RECENT ADVANCES IN THE ARCHAEOLOGY OF THE FIJI/WEST-POLYNESIA REGION

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Born of informal discussions on a boat crossing between islands in Vava’u after the 2005 Lapita Conference, the idea of a working conference devoted specifically to the Fiji/West-Polynesia region took just over a year to reach fruition. Both of us were immediately very enthusiastic about the concept and the potential outcomes of such group discussions. The project was challenging, with the organizers spread between Nouméa and Tutuila, without any specific resources for the project, and with Addison transitioning between jobs a few months before the conference. Luckily, it was possible to transfer Sand’s funding contributed through the French Embassy in Fiji for preparation of a 2008 conference on the Melanesia/Polynesia/Micronesia tripartite cultural division. This money was used to invite a number of indigenous archaeologists of the region, as we felt from the initial planning that the conference could not be really meaningful without the participation of local archaeologists and cultural representatives from Fiji, Tonga and Samoa. Further financial support came from the New Caledonia Government and the American Samoa Community College. Positive responses from colleagues around the globe resulted in the convergence on hot, humid, and remote Tutuila of some 30 archaeologists and students.

For the two of us, it was a pleasure and a great honour to organize the *Archaeology of the Polynesian Homeland Conference*, all the hassle and stress of making the project happen being quickly forgotten. We took a gamble with the unconventional format, but felt richly rewarded by the calibre of the discussions. The success of the meeting was due in large part to the enthusiastic response of the participants, who made the effort to attend and who made the discussions at the conference so rich: Tautala Asaua, Shawn Barnes, Jacques Boles, David Burley, Ethan Cochrane, Sean Connaughton, Janet Davidson, Suzanne Eckert, Julie Field, David Herdrich, Tomo Ishimura, Philip Johnson, Ledua Kuilaisiautabu, Jennifer Kahn, Thegn Ladefoged, Lau Asofou Leapa’a, Sepeti Matararaba, Lisa Matisoo-Smith, Alex Morrison, Ratu Jone Nacabalavu Balenaivalu, Josefa Percival, Fiona Petchy, Erika Radewagen, Timothy Rieth, Andrew Roberts, Anita Smith, Alice Storey, Epi Suafo’a, Frederique Valentin, Unasa F. Vaa, and Honourable Noble Tu’ivanuvou Albert Vaea. They collectively demonstrated that thematic working conferences without formal paper presentations can be immensely fruitful; we hope to see more meetings of Pacific archaeologists with this format.

The success of a project like this also relies on the people who open their facilities to that strange species, Pacific archaeologists. The conference would have felt much less hospitable without the gracious support of the American Samoa Community College’s Dr. Adele Satele-Galea’i, Tapa’au Dr. Daniel Aga, Dr. Minareta Thompson, Pa’u Pepe Faleatua and their staffs who provided facilities, meals, snacks, transportation and a whole array of items and services too numerous to mention. Pemerika L. Tau’ilili and his family graciously hosted some of the participants at the family meeting house (it also provided a relaxed venue for informal gatherings most evenings).

This volume – a series of papers featuring work by some of the conference participants – is the first publication resulting from the conference; a synthesis of the discussions is in preparation. Our thanks to numerous reviewers who provided anonymous comments on all the papers published here. Our gratitude to Glenn Summerhayes and Richard Walter who agreed to have the volume published in Otago’s *University of Otago Studies in Prehistoric Anthropology* series. K. Okenaisa Fau’olo-Manila and her staff at ASCC’s Samoan Studies Institute supported the production of the volume in numerous ways. Special thanks to Joseph Iosua for the initial layout. The graphic wizardry of Les O’Neill at the University of Otago Anthropology Department is responsible for the final look of the volume.

*The Editors*
A group photo of the participants to the Polynesian Homeland Conference in late November 2006.
INTRODUCTION

The region of Fiji-Tonga-Samoa, as well as the neighbouring islands of Futuna and 'Uvea (Wallis), have been identified as the area where unique proto-Polynesian traditions emerged after first human settlement about 3000 years ago (Kirch and Green 2001). This region, geographically isolated by significant water gaps from Island Melanesia to the west and the islands of East Polynesia, has over the millennia developed along a specific path, leading to the unique cultural traditions we see today. Between the 27th and the 30th of November 2006, some 35 archaeologists from around the globe met on Tutuila (American Samoa) to participate in a working conference on the ‘Archaeology of the Polynesian Homeland’ (Fig. 1). The meeting brought together researchers currently working in Fiji/West-Polynesia and those with an interest in the prehistory of the region, to discuss their work and share ideas about specific topics drawn from archaeological work carried out over the last 50 years. The intention was to allow a multifaceted synthesis of the region’s prehistory, highlighting agree-

Figure 1: Location of the 'Polynesian Homeland' in the central Pacific.
Base map courtesy of Peter Minton (http://www.evs-islands.blogspot.com).

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ments and disagreements between researchers, to pinpoint the meaning of the Melanesian/Polynesian 'frontier', and to identify future issues that are likely to define the next decade of archaeological research in the Polynesian Homeland. At the conclusion of the workshop, a number of the participants proposed to submit individual papers as part of a volume on the region, presenting their latest results. This volume is the outcome of this collective effort to bring to the forefront this new research. It also gives the conference organisers, an opportunity to review several of the major issues discussed during the meeting.

A SNAPSHlOT OF THE POLYNESIAN HOMELAND WORKING CONFERENCE THEMES

During the organisation period, we pinpointed twelve major topics/themes that were chosen as a framework for the conference discussions to be held over three days. The topics were structured in chronological order and were circulated beforehand so that each participant could prepare for the two hours of discussion reserved for each topic. The results of the discussions are summarized below in two chronological periods (the first covering the period from about 3000–1000 years ago and the other dealing with the last 1000 years).

From First Settlement to the End of the 'Dark Ages' (c. 1000 BC–AD 1000)

The Eastern Lapita Province

Participants agreed that the picture of the first settlement phase of the Eastern Lapita Province has profoundly changed in the last fifteen or so years, due to continuing efforts throughout the region. A number of major advances have been made in the study of prehistoric landscapes and the palaeoecological conditions encountered by the first Austronesian settlers, as well as the refinement of first settlement dating, with a major shortening of the sequence. Early hypotheses that placed the first Lapita settlement as far back as 1500 BC have now been replaced by a consensus that the first discovery of Western Fiji took place a few decades before 1000 BC, of Tongatapu just after 1000 BC, with a progressive settlement of the other islands of the region over the next 150 years. Consequently, new discussions have emerged on the pattern of prehistoric settlement in this remote Lapita region. Refinement in the study of first settlement cultural remains and the development of a whole new set of excavations of Eastern Lapita sites have facilitated better control of the material culture sequence, leading to a clearer understanding of the mechanisms of transformation that produced a specific regional cultural complex. Questions of the genetic ancestry of the first generation of settlers have also received renewed attention, with the discovery of a series of Lapita-aged burials at several locations.

All these data shed new light on the dynamics of Lapita times in the region (e.g. Burley and Dickinson 2001). In the discussion, the main point about the Lapita phase, was a proposal to identify two specific dynamics in the Eastern Lapita Province, one around Western Fiji, and one encompassing the Lau Islands and West Polynesia. Due to a lack of data, the position of Vanua Levu remains unknown at present. Discussions highlighted that the concepts of 'Early' and 'Late' Eastern Lapita need to be defined in more detail, some participants arguing that there is just an 'Eastern Lapita' with open dentate motifs in the Lau-West Polynesian area.

