anderson et al. 1994). They do not provide evidence for change through time in West Polynesian assemblages that can be equated with the appearance of an Ancestral Polynesian Society.

Several other adze forms do appear to be early West Polynesian, or at least Samoan, innovations. These include the Types VI, VII, IX, X and possibly VIII of Green and Davidson's (1969) typology, argued by Green (1974b) to first appear in Samoan plainware assemblages. They have not been recovered from plainware deposits of the colonising period; however, Types VI, VII and VIII have been identified by Green in the adze assemblage from the early Marquesan site of Hane (reported in Anderson et al. 1994:36). This is discussed further in the following chapter. The near absence of fully published and dated Tongan plainware sites precludes investigation of the distribution of these adze types throughout West Polynesia. They have not been recovered from the plainware contexts on Niuatoputapu investigated in this analysis. It has been suggested by Green (1974a) that these new varieties are a technological response to the new kinds of basalt encountered by the colonisers of Samoa. This is supported by limited sourcing studies that have found the Samoan adzes to be of local basalt (Best et al. 1992; Clark 1996; Weisler 1993). This does not imply any relationship between the new adze types and socio-cultural change in the phylogenetic model.

The findings of the assessment of adze type representation in securely dated sites reflects the contradictions of Green's (1971, 1974b) adze sequence and its use by subsequent researchers. On the one hand, the adze sequence was used to demonstrate continuity from Lapita to East Polynesian assemblages, but on the other, to demonstrate socio-cultural change in West Polynesia reflecting the appearance of an Ancestral Polynesian Society. The adze 'sequence' is not a sequence per se, but composed primarily of a range of static types that do not evolve or change over time.

Artefacts manufactured from organic materials were not recovered from all the analysed sites. This appears to be related to conditions of preservation because, where organic material in general is preserved, such artefacts were recovered. Given the limits of preservation and sample size, the range of artefact types from excavated deposits is relatively consistent across time and space. Comparison of Lapita and plainware assemblages suggested that some shell ornaments (such as shell rings and discs) present in Lapita contexts are missing or very rare in plainware contexts. Again this is based on very low numbers of artefacts and may be a consequence of sample size. Whether these artefacts are associated only with the early period depends on whether dates associated with To.2, Fakatafenga and possibly To.6 are too recent. If these assemblages are included with those dating to the colonisation period, there is a clear association of these shell ornaments with the earliest deposits. Kirch (1988) identifies such artefacts as valuables used in long-distance exchange networks between Lapita communities. The breakdown of such networks following colonisation may account for the absence of the artefacts in plainware assemblages, but a social function of these artefacts in prehistory remains to be demonstrated.

Faunal assemblages

Faunal assemblages are the least published and analysed component of the assemblages. Of all the analysed categories of cultural material, the faunal assemblages appear to be most variable through time, although, like the ceramic assemblages, this variability appears confined to only a minor component of the total assemblage and to the early part of the sequence.

The main source of this variability is in the concentration of indigenous terrestrial fauna, including a range of birds, turtles and reptiles, in deposits dating very early in the sequence. The dominant faunal remains are shellfish, although this does not automatically reflect the importance of shellfish in the diet. Where collected and analysed, fishbone is the other major component, reflecting both the greater preservation of organic material in coastal midden sites and the centrality of the marine resources in the diet. Some change through time is evident in dominant shellfish species in almost all sites with more than one analytical unit. This has been explained as due either to the early over-exploitation of some species (Janetski 1976b) or changing environment (Kirch 1988; Poulsen 1987).

Discussion

Temporal change in West Polynesian material culture and fauna appears confined primarily to the early colonisation period. The continuity in cultural assemblages over the remainder of the period under consideration does not equate with the established West Polynesian cultural chronology. Unless the disappearance of dentate stamped decoration and associated complex vessel forms alone can be argued to reflect the cultural change of the phylogenetic model of Polynesian origins, no such change is evident. Elsewhere, such an argument has been considered simplistic in not accounting for behaviour represented by the other aspects of the cultural assemblages (Spriggs 1997:152).

The West Polynesian cultural chronology was based almost exclusively on the variability of ceramic characteristics and the uncritical use of radiocarbon dates from a limited number of ceramic sites. The findings here suggest an alternative chronology, described in Table 10.1. This is not meant as a replacement cultural chronology, because the relationship of the evidence listed to the construct of a prehistoric culture is yet to be established. Table 10.1 simply summarises the findings and serves to highlight discrepancies between the original cultural chronology and current West Polynesian archaeological evidence.

Table 10.1 Summary of evidence for change through time in the West Polynesian archaeological record.

COLONISATION PERIOD [?CA. 3000 (OR MORE RECENT)–2600 BP?]

- Ceramic assemblages consisting of plainware of simple functional forms some of which include dentate stamped decoration and associated complex vessel forms.
- Few stone adzes mostly of exotic raw materials, shell artefacts including a range of ornaments in association with dentate stamped ceramics and occasionally one-piece shell fishhooks.
- Indigenous terrestrial fauna, especially turtle and birds, mammals and reptiles. Fish and shellfish predominate and the only domesticate is chicken, with a possible exception of pig from a single site.

POST-COLONISATION PERIOD (CA. 2600–1000 BP)

- Plainware ceramic assemblages of simple, functional vessel forms.
- An increased range of adze forms probably associated with new basalt sources, shell artefacts similar to colonisation period but probably without some shell ornaments, occasional one-piece shell fishhooks.
- Fish and shellfish predominate with a small component of indigenous fauna, chicken and very limited evidence for pig and dog before ca. 2000 BP.

MOUND BUILDING PERIOD [CA. 1000 (OR EARLIER) TO THE HISTORIC PERIOD]

- Plainware assemblages continue in some areas.
- Adze types known from Samoan plainware contexts with the possible disappearance of Type V.
- Non-ceramic artefacts little known but appear similar to those from earlier assemblages (see Davidson 1976) with the inclusion of trolling lures (Davidson 1976; Janetski 1980a).
- Evidence for pig is plentiful by ca. 800 BP (Davidson 1976), shellfish and fish predominate in midden sites.
- Construction of a range of mounds, large wells, house platforms and other features in Tonga and Samoa.

HISTORIC PERIOD

An early West Polynesian archaelogical signature?

The concept of a Polynesian homeland in West Polynesia is central to the phylogenetic model of Polynesian origins. A homeland in this context is essentially a linguistic construct, based on the patterning of languages in the present considered derivative of a single ancestral language, in this case, Proto-Polynesian. The archaeological correlate of a linguistic homeland provides both the location of, and absolute chronology for, the development of the proto-language. The archaeological record of the homeland should demonstrate:

- a regional consistency in material culture and subsistence patterns at the time of language development; and,
- be identifiably different to its predecessor and contemporary archaeological signatures elsewhere.

There is a regional consistency in most aspects of the early West Polynesian cultural assemblages. This is characterised by plainware ceramics in both fully plainware assemblages and the undecorated component of Lapita assemblages. It should be noted, however, that non-ceramic assemblages are not necessarily lacking in the early period, but they have not been dated or adequately dated and could therefore not be included in the present analysis. In deposits dating to the colonisation period, the presence of indigenous terrestrial fauna in the assemblages also appears to be a regional pattern. Most shell and other non-ceramic artefacts are consistently found in sites throughout the region with the exception of certain adze types. Fishhooks appear to be associated with only some coastal middens. Kirch and Hunt (1993:240) offer an environmental explanation for this, such that fishhooks are found in assemblages from sites which are not associated with a protected lagoon, and which thus prohibit net and spear fishing. Therefore, angling becomes an important strategy. Most other sources of variability in excavated assemblages can be accounted for in terms of site location and preservation. In both the colonisation and subsequent plainware periods the evidence strongly suggests a regional archaeological signature, fulfilling the first aspect of an archaeological correlate for the linguistic homeland.

Within the phylogenetic model, this regional signature needs to be identifiably different to that which directly preceded the period in which the proto-language is considered to have developed and recognisably different to contemporary archaeological assemblages from elsewhere in the southwest Pacific. As discussed above, there is significant continuity between Lapita and plainware assemblages in West Polynesia. Given that the early dates associated with plainware assemblages suggest the disappearance of dentate stamped decoration within the colonisation period, it is difficult to see the archaeology of the early West Polynesian plainware period as significantly different to that which went before. It is possible that during the plainware period the process of active eastward exploration and colonisation ceased, setting it apart from the preceding Lapita or colonisation period. The current pattern of early East Polynesian radiocarbon dates and archaeology suggests that this is likely, but it does not appear to result in significantly different or new cultural assemblages in West Polynesia.

Can the post-Lapita West Polynesian archaeological record be considered culturally distinct from contemporary archaeological signatures in Fiji or Island Melanesia? By, culturally distinct, I mean within the terms by which culture is identified in the phylogenetic model, that is, by which cultural difference or similarity is assigned primarily on variation in artefact morphology and the presence of certain artefact types. In Chapter 7, I briefly mentioned that the sequence of change from Lapita to fully plainware assemblages in the early West Polynesian record is mirrored by similar changes to post-Lapita plainware assemblages throughout the region in which Lapita sites are found, including Fiji (Best 1984; Anderson and Clark 1999), Vanuatu (Spriggs 1997), New Caledonia (Kirch 1997:73; Sand 1996), the Solomon Islands (Spriggs 1997) and the Bismarck Archipelago (Kirch 1997). This suggests that the ceramic sequence identified in West Polynesia is not unique to the region and that similar processes of change, reflected in the disappearance of dentate stamped decoration, are operating throughout the region in which Lapita sites are found.

Do other aspects of Lapita/post-Lapita archaeology similarly change? To answer this, it is first necessary to look at the range of variability in the initial Lapita assemblages. Regional differences in Lapita assemblages have led to the identification of four geographic regions (Far Western, Western, Southern and Eastern Lapita) within which similarities, especially in the motifs of dentate stamped decoration, have been noted (see Kirch 1997 for a review of the evidence from each region). A further division between Lapita assemblages in Near and Remote Oceania has been made on the basis that Lapita in Remote Oceania is a signature of initial colonisation of the region (Green 1996). In Remote Oceania, the increased distance of water crossings may have led to increasing isolation of Lapita communities giving rise to regional networks (Kirch 1997:70).

Notably absent from Eastern Lapita sites in Fiji and West Polynesia, but present in at least some Lapita sites to the west, is evidence for stilt structures, activity areas, plant remains and 'down the line' exchange, especially of obsidian. Many of these absences can be explained in terms of site location and preservation factors and perhaps by the greater distances over which raw materials and exchange goods would have to have been transported in Remote Oceania (cf. Kirch 1997:70). A further difference between Lapita sites in Near and Remote Oceania may be the presence of pig in Near Oceania but the absence of evidence for pig in Lapita sites in Remote Oceania. However, despite this variation, Green (1996:120) maintains that Lapita in Remote Oceania can be seen as 'a material culture version of a Western (and then Eastern) form of the Lapita cultural complex', a suite of artefactual and other evidence consistently recovered from Lapita sites and reflecting a particular cultural group or people (see Green 1979). This is supported by Spriggs (1997:109–11), who agrees with Green (1992) that Lapita sites should not be and are not defined on dentate stamped ceramics alone, but are better envisaged as a cultural complex. On this basis, Green (1992:15) argues that early plainware ceramic assemblages from the southeast Solomon Islands and Samoa, and early aceramic deposits from Nissan, are part of the Lapita cultural complex. To these sites Spriggs (1997:111) adds the Island Southeast Asian Neolithic assemblages and early Western Micronesian assemblages. If I add to this West Polynesian plainware assemblages in general, then it is reasonable to envisage West Polynesian Lapita and plainware as part of a generalised southwest Pacific archaeological signature, rather than a distinctly different regional signature in Western Polynesia.

Table 10.2 lists material culture, faunal and plant evidence from pre-Lapita Melanesian, Western Lapita, post-Lapita Melanesian, Eastern Lapita and Polynesian plainware, and early East Polynesian deposits (early East Polynesian material is discussed in the following chapter). The information is derived from a large number of site reports, but is by no means complete in that it does not take into account all sites and incorporates only sites for which there is a published chronology for the range of the artefactual and faunal evidence present. Precise information was most difficult to come by for post-Lapita Melanesian sites (for example see Spriggs 1997) because the radiocarbon dating of plainware deposits overlying Lapita deposits is commonly imprecise and disturbance is noted in many of the sites. Also, the non-ceramic material culture in the Late Lapita or plainware contexts is rarely fully reported. Under the heading post-Lapita Melanesian I have included material which is associated with post-Lapita ceramics, but pre-dates ca. 2000 BP, the date at which Spriggs (1997) considers that evidence first becomes archaeologically visible for socio-cultural change which results in distinctive Melanesian societies. For a more detailed list of various kinds of evidence (including plant remains and structures) found in Lapita sites and in pre-Lapita Melanesian and Southeast Asian Neolithic sites see Spriggs (1997:Tables 4.1 and 4.2).

Presenting the data in this manner does mask variability within the artefact categories. For example, Rolett (1993) identifies 21 categories of one-piece fishhooks in early Marquesan sites, whereas only two categories have been identified in Polynesian plainware assemblages (Kirch 1993). Further, the variability of raw materials used in artefacts of the same category, such as shell adzes and armbands, is also not evident in the data and may have a temporal or spatial significance. Despite the limitations, Table 10.2 lists a consistent range of material culture identified in southwest Pacific sites from Lapita to

Table 10.2 Cultural material recovered from pre-Lapita, Lapita, post-Lapita and early East Polynesian assemblages (Code: 1 = Swadling et al. 1991; 2 = Swadling et al. 1989; 3 = Gorecki et al. 1991; 4 = Spriggs 1990; 5 = Allen 1993; 6 = Smith and Allen 1999; 7 = Spriggs 1991; 8 = Gosden et al. 1994; 9 = Wickler 1990; 10 = Smith 1991; 11 = Green 1979; 12 = Kirch 1987; 13 = Kirch et al. 1991; 14 = Fredrickson et al. 1993; 15 = Spriggs 1997; 16 = Marshall and Allen 1991; 17 = Nagaoka 1988; 18 = Gosden pers. comm.; 19 = Kirch and Yen 1982; 20 = Poulsen 1987; 21 = Shutler et al. 1994; 22 = Dye 1987; 23 = Kirch and Hunt 1993; 24 = Jennings and Holmer 1980; 25 = Clark and Michlovic 1996; 26 = Green and Davidson 1974; 27 = Kirch 1988; 28 = Kirch 1981; 29 = Best 1984; 30 = Walter 1990; 31 = Sinoto 1970; 32 = Rolett 1993; 33 = Anderson et al. 1994; 34 = Allen and Schubel 1990; 35 = Rolett and Conte 1995; 36 = Rolett 1992).

CATEGORY OF EVIDENCE	PRE-LAPITA MELANESIA	WESTERN LAPITA	POST-LAPITA MELANESIA	EASTERN LAPITA	POLYNESIAN PLAINWARE	EARLY EAST POLYNESIA
ceramics	2, 3	11	10, 15, 19	20, 21, 22	23, 24, 25, 26	32, 33
stone adze	15	11, 13	15, 19	20, 22	23, 24, 25, 26	30, 32
shell adze	14	10, 11, 12	10, 15, 19	20, 22, 29	27	
shell chisel		10		20, 21		32
hammerstone	16	13	15	20, 22	26	34
polishing/grinding stone	15			22	25, 26	
one-piece shell fishhook	5, 6, 8	10, 11, 12	10, 15, 19	20, 29	23, 24, 27	30, 33, 35
Cypraea octopus lure		10		20, 22	23, 24	31
shell armband/ring	4, 8	11, 12	7, 10, 19	20, 21, 22, 29	23, 24, 27	
shell bead	4		19	20, 21, 22, 29	23	
shell disc or pendant	8	12	19	20, 22	24	33, 32
shell scraper/peeler	6	10, 12	10, 19	20	24, 27	30, 32, 34
shell net sinker	1	10	10	20	26, 27	
other worked shell	6, 8	10, 12	10	20, 29	23, 24	32
drilled tooth		18	?7		23	33
worked bone	15		?7	20	24	32
coral abrader		18	19	20, 21, 22	24, 27	30, 32, 35
echinoid abrader		18	10, 11, 19	20, 22	23, 24, 27	30, 32
pig	?7	12	7, 15, 19		25	33, 36
dog		?13	19		28	36
chicken		13	19	20, 22	23, 24, 27	34, 36
turtle		12	19	20, 22	23, 24	32, 33, 36
bird (other than chicken)	16	12, 17	19	17, 22	23, 24	33, 36
indigenous terrestrial fauna	9, 16	12	7	22, 29	18	36
two-piece fishhook						30, 33
trolling lure						31, 32, 33
harpoon head						30, 32, 33
whale tooth pendant						30, 32, 33
reel ornament						33
pearl shell breast plate						32, 33
tattooing needle						33, 35

post-Lapita plainware assemblages and, to a lesser extent, from pre-Lapita to plainware. Within the terms in which Lapita has been envisaged as a cultural complex, a consistency is evident in the assemblages from southwest Pacific sites until at least ca. 2000 BP, or perhaps more recently in Remote Oceania, from which the composition of West Polynesian plainware assemblages does appear to differ significantly. Similarities in various kinds of non-ceramic material culture from West Polynesian plainware assemblages and contemporary assemblages to the west have been noted by Kirch (1988), Janetski (1980a) and Poulsen (1987).

Other evidence for socio-cultural change in the early East Polynesian archaeological record

The established West Polynesian cultural chronology can be criticised because it does not take adequate account of the available radiocarbon chronology and chronostratigraphic evidence, but also because of the simplistic use of variability in artefact morphology as the primary, and sometimes only, evidence for socio-cultural change. In this monograph, the evidence used for investigating change through time in early West Polynesia has been exclusively drawn from excavated and securely dated assemblages. This was considered necessary for establishing an absolute chronology for cultural material against which the expectations of the model of an Ancestral Polynesian Society could be assessed. However, this resulted in other kinds of archaeological evidence for socio-cultural change not being considered.

In his review of the development of Island Melanesian societies in the post-Lapita period, Spriggs (1997:152) argues that there is a continuity in many aspects of the archaeological record from Lapita to post-Lapita, indicating a cultural continuity until ca. 2000 BP. After this time a suite of changes in the archaeological record indicates the appearance or origins of the diverse Melanesian societies evident at contact. Evidence Spriggs (1997:152) considers suggestive of cultural change includes:

- the cessation of long-distance exchange networks or the major rearrangement of such networks.
- shifts in settlement pattern or general abandonment of previously occupied sites.
- loss of pottery and/or other significant changes in the material culture inventory.
- changed subsistence practices or the use of the landscape.

With the exception of material culture sequences and subsistence patterns, which have been the subject of this monograph, the kinds of evidence listed by Spriggs have not been examined. These fall into two areas: change through time in exchange/interaction networks or settlement pattern, investigated through the presence of raw materials or material culture that can be sourced to a non-local origin; and by the patterned distribution of cultural material within sites or site types across the landscape, respectively.

Kirch (1997:70) argues that during the early phases of Lapita in the Bismarck Archipelago, communities were in close contact, reflected in the exchange of raw materials, especially obsidian. As expansion continued it was inevitable that groups of more closely related and interacting communities formed regional social systems such as that posited for Fiji-West Polynesia. Further, it has been argued that the decline of long-distance interaction at the end of the Lapita period resulted in the increasing isolation of West Polynesia from communities to the west (Kirch 1978). This, along with the maintenance of interaction within West Polynesia, provided the context in which, in the phylogenetic model, the proto-Polynesian language and Ancestral Polynesian Society developed.

The difficulty in maintaining this argument comes from a well recognised lack of archaeological evidence for long distance interaction, especially between Fiji and West Polynesia, during the Lapita and post-Lapita periods (Davidson 1977). Slightly more direct evidence exists for interaction within West Polynesia itself. The uniformity of decorative motifs of dentate stamped decoration from Fijian and West Polynesian contexts has been central to interpretation of the region as an interaction sphere during the Lapita period. This indirect evidence suggests contact between communities during the colonisation period, although this is not conclusive. Davidson (1977), in her review of exchange between communities in West Polynesia and Fiji, concluded that there is sufficient evidence in all periods to infer regular communication and interchange of ideas throughout the region, but recognised the lack of direct evidence for contact. Best (1984:631) reached a similar conclusion based on the Fijian evidence, while recognising greater evidence for interaction (although not necessarily with West Polynesia) in the early Lapita period.

The direct evidence for contact between Fiji and West Polynesia consists of a basalt adze of probable Fijian origin, from the Tongoleleka Lapita site in the Ha'apai Group (Dye 1987:135). Volcanic glass from an early Fijian Lapita context may be from the Tafahi source near Niuatoputapu (Best 1984:432). Within West Polynesia, chert from the Tafahi site has been recovered from Tongatapu Lapita contexts (Poulsen 1987:214) an adze from the Ferry Berth Lapita deposit in Western Samoa has been sourced to a Tongan origin (Leach and Green 1989). Chert, of possibly Futunan origin was recovered from the NT-90 site on Niuatoputapu (Kirch 1988:254). In the plainware period, no direct evidence for Fiji-West Polynesian contact has been recovered, although evidence for inter-island networks within West Polynesia is more common. Volcanic glass of a probable Tutuila origin has been recovered from plainware contexts in Western Samoa (Clark and Wright 1995). Adzes of basalt from American Samoan sources reached Fiji by 900 BP (Best et al. 1992; Clark 1996) and volcanic glass from Tutuila is found in Upolu sites dating 1900 BP and perhaps earlier (Clark 1996). Sourcing studies (Dickinson 1988, 1993; Dye 1987; Hunt and Erkelens 1993; Kirch 1988) of clay and temper used in West Polynesian Lapita and early plainware assemblages indicate local manufacture of ceramics, although Hunt and Erkelens (1993) consider a small percentage of the ceramics from the To'aga sites to be of non-local origin.

Green (1996) has recently summarised direct evidence for interaction in Lapita communities in general, and the possible, rather than demonstrated, exotic origin of a range of excavated and unprovenanced West Polynesian and Fijian material. He (Green 1996:126) found that although there is generally little evidence for a Lapita trade network between Fiji, Tonga and Samoa, there is 'good evidence for Lapita exchange networks within each of these regions, all of them with some ties to adjacent regions'. In contrast to the down-the-line exchange of obsidian in Near Oceania, Green (1996:126) identifies obsidian or volcanic glass in Remote Oceania during the Lapita period as 'small scale direct access or local reciprocity affairs, with only occasional linkages to islands some distance away'.

In short, little evidence exists for interaction between West Polynesia and communities to the west until ca. 1000 BP and this is insufficient to infer any change through time in the on-going contact or isolation of West Polynesia during the colonisation or plainware periods. After 1000 BP, at least in Samoa, there is evidence for increasing external interaction through the movement of basalt from the Tatagamatau quarry on Tutuila Island west to Fiji by 900 BP and to Taumako, north to Tokelau and Tuvalu and to the Southern Cooks ca. 600 BP (Clark 1996; Walter and Sheppard 1996). Best (1984:494) notes the re-establishment of long distance interaction with contact between Fiji and Vanuatu after 1700 BP, although contact with West Polynesia is unclear. In the late prehistoric period Clark (1996:454) describes Fiji, Tonga and Samoa as 'linked in a network of social and economic interactions'.

Green (1986:51) has argued that understanding the Ancestral Polynesian Society settlement pattern is crucial to understanding the subsequent development of social complexity throughout Polynesia. However, Kirch and Green (1987:438; Green 1986, 1994; Kirch 1988:242) have noted that material evidence for the structure of the household unit and for settlement patterns in general is lacking in the early West Polynesian record.

Changes in settlement pattern, in particular the spread of sites away from the coast and the appearance of new site types, have been cited as evidence for social change in West Polynesia and Melanesia (Best 1984; Kirch 1990; Sand 1996). In particular, the appearance of inland sites in Tonga has been associated with an increasing dependence on an agricultural resource base and the development of agricultural systems seen at the time of European contact (Spennemann 1986). Evidence for settlement pattern based on the distribution of site types in Samoa and Tonga has been recently reviewed by Clark (1996) and Burley (1994, 1999), respectively.

In his review of the Western Samoan evidence, Clark (1996:452) found no secure evidence for inland occupation earlier than 2000 BP, with a number of inland sites dating to ca. 1500 BP, but most dating after 1000 BP. He considers that the pattern of continuous dispersed settlement evident in Western Samoa at contact may date only to the last few centuries (Clark 1996:453) and residential occupation in the Vailele area is not demonstrable in the archaeological record until slightly earlier than 1000 BP. Davidson (1974:227) interprets radiocarbon dates associated with five Samoan mounds as suggesting that mound construction may not have begun until ca. 900 BP, but other features such as house platforms and earthwork fortifications may have a longer chronology. Clark (1996:452) also suggests that large mounds appear ca. 800–900 BP on the coast and in some valleys. These might have been bases for houses, the largest being associated with high-ranking individuals or possibly ceremonial activities.

Settlement pattern in American Samoa reflects the geography of high rugged islands lacking large valleys or tablelands, in that settlement has remained primarily on the coast. The chronology of settlements away from the coast is unclear (Clark 1996:452).

The Tongan evidence for settlement pattern in the earlier period is based almost exclusively on the distribution of surface scatters of ceramics. Lapita sites are located adjacent to, or on, a protected bay or lagoon and, according to Burley (1994:382) are 'middens in which habitation is both restricted and aggregated' and apparently village-based. Lapita sites are limited to a single site per island in the Ha'apai Group and only a handful of sites on Tongatapu. This apparent rareness of Lapita sites further suggests the disappearance of dentate stamping in, or immediately following, the colonisation period. In the subsequent plainware period, the number of sites greatly increases and sites are found in beach and inland locations. Spennemann (1986:10) describes plainware sites as indicating 'a dense but dispersed settlement' similar to that observed at the time of European contact. Burley (1994:389) has contested such an interpretation for the Ha'apai evidence because inland plainware sites rarely comprise more than a few scattered sherds without associated evidence for habitation, and are therefore not secure evidence for interpreting settlement pattern. Burley (1994:391) found that configuration of plainware sites to be little different from Lapita:

> If one accepts Lapita as village-like then it is hard to argue that plainware sites are not. Lapita settlement pattern has not changed in the late ceramic period, new occupation sites have simply been established.

This view is consistent with Kirch's (1988:242) conclusions for Niuatoputapu that settlement pattern does not change during the ceramic period, but settlement numbers do expand.

Dating the appearance of burial mounds and other features in the Tongan landscape is unclear, although they are commonly attributed to the last millennium (Davidson 1977; Kirch 1990). Two burial mounds on Tongatapu excavated by Davidson (1969a) in 1964 containing a small number of sherds in the lower stratigraphic units revealed a long sequence of usage. Radiocarbon dates from one mound suggested a date of ca. 1000 BP for early deposits.

Evidence for interaction, especially between West Polynesia and communities to the west, and for change through time in settlement pattern securely dated to pre-1000 BP, is currently insufficient to permit any understanding of changing social patterns. Where change in these 'systems' is evident in archaeological evidence, it does not equate with the plainware period, or at least not early in this period, and appears to be associated with the period from at least 1500 BP. After 1000 BP visible changes in the archaeological evidence accord with the kinds of evidence suggested by Spriggs (1997) as archaeological indicators of cultural change. These are currently lacking from the earlier record.

Discussion

The archaeology of the Ancestral Polynesian Society has been described as 'the transformation of an ancestral Lapita technology to a truly Polynesian form' (Kirch 1984:52). The findings of this analysis demonstrate that, while this may be the case, the kinds of archaeological evidence cited in support of this model are not visible in the early archaeological record of West Polynesia. Contrary to the expectations of the phylogenetic model, in the period following colonisation of West Polynesia the archaeological evidence varies from that of the colonisation period only in the disappearance of a minor component of material culture and faunal assemblages. There do not appear to be new or different kinds of evidence associated with plainware ceramics. Conversely, there is continuity in most aspects of the archaeological record that appears to mirror post-Lapita sequences in Fiji and Island Melanesia and is consistent in West Polynesia until ca. 1000 BP or slightly earlier. This may be a product of limited research in post-Lapita sites across the region. Given the apparent time span of 2000 years for plainware assemblages in West Polynesia, the handful of securely dated sites from across the region is hardly adequate to understand social patterning and subsistence strategies throughout the period.

The analysis of the ceramic assemblages and other cultural material suggests that Lapita, as characterised by the presence of dentate stamping, disappears early in the sequence. The faunal evidence in plainware sites, contemporary with Lapita, suggests they may be colonisation sites, which supports Anderson and Clark's (1999) suggestion that dentate stamped decoration disappeared within the colonisation phase. These findings dissociate plainware assemblages from the construct of an Ancestral Polynesian Society. The plainware assemblages show little change through time and this cannot be associated with social or cultural change. The evidence as a whole cannot be considered as an archaeological correlate for the Ancestral Polynesian Society of the phylogenetic model.

The construct of an Ancestral Polynesian Society is a response to questions of the origins and ethnogenesis of Polynesians; that is, when and in what context did the various characteristics (social, linguistic, material and biological) identified by Europeans as 'Polynesian' first arise. They do not appear to be in West Polynesia prior to ca. 1000 BP, at least on current archaeological evidence. While this does not refute the model per se, it opens two possibilities. The first is that archaeological evidence is of such a different order to that of linguistic or ethnographic evidence that a model of prehistory based on evidence from these disciplines will not be directly reflected or supported by archaeological evidence. The second possibility is that the linguistic and social characteristics of the societies identified by Europeans as Polynesian did not first appear in the period following initial colonisation of West Polynesia, but in a more recent context. These possibilities are not mutually exclusive. The implications of both these possibilities are discussed in the final chapter.

11

Conclusion

IN CHAPTER 1, it was argued that the early prehistory of West Polynesia has been constructed in response to questions concerning the origin of Polynesian societies. These have been formulated within a linguistic and phylogenetic model of the genesis of Polynesian societies, the strength of which is dependent upon the identification of a Polynesian homeland.

I argued that the phylogenetic model requires an archaeological correlate for the Ancestral Polynesian language in order to give it a historical context — a reality in time and space. However, this assumes that language change or development and an associated cultural change will be visible in the archaeological record. The analysis of published West Polynesian archaeological evidence presented in this monograph demonstrates that such an assumption cannot be made in regard to a Proto-Polynesian language and the West Polynesian archaeological record in the period from colonisation until ca. 1000 BP. The results present a picture of the early prehistory of the region that is very different to that suggested on the basis of the phylogenetic model. Not only are the expected temporal changes in cultural assemblages not apparent in sites with a reliable radiocarbon chronology, but the West Polynesian regional archaeological record appears to reflect a general southwest Pacific signature until at least ca. 1500 BP, and probably as recently as 1000 BP. In this concluding chapter, the implications of these findings are discussed with regard to the current evidence for the colonisation of East Polynesia and the phylogenetic model of Polynesian origins.

Implications of the assessment for understanding colonisation in remote oceania

Neither of the current contradictory models for the chronology of East Polynesian colonisation support the established West Polynesian cultural chronology. The model of continuous colonisation in Remote Oceania put forward by Irwin (1992) does not permit the development of Proto-Polynesian within West Polynesia prior to eastward colonisation, nor the use of the West Polynesian ceramic and adze sequences as an archaeological correlate for the development of an Ancestral Polynesian Society. The chronology for East Polynesian colonisation in the late model of Spriggs and Anderson (1993) places colonisation within the aceramic phase of West Polynesian prehistory, breaking an association between plainware ceramics, and an Ancestral Polynesian Society.

The late model of East Polynesian colonisation has been developed primarily from assessments of radiocarbon dates (Spriggs and Anderson 1993) and revisions of the Marquesan sequence (Anderson et al. 1994; Rolett and Conte 1995). This implies that, contrary to a model for continuous voyaging in Remote Oceania put forward by Irwin (1992), an interval of up to 1500 years ensued prior to further eastward colonisation. Although it would seem logical that eastward colonisation reflected in Lapita and early Samoan plainware sites continued beyond West Polynesia, it is primarily on logic rather than substantive evidence that such an argument rests. As Irwin (1981, 1992) has argued, there is no navigational or seafaring barrier within Remote Oceania that would require the development of new technologies prior to further eastward colonisation. It is therefore arguable that the pattern of colonisation reflected in Lapita archaeology was continued across the whole of Remote Oceania. However, the current absence of clear evidence of cultural deposits in East Polynesia dating prior to ca. 1500 BP argues against the logic of a continuous voyaging model.