Proto-Polynesian Developments

The post-Lapita regional evolutions between ca. 2600 and 1800 BP, and the emergence of Proto-Polynesian cultural traits were the focus of the second theme. Questions such as 'how similar do archaeological remains need to be to show cultural relationship between distant islands?' were debated, as one of the issues in Fiji/West-Polynesia during its first millennium of settlement is the apparent homogeneity of the material cultural changes across most of the region, especially when one compares the regional picture with the diversity at play in Island Melanesia over the same time period. Nonetheless, localised studies have shown that the apparent regional similarities are undermined by local variation (e.g. Clark 1999).

There was much discussion on whether this period can still be viewed as having developed a set of common cultural traits over the entire region or if we are witnessing a more diverse situation, with marked cultural differences already developing between archipelagos. The plainware chronology in particular appears to undergo progressive diversification in West Polynesia, with specific vessel forms and perhaps even specific pot uses between archipelagos emerging early in the ca. 1000-year plainware period. Participants agreed that even after 50 years of research, much remains to be done to pinpoint the end of ceramics in each sub-region of West Polynesia and to define with more certainty if ceramic manufacture terminated everywhere at the same time.

The question of post-Lapita evolutions is not a mere typological and chronological obsession; it is central to the debate on the emergence of the Proto-Polynesian culture and its archaeological signature. The last decade has seen the confrontation of two opinions about the development of specific Proto-Polynesian cultural traits during the prehistoric chronology of the Fiji/West-Polynesia region. One favours an immediate post-Lapita chronology before 2000 BP (e.g. Kirch and Green 2001), the other suggests a lack of such data until a later period during the first millennium AD (Smith 2002).

It was hoped that through complementary analyses from different practitioners working in the field, and by questioning the position of Fiji as an 'Archipelago in Between' Melanesia and Polynesia, that a more balanced understanding of this key issue would be reached in panel dis-
discussion. But significantly, no consensus emerged around the concept of 'Ancestral Polynesia'. The overall discussion focussed on what can be defined in archaeological terms as Proto-Polynesian, and where we stand today in the debate over the chronology of its emergence. Not surprisingly, Kirch and Green's book 'Hawaiki' was at the core of the discussion, as was the link between the Fiji/West Polynesia region during the first millennium AD and the first settlement of East Polynesia. A series of provocative proposals were made at the end of the session, such as the possible arrival of new groups of people in Fiji and/or West Polynesia during this time period. Overall, the discussion ended without consensus about the spatial and chronological patterns of artifact traits or their meaning. Clearly, this is an issue that requires further research.

Subsistence Strategies

One topic discussed as a general theme overlapping the chronological divides of the conference was an overview of subsistence strategies in the Fiji/West Polynesian region. Excavation of first settlement sites has demonstrated the significant impact of human settlement on the endemic fauna, with the extirpation and extinction of numerous land-birds, such as megapodes and reptiles (e.g., Steadman 2006), and a drastic reduction in the size of turtle populations, as well as the average size of some shell fish. The development of horticulture had varied effects on different islands (the replacement of forests by grasslands, massive erosion in some islands, or in some instances apparently little effect) and pathways of intensification were multifaceted, some participants noting that no evident sign of this process could be identified on some islands.

It appears that the topic of 'strandloopers', first proposed by Les Groube over 35 years ago (Groube 1971), is back on the table. Conference participants were open to the idea that there may have been an initial heavy reliance on wild resources with minimal horticulture in at least part of the region until later periods. Conference participants were surprised when discussion of faunal data from the different islands showed a much greater variety of situations than the simple 'blitzkrieg' scenario often presented as a consequence of first human arrival. This was also the case with horticulture, and a series of case studies showed clear differences in the development and effects of horticulture on different islands. There was discussion around the topic of landscape transformation, leading to the questioning of the definition of the concept of 'intensification' in the region, and the need for a more supple understanding of individualized local scenarios.

The Dark Ages

This central part of the prehistoric chronology of the region, covering broadly the first millennium AD, and especially the period after the disappearance of pottery in West Polynesia, remains poorly known. This period has been conveniently referred to as the 'Dark ages' (Davidsen 1979), although the literature shows the existence of archaeological data from this pivotal millennium AD. The conference, which gathered many of the archaeologists working in the region, was a good opportunity to obtain a fuller understanding of this period, be it from archaeology, but also from linguistics, and to identify what the newly acquired data reveal about the cultural dynamics of the first millennium AD. A reasonable number of 14C dates are from this period, although discussions highlighted how most of them are just 'dates' without real usable context to define the cultural processes at play. A set of discussions focussed on recent work showing that this period was also a time of major landscape transformation, leading to questions about how these changes influenced long-term cultural development, and the connections between demography, environmental conditions, and the possible arrival of new people. The main consensus was that we are still dealing with Dark or at least 'Gray' Ages.

The 'Traditional' Past: the Last 1000 years

The Emergence of the Traditional Chiefdoms

The second part of the working conference focussed on the last 1000 years of the prehistoric chronology, by discussing first, from a regional perspective, the emergence of what can be termed the 'traditional chiefdoms' (AD 1000–1500), relying on myths, oral traditions and archaeology. All the islands of the Fiji/West-Polynesia region have complex histories and traditions relating to the appearance of their ancestral chiefdoms, marking the foundation of the political systems witnessed by the first Europeans in the 18th century. Archaeology, for its part, has identified the development of new landscape uses and new cultural signatures after AD 1000, testimony to new cultural dynamics (e.g., Burley and Clark 2003). The conference discussions tried to better understand the relations between traditions of wide-scale development of new political systems and the archaeological record, in terms of internal developments, outside influences, environmental change etc., with a nice balance between pure archaeology and debates on the accuracy and appropriate use of oral traditions. Even if the fundamental conditions leading to the rise of traditional chiefdoms about or just after AD 1000 remained controversial, most participants agreed that there was a unique political and cultural dynamic during the period.

Interaction, Exchange and Monumental Architecture

The conference discussed data on the development of new production centres and the emergence of local and regional exchange networks during the second millennium AD, as well as their role in the appearance of new political strategies. Geochemical studies have allowed over the past decades the identification of exotic manufactured goods like stone adzes found over unexpected distances. Such archaeological data reinforces the ethnographic accounts on the existence of local specialised production centres, the presence of multiple island connections, and structured
networks between the archipelagos of the region during the second millennium AD. This period also saw the settlement of different parts of the Melanesian chain by people from West Polynesia, leading sometimes to a major cultural influence on some islands. The panel discussed the technical processes used today to identify the movement of transported artefacts, but also the cultural outcomes of interaction at different scales. The discussion in the end highlighted how little we still know about most of the region, pointing to the need for more research programs focussed on geochemical provenience studies. It appeared that we may not have at present enough data to differentiate 'exchange networks' from 'occasional movement of objects'. The need for better technological analysis on the production process of adzes was also raised, to allow differences between expedient production and specialized tufuga-related manufacture of objects to be identified.