The early West Polynesian evidence cannot directly inform us as to whether colonisation was continuous beyond West Polynesia. However, intrinsic to Irwin's model of exploration and colonisation is the concept of return voyaging and the interaction of communities during the exploration and colonisation phases and, at least in East Polynesia, the maintenance of networks of interaction until perhaps as recently as 500 BP. Given this, it is fair to expect that some archaeological material should be recovered from early West Polynesian sites which can be sourced to East Polynesia. However, to date, none has been reported from sites dating earlier than ca. 1000 BP. Although as Irwin (1992:89) argues, a connection between West and East Polynesia may not have been maintained for long after settlement of East Polynesia — Lapita elsewhere is characterised by interaction, at least early in the colonisation phase. West Polynesian adze types that appear from Green's and the present analyses to be a Samoan innovation recovered from later, post-2500 BP plainware assemblages have been identified in the early Marquesan site of Hane (see Anderson et al. 1994:36), suggesting colonisation of the Marquesas did not take place until after 2500 BP.

More importantly, early East Polynesian sites should contain clear indications of homeland artefacts. However, differences have long been recognised between the material culture of early East Polynesian sites, known as Archaic East Polynesian, and that of West Polynesian sites dated ca. 2200 to 1800 BP [the timing for East Polynesian colonisation in the orthodox chronology (Davidson 1976; Kirch 1985)]. Some of these differences are illustrated in Table 10.1 through the presence of a number of artefact forms common to early East Polynesian sites, but unknown in early West Polynesian assemblages. These include two-piece fishhooks, harpoons, whale tooth pendants and reel ornaments, and a large variety of one-piece fishhooks. It has been argued that the early Marquesan sites demonstrate the development of these East Polynesian artefacts from earlier West Polynesian forms (Green 1974b; Kirch 1986). However, revisions to the Hane (Anderson et al. 1994) and Ha'atuatua (Rolett and Conte 1995) sequences wipe out this earlier developmental phase and, along with the artefactual evidence from the earliest sites in the Society and Cook Islands, present a pattern of distinctly Archaic East Polynesian artefact forms. This is uniform and widespread in the earliest East Polynesian deposits (Walter 1996).

The question remains as to whether the poorly documented West Polynesian material culture of the mound-building period demonstrates the expected similarities. Rolett (1993) and Rolett and Conte (1995) identify early Marquesan trolling lures as being of a 'West Polynesian type'. These artefacts do not appear to be associated with early West Polynesian assemblages, but are recovered from assemblages dating to the last millennium (Davidson 1969a). Basalt sourced to Samoa has been recovered from Southern Cook Island sites dated to ca. 600 BP (Walter and Sheppard 1996). This has been associated with the re-establishing of links between West and East Polynesia in the last 1000 years but, given the pattern of early radiocarbon dates from East Polynesia, may now be argued to be associated with the colonisation or post-colonisation period. Ceramics sourced to West Polynesia or Fiji have been recovered in small quantities from early Marquesan (Dickinson and Shutler 1974) and southern Cook Islands (Walter and Dickinson 1989) sites. The manufacture of ceramics in West Polynesia now appears to have continued in some areas into the last millennium. Green's (1974a:247) original interpretation of the small quantities of ceramics in early Marquesan sites as reflecting the decline of ceramic manufacture in West Polynesia ca. 2000 BP may equally apply to a more recent date.

The major change in the West Polynesian regional sequence comes with the appearance of monumental architecture or earthworks on the landscape throughout the archipelago. The chronology for the earliest of these structures is unclear. It is generally accepted that the structures indicate social change in the region towards the kinds of systems in place at European contact (Burley 1999; Kirch 1990), these being hierarchical chiefly polities, the power of which is expressed through monuments on the landscape. The monuments, along with those of East Polynesia, are considered to characterise the Polynesian landscape after colonisation of East Polynesia and to be a convergent social evolutionary characteristic indicative of a common 'proto-Polynesian' origin. The radiocarbon dates from Samoa and Tonga, while insufficient for establishing any sort of chronology for mound construction, do suggest that mound construction began later than 1500 BP and was certainly under way by 900 BP (Davidson 1976). This is precisely the period suggested by the late chronology for East Polynesian colonisation. On the basis of the material evidence and the radiocarbon chronology, the appearance of mounds on the landscapes of both East and West Polynesia may be associated with East Polynesian colonisation. The convergent evolution of social forms is perhaps better understood as the transference of a social characteristic from West to East Polynesia during colonisation, or one which developed within an interaction sphere which included both West and East Polynesia.

If the colonisation of East Polynesia did not take place until after 1500 BP, then there was a pause or gap in colonisation east of West Polynesia of at least 1300 years, and perhaps as much as 1800 years. This does not preclude the possibility of exploratory voyages or occasional visits to East Polynesia (Anderson 1995), but infers a cessation of the pattern of colonisation reflected by Lapita archaeology in Remote Oceania — a pattern characterised by archaeologically sudden and widespread colonisation of a previously uninhabited region, identifiable in the archaeological record by similarities in material culture, site location, faunal evidence and the associated radiocarbon chronology. The archaeology of West Polynesia, like that elsewhere in Remote Oceania, does not suggest any major social change or technological innovation in the post-Lapita period for at least 1300 years. Then, around 1000 BP, there are changes in the archaeological record that coincide with the chronology of early sites in East Polynesia. Early East Polynesian sites appear throughout the region within a few hundred years and are identified by a consistent range of material culture, their location on beaches and lagoons, and the associated suite of faunal evidence reflecting initial human exploitation of islands.

Walter (1990) has noted a similarity in the archaeological pattern of colonisation reflected by Lapita and early East Polynesian sites which he initially interpreted as evidence in support of a model of continuous voyaging. The revisions of the early East Polynesian radiocarbon and archaeological sequences and the results of this assessment of the early West Polynesian evidence question such an interpretation, suggesting that this may be a pattern of island colonisation, rather than a pattern that can be associated with a particular group or single episode of colonisation.

Implications of the assessment for the construct of an ancestral Polynesian society and the origin of Polynesian societies

The assessment of the early West Polynesian archaeological record presented in this monograph has indicated that the pattern of archaeological evidence does not conform to expectations of the linguistic model of an Ancestral Polynesian Society. This does not mean that the model of language change is incorrect, but that the expectation that archaeological evidence will reflect language change is unfounded. In Chapter 1 it was argued that linguistic and archaeological evidence represent different kinds of evidence, each with their own limitations in regard to the recognition and interpretation of data, and that connections between the evidence must be made in light of this. Underlying the expectation that language change will be reflected in changes in the archaeological evidence is an assumption that language, material culture and biology are tied together under the umbrella of culture. As I (Smith 1995) and others (e.g. Terrell 1989; Terrell et al. 1997) have argued, there is no necessary relationship between these three kinds of evidence, even if it can be argued the colonisation of Remote Oceania was achieved by a single cultural group.

The phylogenetic model is not simply a model of language origin and development, but one that uses linguistic evidence to construct a history of Polynesian societies and, as such, is a model of ethnogenesis. The central tenet of the model is that the ultimate origin of Polynesian languages, biology, resource base, and material culture is in Southeast Asia, and the evolution of these cultural traits can be envisaged as a series of stages (Neolithic Southeast Asia, Lapita, Ancestral Polynesian, Archaic East Polynesian) that culminate in the Polynesian societies observed by European voyagers. It has been argued that these cultural stages are visible in particular kinds of archaeological assemblages, characteristics of which can be shown to have 'evolved' over time and space from ca. 5000 BP in Southeast Asia to the proto-historic in Polynesia. Archaeological evidence is now available from Island Melanesia, West Polynesia and East Polynesia that appears to contradict this linear developmental model:

- As discussed in Chapter 1, the association of Lapita assemblages in Near Oceania with the arrival of Austronesian-speakers from Island Southeast Asia has been challenged by research into the pre-Lapita economy and material culture demonstrating continuity with aspects of Lapita assemblages.
- The early West Polynesian evidence does not conform to the expectations of the model of an Ancestral Polynesian Society, breaking the cultural link between Lapita and Archaic East Polynesia in the phylogenetic model. Similarities in the post-Lapita evidence from West Polynesia and elsewhere suggest that during this period Melanesia and West Polynesia may also be considered a kind of regional melting pot, and that a distinctive West Polynesian society is not evident in the archaeological record until ca. 1000 BP. Although suggested by the current evidence, confirmation of this requires further research.
- The archaeological evidence for East Polynesian colonisation does not support a model of direct cultural evolution from Lapita communities in West Polynesia to early East Polynesian communities. There is currently no direct archaeological evidence for socio-cultural change in West Polynesia prior to ca. 1000 BP. However, at ca. 1000 BP the appearance of such evidence in West Polynesia is coincident with the chronology for a late model of East Polynesian colonisation. On current evidence, Lapita colonisation of the region appears unrelated to East Polynesian colonisation in both a temporal and cultural sense. The uniformities observed in Polynesian societies are, in this model, more likely to result from interaction following colonisation than from a phylogenetic relationship of Polynesian societies to a single ancestral society.

The similarities in Polynesian societies observed by Europeans require an explanation in terms of the history of those societies. The phylogenetic model has been offered as a framework with which to understand that history. However, it fails to offer a satisfactory explanation for the current pattern of early archaeological evidence in Remote Oceania.

Conclusion

In Chapter 1, the phylogenetic model was criticised because it privileges ethnogenesis as an explanation of variability in the archaeological record, without first arguing how culture or ethnicity may be reflected in material culture. Further, it does not take into account the complex processes affecting the pattern of archaeological evidence in the present. In the phylogenetic model of Polynesian origins this is compounded by the structuring of the model on linguistic evidence in the absence of clearly articulated theories of how language and language change may be reflected in the archaeological evidence. Language and patterning in material culture are used by individuals in the present to construct ethnic boundaries, both in terms of themselves and others, but these boundaries do not exist outside of the agreement (or disagreement) of individuals. Attempting to stabilise a concept of ethnicity or culture by identifying it in archaeological evidence denies both the fluidity of the construct in the present or ethnographic past and the structure of archaeological evidence.

The absence of an independent, absolute chronology for language development means that features of past societies identified from reconstructed proto-languages need to be associated with a set of archaeological evidence in order to be located in time and space. This, in turn, requires both clearly articulated theories of how material culture reflects social patterning and change, and recognition that archaeological evidence is not a record of human behaviour per se, but a conflation of behaviours and non-cultural processes. In short, linguistic and archaeological evidence are two very different kinds of evidence. This is not to say that one form of evidence is more illuminating or credible, or that both are not useful for reconstructing the past, but simply that any relationship between the two needs to be demonstrated, rather than assumed.

Adherence to a linguistic framework for interpreting the early West Polynesian archaeological record originates in a desire to trace the origin of the characteristics identified as Polynesian. As a consequence, this search for Polynesian origins has been confused with questions of when and how people came to be living on Pacific islands at the time of European contact, and has marginalised evidence which may inform us of the processes and perhaps motives for colonisation in Remote Oceania. When patterning of archaeological evidence is central to the creation of interpretive frameworks, despite sampling and preservation induced biases, it is capable of generating a different kind of information about past behaviour. This is clearly evident in the early West Polynesian record.

The focus of this monograph has been the archaeological evidence. In regard to the early prehistory of West Polynesia, the assessment presented herein has demonstrated that there is no necessary chronological relationship between the early archaeology of the region and the origins of the socio-cultural characteristics that have been used to identify a society as Polynesian. Models of Polynesian origins have assumed that, as well as being the geographic homeland for the people who colonised East Polynesia, West Polynesia provided their cultural homeland. While this may be the case, it is not evident in the early archaeological record of the region.

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Appendix A

Assessment of West Polynesian ^{14}C determinations

Kingdom of Tonga

Niuatoputapu

Lolokoka NT-90 (see Table A.1)

The archaeological deposits at the Lolokoka site, NT-90, are the earliest evidence of human occupation on Niuatoputapu. Surface artefactual material, primarily ceramic sherds, had been initially identified by Rogers (1974) in 1971 and were excavated by Kirch (1988) in 1976. The site is located in the ceramic zone on the northern side of the Island and contains dentate stamped Lapita sherds. An area of 51.25m^2 (Kirch 1988:Table 6) was excavated in a grid laid out over an area of 240m^2 (Kirch 1988:85).

Kirch (1988:85–87) describes a uniform shallow stratigraphy across the site consisting of two layers. Layer I is the cultural component of the site, with both disturbed and undisturbed facies, and is divided into Layers IA and IB. Layer IA is garden soil with 'extensively reworked' cultural deposit, while Layer IB has 'less disturbed cultural material often with intact features near the base'. Layer II comprises the underlying parent dune sand, sometimes containing sparse cultural materials in the upper portion, designated IIA. Layer IIB is heavily concreted basal sterile calcareous sand. Kirch (1988:85, 90) identifies the 'considerable post-depositional disturbance' of the site as posing problems for interpretation.

All dated samples come from different excavation units within Layer IB. The exact provenance of the samples is not discussed in relation to the disturbance and features noted for Layer IB. However, Unit Q28 II(3), Layer IIB and Unit A25 I/II, Layer IB (from which the charcoal samples for

Table A.1 Niuatoputapu radiocarbon determinations (after Kirch 1988:Table 13) (Code: * = $\delta^{13}C$ corrected).

SITE	LAB NO.	DATE BP	CAL RANGE BP (2σ)	PROVENANCE	CATEGORY
NT-90	I-10632	3770±90*	3814-3350	Unit S24 II(2), Layer IB	2
NT-90	I-10633	3620±85*	3600-3192	Unit I21 III(3), Layer IB	2
NT-90	I-9934	1815±130	2035-1411	Unit A25, Layer IB 34-54 cm bs	2
NT-90	I-10481	1110±75	1176-802	Unit Q28 II(3), Layer IB 32-36 cm bs	2
NT-100	I-9936	1120±165	1339-688	Unit 220, Layer IB 57-66 cm bs	3
NT-100	I-9937	1220±95	1306-932	Unit 269, Layer IIA 67-75 cm bs	1
NT-100	I-10634	1720±80*	1308-971	Unit 269, Layer IIA	1
NT-100	Beta-8682	1290±100	928-548	Unit 210, 40-60 cm bs	2
NT-100	Beta-8684	1160±60*	1261-953	Unit 269, Layer IIA 67-75 cm bs	1
NT-93	Beta-8683	1750±60*	1302-1053	Unit 120, Layer IC	2
NT-125	I-10482	1140±75	1259-924	Unit 20N, Bed 4	3

I-9934 and I-10481 were excavated) are listed as having an earth oven containing ash and charcoal at the base and a probable trash pit containing midden and sherds (Kirch 1988:Table 8). The relationship of the dated samples to these features is not discussed. No illustrated sections of the units from which the ^{14}C samples were collected are provided by Kirch (1988).

I-10632 and I-10633 are on *Tridacna* shell samples from the same layer (IB) as the charcoal samples, but give a much earlier date. Kirch (1988:142) argues that the *Tridacna* samples were humanly modified and X-ray analysis 'showed them to be nearly pure aragonite, indicating no significant re-crystallisation or calcite formation' — that is, not fossilised at the time they entered the deposit and therefore not having an in-built age. However, the nature of the cultural modification of the shells is not discussed and Spriggs (1990:19) considers it possible that the shells are significantly older than the associated cultural remains. All the NT-90 dates are considered questionable because of the disturbance to the site and the lack of data provided on the exact provenance of the samples.

Loto'aa NT-100 (see Table A.1)

The stratigraphy of the NT-100 site is similar to that of NT-90 (Kirch 1988:98). The main cultural deposit, Layer IB, is described as relatively undisturbed, but disappears in parts of the site where the deposit has been reworked by gardening activities. I-9936 is a date on charcoal from Layer IB, but it has a standard deviation >150 years and is hence rejected. The excavation layer from which the *Tridacna* sp. shell sample for Beta-8682 was collected is not reported. Correlating its recorded depth below surface with the generalised stratigraphic diagram for the site (Kirch 1988:Fig. 59) also suggests it may come from Layer IB, but without a means to confirm this Beta-8682 is considered questionable.

Two of the remaining determinations (I-9937 and Beta-8684) are from charcoal samples and I-10634 is from a shell sample (*Tridacna* sp.). All three are from excavation Unit 269, Layer IIA, for which no disturbance is mentioned. The three determinations overlap at 2s and all are considered acceptable.

Pome'e-Nahau NT-93 (see Table A.1)

The NT-93 site, also in the ceramic zone of Niuatoputapu, was excavated in two main stratigraphic layers, Layers I and II, which were further subdivided into Layers IA, IB and IC and IIA and IIB. Layer II was culturally sterile except for some sherds and midden in the upper portion of Layer IIA. The main cultural deposits are Layers IB and IC, with a few sherds occurring in the highly disturbed Layer IA.

The shell sample (species unreported) for Beta-8683 was excavated from Layer ICA. This layer is described by Kirch (1988:104) as a cultural layer which appears to represent the initial occupation of the site and is a little disturbed by more recent gardening activities. The determination represents a single date for the site and is therefore questionable.

A further date from the site, I-9935, has a conventional date of 645±95 BP, outside the range of the present analysis. The charcoal sample is from a pit feature in the site that Kirch (1988) considers may be a more recent feature than the cultural deposit with which it is associated.

Niutoua NT-125 (see Table A.1)

NT-125 is an aceramic mound site (Kirch 1988:116) located near a freshwater spring on the coastal margin of the island. Test pits were excavated along transects across the mound. The site consisted of a complex stratigraphy with 12 beds (layers) in excavation Unit 10N at the highest point on the mound. I-10482 is a charcoal sample described as coming from Bed 4 in Unit 20N. While Bed 4 is described as the major prehistoric deposit (Kirch 1988:121), the relationship of the stratigraphy in Unit 20N to the reported stratigraphy in Unit 10N is not discussed. The stratigraphy of Unit 20N is neither described nor illustrated. The nature of the cultural deposit in association with the date is not discussed and I-10482 is considered unacceptable.

A further ^{14}C date of 650±85 BP from a charcoal sample taken from Unit 10W is reported, but the stratigraphy of this unit is also not described and the date is too recent for consideration in the present analysis.

Tongoleleka (see Table A.2)

The Tongoleleka site is situated on Lifuka Island in a long sand dune located inland of the present beach line. The site was first excavated by Dye (1987) and re-excavated by Burley et al. (1999) in 1995 and 1997.

Dye (1987a:124) describes the stratigraphy of the dune as follows: at the base of all excavation units is sterile fine white sand, probably of aeolian deposition. Lying on this basal deposit is Cultural Unit III, dark loose sand containing some artefacts and faunal remains. Cultural Unit II overlies Unit III in all but one of nine test pits, where it rests on the sterile sand. The colour and texture of Unit II varied considerably, being a single unit on the inland portion of the dune but on the top and front face, divided into IIa and IIb. Unit IIa contains large Lapitoid potsherds and abundant midden deposit, while Unit IIb contains *in situ* deposits of ceramics and shellfish associated with living surfaces of hard-packed ashy soil. Unit I, overlying Unit II in all excavation units, is a dark brown sandy loam with sparse cultural remains including some sherds.

Beta-14171 and Beta-11243 are from separate excavation units on samples described as charcoal rich sand derived from living surfaces on the top of the stratigraphically correlated Cultural Layer III (Dye 1987:129). Dye (1987a:145) rejects Beta-11243 on the basis that it is too recent for the association of the sample with Lapita ceramics. He explains the date as probably due to disturbance of the unit from a feature in the south face noted at the time of excavation. Given this evidence for disturbance, Beta-11243 is unacceptable in the present analysis. The charcoal sample for Beta-14171 was collected from an apparently undisturbed living surface in Layer III and is acceptable.

AA-1920, AA-1921 and AA-1923 are all on turtle bone (Dye 1990). There is some confusion about the designation of layers from which the bone comes. Excavation Layer IV is equivalent to Cultural Unit III (Dye 1987:124-6). The turtle bone is reported by Dye (1990:146) as coming from Layer IV. It is assumed on the basis of discussion of the bone being associated with the basal cultural deposit (Dye 1990) that the bone derives from excavation Layer IV (Cultural Unit III). Therefore, all the Tongoleleka dates are from samples from the same layer. The specific provenance of the bone samples within Layer IV is not reported. AA-1920 has a standard deviation >150 ^{14}C years and is rejected. The 1σ calibrated distributions of AA-1921 and AA-1923 overlap. Due to the lack of information about the exact provenance of the bone samples, especially given that disturbance in Layer IV in Unit 0N11W is used to explain the early Beta-11243 date, AA-1921 and AA-1923 must be considered questionable. These determinations have also been criticised on the basis of the difficulty in determining the carbon uptake by sea mammals, especially those such as turtles that have such a large geographic range in which they migrate (Shutler et al. 1994:59).

The stratigraphy identified by Burley (n.d.) on the basis of the 1995 and 1997 excavations varies somewhat from that of Dye (1987). Burley's Stratum IV is a coral sand found at the base of all cultural deposits. Stratum III appears to correlate with Dye's (1987a) basal cultural deposit, Cultural Unit III. The dates CAMS-34560, CAMS-34561 and CAMS-41514 all come from this stratum which represents the Lapita settlement of the site (Burley n.d.:27). Stratum II is divided into IIa, IIb, and IIc.

Table A.2 Northern Ha'apai radiocarbon determinations.

SITE	LAB NO.	DATE BP	CAL RANGE BP (2σ)	PROVENANCE	CATEGORY
Tongoleleka	Beta-14171	2330±60	2702–2156	Unit 45N1W, Cultural Layer III	1
Tongoleleka	Beta-11243	1370±120	1523–973	Unit 0N11W, Cultural Layer III	3
Tongoleleka	AA-1920	3660±190	3979–3024	Unit 0N0W, Excavation Layer IV	3
Tongoleleka	AA-1921	2960±120	2932–2331	Unit 45N1W, Excavation Layer IV	2
Tongoleleka	AA-1923	2960±60	2788–2474	Unit 0N0W, Excavation Layer IV	2
Tongoleleka	CAMS-34558	2450±40	2700–2350	Unit 4, Level 5, Stratum IIa	1
Tongoleleka	CAMS-34559	2600±60	2760–2380	Unit 4, Level 8, Stratum IIb	1
Tongoleleka	CAMS-34560	2560±50	2730–2370	Unit 4, Level 10, Stratum III	1
Tongoleleka	CAMS-34561	2720±60	2920–2560	Unit 4, Level 15, Stratum III/IV	1
Tongoleleka	CAMS-41512	2490±50	2710–2360	Unit 11, Level 4, Stratum IIa	1
Tongoleleka	CAMS-41513	2430±50	2700–2310	Unit 11, Level 7, Stratum IIb	1
Tongoleleka	CAMS-41514	2690±50	2850–2530	Unit 10, bottom of Stratum III	1
Fakatafenga	Beta-14170	5030±70	5919–5603	Unit 82N2W, living surface at base Layer III	2
Fakatafenga	Beta-11244	1800±20	1816–1614	Unit 8N1E, earth oven at base Layer III	2
Faleloa	CAMS-7145	2940±60	3320–2873	Unit 7, Zone III	1
Faleloa	CAMS-7146	2560±70	2778–2359	Unit 10, Zone III, pit feature U	1
Faleloa	CAMS-8074	2560±60	2771–2362	Unit 12, Zone III, pit feature W	1
Faleloa	CAMS-41529	2550±50	2730–2370	Unit 18, Level 3, Stratum II	1
Faleloa	CAMS-41530	2600±50	2750–2380	Unit 18, from pit feature originating in Stratum III	1
Pukotala	CAMS-7147	2630±60	2800–2390	Unit 1, Level 7, Stratum III	1
Pukotala	CAMS-7148	2870±60	3130–2780	Unit 1, Level 9, Stratum IV	1
Pukotala	CAMS-41515	2560±50	2730–2370	Unit 14. Level 9, Stratum II	1
Pukotala	CAMS-41516	2640±50	2780–2400	Unit 14, Level 14, Stratum III	1
Pukotala	CAMS-41517	2540±50	2730–2370	Unit 12, Level 7, Stratum II	1
Pukotala	CAMS-41518	2480±50	2710–2360	Unit 14, Level 15, Strata III/IV	1
Holopeka	CAMS-12918	2800±70	3157–2755	Unit 96N/100W, Stratum III	2
Holopeka	CAMS-12919	2590±60	2780–2382	Unit 97N/100W. Stratum III	2
Holopeka	CAMS-41527	2540±50	2730–2370	Unit 95N100W, Level 5, Stratum II	2
Holopeka	CAMS-41528	2510±50	2710–2360	Unit 96N/100W, Level 11, Stratum II	2
Vaipuna	CAMS-41523	2580±50	2740–2380	Unit 12, Level 5, Stratum II	1
Vaipuna	CAMS-41524	2760±50	2940–2750	Unit 8, Level 10, Stratum III	1
Vaipuna	CAMS-41525	2560±50	2730–2370	Unit 14, Level 5, Stratum II	1
Vaipuna	CAMS-41526	2690±50	2850–2530	Unit 14, Level 8, Stratum III	1
Vaipuna	CAMS-41531	2620±50	2760–2390	Unit 3, Level 8, Stratum III	1
Mele Havea	CAMS-41519	2490±50	2710–2360	Unit 3, Level 5, Stratum II	1
Mele Havea	CAMS-41520	2640±50	2780–2400	Unit 8, Level 9, Strata III/IV	1
Mele Havea	CAMS-41521	2510±50	2710–2360	Unit 10, Level 5, Stratum II	1
Mele Havea	CAMS-41522	2620±50	2760–2390	Unit 10, Level 8, Stratum III	1

Stratum IIc appears to be a stabilised land surface covering Stratum III and is only found in some parts of the site: Strata IIb and IIa both contain dense plainware ceramics and moderate shell content. They appear to be differentiated on the basis of sediment colour and sand content. Stratum I is the surface of the site, and contains some ceramics thought to have been displaced from underlying deposits, suggesting some disturbance to the upper part of the site. CAMS-34558 and CAMS-34559 are on charcoal samples from Strata IIa and IIb, respectively, in Unit 10. CAMS-41512 (Strata IIa) and CAMS-41513 (Strata IIb) are from Unit 11. In both cases the dates in each unit fully overlap and no time difference can be discerned on radiocarbon evidence.

Fakatafenga (see Table A.2)

Fakatafenga on Tungua Island is a ceramic deposit in sandy soils about 85m from the present beach line. Four stratigraphic units were identified in the 14 units excavated at the site (Dye 1987:103). The basal sterile deposit, with some artefactual material pressed into its upper surface, is a loose yellowish sand. This is overlain by the main cultural deposit, Layer III, a dark greyish brown loamy sand with numerous cultural features, decorated Lapita ceramics and shellfish midden. Layer II, of similar description to Layer III, also contains some artefactual material, including Lapitoid ceramics, but no features. Layer I is a surface layer of dark loamy sand.

The dates for the site derive from excavation Units 82N2W and 8N1E, located approximately 80m apart. The sample for Beta-14170 is described as charcoal and ash mixed with calcareous sand, and was collected from the base of Layer III from a 5cm thick band of charcoal rich soil, rich in ceramics, lying directly on unconsolidated white sand. The feature was interpreted as a living surface (Dye 1987:103). The date is considered too early by Dye (1987a:120) and, although he stresses that the laboratory procedures and calculations are correct, he offers no explanation to account for the date. The lack of explanation means Beta-14170 must be considered questionable within the protocols of the present analysis, although it is substantially earlier than any other date from the region.

Beta-11244 is a sample of charcoal and ash mixed with calcareous sand from an earth oven, in association with 'primary ceramic-bearing deposit' (Dye 1987:107). The ceramics include dentate stamped Lapita pottery. The sample was excavated from 'the base of the cultural deposit, immediately above the culturally sterile beach sand' (Dye 1987:120). No section drawing of the unit is provided. The date is considered too recent by Dye (1987a:120) given that 'by the last century BC Tongan pottery was only rarely decorated'. There is no evidence that the pit is intrusive in the ceramic deposit; however, Dye (1987:145) identifies post-depositional disturbance in one corner of the excavation unit as possibly accounting for the recent date. Beta-11244 is considered questionable because of the possibility of post-depositional disturbance to the unit.

Faleloa (see Table A.2)

Faleloa is on a protected bay on the leeward coast of Foa Island. The site was excavated over two seasons in 1991 and 1992 and again in 1997. Three dates from the site come from the 1992 excavations. Units 7 and 10 are both from the main trench excavation, while Unit 12 is a 1m × 1m unit located approximately 16 m from the trench. The stratigraphy of the site is characterised as four main zones (Shutler et al. 1994:61), although these are further divided into substrata according to the nature of the deposit. Zone I is the uppermost unit containing mixed artefactual material from the zone below and modern material; Zone II contains some slope washed deposit and a plainware ceramic assemblage interpreted as late ceramic mixed with aceramic deposit; Zone III is the earliest occupation layer, having the majority of the ceramic assemblage from the site and including dentate stamped Lapita sherds; while Zone IV is sterile unconsolidated carbonate sand of the original beach.

The samples collected for dating are described as charcoal pieces and all come from Zone III. No stratigraphic diagrams are available for the units from which the dated samples were selected. The earliest determination, CAMS-7145, is described as coming from undisturbed deposit (Unit 7), but nothing further is reported of its provenance. CAMS-7146 (Unit 10) is from a pit feature that originated in the upper part of Zone III. CAMS-8074 is also from a pit feature originating in Zone III, but intruding into the underlying sterile sand (Shutler et al. 1994:62). All three determinations are considered acceptable under the present analysis protocols.

A further two charcoal dates were obtained from the 1997 excavations, CAMS-41529 and CAMS-41530 (Burley n.d.; Burley et al. 1999). The charcoal samples were taken from Strata II (plainware deposit) and III (Lapita deposit) respectively, as defined by Shutler et al. (1994). Both are considered acceptable.

Pukotala (see Table A.2)

Pukotala in on the leeward coast of Ha'ano Island. In a single test pit excavated in 1992 (Shutler et al. 1994:63), four strata were identified. Stratum IV is the original beach on which initial occupation of the site is considered to have taken place. Stratum III contains the highest concentration of cultural material

(Shutler et al. 1994:64). Strata I and II are both described as silty loam and have low concentrations of cultural material.

The sample for CAMS-7148 is described as charcoal fragments collected from Stratum IV, but is considered to originate from the initial occupation (Shutler et al. 1994:64). CAMS-7147, also a charcoal sample, is from Stratum III at the same arbitrary level as the single sherd decorated sherd in the deposit. Although little information is currently published about the site, the determinations as reported are considered acceptable.

In 1997, further excavations were undertaken at the site by Burley (n.d.) that appear to confirm the original interpretation of the stratigraphy, with Stratum IV the original beach on which the Lapita occupation was established and Stratum III the main cultural deposit. However, there is no clear stratigraphic break between Strata III and II, and the latter is described as disturbed by postholes and large pits (Burley n.d.:10) and some mixing of Strata III and II is likely. Four further radiocarbon determinations were obtained on charcoal from the 1997 excavations. The samples for CAMS-41515 and CAMS-41517 were taken from Stratum II, CMAS-41516 is described as dating Stratum III and CAMS-41518 dates Strata III/IV.

All six radiocarbon determinations from the site come from either Strata III/IV or II and appear to have a secure context and to be associated with Lapita and/or plainware assemblages. All are considered acceptable.

Holopeka (see Table A.2)

The Holopeka site on Lifuka Island, south of Foa Island, has not yet been fully published. A preliminary report of the radiocarbon dates for the site, Burley et al. (1995), and a report of the 1997 excavations (Burley n.d.:79) refer to the charcoal samples for CAMS-12918 and CAMS-12919 being excavated from the earliest occupation level at the site, Stratum III, representing the lower plainware period. The charcoal samples for CAMS-41527 and CAMS-41528 are from the overlying Stratum II, described as upper plainware (Burley n.d.:79). No details of the site stratigraphy are yet available and all dates are therefore considered questionable.

Vaipuna (see Table A.2)

The Vaipuna site on 'Uiha Island was test excavated in 1995 and fully excavated in 1997 (Burley n.d.:31). The cultural deposits, over 1 m in depth, had the following stratigraphic profile. The basal Stratum IV is the original beach deposit on which Stratum III, a sandy loam with numerous cultural features, rests. The break between Strata IV and III is for the most part abrupt. Three charcoal dates are associated with Stratum III: CAMS-41524, CAMS-41526 and CAMS-41531. Stratum II is a grey brown silty loam with abundant faunal remains and plainware ceramics (Burley n.d.:34). The excavators found the boundary between Strata III and II difficult to define. Two charcoal dates, CAMS-41523 and CAMS-41525, are on samples from Stratum II. Stratum I is the surface deposit containing degraded ceramics argued to originate in the ceramic deposit below. All charcoal samples appear to be securely associated with cultural deposits and are considered acceptable. The cultural material from the site has not yet been fully reported.