Another clear archaeological signature of change during the second millennium AD is the appearance of monumental architecture. The region is renowned for its monumental structures, ranking from large fortified complexes to massive artificial platforms, cut slabs on burial mounds and different types of specialized building (Kirch 2000). Marked inter-archipelago differences, as well as a series of basic similarities can be observed, that do not yet allow us to disentangle local developments from regional influences. Discussions were focused on bringing together different perspectives on the regional monumental architecture, as well as a series of localised studies, in order to disentangle the when, the where, the how and the why on this topic. This exercise has highlighted how little we know from direct archaeological data, and how much most of the ¹⁴C dating concentrates in the last 500–600 years.

The Tongan Maritime Chiefdom

A conference on the Polynesian Homeland wouldn’t be complete without a discussion specifically dealing with the topic of the ‘Tongan maritime chiefdom’, its spread across the region and its wide socio-political influence. The Tu’i Tonga chiefdom on Tongatapu has clearly been the single most influential political centre in the region over the last 500 years (Burley 1998), with the sudden development across the Fiji/West-Polynesia region of multiple monumental constructions that can be studied through archaeology. The regional data from oral traditions allow a nearly historical understanding of some of the key events surrounding the influence of the Tongan maritime ‘empire’ on other archipelagos and islands in terms of politics, land tenure, and exchange of goods.

This late influence of Tongatapu may have overshadowed former connections not centred on Tonga, obscuring our understanding of the region’s dynamics in former times. The session led to a series of discussions about the term ‘empire’, and what had happened before. The role of the Samoan influence in the region prior to the 15th century was debated, as were the types of political and social relations between Samoa and Tonga. Questions of chronology were also raised with a suggestion of a unification process of the Tongatapu polity around the 15th century. If this scenario is correct, it was only after that time that the Tu’i Tonga chiefdom could start expanding outside southern Tonga.

Early European Contact

One of the unexpected consequences of the rich corpus of oral traditions focussing on local politics has been to prevent the development in Fiji/West-Polynesia of a proper study of the consequences of the first two centuries of European intrusions into the region. Surprisingly little has been done in terms of the archaeology of the contact period (but see Davidson 1969), although first encounters with Westerners started as early as the 17th century. Elsewhere in the Pacific, more detailed understanding of the consequences of these first relations, especially with the introduction of new goods but also of new diseases, leading to population collapse and population movement, as well as the weakening of some traditional pre-contact centralized political systems, has raised a whole new set of questions on the indirect influences of European contact on islanders and island societies. The participants agreed that it is time to discuss those questions in detail for the Fiji/West-Polynesia region. Debates on first contact and on the early colonial period focussed on two major components. The first was on the archaeological remains of these early contacts, the second was on demography. Roger Green’s paper on Samoa (Green 2007) is an up-to-date starting point to questions about demography in the region. There was no consensus on the final outcomes of first contact, but participants highlighted the need to test the models at hand, especially through settlement pattern studies.

Future Directions in the Archaeology of the Polynesian Homeland

The workshop ended with a general discussion about the archaeological projects urgently needed in Fiji and West Polynesia to foster a better understanding of the ‘longue durée’ in the region. After over 50 years of archaeological research looking mainly for the origins of the old Polynesian Homeland, a great number of islands, big (like Vanua Levu) and small, have still received no real attention by archaeologists. Any strategy to develop a global understanding of the region’s history should take into account the numerous gaps in our knowledge, gaps that we ultimately need to fill. At the same time, a whole set of cutting edge analyses are emerging from the efforts of different research teams, and these need to be thoroughly developed and integrated in future research programs. Finally, Pacific Islanders are increasingly aware of the tools of archaeology, and are expressing a strong desire for the sharing of information and some sort of control on the research topics developed on their land.

With this background and new understanding, the concluding discussion aimed at identifying the major research
trends emerging, in order to set the scene for the prospects of future archaeology in the Fiji/West-Polynesia region. To get a better understanding of Lapita and its aftermath in Fiji appears as a central question if we want to define more precisely the start of the regional cultural chronology. But discussions revolved also around other considerations, like the need to get the governments of the region aware that archaeological sites are getting destroyed at a fast rate because of resort constructions and other economic development activities. Some participants proposed to fulfill a series of geochemical analysis on Fijiian and West Polynesian collections in their laboratories, in order to start building a specific data-base for adzes, for example. The last point discussed was the possibility of putting together a project on the model of the ‘Lapita Homeland Project’, perhaps focusing on Vanua Levu – still an archaeological terra incognita. This last prospect is a good illustration of how much still remains to be done in this core cultural region of the central Pacific, but also the significant rise of the number of archaeologists, especially young practitioners, eager to work specifically on the past of the Fiji/West-Polynesia region.

THE PAPERS

The papers collected here were not presented at the conference. As noted earlier, the conference format was an open forum on focussed topics. The present volume is the result of conference participants expressing a desire to formally present some of their recent work. As with the archaeologists working in the region, the papers are diverse. Aside from a regional focus, there is little to unify the papers, which range through methodological and technical topics to data-rich papers on specific sites and sub-regional summaries. We have arranged these diverse papers by archipelagos from West to East; thus Fiji, Tonga, then Samoa.

Perhaps appropriately for a discipline interested in time, we begin the volume with Janet Davidson’s historical review of developments in the archaeology of the region. Davidson draws on her career of some four decades in Pacific archaeology to give us some perspective on what came before. This is not a review of early research data from the region, but rather traces the intellectual context of early work in the region – including the concept of a ‘Polynesian homeland’.

Julie Field also touches an earlier generation of work in the region in her paper on the 2000-year sequence at Tatuba Cave in Fiji. First excavated in 1972, Field returned to the site thirty years later and here gives us a synthesis of the combined results as well as the first publication of much of the earlier data.

Frédérique Valentin, Christophe Sand, Isabelle Le Goff, and Hervé Bocherens examine a skeleton from the very north-eastern margin of Fiji at Cikobia-i-Ra Island. Through their chemical and macroscopic data, they offer a bioanthropological understanding of the life-history of the individual as well as placing it in regional context.

Alice Storey’s paper continues with human bones as subject matter, but in Tonga and with a different focus. Storey’s analysis of modified human bone from four islands in Ha’apai seeks to distinguish evidence of cannibalism from evidence of tool manufacture.

Shawn Barnes and Roger Green lead off our series of four papers on Samoa. They tackle a period often neglected in the region – the time after Europeans showed up. Their paper points to the rich arena awaiting archaeologists willing to tackle what was a highly dynamic period in the region.

Fiona Petchey and David Addison review technical issues relating to marine-reservoir effect and marine-shell dating in Samoa. They offer a new local marine reservoir correction (AR) – one that suggests marine shell in Samoa is very near the average worldwide reservoir.

Timothy Rieth and David Addison discuss the concept of a ‘Samoan Dark Ages’ and recent data covering that period (~1500–1000 BP). Their review of this and previous data suggest both continuity with earlier deposits and diversity across the archipelago.

We end the volume with a paper by David Addison, Jeffery Toloa, Tuipuavai Tago, and Siaiki Vaueli reviewing the current state of knowledge of Samoan Plain Ware ceramics in American Samoa. They argue that the discovery of a large number of ceramic sites on Tutuila over the last decade must lead to a new understanding of their spatial and temporal distribution with broader implications for settlement pattern, subsistence, etc.