Mele Havea (see Table A.2)

The Mele Havea site on Ha'afeva Island was excavated by Burley et al. (1999) in 1997 in 11 1 m × 1 m excavation units. A stratigraphy similar to that of the other Ha'apai Lapita sites was observed. Stratum IV is a yellow coral sand. Stratum III is a stained sand containing shell and ceramics and is considered to represent the Lapita occupation zone (Burley n.d.:44). Stratum II is a dark brown loam with sand and cultural material, including faunal remains and plainware pottery. Some decorated Lapita sherds were also recovered from this context. Stratum I, the surface layer, has a mixture of late prehistoric and historic artefacts (Burley n.d.:42). The stratigraphy was clear and easily defined. CAMS-41519 and CAMS-41521 are charcoal samples taken from Stratum II. CAMS-41520 and CAMS-41522 are charcoal samples from Stratum III. All dates are considered acceptable.

Tongatapu

To.1 (see Table A.3)

The To.1 site is a low-lying midden approximately 400–500 m from the present Fanga 'Uta Lagoon shoreline. The stratigraphy of the site can be divided into two main components (Poulsen 1987:16). The lower deposits (described as formations A, B and C) are clay deposits which may date to a period when the lagoon covered, or had very recently receded from the area of the site. The upper portion of the site is composed of midden deposit, divided into the Lower Horizon I and Upper Horizon II.

Horizon I is a compact, concentrated shell midden with artefactual material, including ceramics. The boundary between Horizons I and II was easily identified. Horizon II consists of two layers: a further midden deposit, but with less shell; and the overlying topsoil mixed with midden deposit. Several hearth, oven and pit features, postholes and a burial were identified in the site (Poulsen 1987:16–21). Two dates are available for the site. Both samples were excavated from a burnt layer in Pit A which, at the time of excavation, was thought to originate at the interface between Horizons I and II, cut through to the subsoil beneath the midden. The dates are widely divergent: K-904, a shell date, and the much more recent charcoal date K-961 (420±100 BP). The charcoal sample was redated following Groube's (1971) criticism of Poulsen's chronology for the Tongatapu mound sites and gave a statistically identical date (NZ-597, 464±82 BP) (Poulsen 1987:22). Groube's (1971) explanation for the discrepancy between the dates is that the dated shell was introduced to the pit feature from an earlier context following disturbance to the site. Poulsen (1987:23) agrees that the shell sample for K-904 was either introduced from the stratigraphic context into which the pit intrudes or from elsewhere, and K-961 dates the pit feature. K-904 is therefore considered unacceptable.

Table A.3 Tongatapu radiocarbon determinations [Code: * = δ13C corrected after Poulsen (1987:Table 83); ** = $\delta^{13}C$ corrected after Spriggs (1990:15)].

SITE	LAB NO.	DATE BP	CAL RANGE BP (2σ)	PROVENANCE	CATEGORY
To.1	K-904	2779±100	2694–2108	Trench A, Pit A	3
To.2	ANU-541	2680±95*	2471–1987	Square 50/54, base of Zone 1	1
To.2	NZ-635	1620±60	1689–1351	Oven M, top of Midden Horizon	3
To.5	NZ-637	1600±87	1694–1306	Trench 1, Oven B	3
To.6	NZ-636	2380±51	2708–2212	Oven K	1
To.6	ANU-24	2350±200	2845–1886	Oven DN	3
To.6	ANU-873	2320±60*	1949–1660	Horizon 1	1
Vuki's	ANU-442	1150±90	1263–803	Layer 1b	3
Vuki's	ANU-429	2210±145	2710–1838	Layer 4	2
Vuki's	ANU-435	1830±800	3680–286	Layer 10	3
Vuki's	ANU-441	2440±110	2758–2159	Layer 14	2
Vuki's	ANU-424	2540±160	2995–2160	Layer 14	3
Vuki's	ANU-436	2260±415	3324–1308	Layer 15	3
Mangaia	NZ-728	2175±45**	1761–1513	Layer 2	3
Mangaia	NZ-727	3040±50**	2790–2603	Layer 3	2
Mangaia	NZ-725	2510±50**	2151–1885	Pit J	3
Mangaia	NZ-726	3540±70**	3460–3112	Pit C	3

To.2 (see Table A.3)

To.2 is a mound site, presently located ca. 200m from the beach on the eastern side of the Fanga 'Uta Lagoon entrance. Poulsen (1987:24) has identified two main stratigraphic and analytical divisions in the site. The Midden Horizon, divided into Zones I to III, comprises shell midden in primary depositional context, with dentate stamped Lapita and other sherds. This underlies the Mound Horizon, representing the mound building episode proper. The Mound Horizon contains fill from both the

Midden Horizon and elsewhere. A pre-Midden Horizon is also represented at the site by three depressions (interpreted as ovens) and three postholes, all sealed by the Midden Horizon.

The sample for ANU-541 comprised six culturally modified shells (*Anadara* sp.) identified as net sinkers from the very bottom of Zone I (the lowest unit) of the Midden Horizon (Poulsen 1987:26). The context of the samples appears secure and the determination is considered acceptable.

The charcoal dated for sample NZ-635 is described as scattered through a sequence of burnt layers in Oven M, situated 'on the top of the midden' (Poulsen 1987:25). Poulsen originally interpreted the date as being associated with the later phase of the Midden Horizon, but following Groube's (1971) reassessment of the Tongan ceramic chronology, he now considers that the oven feature post-dates the midden formation, but may be associated with the construction of the burial mound, i.e. the Mound Horizon (Poulsen 1987:27). An argument for this association on stratigraphic grounds is not made and hence the date must be rejected.

To.5 (see Table A.3)

Mound site To.5 presently lies about 150m from the shoreline of Fanga 'Uta Lagoon. Excavations at the site revealed two cultural horizons. On the subsoil of coral rock and in some areas coral sand are a series of discrete cultural layers separated by 15–20cm of coral sand. These deposits are identified as Horizon O. Overlying this is a dense midden deposit with three distinct horizons. Horizon I is a very compacted shell deposit in which most of the shells are whole, except on the surface in one part of the midden where fragmented shell is mixed with soil. Horizon II has a lower density of shell and includes cooking stones and charcoal in dark soil and is clearly distinguishable from Horizons I and III. At the base of Horizon II is a thin clay lens which may be slope wash or deliberately added (Poulsen 1987:33–37). Horizon II is not continuous across the site and in parts Horizon III rests directly atop Horizon I. Horizon III is the surface deposit of sticky clay and topsoil with scattered, fragmented shell.

Only a single date from To.5 lies within the range considered in the present analysis. More recent dates, ANU-23/1 (330±63 BP) and ANU-23/2 (340±100 BP) both from the same charcoal sample, were obtained from an oven feature, Oven D, dug into the ceramic deposits. The charcoal for NZ-637 was also obtained from an oven, Oven B. The oven originates at the boundary between Horizons I and II, is dug into Horizon I and is surrounded by the brown clay layer on the surface of Horizon I in this part of the site. Poulsen (1987:34) considers that the oven was constructed between the formation of Horizons I and II. On the basis of Groube's (1971) revised chronology for ceramics, Poulsen (1987:36) rejects this date as being too recent to be associated with decorated ceramics which were present throughout the site. Poulsen's description of the site suggests the clay lens seals Horizon I where Oven B is located The oven lies on top of this lens and must post-date the formation of Horizon I. The chronological and cultural relationship of the determination to either horizon is unclear, although Horizon I may be said to predate NZ-637, making the date unacceptable for the present analysis.

To.6 (see Table A.3)

Site To.6 is situated on the top of a slope, located ca. 200m from the present lagoon shoreline, on an earlier coral shoreline. The stratigraphy is described as consisting of an underlying subsoil of compacted clay, into which several oven features have been cut (Poulsen 1987:39). These are sealed by an overlying midden. The midden is composed of three horizons. Horizon I is a compact mixture of earth and shells with cooking stones and is only about 20cm thick. This deposit was not continuous across the site. Several hearths or ovens are associated with this deposit.

It is from Horizon I that the three radiocarbon samples for the site originate, two from charcoal recovered from ovens (NZ-636 and ANU-24) and the third (ANU-873) from a sample of culturally modified shell (species unreported) from the middle level of Horizon I. Ovens K and DN are both cut into the underlying clay subsoil. NZ-636 is considered acceptable; however, ANU-24 has a standard deviation >150 years and is therefore rejected. The shell samples for ANU-873 are described by Poulsen (1987:46) as coming from the middle levels of Horizon I, where it is securely sealed by Horizon II. ANU-873 is an acceptable date within the present protocol.

Vuki's Mound (see Table A.3)

A full report of the excavations undertaken by Groube at Vuki's mound is unavailable, making assessment of the reported dates difficult. The low mound lies at the edge of a relatively steep slope down to mangrove at the edge of Fanga 'Uta Lagoon. In Groube's (1971:299–300) description of the site he states there is a thin lens at the base of the mound containing a few greatly eroded Lapita ceramics, which are clearly unrelated to the successive house floors which make up the mound itself. All the layers of the mound contain only plainware ceramics, decreasing in density with successive layers. There is much disturbance in the form of postholes, pits and ovens, although Groube (1971) very carefully excavated the mound, recording a three dimensional position for each sherd excavated. Groube (1971:295) states that the dates are all from charcoal samples taken from sealed fireplaces in successive house floors, suggesting that none are associated with the lens containing Lapita sherds at the base of the mound. Spriggs (1990:14) associates the Vuki's Mound dates with Lapita ceramics; however, his reasons for this are not discussed.

The dates ANU-435, ANU-424 and ANU-436 have unacceptably high standard deviations. The most recent date, ANU-442, is from charcoal taken from a fireplace cut into the surface of the mound after its abandonment and has been rejected because its chronological association with cultural material is unclear. Although the provenance of the charcoal samples for the remaining dates (ANU-429 and ANU-441) appears secure, in the absence of more detail about the stratigraphy they are considered questionable.

Mangaia Mound (see Table A.3)

Mangaia Mound was discovered by Golson in the late 1960s and excavated by him in association with Lawrie and Helen Birks (Janet Davidson pers. comm.). The radiocarbon dates from the site are discussed in Groube (1971); however, a site report is unavailable and full assessment of the dates cannot be determined. NZ-728, NZ-725 and NZ-726 are from shell samples (species unknown). Groube (1971:302) states that samples for NZ-725 and NZ-726 are from pits cut into the mound and cannot be accepted as reliably dating the ceramics in the layers into which the pits intrude. Hence, they have been rejected. The charcoal sample for NZ-727 was taken from Layer 3, described as a mixed soil and midden deposit underlying the mound and containing decorated pottery (Groube 1971). The association of ceramics with NZ-728 is less clear. Golson (Groube 1971:302 footnote) considers Layer 2 to have been redeposited and that NZ-728 does not date the associated ceramics. NZ-728 has also been rejected.

Futuna/Alofi

Tavai (FU-11) (see Table A.4)

The Tavai site (FU-11) is one of several ceramic sites excavated by Kirch (1981) on Futuna and Alofi, but the only one with a ^{14}C sequence. The stratigraphy of the beach site, visible where the deposit has been cut away by a modern stream, was excavated as ten layers (Layers I to X), with the basal Layer X being a sterile horizon of compacted coarse beach sand (Kirch 1981:127).

The earlier date, I-8355 is on charcoal from Layer IX, a cultural deposit containing ceramics and charcoal but without features. I-8355 is acceptable. The charcoal sample for I-9942 comes from Layer VII. Charcoal flecking was abundant throughout the layer that is described as reworked due to agricultural activities (Kirch 1981:129). The latter date has a standard deviation >150 years and is unacceptable.

Asi Pani SI-001A (see Table A.4)

The Asi Pani site on Futuna (originally a coastal site but now covered with alluvial deposits) was excavated by Sand (1990), revealing four anthropogenic layers containing ceramics.

Table A.4 Futuna/Alofi radiocarbon determinations.

SITE	LAB NO.	DATE BP	CAL RANGE BP (2σ)	PROVENANCE	CATEGORY
Tavai	I-8355	2120±80	2329-1890	lower 20 cm of Layer IX	1
Tavai	I-9942	1315±175	1540-803	Layer VII	3
Asi Pani	Gif-7489	2050±280	2743-1351	lower Pottery Horizon	3
Asi Pani	Gif-7488	2180±280	2941-1524	upper Pottery Horizon	3
Asi Pani	Gif-7487	1120±70	1176-805	lowest Horticultural Horizon	3
Alofitai	Gif-7485	2340±280	3021-1632	lower Pottery Horizon	3
Alofitai	Gif-7484	1500±80	1540-1263	upper Pottery Horizon	1
Plateau D'asoa	Gif-7486	1140±50	1173-932	Anthropogenic Horizon	3

The two main ceramic horizons have been dated using charcoal samples (Gif-7488 and Gif-7489). Gif-7489, from the lower pottery horizon is associated with Lapita ceramics. Both the dates have standard deviations >150 radiocarbon years and are therefore unacceptable in respect to the present analysis. A third determination from the site, also from a charcoal sample (Gif-7487), is described as dating a Horticultural Horizon. In the absence of further data concerning the provenance of the dated charcoal sample and the associated cultural material, this determination is also rejected.

Alofitai (see Table A.4)

The Alofitai site on Alofi Island was excavated by Sand (1990). The site has not yet been fully published, but some information is available about the ceramic assemblages from the dated deposits. Both dates from the site are from charcoal samples. Gif-7485, dating the lower ceramic horizon has an unacceptably large standard deviation. Gif-7484 is for the upper pottery horizon, just below the present ground surface, in association with plainware ceramic assemblage. Gif-7484 is acceptable.

Plateau D'asoa AL-32B (see Table A.4)

Gif-7486 is the only radiocarbon determination available from excavations at the Plateau D'asoa site on inland Futuna. The dated sample has not been described. The date comes from what is described by Sand (1990:124) as an Anthropogenic Horizon with potsherds. No further information is available and Gif-7486 is considered unacceptable in the present analysis.

American Samoa

To'aga AS-13-1 (see Table A.5)

The beach site of To'aga is on Ofu Island. The site was located by Kirch and Hunt (1988) during survey of the Manu'a Group in 1986. An initial test pit was excavated and the shell sample for Beta-19742 obtained. The major excavations in 1987 and 1989 consisted of a main trench of seven 1m × 1m excavation units (Units 1 and 4 to 9) and 23 other units along a total of 19 transects running across the beach from the steep cliffs at the rear to the shoreline (Kirch and Hunt 1993:46–83). The stratigraphy across the site is described as resulting from the progradation of the beach over the last 3000 years through both colluvial deposits from the steep cliffs behind the site and the deposition of calcareous beach sands (Kirch and Hunt 1993:47). The main cultural deposits lie towards the colluvial slope at the back of the beach and the seaward portion of the beach is primarily culturally sterile coral sand and reef detritus. Excavations were carried out according to stratigraphic layers designated by Roman numerals, beginning with Layer I at the top of each test pit. The overall stratigraphy of the site is difficult to assess and the site extends at least 700m (Kirch and Hunt 1993:83). The stratigraphic units are not all correlated across the site, although this has been done for adjacent excavation units and some excavation units along the same transects. Therefore, it was assumed for example, that Layer III in one excavation unit is not necessarily the same as Layer III in any other excavation unit, unless stated otherwise.

Table A.5 American Samoan radiocarbon determinations [Code: * = $\delta^{13}C$ corrected after Kirch (1993a:87-9)].