CONCLUSION

As this set of papers shows, it is a thrilling time to be working in the Fiji/West-Polynesian region; the Polynesian homeland. After decades of research that has allowed the erection of a regional framework, it appears that archaeologists of the region are poised to begin filling in important areas as well as posing new and innovative questions. It is pleasing to see the continuing interest in the region by a new generation of archaeologists. Particularly satisfying is the emergence of a small but growing cadre of indigenous archaeologists – we hope this trend continues and that the established archaeologists in the region continue to undertake community outreach and education. The coming decade will be an exciting time for the archaeology of the region and we eagerly anticipate the results to come.

ACKNOWLEDGEMENTS

This short review of the archaeological knowledge about the Polynesian homeland region would not have been possible without the dynamic participation of all our colleagues to the conference. The input of each participant in the new ideas that emerged from the discussions will
be acknowledged in the final proceedings of the sessions, something that was beyond reach for this paper. It was also decided, after some hesitation, to keep the reference list to a minimum in order to avoid uncomfortable lecture. Thanks are due the outside reviewer for comments on this paper.

REFERENCES


THE ARCHAEOLOGY OF THE POLYNESIAN HOMELAND:
A RETROSPECTIVE VIEW OF THE EARLY YEARS

Janet Davidson*

ABSTRACT

Archaeology in Fiji/Western Polynesia began with McKern’s pioneering fieldwork in Tonga in 1920–1921. His study was part of a collaborative approach to the question of Polynesian origins. Over the next 50 years, ideas about a Polynesian Homeland changed dramatically from an external homeland beyond the Pacific to an internal homeland within the Polynesian triangle. Archaeologists from McKern onwards were concerned about Polynesian origins, but worked hard and often collaboratively to document the range of field evidence in different islands and, through excavations, to develop ceramic sequences and evidence for chronological change and regional differences. This pioneering research laid a firm foundation for subsequent work and still provides object lessons for a new generation of researchers.

INTRODUCTION

The workshop on the Archaeology of the Polynesian Homeland, held in Tutuila in late 2006, offered an opportunity to reflect on the origins of archaeological work in the region. This paper reviews the course of research from the pioneering fieldwork of McKern in 1920–1921 until the publication of the ‘Jennings Volume’ (Jennings 1979). That volume was singled out by Burley and Clark in their comprehensive review of the archaeology of the ‘Post-Lapita’ era in Fiji/Western Polynesia as something of a landmark, a point at which archaeology in the western Pacific was ‘no longer embryonic’ (Burley and Clark 2003: 235). Their study and previous reviews by Clark (1996) on Samoa and Burley (1998) on Tonga provide good coverage of work since 1979. I hope to show, however, that the pioneering research was by no means embryonic, in the sense of being unformed or immature; on the contrary, it took place within a clear intellectual framework and laid a firm foundation for subsequent research.

THE CONCEPT OF THE POLYNESIAN HOMELAND

The question of the origins of the Polynesians first arose when European explorers and scientists came face to face with Polynesians. In 1770, botanist Joseph Banks wrote:

From the similarity of customs, the still greater of Traditions and the almost identical sameness of Language between these people [the New Zealand Maori] and those of the Islands in the South Sea [the Society Islanders], there remains little doubt that they came originally from the same source: but where that Source is future experience may teach us, at Present I can say no more than that I firmly believe that it is to the Westward and by no means to the East. (Beaglehole (ed.) 1963 (II): 37)

One hundred and fifty years later, when field archaeology began in Polynesia, the question of Polynesian origins was still a major preoccupation (Gregory 1921: 13). In the intervening period, a great deal had been written on the subject, invoking philology, traditions, ethnology, physical anthropology, voyaging capabilities, and pure speculation. The many theories and debates have been well reviewed by Howard (1967). The debates continued, still largely in...
an archaeological vacuum, throughout the first half of the twentieth century. As Kirch (2000: 208) has pointed out, the focus was on bringing the Polynesians, fully fledged, into the Pacific from somewhere else. Te Rangi Hiroa's (1938) view that the Polynesians migrated from Asia through Micronesia to Samoa and the Society Islands was very influential and scholars such as Handy (1930) saw culture change in Polynesia as the result of sequential migrations. The idea that the Society Islands might have been the central dispersal point following arrival in Polynesia and that there might have been successive waves of migration into Polynesia were still prevalent in the mid-twentieth century.

Internal distinctions within Polynesia became of interest in the 1930s, with Skinner (1934) proposing a division into Western and Marginal Polynesia. This division was systematically explored by Burrows (1938) and found wide acceptance.

From the mid-twentieth century, modern studies in linguistics began to have a strong influence on thinking about Polynesian prehistory. Grace (1959: 65) first argued that 'Rotuman, Fijian, and the Polynesian languages have passed through a period of common history apart from all the remaining languages of the Austronesian family.' Elbert (1953) made the first attempt at sub-grouping the Polynesian languages, suggesting that pre-Tongan was the first to separate from the parent language, followed by pre-Samoan. These studies were influential when archaeology took off in Fiji, Samoa, and Tonga in the 1960s. Pawley’s (1966) study, using a different method, produced results not unlike those of Elbert. Both Emory (1963) and Green (1966) used linguistics as a guide to understanding patterns of prehistoric settlement. The excitement generated by these studies ran parallel to the excitement generated at the same time by the new developments in archaeology, particularly the growing body of evidence about Lapita pottery.

A major shift in popular thinking about Polynesian prehistory resulted from Suggs’ work in the Marquesas in the late 1950s. Suggs (1960b) used his data from the Marquesas, including his apparently early pottery and radiocarbon dates, and information supplied to him by Jack Golson (discussed below) to argue that a culture ancestral to those of Polynesia entered Western Polynesia from the west in the first millennium BC.

However, the honour for first proposing a homeland within the Polynesian triangle probably goes to Kenneth Emory, who in 1959 argued:

It seems, therefore erroneous to consider that there was ever a migration to Polynesia of a people already identical to the Polynesians as we know them, and as already possessing the distinctive features of Polynesian language and culture. What now appears most likely is that people of somewhat diverse origins came together in a western archipelago in the Polynesian area about B.C. 1500, and, in comparative isolation, their descendants, their language and their culture took on features which the Polynesians now share in common and which give them their distinctive characteristics. (Emory 1959: 34)

This view was espoused by Green (1967b: 236) who took it a stage further:

…it is important to stress that the theory differs from many earlier ones…, by dismissing the theory of a distinctive migration or route within Melanesia. This is replaced by the concept of development within Polynesia itself of the Polynesian racial, linguistic and cultural patterns which were based on ancestral forms found in Eastern Melanesia and in particular in Fiji.

At the same time, however, Green (1968: 107) undermined the concept of Western Polynesia as a 'fundamental entity in the analysis of Polynesian prehistory', seeing it rather as 'the result of a series of diverse processes', much as Burrows (1938) had previously suggested.

The growing recognition of the significance of Lapita pottery during the late 1950s and early 1960s reinforced the idea of a homeland within Polynesia. Here was a clear trail of footprints coming from the west and ending, apparently, in Tonga. Surely this was the place where those uniquely Polynesian characteristics, recognised by many writers over so many years, developed.

The debate about Polynesian origins was of great interest during the early period of archaeological work in Fiji and Western Polynesia, and provided the ostensible objective of most of the research. Yet at the grass roots, much of the archaeological research focused primarily on monuments and ceramics, aiming to define the range of features and develop sequences (usually primarily ceramic) in the individual island groups. However, as Green (1970a) pointed out, there was also an interest in settlement pattern archaeology, where chronological change was a secondary consideration.