SITE	LAB NO.	DATE BP	CAL RANGE BP (2σ)	PROVENANCE	CATEGORY
To'aga	Beta-25035	3820±70*	3823-3445	Unit 6, Layer V	3
To'aga	Beta-25673	3620±80*	3587-3204	Unit 1, Layer V	3
To'aga	Beta-35601	2900±110*	3356-2761	Unit 28, Layer II	2
To'aga	Beta-35602	2630±100*	2947-2361	Unit 23, Layer IIIA	1
To'aga	Beta-26464	2620±140*	3023-2344	Unit 10, Layer IIB	1
To'aga	Beta-35603	2600±170*	3156-2210	Unit 23, base of Layer IIIB	3
To'aga	Beta-35604	2770±80*	2649-2133	Unit 23, Layer IIIB	1
To'aga	Beta-25033	2640±80*	2354-1975	Unit 6, Layer IIA-1	1
To'aga	Beta-25034	2570±80*	2306-1916	Unit 6, Layer IIB	1
To'aga	Beta-19742	2350±50*	1962-1705	1986 test pit, Layer D, Level 10	2
To'aga	Beta-35924	2100±70*	1716-1368	Unit 15, Layer II	1
To'aga	Beta-26463	1910±50*	1465-1251	Unit 3, Layer II	3
To'aga	Beta-26465	1600±70*	1203-902	Unit 13, Layer III	3
To'aga	Beta-35600	1190±70*	1275-935	Unit 17, 53 cm bs	1
Ta'u Village	Beta-19741	2330±50	1939-1690	Unit 1, pottery bearing midden	2
Faga	Beta-38752	910±80	962-668	Unit 1, Layer VII	3
'Aoa	Beta-48049	2890±140	3382-2742	Locality 2 XU-7, Layer VII 170 cm bs	2
'Aoa	Beta-48911	2460±110	2764-2164	Locality 2 XU-8, Layer VII 128-48 cm bs	2
Leone	Beta-48912	930±80	967-672	test pit 6, Layer V, Level 9	3
Alega	Beta-38438	1040±230	1387-547	Units 2 and 4, interface Layers I/II	3

Beta-19742 is on shell (*Turbo setosus*) excavated from an initial test pit dug in 1986. Although in the summary of radiocarbon determinations from the site the provenance of the shell sample is given as Layer D, Level 10 in association with a small quantity of thick, coarse tempered sherds (Kirch and Hunt 1993:87), in discussion of the stratigraphy for this test pit (1993:46), the stratigraphic layers are designated Layers I to III. Beta-19742 is described as dating Layer II, from which four thick ware sherds were excavated. The apparent contradiction in provenance appears due to misreporting and the date must be considered questionable, although the association of the dated sample with a limited number of ceramics seems secure.

Four determinations, all from shell samples, are available from the main excavation trench in which five main stratigraphic layers were identified: Beta-25033 (Layer IIA-1), Beta-25034 (Layer IIB), Beta-25035 (Layer V) and Beta-25673 (Layer V). Layer II was divided into Layers IIA-1, IIA, IIB and IIC on the basis of differences in the colour, texture and cultural content of the deposit. Beta-25033 is from Layer IIA-1, a thin discontinuous lens of darker, organically enriched calcareous beach sand interpreted as representing a vegetated, stable surface and containing some cultural material, including sherds described as Polynesian plainware (Kirch and Hunt 1993:87). Beta-25034 is from Layer IIB, which is slightly darker and more compacted than the overlying IIA. This is the main ceramic bearing deposit that contained *Turbo* fishhooks. The differences observed in the deposit of Layer II are not evident in the dates Beta-25033 and Beta-25034, which fully overlap at 1s. The two dates are acceptable.

The shell samples for Beta-25035 and Beta-25673, also from the main trench, were excavated from the basal Layer V in association with marine shell and reef detritus. This is interpreted as representing an active beach ridge (Kirch and Hunt 1993:51). Kirch (1993a:87–88) suggest that the shell samples are probably non-cultural, although two ceramic sherds were found in this layer. Using the protocols of the present analysis, Beta-25035 and Beta-25673 are unacceptable.

Beta-26463 is on *Turbo setosus* from Unit 3 which is seaward of the main excavation unit and has a less complex stratigraphy with only two stratigraphic layers identified: Layers I and II. It is unclear exactly where the shell sample came from and with what, if any, cultural material it was associated. The shell sample is said to come from Layer II (Kirch and Hunt 1993:88) described as loose calcareous beach sand and culturally sterile (Kirch and Hunt 1993:52), although the excavators claim that the shell sample for the date is culturally modified (Kirch and Hunt 1993:88). Elsewhere (Kirch and Hunt 1993:56) the sample is said to come from the base of an aceramic occupation deposit 'which stratigraphically postdates Layer II in the main trench', but it is not discussed whether this means the shell sample is associated with the aceramic occupation deposit or pre-dates it. The main trench is ca. 25 m from Unit 3. The association of the shell sample for Beta-26463 with cultural material is unclear and it is considered unacceptable. Kirch and Hunt (1993:56) interpret the determination as an estimate of the chronology for the end of ceramic use at the site.

The stratigraphic sequence in Unit 10 is similar to the main trench with four main stratigraphic layers identified. Similarly to the main trench, Layer II of Unit 10 is also further divided into Layers IIA, IIB and IICA. Layer IIB is the main ceramic zone. The determination Beta-26464, from a sample of charcoal flecks collected over a depth of 10cm, is considered acceptable; however, the large standard deviation (2620±140 BP) limits its value for interpreting the chronological sequence.

Beta-26465 is listed as being from three humanly modified shells (*Turbo setosus*) from Layer III of Unit 13, in direct association with an aceramic cultural midden near the base of a pebble-paved house platform (Kirch and Hunt 1993:88). However, in description of the stratigraphy for this unit there is no Layer III mentioned (Kirch and Hunt 1993:55). The shell is described as coming from 35-45 cm below surface (Kirch and Hunt 1993:88) which, in the description of stratigraphy (Kirch and Hunt 1993:55), equates with Layer IB which contains shell and numerous sea urchin spines. In the lower portion of IB, at an equivalent depth below surface from where the dated shell was excavated, a human burial was excavated which had been cut into Layer IB from the overlying Layer I (Kirch and Hunt 1993:55). Beta-26465 may reflect the date of the modification of the shells, but the association of the shell with other cultural material is unclear and given the deposit of Layer IB is disturbed by an intrusive burial, the date is considered unacceptable.

The finely dispersed charcoal and ash which provided the sample for Beta-35600 was collected from a gravel pavement, interpreted as a house floor in Layer III, Unit 17. Layer III is made up of 'three successive pavements with discontinuous bands of black ash and fine charcoal throughout the deposit…probably deriving from hearth rake-out events' (Kirch and Hunt 1993:61). No portable artefacts are associated with the charcoal sample. The gravel pavements are sealed by overlying midden deposit and the charcoal sample appears to date use of the gravel pavements and is acceptable within the protocols of the present analysis.

Beta-35601 is from a sample of charcoal flecks collected 290–300cm below the surface in Unit 28. The sample is listed as coming from the base of Layer II (Kirch and Hunt 1993:88). In the description of the stratigraphy of Unit 28 (Kirch and Hunt 1993:66–7), Layer II is divided into Layers IIA, IIB and IIC, and Beta-35601 is reported to come from Layer IIB, which overlies Layer IIC. This would appear to contradict its coming from the base of Layer II. The charcoal is also discussed as coming from the Layer II/III interface (Kirch and Hunt 1993:67). No section drawing is published for Unit 28 and the depth of the deposits within Layer II is not discussed. Beta-35601 does appear to date Layer II, but as the exact provenance of the date is unclear it is considered questionable.

Three dates come from Unit 23. All are from Layer III, described as the main cultural deposit, and divided into Layers IIIA (a food preparation activity area) and IIIB (containing the highest density of cultural material). Beta-35602 is a charcoal sample from an earth oven feature cut into Layer IIIB from the upper part of Layer IIIA. Beta-35603 is also charcoal from the base of Layer IIIB, but has a standard deviation >150 years and is therefore unacceptable. Beta-35604 is a shell sample (*Tridacna maxima*), also from Layer IIIB. Beta-35602 and Beta-35604 overlap at 2s which suggests Layers IIIA and IIIB may be contemporary. Both dates are considered acceptable.

Culturally modified marine shell (*Turbo setosus*) from Layer II in Unit 15 provided the sample for Beta-35924. Layer II is a shell midden deposit in which the presence of dispersed charcoal and fire-cracked stones has been interpreted as representing a 'cookhouse' area (Kirch and Hunt 1993:89). Beta-35924 is the most recent date associated with ceramics at the To'aga site and is acceptable within the analysis protocols.

Ta'u Village (see Table A.5)

Ta'u Village is located on the narrow coastal plain of Ta'u Island. Excavation of three test pits in the village by Hunt and Kirch (1988) in 1986 revealed a plainware ceramic deposit in one test pit on the inland slope of a calcareous dune ridge. The single determination for the site, Beta-19741, is from a shell (species unreported) excavated from the ceramic deposit. The full stratigraphy of the site has not been published. Given this and that Beta-19741 is the only determination from the site, it must be considered questionable.

Faga AS-11-1 (see Table A.5)

Beta-38752 is charcoal collected from the Faga site, a coastal flat on Ta'u Island. It is the only available date from the site. The sample was taken from Layer VII, 130–116cm below the surface. Layer VII is sand underlying a house floor in an excavation unit ca. 50m from the coastline. It is interpreted as approximating the period of initial use of this part of the coastal flat (Clark 1993:329). The association of the charcoal to the overlying house floor is unclear and as no detailed description of the sample, its cultural association, or the site stratigraphy is available, the date is considered unacceptable.

'Aoa AS-21-5 (see Table A.5)

The 'Aoa Valley is on the north coast of eastern Tutuila. Locality 2 (AS-21-5), about 700m from the present coastline, lies at the edge of the prehistoric shoreline of an ancient bay which has since been infilled. The strata of sediments excavated at the site represent colluvial and alluvial deposits from the surrounding mountains (Clark and Michlovic 1996:5). Eight excavation units were excavated at the site between 1986 and 1991.

Clark and Michlovic (1996:7) characterise the stratigraphy as eight soil layers (designated I - VIII). Layer VII is the basal cultural deposit. Periods of minimum deposition and landform stability were suggested to the excavators (Clark and Michlovic 1996:7) on the basis of weathering in the profile identified as A-horizons. This evidence for periods of landform stability is reinforced by the presence of features such as fireplaces cut into the surface of some layers exhibiting A-horizons.

The charcoal for Beta-48049 and Beta-48911 is from Layer VII in adjacent excavation units. Both dated samples derive from charcoal scattered within deposit that contains ceramics and other artefacts. Layer VII does not exhibit features of landscape stability evidenced in the overlying A-horizons and may therefore have been washed in from further up slope. The absence of features, the dispersed nature of the charcoal and the rounded appearance of many of the sherds (Clark and Michlovic 1996:11) suggest that the deposit may be in a secondary context, although the authors argue the integrity of the stratigraphy and association of the dated samples with the cultural material on the basis of differences in cultural material between the early and late components of the site. The determinations from the site are considered questionable.

Dates from the upper layers (V and II) of the site cluster around a calibrated age of 507–476 BP (Clark and Michlovic 1996:13). These layers also contain ceramic deposits for which the associated dates indicate continuation or reintroduction of ceramic manufacture in the 'Aoa area about 1000 years after ceramic manufacture is generally considered to have ceased elsewhere in the Samoan archipelago.

Leone AS-34-35 (see Table A.5)

The small charcoal sample for Beta-48912 was excavated from Layer V (at a level of 85–90cm below the surface) of site AS-34-45 in the Leone Valley. It is one of five reported dates from sites in the valley (Clark and Herdrich 1993), but is the only date available from this site that has not yet been fully published. There is no published description of the site or associated cultural material. Beta-48912 has been rejected.

Alega AS-23-21 (see Table A.5)

Site AS-23-21 is a terrace site in the Alega Valley. The site has not been fully published, but the stratigraphy of the site is described as consisting of two layers: Layer I (terrace fill) and Layer II (underlying subsoil) (Clark and Herdrich 1993:329). The scattered charcoal for Beta-38438 came from the interface between these layers and is interpreted as representing the start of terrace use (Clark and Herdrich 1993:329). A further determination (Beta-38753) not included in the present analysis was collected from the same layer and gave a date of 590±70 BP radiocarbon years (Clark and Michlovic 1993:Table 3). This is also interpreted as representing the commencement of terrace building activities. Beta-38438 has a standard deviation >150 years and is therefore unacceptable.

Western Samoa

Upolu

Vailele Area

The excavation of dated deposits from five sites in the Vailele area, northern Upolu, is reported in Green and Davidson (1969a). All are mound sites, four in the coastal Vailele Village (SUVa1, SUVa2, SUVa3 and SUVa4) and the fifth (SUVa38) inland in the Vailele Valley. Site SUVa1 was historically important because it revealed ceramics for the first time in a prehistoric Samoan context (Golson 1969). Green (1969b:101) describes the excavated mound sites in the area as having 'all been disturbed prehistorically and historically and contain[ing] numerous postholes, features and platforms of former structures'.

SUVa1 (see Table A.6)

The stratigraphy of this mound site was first analysed by Golson (1969) as five layers (I - V) numbered from the mound surface down. Layer V was the main ceramic deposit, the basal cultural deposit and the deposit from which the samples were taken for all three radiocarbon determinations. Layer V is considered to represent different prehistoric activity on the basis of the artefactual assemblage and the presence of weathering (Golson, 1969:110) or palaeosol formation (Green 1969e:116) at the interface of Layer V and IV, suggesting discontinuous occupation or site use. The upper layers (I to IV) represent mound building activities proper (Golson 1969:110).

Some post-depositional disturbance is apparent in features reported as having been cut into the basal non-cultural Layer VI, some of which originate in deposits overlying Layer V. The extent of the disturbance is unclear. Green (1969e:117) suggests that the Layer V deposit is refuse rather than an occupation area. There is an absence of features or stratigraphy as well as an absence of concentrations of ceramics, other artefacts or charcoal in the deposit. On the basis of this and the presence of only a very few conjoining sherds, Green (1969e:122) considers the deposit may be in a secondary context; however, he does not question the association of the charcoal samples for NZ-362, NZ-361 and NZ-362 with the ceramic assemblage (Green 1974b:247). The statistical similarity of all the dates further supports this assertion. The dates are all considered acceptable.

From the overlying layers of the mound, two further radiocarbon dates are available (Green and Davidson 1965:64), but they lie outside the range considered in the present analysis (Gak-501, 220±70 BP, Layer Ib and Gak-500, 680±80, Layer IVb).

SUVa2 (see Table A.6)

SUVa2 is described as an aceramic mound site, although a single sherd was found in Layer 2, as well as two sherds in the underlying basal deposit. All are considered by the excavator to be in a secondary context (Green 1969d:150). The stratigraphy of the site has been analysed as a series of beds (1 - 20), with Bed 1 being the basal non-cultural deposit.

Table A.6 Vailele/Leuluasi (Western Samoa) radiocarbon determinations.

SITE	LAB NO.	DATE BP	CAL RANGE BP (2σ)	PROVENANCE	CATEGORY
SUVa1	NZ-362	1850±50	1917–1615	base Layer V	1
SUVa1	NZ-361	1880±60	1946–1627	top part Layer V	1
SUVa1	NZ-363	1950±120	2296–1570	pit sealed by Layer V	1
SUVa2	Gak-502	850±70	927–660	Square B6, Layer 2	3
SUVa3	Gak-503	865±70	930–664	Square C, Layer 5a, firepit	3
SUVa4	Gak-1198	1660±80	1767–1352	base of Layer F-1, surface Layer F-2	3
SUVa4	Gak-1693	1600±350	2336–765	Square A-1, Layer E oven	3
SUVa4	Gak-1199	1680±80	1778–1374	Hearth Horizon cooking pit	2
SUVa4	Gak-1194	2150±100	2347–1885	Hearth Horizon	2
SUVa4	NZ-855	927±241	1304–508	Layer F-1a, fire hearth	3
SUVa38	Gak-1439	1550±80	1607–1295	firepit under mound, Layer 14	3
SULe12	NZ-1429	881±20	883–695	Square C-3 interface Layer 4 and natural	3
SULe12	Gak-1442	890±80	954–665	Square F-5, Layer 1	3
SULe12	Gak-1443	1410±80	1517–1173	Square F-6, surface layer	3
SULe12	Gak-1444	2210±100	2359–1933	Square F-7, Layer 5b pit	2

The charcoal sample for Gak-502 is from a lens of organic material and charcoal from the surface of Bed 2 (Green 1969d:144) or Layer 2 (Green and Davidson 1974:Table 23), the lowest cultural layer. This is described as a fossil soil horizon with flecks of charcoal scattered throughout the deposit and with a small number of features such as scattered hearths, pits and possibly postholes, characterised as Period I (Green 1969d:144). The charcoal sample was taken from a lens on the surface of Layer 2 and Green (1969d:144) interprets it as preceding the construction of the mound and post-dating Layer 2 which contained a few flakes and a single ceramic sherd. The determination is the only one available from the site and is within the questionable range of Gakushuin laboratories. The date is considered unacceptable because the relationship of the dated sample and cultural deposit is unclear.

SUVa3 (see Table A.6)

The mound site SUVa3 was excavated in five layers, with Layer 5 (the basal cultural deposit) being further divided into Layers 5a and 5b. Similarly to SUVa2, artefactual material is limited primarily to the upper, undated layers. Layers 2 and 3 consist of a series of pebble floors with numerous postholes and pits.

Gak-503 is from a charcoal sample from a firepit (Green 1969c:154) at the base of the mound in Layer 5a [originally reported in Green and Davidson (1965:64) as coming from the base of Layer 4], which is described as a deposit similar to the underlying basal non-cultural deposit, but 'much disturbed by subsequent human activities including the building of fires and the digging of several large shallow pits' (Green 1969c:154). The evidence is similar to that of SUVa2 and in Green's (1969c:154) opinion the deposit is associated with horticultural activities. The association of the firepit and the charcoal sample with horticulture or other human activities is unclear and the date is in the questionable Gakushuin range. Gak-503 is unacceptable.

SUVa4 (see Table A.6)

Initial excavations at the SUVa4 site in 1963 and 1964 revealed a ceramic deposit at the base of the mound. The ceramics were in association with obsidian that had not previously been recovered from an excavated context in Samoa. The primary objective of the 1965 excavation of the site was to increase the ceramic sample size to provide a comparative collection to that excavated from SUVa1 (Terrell 1969:158).

The mound site was excavated in several 2m × 2m squares and a bulldozer trench provided a section across the mound [Date 43 (NZ-855) was taken from the bulldozer trench section]. The square from which Dates 49 (Gak-1198) and 52 (Gak-1199) were taken is not clear in the published report.

Terrell (1969:160) describes the stratigraphy as being similar across the mound. Layers A through F were excavated, Layer A being the surface of the mound. The basal Layer F is further divided into two zones: F-1 and F-2. F-1 is considered by Terrell (1969:164) to be the weathered surface of a palaeosol and is again further divided into Layers F-1a and F-1b. F-1a is a dark brown zone at the top of Layer F-1 containing few cultural finds. Layer F-1b, underlying F-1a, is the primary ceramic deposit. It was not possible to distinguish between these layers in all parts of the site. The stratigraphy is further complicated by the presence of what Terrell (1969:161) describes as the Hearth Horizon in some parts of the site. The Hearth Horizon overlies Layer F-2 in some parts of the site where Layer F-1 is absent and appears stratigraphically contemporaneous with Layer F-1, although no sherds are associated with it.

The charcoal sample for Date 49 (Gak-1198) was taken from a lens at the base of Layer F-l and on top of Layer F-2, which was not an obvious cultural feature but scattered material (Terrell 1969:164). From Terrell's description it appears the charcoal lens lay beneath the ceramic Layer F-1b and is not associated with a cultural feature. However, Green and Davidson (1974:218) state that the sample was obtained from:

> a thin concentrated lens of carbon and fire-burned pebbles within and near the base of layer F-1 at a point where the deposit was not differentiated into Layer F-la and F-lb.

If this was the case Gak-1198 would be associated with ceramics. Terrell maintained that none of the dated samples were directly associated with ceramics. Gak-1198 has been rejected because of the conflicting reports of its cultural association.

The two dates from the Hearth Horizon, Gak-1199 and Gak-1194, do not overlap at two standard deviations, suggesting the deposit represents a minimum of 200 radiocarbon years but perhaps far more. The charcoal samples for both dates appear, on the basis of Terrell's (1969:164) description, to be in a stratigraphically secure context (there is no indication on the section diagrams provided of where samples were taken from). Green and Davidson (1974:217) reject Gak-1194 on the grounds that they consider it too early given that it is 'in conflict with all other age results for this mound'. They explain it as either older charcoal incorporated into the deposit, an incorrect interpretation of the Hearth Horizon stratigraphy or an incorrect radiometric assessment. Given that no evidence is reported to support this, Gak-1194 is considered questionable. Both Gak-1194 and Gak-1199 are from early in the Gakushuin laboratory sequence and are therefore considered questionable.

Standard deviations of >150 years exclude Gak-1693 and NZ-855 from further consideration.

SUVa38 (see Table A.6)

SUVa38 is an inland mound site. Hougaard (1969:177) identifies the stratigraphy as consisting of 15 layers, Layer 15 being sterile subsoil. The charcoal sample for Gak-1439 comes from Layer 14, which is the fill of a firepit dug into Layer 15 consisting of burned stones and clay. The relationship of the firepit and dated sample to the overlying mound layers is not discussed. This is the only date available for the site and is rejected.

Leuluasi SULe12 (see Table A.6)

The Leuluasi area is in the interior of the Felefa valley in north eastern Upolu and was extensively surveyed by Davidson (1974b). SULe12 was subsequently excavated by Davidson and Fagan (1974). The site was identified as a house site on the basis of the surface features that included curb stones, an existing stone platform and the remains of several others (Davidson and Fagan 1974:74).

The stratigraphy of the site was identified as seven layers (1-7) on top of the 'natural' or sterile subsoil and interpreted as a series of occupations, A to E (A being the earliest). The dated charcoal samples all come from different excavation squares. Squares F5, F6 and F7 are adjacent to each other, but Square C3, from where the sample for NZ-1429 was collected, is approximately 8m from F6. The stratigraphy of the site is very complex. The layers are sometimes indistinguishable and many postholes and pits are found throughout the site (Davidson and Fagan 1974:74). Occupation A is the stratigraphically earliest direct evidence of use of the site and includes cultural remains associated with the basal Layer 7, although these are not considered to represent habitation at the site but, by their distribution, to possibly represent occupation to the south of the excavated area (Davidson and Fagan 1974:77).

There are eleven radiocarbon dates for the site; however, seven of these (NZ-1427, NZ-1428 and NZ-1430 to NZ-1434) post-date the time period under consideration and date the upper stratigraphic layers (Davidson and Fagan 1974:82). Gak-1442 (954 –665 cal BP) is from a charcoal sample from Layer 1, the surface layer of the site. The date is inverted in relation to the modern dates (Gak-1427 and Gak-1431) from the immediately underlying layers. The dated sample comprised diffuse charcoal fragments (Davidson and Fagan 1974:77). Given the association with cultural material is unclear, Gak-1442 has been rejected.

The charcoal sample for NZ-1429 comes from Layer 4 in the area of the excavation of a structure identified as House II, separate to the main excavation. Layer 4 is described as an artificial fill which extended the area of the original platform of Layer 6 (Davidson and Fagan 1974:74). According to Davidson and Fagan (1974:83) the sample was taken from the base of Layer 4, which in this part of the site rests on the natural or sterile subsoil. They interpret the determination as dating the extension of the platform by the addition of Layer 4. NZ-1429 is presumably earlier than Layer 4 but this is unclear. The relationship of the dated sample to the overlying cultural material is unclear except to say that it probably predates it. NZ-1429 is unacceptable.

Although described as having come from the surface of Layer 7, the charcoal sample for Gak-1443 was taken from a part of the site where Davidson and Fagan (1974:83) describe Layer 7, the basal cultural deposit, as being so thin as to be almost non-existent. They feel the date:

> although not actually associated with the structural remains of Occupation A [may] be taken as a probable indication of the age of Occupation A, or of the clearing of the ground immediately before platform construction. (Davidson and Fagan 1974:83)

The chronological relationship of the determination to Occupation A or cultural material in general remains unclear and Gak-1443 is considered unacceptable.

Gak-1444 from Layer 5b is inverted in relation to Gak-1443 from the stratigraphically earlier Layer 6/7 interface with which it does not overlap at 2σ (see Davidson and Fagan 1974:Fig. 42). The sample consists of charcoal taken from the very base of a depression in Layer 5b. Davidson and Fagan (1974:84) explain the early age of the date (2210±100 BP) as either accurately dating Layer 5b, which would mean Gak-1443 was too recent, or the sample was actually drawn from Layer 7 into which the base of the depression or pit intrudes. In their description of the stratigraphy, Davidson and Fagan (1974:74) describe Layer 5 as 'dark sticky deposit similar to Layer 7' and a confusion as to provenance of the sample is therefore a possibility. There is insufficient evidence to assess whether Gak-1443 or Gak-1444 is out of sequence and/or an erroneous date. Given this and its being an early Gakushuin date, Gak-1444 is considered questionable.

Savai'i

Ologogo SSOIC1 (see Table A.7)

The site SSOIC1 is one of a group of platforms in the prehistoric inland village site of Ologogo on the island of Savai'i. Gak-1200 is the only radiocarbon determination available for the site. The charcoal sample was excavated from the fireplace of one of the platforms (Buist 1969:48). No evidence is provided for an association of the fireplace with the platform and the location of the excavation and the stratigraphy are not illustrated. No associated portable artefacts are discussed. The date is unacceptable.

Puna SULam1 (see Table A.7)

The mound site SULam1 is one of a group of mounds inland in the Puna area of the Vailele Valley. Hansen (1974:61) describes the stratigraphy of the mound sequence as three layers (I-III); Layer III being the original ground surface; Layer II, the bulk of the mound constituting the fill with which the mound was built; Layer I, the surface layer of the mound composed of a number of pebble floors. Hansen

Table A.7 Savai'i/Luatuanu'u Sasoa'a (Western Samoa) radiocarbon determinations.

SITE	LAB NO.	DATE BP	CAL RANGE BP (2σ)	PROVENANCE	CATEGORY
SSOlC1	Gak-1200	890±70	950–668	firepit in house platform	3
SULam1	Gak-1438	1050±80	1169–760	Square C, Layer II, Level 3	3
SUFo1	Gak-1435	1410±110	1528–1073	Square D-11, brown layer under terrace	3
SULu41	Gak-799	1500±80	1540–1263	Cutting VIII, Layer IV	3
SULu53	Gak-1340	1660±80	1767–1352	agricultural activity Layer 2	3
SULu53	Gak-1339	2170±100	2351–1896	firepit under terrace	3
SUSa3	Gak-1341	1800±80	1918–1528	Square F-6, Layer 4, Level 2	2
SUSa3	Gak-1441	1840±100	1992–1529	Square I-6, Layer 5	2

(1974:64) considers the mound to have been constructed in a single operation using the brownish clay of Layer III as fill. Gak-1438 is charcoal from one of a number of charcoal lenses at the base of Layer II. Hansen (1974:66) interprets the date as either the remains of previous occupation or to have resulted from the clearing of the area prior to the building of the mound as 'they seemed not to be associated with any well defined feature'. This is the only determination available for the site and is unacceptable because the relationship of the dated sample to cultural material is not specified.

Folasa-a-Lalo SUFo1 (see Table A.7)

SUFol is about 3.2km inland in an area of the Falefa Valley, Upolu known as Folasa-a-Lalo. The site consists of house remains comprising at least nine successive house foundations. The charcoal sample for Gak-1435 was excavated from a brown soil layer that underlies the terrace, on which the successive house foundations rest and overlies the basal non-cultural clay layer. Ishizuki (1969:56) interprets the determination as probably dating the clearing of the area of vegetation, with accompanying soil disturbance prior to commencement of building the terrace. Gak-1435 appears to predate the house construction, but the chronological and cultural relationship is unclear and the determination is rejected.

Luatuanu'u Area

SULu41 (see Table A.7)

The site SULu41 is a large inland fortress in the Luatuanu'u area of Upolu. The site consists of a fortified complex extending along the crest of a ridge for about 1km. The dominant feature is a large earth embankment protecting the main approach along the ridge from the coast (Scott and Green 1969:205).

The charcoal for Gak-799 was excavated from Cutting VIII, one of a series of excavations in the inner defensive wall (Scott and Green 1969:205). Several stratigraphic layers were identified in the cutting. The charcoal was collected from Layer IV, which Scott and Green (1969:208) interpret as a construction layer, part of an earlier phase in the construction of a bank. The sample is described as being made up of charcoal flecks (Scott and Green 1969:208) and the authors concede the difficulty in making a connection between the date itself and the event of the mound construction. They consider it likely that the charcoal was present in the deposit prior to its incorporation in to structure. The determination is considered unacceptable.

SULu53 (see Table A.7)

Site SULu53 is a star mound built on an earth terrace in the inland portion of the Luatuanu'u Valley on the north coast of Upolu. Peters (1969:212–13) identified 18 stratigraphic layers. Layers 13 to 18 represent the period in which the mound was constructed; below this is a terrace, Layers 5 to 11. Layers 2, 3 and 4 represent initial site usage and the dispersed charcoal throughout these deposits is argued to indicate burning of the area as part of vegetation clearance and horticultural activities (Peters 1969:216).

The samples for both radiocarbon determinations are from charcoal lenses beneath Layer 5. The earlier date, Gak-1339, is from a firepit, also described as an oven (Peters 1969:221), sealed by the bottom layer of the terrace (Peters 1969:216). Gak-1340, first reported in Green and Davidson (1974:222), is from pockets of charcoal found in depressions on the former ground surface of Layer 1 and was stratigraphically sealed under Layer 5, the first of a number of extensive habitation floors. Green and Davidson (1974:222) interpret the date (similarly to Gak-1339) as being evidence of agriculture or vegetation clearance prior to mound construction and account for the difference between the dates as indicating several centuries of agriculture prior to habitation at the site. The stratigraphic relationship of the two determinations is unclear and no description of associated cultural material is provided. Gak-1339 and Gak-1340 are unacceptable.

Sasoa'a

SUSa3 (see Table A.8)

The site of SUSa3 lies in the Falefa Valley at Sasoa'a between branches of the Falefa River, an area subject to regular flooding which deposited the alluvium covering the site. Below the surface features of the house site are cultural deposits that lie beneath the water table following periodic heavy rain. Green (1974b:108) suggests that rapid deposition of alluvial sediments as a result of cultural activities, including removal of natural forest, may have raised the ground surface in the valley over the period since the site was initially occupied, which would account for the presence of extensive cultural deposits in a recurrently flooding environment.

The site was excavated as five stratigraphic units which were relatively uniform and distinctive across the site (Green 1974b:109). In parts of Layers 4 and 5 where the deposit was thick, excavation was carried out in a series of levels. Layer 5 is the basal cultural layer of compact charcoal-stained, brown to black gravelly clay which rests on the natural clay underlying the entire area. Several features were identified on the surface of this basal non-cultural clay deposit which were sealed by Layer 5 deposit and considered to predate it. These are designated Occupation A (Green 1974b:111).

Occupation B consists of the lower part of Layer 5 (including the fill of the features identified as Occupation A) and a pavement of small boulders and gravel associated with this layer in one part of the site. No features were identified in the diffuse boundary between Layers 4 and 5, but a group of features were identified on the surface of Layer 4, described as a compact dark-brown gravelly clay lacking obvious internal bedding (Green 1974b:111). These were identified as Occupation C (Green 1974b:115). Many of these features were filled with river gravels brought to the site as floors evident in the overlying, more recent Layers 3 and 1. Layer 2 is a compact sandy clay similar to the basal clay deposit at the site.

Table A.8 Jane's Camp/Ferry Berth/Apulu area radiocarbon determinations [Code: * = δ^{13}C corrected after Spriggs (1990:15)].