MCKERN, GIFFORD, AND SOME MINOR PLAYERS

Archaeology in the Fiji/Western Polynesia region began with the pioneering fieldwork of William McKern, who spent nine months in Tonga from September 1920 to June 1921 as a member of the Bayard Dominick Expedition. Missionaries and other visitors to the region had previously commented on monuments and fortifications but this was the first actual archaeological investigation.

The Bishop Museum’s Bayard Dominick Expedition to various islands represented the first co-ordinated approach to Polynesian anthropology. In 1920, Herbert Gregory, newly appointed Director of the Bishop Museum, convened the first Pan-Pacific Science Congress in Honolulu, at which
a resolution was drawn up for anthropological research, including archaeology. The section on archaeological research began as follows:

In the insular areas of the Pacific, the fundamental problems are the origins, migrations, and external contacts of the inhabitants. Our chief interest in this connection centers in Polynesia. Since the Polynesian race is still represented in the flesh and shows, through its traditions, continuity from the present to the time of its residence outside the Pacific [emphasis added], it is difficult to consider the problem from an archaeological standpoint alone. (Gregory [ed.] 1921: 117)

It was therefore proposed that an archaeologist and an ethnologist be sent to each island selected for study. The archaeologists would study material culture and conduct surveys, select typical sites for detailed study and carry out excavations where needed. The fundamental objective would be chronology. A wide range of site types was mentioned, and the value of currently uninhabited islands as ‘way-ports of the Polynesian migrants’ was noted.

Gregory, a geologist, had come to the Bishop Museum from Yale and brought with him an association with that university and a grant of $40,000 from a Yale alumnus, Bayard Dominick. After consultation with authorities in the United States and New Zealand,1 a program was approved and teams consisting of an ethnologist, an archaeologist, and in some cases a botanist2 were promptly set to work in Hawai‘i, the Marquesas and the Australas, as well as Tonga (Gregory 1921: 13–14). Thus began the involvement of the Bishop Museum in Polynesian archaeology and its long relationship with Yale. The role of the Pacific Science Congresses in formulating research programs would be repeated in future.

The early results of the Bayard Dominick Expedition, reported in the Bishop Museum’s Annual Report for 1922, were of such interest that they were reprinted in full in the *Journal of the Polynesian Society* in 1923. The editor, W.H. Skinner, described the Expedition as ‘the first comprehensive attack on a large scale on the problem of Polynesian origins’ (Skinner 1923: 250).

McKern found Tonga ‘poor in stratified deposits attributable to human sources, but rich in artificial monuments of earth and stone’ (McKern 1929: 4). Most of his monograph is devoted to the description of all the visible forms of field evidence. This account has provided the basis for all subsequent investigations in Tonga. The last part of the monograph reports on excavations in three ‘kitchen middens’ (one of which was the Mangaia mound, mentioned again below) and five burial sites, and describes the pottery found in some of the excavations. This consisted of 1587 sherds,3 of which 11 had a curious decoration, now recognised as Lapita. McKern thought the Tongan pottery was ‘Fijian in origin and basic type’ (1929: 122) but cautiously decided that some of it, at least, must have been made in Tonga. McKern also studied Tongan material culture, but his monograph on the subject has never been published (McKern n.d.).

In defending the amount of detail in his monograph, McKern (1929: 4) wrote as follows: ‘… conclusions, even general remarks, are devoid of meaning when separated from the detail of listed phenomena.’ (1929: 4) He thus set for subsequent workers a standard of thorough reporting.

McKern found uniformity of culture throughout Tongatapu, Ha’apai and Vava’u but reported that most of the monuments and kitchen middens were in Tongatapu (1929: 119), which was ‘culturally and politically, the center of Tongan life.’ (1929: 4) He believed that ‘the great stone structures of Tonga definitely reflect the strongly centralized socio-political organization of its primitive inhabitants’ (1929: 120). He collected traditional interpretations of monuments and distinguished between ‘fanciful ways’ of explaining their presence and ‘a much more plausible group of traditions’ which were ‘surprisingly consistent in their wide repetition and flately historical in style…’ (1929: 4). In his concluding discussion, McKern tackled the relationships between Tonga, Fiji, and Samoa, with an emphasis on the sudden appearance of stone construction in Tonga, which he believed came from Fiji. Samoa, he thought, had been settled long before Tonga.

With McKern’s work, therefore, the archaeology of Western Polynesia got underway with the establishment of ceramics and monuments (and other field evidence) as major themes, a belief in full publication rather than summaries unsupported by detailed evidence, a conviction that careful use of traditions could enhance the understanding of monuments, and an enquiry into the relationships and influences within the region.

McKern acknowledged the active interest and cooperation he received from Queen Salote, her son Prince Tungi (later King Taufa‘ahau) and the Premier, Hon. Tui Vakano. Thus archaeology in a Western Polynesian nation began with the blessing of the leaders of that country. Later archaeologists throughout the region have also received strong support for their work from local leaders.

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1 Clark Wissler of the American Museum of Natural History, Roland Dixon of Harvard University, William Churchhill of the Carnegie Institution, S. Percy Smith, President of the Polynesian Society, J. MacMillan Brown of Canterbury College, Elsdon [sic] Best of the Dominion Museum, and others familiar with the status of Pacific anthropology (Gregory 1921: 13). Economic botany, geography and zoology were considered part of the program.

2 Economic botany, geography and zoology were considered part of the program.

3 McKern’s figures do not add up, probably as the result of a typographic error. The most likely interpretation is that there were 1557 sherds from Tongatapu, not 1577, which with the 30 sherds from other islands and islets would total 1587.
In the decades following McKern's field work, brief reports appeared on earth mounds and caves in Samoa (Thomson 1927; Freeman 1943, 1944a, 1944b, 1944c), while Hiroa (1930: 321–329) incorporated some mention of field evidence and traditional sites in his monograph on Samoan material culture. These reports, together with McKern's work, would provide a starting point for further work in Samoa in the 1950s.

Andrew Thomson (1927: 121) reported that 'In Samoa we have mounds innumerable—mounds for pigeon catching, mounds for house sites, mounds for forts and, possibly, mounds for holding meetings. It is so very hard to get to the ultimate truth on the subject of the purpose of mounds, who had the right to build mounds and who had not, that I have left out a great deal of material.' Derek Freeman, at the time a New Zealand teacher in Samoa, later to become famous as an anthropologist and for his dispute with Margaret Mead, provided an authoritative account of the large earth mounds in the Vailele area (1944c), including plans, elevations and sketches, and details of the traditional history obtained by interviews in Samoan with the chiefs and orators of the district concerned.

After the Second World War, Fiji became for a time the focus of attention with fieldwork by Edward Gifford on Viti Levu for six months in 1947 (Gifford 1951). Gifford had been in Tonga as Ethnologist on the Bayard Dominick Expedition (and had collected potsherds), but had concentrated on social organisation and mythology (Gifford 1923, 1924, 1929). In contrast, his work in Fiji, supported by the Viking Fund and carried out during a sabbatical year from the University of California, was strictly archaeological.

Gifford thought that excavations in tropical Polynesia revealed traces of only earlier phases of the cultures known in the early historic period. He went to Fiji in the hope of finding 'a succession of cultures' and perhaps also 'traces of early Polynesians, if [emphasis added] they had come via Fiji' (1951: 189). At this time, Hiroa's views about the Micronesian route were still prevalent. Gifford was also attracted by the fact that pottery was still being made in Fiji. He wrongly assumed that he might find an early horizon without pottery, reflecting the presence of Polynesians. Like McKern, Gifford thought that Polynesians on the whole did not make pottery and that the pottery he and McKern had found in Tonga was Fiji-inspired. He therefore expected that ancestral Polynesian deposits would be aceramic. This view, still widely held in the mid-twentieth century, would soon be turned upside down by the possibility that Lapita pottery was made and used by people ancestral to Polynesians, some of whom had colonised Fiji and Tonga. Pottery, not the absence of pottery, might be the new clue to Polynesian ancestors.

Despite his experiences in Tonga, Gifford does not appear to have been at all interested in monuments or fortifications. His focus was on pottery; he considered that the chief characteristic of Fijian archaeology was 'Pottery, above all else' (1951: 189). He visited and surface collected 39 sites and selected 2 for excavation: Navatu (Site 17) and Vunda (Vuda) (Site 26). These were both deep sites and Gifford chose them for excavation at least partly because they were thought to be the ancestral sites of specific tribes, occupied continuously until their abandonment in modern times. Moreover, Vunda was reputed to be the first settlement site on Viti Levu (1951: 190).

Gifford recorded two sites at Sigatoka (Sites 20 and 21). A Dr Lindsay Verrier subsequently collected sherds with Lapita decoration and others with mat and leaf decoration from one or both of these sites. Gifford commented on these sherds as different (1951: 232) and noted a possible connection with McKern's material, but suggested that the Tongan sherds were late introductions from Fiji. It was not until his subsequent field work in New Caledonia in 1952, and the excavation of Site 13 there, that Gifford came to appreciate the significance of the Sigatoka sherds (Gifford and Shutler 1956: 75, 94). Green and Palmer (1961) subsequently clarified that the source of these Fijian sherds was almost certainly Gifford's Site 20, later to be known as VL16/1.

Gifford's technique of excavation by arbitrary spits, common in North America at that time, led him into the problem that would bedevil later workers, particularly in Tonga—unrecognised disturbance in these deep deposits in long inhabited places. He was unable to establish the sequence of cultures he hoped for from the material he excavated and it would fall to later workers to establish and refine a Fijian sequence. Green (1963) and Shaw (1967) were able to undertake this work, because Gifford's collections were well curated and well documented.

Gifford, like McKern, believed in detailed publication. Unlike McKern, who seems to have failed to notice that his kitchen middens contained anything worthy of study other than pottery, Gifford arranged for and published faunal identifications (by presence/absence or weight according to site and spit) and promoted the first monograph in Pacific archaeozoology (Fowler 1955). He also instigated petrographic study of potsherds, identification of adze materials, and pedological examination of soil samples. After his full report on Fiji had been published, Gifford obtained the first radiocarbon dates for the Fiji/Western Polynesia area (Gifford 1952, 1955). Later workers have found Gifford's material hard to use, as Green (1963) freely admitted. Even so, we should recognise Gifford's commitment to faunal and petrographic analysis which, for its time, was a first for the Pacific.

Gifford was somewhat of a polymath, despite his lack of formal education (he never completed his high school education), having worked as a conchologist and as an ornithologist before settling in to a wide-ranging career in archaeology and ethnology (Shutler 1960). He brought a range of skills and interests to his archaeological work.
GOLSON IN TONGA AND SAMOA

Attention now switched back to Tonga and Samoa. From August to October 1957, Jack Golson carried out a reconnaissance in both groups, accompanied in Samoa by Wal Ambrose, under the auspices of the Tri-Institutional Pacific Program (TRIPP). This program, which was not only archaeological, ran during the 1950s and into the early 1960s with funding from the Carnegie Institution in the United States. The three institutions were Yale University, University of Hawai‘i, and Bishop Museum, reflecting the on-going relationship between Bishop Museum and Yale.

Harvard anthropologist Douglas Oliver visited Auckland University in 1955 and met Golson, who had joined the staff of the young Anthropology Department there in 1954. Oliver was interested in Golson’s New Zealand work and it appears that he recommended him to the Board of TRIPP (of which he was a member). Golson was invited to undertake fieldwork funded by TRIPP in Samoa and Tonga (Golson pers. comm. 2007). It should be noted also that it was Oliver who encouraged the young Roger Green to work in the Pacific and arranged for him to spend the period of his Fulbright Scholarship in 1958 in Auckland. Oliver also encouraged Green to visit Samoa on a preliminary reconnaissance in 1960, on the completion of 18 months of fieldwork in French Polynesia (Green 1969: 3, pers. comm. 2007). Thus Oliver can be seen as a significant figure in the promotion of archaeology in Western Polynesia at this period.

The Samoan section of Golson’s TRIPP report (Golson n.d.a) was eventually updated and published (Golson 1969). The Tongan section was never published, although it was summarised by Suggs (1960a: 56–60) and by Golson himself (1962: 172–176). However, the original unpublished report informed two other works that were, at the time, influential—the second of Golson’s three Macmillan Brown lectures, a prestige lecture series delivered at the University of Auckland in 1959 (Golson n.d.b), and his paper in French in *Journal de la Société des Océanistes* (Golson 1959). Copies of the Macmillan Brown lectures and of an English translation of the French paper4 circulated widely.

4 This translation was, as I recall, done by the Translation section of the New Zealand Department of Internal Affairs, at the request of Dr T. Barrow, Ethnologist, Dominion Museum, Wellington. Golson had written in English in longhand, and he and Jim Hollyman (of the French Department at Auckland University) then translated the text into French.

Figure 1. The Birks’ excavation at the Mangaia mound, Tongatapu, in 1959. The Birks excavated 58 m². The site had previously been tested by Golson in 1959 (3.9 m²) and McKern in 1921 (2.3 m²). Photograph by Lawrie Birks.
In Tonga, Golson revisited many of McKern’s sites on Tongatapu, concentrating particularly on the areas of monumental architecture at Niutoua (Heketa) and Mu’a. He excavated at six locations, recovering pottery in some quantity from a large low mound at Mu’a, and the Mangaia mound (Figure 1) on the outskirts of Nuku’alofa.

In Samoa, Golson provided a first listing of all the forms of field evidence (including the large circular raised-rim pits, now generally referred to as *umu ti*, the function of which he was unable to elicit)\(^5\) (Figure 2). He also carried out interviews to ascertain the histories of old village sites and the related population movements, forming the impression that coastal settlement may have been more or less coincident with the arrival Europeans. He commented perceptively ‘that whereas in Tonga the mound was raised and elaborated in honour of the dead, in Samoa it was pressed into the service of the living (Golson n.d.a: 15, 1969:14).

He revisited and tested Freeman’s cave sites, and excavated at three other locations, the most important of which was a mound at Vailele, from the base of which he recovered the first pottery found in Samoa and obtained the first radiocarbon dates for Western Polynesia (Golson 1969:19; Grant-Taylor and Rafter 1963).

\(^5\) I was able to clarify this in 1964 (Green 1964:39).

In the unpublished conclusion to his TRIPP report, Golson (n.d.a:25) expressed his intention of including his Western Polynesian data in a classification of Polynesian field monuments, undertaking a specific study of Samoan settlement data using early European records and published traditional evidence as well as the results of his own fieldwork, and undertaking comparative study in Fiji—certainly of pottery and preferably also of field monuments. He also wished to extend the excavations at Vailele.