SITE	LAB NO.	DATE BP	CAL RANGE BP (2σ)	PROVENANCE	CATEGORY
Jane's Camp	RL-464	2632±110*	2446–1896	Test Pit I, Stratum I	3
Jane's Camp	NZ-2726B	2760±60*		same as sample RL-464	
Jane's Camp	NZ-2727B	2781±36*	2370–2265	same as sample RL-464	2
Jane's Camp	NZ-2728B	2838±30*		same as sample RL-464	
Jane's Camp	RL-479	3632±130*	3705–3077	Test Pit I, Stratum II	2
Jane's Camp	RL-478	2542±30*	2150–1963	Test Pit I, Stratum III	1
Jane's Camp	RL-481	2632±120*	2472–1875	Test Pit II, Stratum IV	1
Jane's Camp	RL-477	2922±120*	2812–2276	Test Pit II, Stratum IV	1
SUMu165	RL-459	1150±110	1293–797	Fs1 base of fire basin	3
Apulu	UGa-1986	945±60	961–694	fill of basin beneath stone piles	3
Apulu	UGa-1990	1205±60	1286–955	bottom of storage pit	3
Tulaga Fale	UGa-1985	1115±75	1256–802	firebasin under platform	3
Ten Points	UGa-1991	1620±65	1690–1334	base of star mound	3
Ferry Berth	NZ-1958B	2980±80	3339–2642	base of coquina layer sealing Lapita deposit	3
Sapapali'i	UGa-1671	14920±175		earth oven	3

No single feature yielded a pure carbon sample of sufficient size for dating (Green 1974b:113). Gak-1441 is from a 'general sample taken from very black, charcoal-rich Layer 5 deposit' in Square I-6 excavated from the base of the deposit (Green 1974b:113). The sample for Gak-1341 was taken from a small charcoal filled depression within Layer 4. Gak-1341 lies within the range of Gak-1441, suggesting to Green (1974b:115) that 'no great interval of time is indicated for the accumulation of both layers [Layers 4 and 5], despite some differences in the pottery they contain' and that Layer 4 was laid down rapidly with no break between it and the underlying Layer 5. The charcoal samples appear securely associated with the cultural material found in the layers from which they were obtained, although a question remains about the origin of the diffuse charcoal for Gak-1441. Both dates are from early in the Gakushuin laboratory sequence and are assessed as questionable.

Jane's Camp (see Table A.8)

Jane's Camp is a coastal midden site on the western half of the north coast of Upolu, excavated by Howard Smith in 1974 as part of the University of Utah research program directed by Jennings (1976). The site is presently 15–20m from the high tide mark and consists of a low mound measuring 60–65m in length and 30m in width (Smith 1976a:61). Ceramics were excavated from all strata, the density of sherds being highest in Stratum I (Smith 1976b:84).

The site was excavated as five test pits. The stratigraphy of the site is described by Smith (1976a:62–4) as five strata (labelled I to V), all with calcareous sand as their primary component. Stratum I is the basal cultural deposit. Strata I and II were distinguished principally on differences in texture of the silty sand, although no mention is made of the nature of the boundary between these strata. Stratum II contained less charcoal and ash than Stratum I. Strata I and II were only seen in Test Pit 1. Stratum III is dark grey sand with large quantities of shell and charcoal. Strata IV and III are identical, but separated by discontinuous lenses of clean white sand at approximately the same level throughout the site. Stratum V is composed of silty brown sand and contains numerous historic artefacts.

All the dates are from shell samples. RL-464 is on *Tridacna* shell that was re-dated by the New Zealand laboratory who used three different samples from the single *Tridacna* valve for NZ-2726B, NZ-2727B and NZ-2728B. The three dates have a calibrated pooled mean of 2370–2265 BP. Although this overlaps with the calibrated range of RL-464, the latter has a much greater standard deviation and is much less precise. The pooled determinations have been retained and RL-464 rejected.

The shell species used for the remaining determinations (see below) are unknown. The dates all overlap at 2σ, with the exception of RL-479 from Stratum II. It appears inverted in relation to NZ-2726/7/8 from the underlying Stratum I and is considered unacceptably early by the excavator (Smith 1976a:64). However, there is no distinct boundary between Strata I and II, only changes in the density of charcoal and ash, and there is no way to determine which of the dates, NZ-2726/7/8 or RL-479, is out of sequence and both dates are therefore considered questionable.

RL-478 is from Stratum III, while RL-477 and RL-481 are from Stratum IV. The deposit from the two strata is considered identical and the dates, all overlapping at 2σ, suggest that they may represent a single stratigraphic unit. All are considered acceptable.

[There is some confusion in the report concerning the numbering of radiocarbon determinations from the site. R-4973 is mentioned by Smith (1976a:62), but not discussed further or listed in the summary of determinations from the site in Jennings and Holmer (1980:8-10). The date of 2550±50 BP is the same as the uncorrected determination listed for NZ-2727B and may refer to the same sample.]

Cog Site SUMu165 (see Table A.8)

The Cog Site, located inland from the westernmost tip of Upolu, includes a number of mound and raised walkway features, as well as Cog Mound itself. The carbon sample for RL-459 was excavated from a firebasin about 1.5m outside the area of the mound itself. This feature was filled with stones that were heavily fire-reddened and a thick layer of charcoal at the base provided the dated sample (Holmer 1976:29). From the illustrated stratigraphy (Holmer 1976:Fig. 8) the firebasin is cut into Stratum I (sterile subsoil) from Stratum II (identified as weathered Stratum I material). These strata underlie the mound structure. Charcoal collected from the mound itself yielded ages averaging ca. 500 BP (RL-460 and RL-461). RL-459 appears to date the firepit. The chronological relationship of the pit to the adjacent mound is unclear. The determination is considered unacceptable because what it dates is unclear.

Apulu SU17483 (see Table A.8)

The Apulu site in inland western Upolu consists of a number of house platforms of varying sizes and accompanying features such as walkways and fences. The charcoal sample for UGa-1986 was collected from a basin filled with fire-reddened stones and a small number of artefacts in a small mound of stones near the platform SU17483 (Holmer 1980b:82). Although associated with some artefactual material, including a single sherd of pottery, the basin was open on the ground surface and these objects have been placed in it from elsewhere. The chronological relationship of the dated charcoal to these and to the surrounding features is unclear. The basin appears to have been cut into the stone mound (Holmer 1980b:82). The chronological relationship of the basin and mound is unknown.

UGa-1990 is from a charcoal sample excavated from the base of one of two parallel lozenge-shaped pits, 1m × 4m and 90cm deep, at the edge of a platform. The continuation of the stone and rubble platform fill across the pits suggests they were dug prior to construction of the adjacent platform; however, Holmer (1980b:80-1) suggests that the platform stones may have been removed and replaced several times if the pits were in use for food storage. The chronological relationship of UGa-1990 to the surrounding platforms and other features is unclear.

Both UGa-1986 and UGa-1990 have been assessed as unacceptable. They are single dates that appear to date cultural activity, but the nature of the activity is unclear. Both appear to come from burning inside structures, but the chronology of the burning is not succinctly argued to date the structure. It may be said the determinations post-date construction of the basin and pits, provided that the charcoal itself does not have an in-built age.

Tulaga Fale SU17130 (?SU1791) (see Table A.8)

The Tulaga Fale site consists of a number of platforms, raised walkways and other features. Five of the platforms were excavated. There is some confusion in the site report (Hewitt 1980b) as to the location from which the charcoal for UGa-1985 was excavated. The charcoal is from a fire basin associated with feature SU17130 at Tulaga Fale (Jennings and Holmer 1980:Table 2) which is discussed as Platform 6 and described as the largest and most disturbed platform (Hewitt 1980b:45). However, there is no mention of the date in the description of the platform nor its association with cultural material.

A date from a fire basin of 1100±110 BP from a separate platform feature (SU1791, Platform 2) in the Tulaga Fale area is mentioned in the text (Holmer 1980b:44), but no laboratory number is provided. The date comes from a firebasin or oven dug into the subsoil beneath the platform structure. 1100±110 BP is the secular corrected date for UGa-1985 (Jennings and Holmer 1980:Table 2); however, the site number with which UGa-1985 is associated is listed as SU17130, not SU1791. The context and cultural association of the date cannot be determined on the available information.

Ten Points SU17552 (see Table A.8)

The Ten Points site in western Upolu consists of three features: the Ten Points star mound, a raised walkway and large oval clearing. The star mound itself is labelled feature SU17552 and was excavated to provide details of its construction. Hewitt (1980c:39) describes the stratigraphy of the site as consisting of Stratum I (the sterile subsoil) and Stratum II (a dark brown crumbly forest soil) which is the original surface for all the features at the site. The mound structure itself is entirely composed of a loose rubble of basaltic stones. According to Hewitt (1980c:39–41) the charcoal sample for UGa-1991 was collected from 'on the forest soil beneath the star mound'. No information is reported about whether this deposit is cultural or contains artefactual material. The charcoal sample may be the result of vegetation clearance for mound construction, but there is no evidence to support a contemporaneous date for the sample and mound construction. UGa-1991 is therefore considered unacceptable.

Ferry Berth SU171 (see Table A.8)

The Mulifanua Ferry Berth site is a submerged ceramic deposit containing sherds with the characteristic Lapita decoration of dentate stamping. This is currently the only site in Samoa to have unequivocally Lapita ceramics. The site was first investigated by Jennings (1974) in 1973 following recovery of decorated sherds through dredging activities at the site which brought the ceramics to the surface as a spoil heap. The ceramic deposit itself is undated; however, the deposit was sealed by a 'coquina layer' of cemented coral and shell and from the base of this layer, a shell was dated to give NZ-1958B. A direct association of the shell with cultural material has not been argued, but the ceramics are likely to pre-date NZ-1958B. The determination is unacceptable according to the protocols of the present analysis.

Sapapali'i SS1385 (see Table A.8)

UGa-1671 from the inland mound and platform complex of Sapapali'i on Upolu is a charcoal sample excavated from an earth oven in association with several other excavated ovens. Little information regarding the context of the date or sample is available. Two radiocarbon dates (UGa-1672 and UGa-1673) were obtained from adjacent ovens which yielded dates of ca. 500 BP. Date 89 is considered unacceptably old by the excavators (Jackmond and Holmer 1980:150). There is no argument presented by the excavators to account for the extremely early date of 14,920±175 BP. Given the earliest dates for colonisation of Remote Oceania are ca. 3500 BP, UGa-1671 does not appear to date human activity. Its seems also highly unlikely, given the very early date, that the determination could be accounted for by in-built age of wood. Given the absence of information upon which to assess the date and the standard deviation >150 years, this date is considered unacceptable.

Manono Island

Falemoa (see Table A.9)

Falemoa is one of two coastal sites excavated on the small island of Manono, off the western tip of Upolu. Falemoa has a complex stratigraphy, including many features. The site has dimensions of about 30m × 20m and, although only ca. 10m from the present high tide mark, it is described as 'relatively undisturbed' (Lohse 1980:25) when compared to the other Manono site (i.e. Potusa, discussed below).

Lohse (1980:25) identifies seven strata (I–VII) in the site. Stratum I is non-cultural subsoil, Strata II and III are the main cultural deposits. Stratum IV also consists of cultural midden, but is less dense in artefactual material. Stratum V is recent modern beach sand covering the site. Stratum VI contains some cultural material, but is considered to be a zone of down slope wash, while Stratum VII is the modern forest soil containing some cultural material.

UGa-1484 and NZ-4343B are from a single *Tridacna* sp. valve excavated from Stratum II which is considered in situ deposit, undisturbed and containing sherds and other artefacts (Lohse 1980:26). The dates do not overlap at 2σ and no information is provided as to the source of this difference. The excavators reject Uga-1484 in favour of NZ-4343B. Spriggs (1990:15) provides a $\delta^{13}C$ corrected date for NZ-4343B that has been retained as questionable in the present analysis, while UGa-1484 has been rejected.

Stratum II is described as the upper 15–20cm of fossil beach sand of Stratum I and the staining observed in the stratum is considered to be from downward leaching from the overlying Stratum III (Lohse 1980:27). UGa-2210 is also from Stratum II and is a shell sample of unrecorded species. This date is not discussed in the text but is listed in the Table 2 of Jennings and Holmer (1980) and appears out of sequence with respect to the very similar dates UGa-2208 and Uga-2211. In the absence of further information the date determination is considered unacceptable.

UGa-2208, a shell sample (species unreported), is from Stratum III which is described as having agglutinated clumps of shell and bone mixed with charcoal stained sand, possibly the result of cooking fires on the sand and inundation of the area by sea water (Lohse 1980:29). Given this, the

Table A.9 Manono Island radiocarbon determinations [Code: * = $\delta^{13}C$ corrected after Spriggs (1990:15)].

SITE	LAB NO.	DATE BP	CAL RANGE BP (2σ)	PROVENANCE	CATEGORY
Falemoa	UGa-2208	2020±55	1679–1378	Stratum III	2
Falemoa	UGa-2211	2080±60	1686–1365	Stratum IV, surface of platform	2
Falemoa	UGa-2210	1565±60	1147–891	Stratum II	3
Falemoa	UGa-1484	2260±65	1889–1555	Stratum II	3
Falemoa	NZ-4343B	2610±50*	2678–2332	same sample as UGa-1484	2
Potusa	UGa-1485	1660±60	1248–951	Stratum II	3
Potusa	NZ-4342B	1850±40	1365–1214	same sample as UGa-1485	3

deposit may have been disturbed and the shell may result from non-cultural beach accumulation, although this is not discussed in the text. The date, UGa-2208, must be considered questionable.

Stratum IV, from where the shell sample for UGa-2211 originates, is a sandy midden that occurred uniformly throughout the site (Lohse 1980:29). The dated shell (species unreported) is described in the table of dates (Jennings and Holmer 1980) as being collected from the surface of a feature interpreted as the remains of a stone platform in the upper portion of the Stratum III. With no further data available the determination is considered questionable.

Potusa (see Table A.9)

The Potusa site is a beach deposit situated only 1.5m above the high tide mark. According to the excavators the site was 'riddled with vertical crab holes' (Jennings and Holmer 1980:22). There were no features or midden lenses identified in the excavation; however, four strata could be discerned. Strata I and II are the basal deposits and contain ceramics. These deposits are considered to be colluvial, originating from the knoll behind the beach (Jennings and Holmer 1980:22). The ceramic deposits are therefore in a secondary, disturbed context. A *Tridacna* valve from Stratum II has been dated twice to give UGa-1485 and NZ-4342B. Given the secondary context of the deposit and the likelihood that it has been reworked by wave action, the relationship of the *Tridacna* valve to the cultural material excavated from the site is unclear. Further, there is no discussion as to the condition of the *Tridacna* valve that may have been fossilised, giving an earlier date than that of the associated material. Both determinations must be considered unacceptable.

An archaeology of West Polynesian prehistory

AN ARCHAEOLOGY OF WEST POLYNESIAN PREHISTORY publishes the results of this research. By assessing the evidence in a regional chronological framework Smith identifies major gaps between the expectations of the established model and the archaeological evidence suggesting that the association of Polynesian cultural origins with the post-colonisation period in West Polynesia may be unfounded. This has implications for current ideas about colonisation and cultural change in Remote Oceania and in particular lends support for a late model of East Polynesian colonisation.

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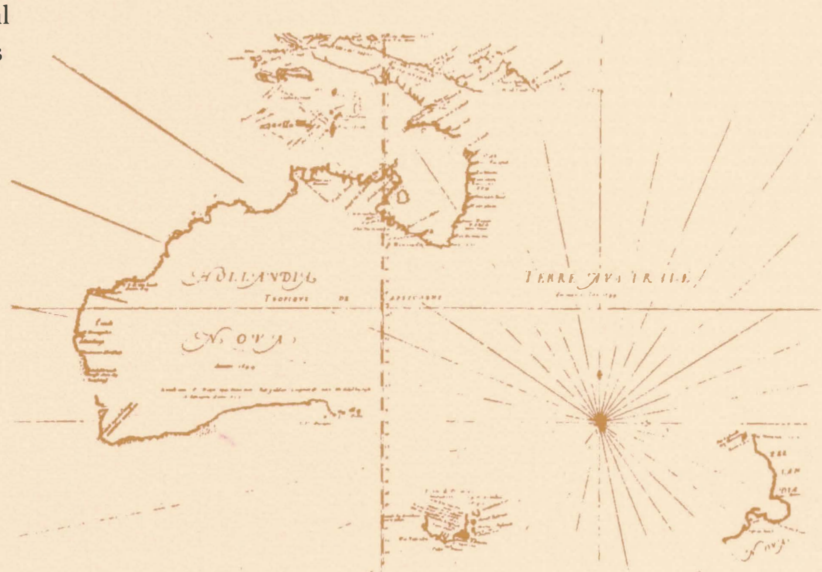
Smith asks the question 'Does the early archaeological evidence from West Polynesia support a model of Polynesian cultural origins in the homeland of West Polynesia around 2500 BP?' According to the established cultural chronology for the region, changes should be apparent in the early archaeological evidence indicating the emergence of an Ancestral Polynesian society. Drawing on debates about the nature of Lapita and the chronology of East Polynesian colonisation, Smith investigates the relationship between the expectations of this model and published evidence from securely dated West Polynesian sites.



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