In the event, none of this happened. Golson arranged for further excavation not at Vailele, but at the Mangaia mound in Nuku’alofa, under threat from the building of a new church on the site. This was carried out by Lawrence and Helen Birks in 1959 (Birks n.d.) (Figure 1 above). They returned to Tonga for further work in the vicinity of the Mangaia mound in 1960. In the 1950s, travel to and around the Polynesian homeland area was generally by sea. Both Golson and the Birks called at Fiji on their way to Tonga, visiting the museum and establishing contacts with Derrick, the curator. The Birks also visited Niue and Samoa as well as Fiji again on their way home from Tonga in 1959.

Instead of working in Fiji as he had planned, Golson followed in Gifford’s footsteps to New Caledonia, spending the southern summer of 1959–1960 excavating at the Lapita site of St Maurice (now usually known as Vatcha) on the Isle of Pines and investigating the mysterious tumuli.
in the interior of the island (Golson 1962: 168–172). The connections between all the previous far-flung discoveries of pottery with what would become known as Lapita decoration were made by Gifford and Shutler (1956: 94) after their excavations at Site 13 on the main island of New Caledonia, but in his writings from 1959 onwards, Golson did a great deal to promote the idea of what would become known as the Lapita cultural complex.

In 1961, Golson moved from Auckland to Canberra, to be replaced at Auckland by Roger Green. Although Golson himself soon became involved in New Guinea prehistory, he directed some of his PhD students towards Lapita sites: Jim Specht to Watom, the site of the first discoveries off the coast of New Britain, and Jens Poulsen to Tonga, to continue the work begun there by McKern, Golson and the Birks.

**Poulsen in Tonga**

Jens Poulsen had been a sailor in northern seas before studying archaeology to MA level in Denmark. He was attracted by the Pacific and came to Canberra as a PhD student. He was in Tonga from September 1973 to September 1974 and submitted his dissertation (Poulsen 1967) after returning to Denmark, to a university position at Aarhus. This job required him to work and teach mainly on the Danish Bronze Age, but he never lost his love of the Pacific and over a long period he reworked and revised his Tongan material (Poulsen 1972) for a final comprehensive publication (Poulsen 1987).

Poulsen's work was very much along the lines of Gifford's. His aim was to establish and date a pottery sequence for Tonga and see whether there was at any time an aceramic period. He would then be able to explore the external relationships of Tongan pottery, particularly but not only the apparent similarities already recognised with Watom, New Caledonia and Fiji. Data collected would help in reconstructing Tongan culture at different times on Tongatapu and might help in establishing the ages of fortifications and mounds (1987: 2–3).

Poulsen encountered problems similar to those experienced by Gifford and later workers in disentangling the complex stratigraphy of 'kitchen middens' and mounds, recognising intrusive pits, and selecting radiocarbon samples that actually dated what appeared to be associated pottery. His initial results suggested an unbroken sequence up to the European contact period. Poulsen was unhappy about aspects of this, but was persuaded it must be correct, partly because of the historical evidence for pottery use in Tonga. This view was presented in his dissertation (Poulsen 1967) and a subsequent paper (Poulsen 1968), and appeared to emphasise growing differences between Tonga and Samoa. However, Poulsen accepted the criticisms of Groube (1971), discussed below, and took account of them in revising his results for eventual publication.

Poulsen's research centred on his ceramic sequence, and his publications reflect this, but he also recovered far more non-ceramic artefacts than most other excavators of ceramic sites in the Polynesian Homeland area. Like Gifford, he did his best to publish faunal and environmental detail as well as his ceramic and other artefactual material. His final publication remains an important resource for later workers.

**The Pacific Science Congress in 1961 and the Polynesian Programmes of the 1960s**

The Tenth Pacific Science Congress in Honolulu saw a spirit of collaboration among archaeologists now working in the Pacific, perhaps reflecting the spirit of the First Conference back in 1920. Almost all the key players of the day were there except Golson, who had been denied entry to the United States because of his political allegiances as a student at Cambridge. A far-reaching resolution set out the aims for future archaeological work throughout the Pacific. This is quoted in full by Green (1961: 479). A standing committee consisting of Spoehr, Solheim, Emory, Yawata, Heyerdahl and Green was established to advance the proposed program. Sub-committees drew up prospectuses for desirable research projects and priorities in the areas of Micronesia, Melanesia and Polynesia, which were reviewed and amended by those present at the conference (Green 1961: 479).

Although Fiji was listed as a priority in the Melanesian prospectus (which in fact included all the main island groups except the Solomons), no suggestion for work there was put forward. In Polynesia, a need was seen to attain a balance between work in Eastern and Western Polynesia—the conference had been treated to reports of work in the Society Islands, the Marquesas, Mangareva and the Australs, as well as Hawai'i, New Zealand and Easter Island.

Green expressed interest in Western Samoa and the Bishop Museum in American Samoa, but plans for investigations elsewhere in Western Polynesia ‘were not forthcoming’ (Green 1961: 481). However, this problem was ameliorated as far as Tonga was concerned by Golson’s subsequent deployment there of Poulsen, described above.

Out of these discussions arose the Three-Year Polynesian Prehistory Program, funded by the US National Foundation (G-21572) and managed by the Bishop Museum. This enabled funds to be channelled to New Zealand-based archaeologists, who had ‘a source of trained manpower’ and ‘political and geographical associations with Pitcairn, the Chathams, the Cook Islands and Samoa’ (Green 1961: 481). Roger Duff of the Canterbury Museum undertook work in the Cook Islands, and Peter Gathercole of the University of Otago in Pitcairn. The funding for the three-year pro-

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6 A similar spirit would be apparent when the Lapita Homeland Project was discussed at the Fifteenth Pacific Science Congress in Dunedin in 1983.
gram was $77,000 (Anon. 1962). This was a large amount of money (at least to New Zealand archaeologists) at the time.

The main project in what later came to be seen as the Polynesian Homeland area was Green's program7 in what was then Western Samoa (now Samoa or Independent Samoa). However, Kenneth Emory and Yoshiko Sinoto, as managers of the over-all program, in consultation with Green, were able to provide funding for some work in Tonga and Fiji, noted below, as well as American Samoa. The main focus of their own research was, of course, the Society and later the Marquesas Islands. In mid 1965, funding ($129,200) was received from the National Science Foundation (GS/903) for a further two-year program (Anon. 1965: 262–263). Linguistics was a significant component of the new program along with more archaeology and the title was changed from Polynesian Prehistory to Polynesian Culture History. Green's archaeological program in Samoa, begun in 1963, continued until 1967.

**Samoa**

In 1961, William Kikuchi had carried out a preliminary survey in American Samoa, which provided some material for his Master's thesis (Kikuchi 1963). He returned to American Samoa as Sinoto’s field assistant in 1962 to participate in the Bishop Museum’s contribution to this part of the new Program. Sinoto and Kikuchi ‘prospected’ in American Samoa, visiting sites already located by Kikuchi, testing with a post-hole digger (13 holes), excavating approximately one metre square holes by 15 cm arbitrary levels (7 holes) and ‘test excavating’ 12 sites—9 on Tutuila (including 5 at Leone) and 3 on Ta’u. They also described petroglyphs (Kikuchi 1964), including the first examples known from Ta’u, and recorded stone tools. No pottery or fishhooks were found (Emory and Sinoto 1965: 40–49). In their unpublished report to the National Science Foundation, Emory and Sinoto (1965: 47) wrote:

What is required in American Samoa is a long-range archaeological program, especially for prospecting sites. It would be ideal to have someone living in Samoa who can investigate accidental findings of both artefacts and sites. This system has worked out well in the Society Islands.

This vision could perhaps be said to have been realised, although not in the form they expected, with the development of cultural resource management and mitigation archaeology in American Samoa in recent decades.

After this brief foray, Bishop Museum concentrated on Eastern Polynesian archaeology and left Samoa to Green. The initial aims of Green’s Western Samoa project and the revised aims as the program developed were set out in the introduction to the first volume of results (Green 1969: 5–6). In retrospect, Green’s discussion of the research program seems rather too apologetic. This was a pioneering project in largely unknown territory and there was, inevitably, a rather large serendipitous aspect. When the program was first formulated in 1962, there was nothing to go by other than the brief reports of Thomson, Freeman and Golson on Samoa, and the comparative material of McKern and Gifford.

Initial aims included excavation in mounds to develop typological and functional interpretations, accompanied by definition of portable artefacts associated with pottery and documentation of change in them; more detailed study of field monuments and intensive site surveys as a basis for settlement pattern analysis; the development of a new approach to beach middens and a focus on Samoan fishing gear. The results of this part of the program were reported in the first volume edited by Green and Davidson (1969). They included site surveys on Savai’i and at Vailele and Luatuanu’u on Upolu; excavations in mounds at Vailele (Figure 3) and a coastal midden at Lotofaga, and discussions of adzes and other stone tools. Significant data on faunal material and fishhooks were not forthcoming.

The aims for the next phase included finding and excavating an earlier pottery site (for Poulsen’s results were becoming known by now); developing a chronological sequence based on excavation in a location other than Vailele; documenting changes in settlement pattern and tracing the origin and history of fortifications; and tackling beach middens, fishhooks and mound function through excavations (again). Most of the results appeared in the second volume edited by Green and Davidson (1974), including the Falefa Valley survey and excavations (addressing the first two aims, particularly), other site surveys, and the series of concluding papers. The settlement pattern objective had been addressed in a separate paper (Davidson 1969a), while the discovery of Lapita pottery in the lagoon at Mutifanua, which took place six years after the conclusion of the fieldwork, addressed to some extent the need to find, if not excavate, an earlier site to match the Tongan discoveries. Little or no progress had been made with beach middens or fishhooks.

The Samoan research had consistently built on previous work, but was infused with elements of serendipity and expediency. Golson’s fieldwork was opportunistic in the sense that he was invited to undertake it; he had followed the existing trail to Vailele, where the bulldozing of a mound to reveal pottery at the right moment was serendipitous. Naturally, Green followed it up with more detailed work there. The Lotofaga site was selected for excavation for logistic reasons—there was an excellent base for me to work there—without fully considering geomorphological aspects of the site. The Falefa Valley attracted me, as it had attracted Golson, because the cattle-grazed flats offered ideal conditions for site-surveying in an area uncluttered

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7 When this work was proposed and initiated, I was student at Auckland University. The design and direction of the research were Green’s alone.
with the huge amounts of volcanic stone found further west (Figure 2 above). The discovery of pottery at Sasoa’a was serendipitous in a sense, although it resulted from a targeted excavation based on an extensive site survey.

Little progress had been made with beach middens and fishhooks—both important to Green because of their importance in Eastern Polynesia, but the prevailing Western Polynesian themes of ceramics and monumental architecture had certainly been well addressed. The settlement pattern approach espoused by Green ensured that a wide range of field evidence was fully explored, not just big mounds. It is worth noting that although the great mound of Pulemelei on Savai’i (Figure 4) was previously unknown in the archaeological literature, it was already on the tourist route in the 1950s, for Susan Bulmer (then Susan Hirsh) was taken there by the wife of a New Zealand administrator during a quick tour of Savai’i in 1957 (Bulmer pers. comm. 2006).

Fiji

Archaeological research in Fiji had resumed in the early 1960s. Bruce Palmer, a New Zealander, had been appointed Director of the Fiji Museum in 1962, and inaugurated and co-ordinated work in Fiji until his sudden death in 1974 (Frost 1979: 63–64). Palmer established a formal site recording and numbering scheme along the lines of that already running in New Zealand and initiated surveys and excavations (Palmer 1965a, 1965b). In 1964, the Bishop Museum was able to find funding for Colin Smart’s survey and test excavations on Kabara in the Lau Islands (Smart 1965).

The second stage of the Polynesian Program explicitly provided for work in Fiji, bringing it firmly into a phase of collaborative research with Western Polynesia. In 1965, Palmer set up a two-year Sigatoka Research Project (Palmer 1967a, 1968). This involved a site survey for about 40 miles of the Sigatoka River Valley, concentrating on mounds and fortifications and relocating some Naga ceremonial sites; the study of contemporary pottery-making communities (e.g., Palmer et al. 1968); and the Birks’ excavations in the Sigatoka dunes (Birks 1973) and at Yanuca Island (Hunt 1980: 20–45) (Figure 5). Here again the focus on monuments and ceramics is apparent. According to Emory (1965: 3), Les Lockerbie from the Otago Museum excavated coastal sites in Fiji at this time but if so, no results were ever published.

The Birks’ excavations at Sigatoka were the most immediately important outcome of this research. The excavation strategy adopted by the Birks and carried out over two seasons, enabled them to demonstrate the clear separation of three different pottery-bearing occupations (a very rare phenomenon anywhere in the Fiji/Western Polynesia area),

Figure 3. Kaye and Roger Green, recording the bulldozer-cut section through mound SU-va-1 at Vailele in February 1964. This was the site at which Golson found the first pottery in Samoa in 1957. Author’s photograph.
Figure 4. Pulemelei mound, Sava’i, in 1966, two years after it was studied by Scott (1969). The left of the two men is Atonio Maiava, research assistant during much of Green’s Samoan work. Photograph by Anne Leahy.

Figure 5. Excavations at the Yanuca Rock shelter near Sigatoka in September 1966. The figure at the left is probably Lawrie Birks. Photographer unknown.
and the site offered a unique opportunity to reconstruct vessel forms. Although the material was exceptionally suited to this purpose, the time and effort devoted by the Birks to this labour of love were also exceptional, as was the work of Winifred Mumford, who drew the reconstructed pots. The Sigatoka dunes have seen ongoing research and contested interpretations over a long period (Marshall et al. 2000; Burley 2003). This more recent research included the recovery of 58 often fragmentary individuals from a cemetery dating to the first half of the first millennium AD (Visser 1994a, 1994b) and the further discovery of additional burials (Marshall et al. 2000).

Other work carried out in Fiji at this time under Palmer’s direction included the excavation by Elizabeth Shaw (later Hinds) at Natunuku (Davidson et al. 1990), Palmer’s own surveys on Wakaya (Palmer 1967b) and of ring-ditch fortifications (Palmer 1969). Pottery, mounds and forts were central to these various projects. New Zealand archaeologists (in this case Shaw and Smart as well as the Birks) were involved in this work, just as Green had involved mainly New Zealand archaeologists in Samoa (Ishizuki, Scott and Terrell being the exceptions). Hirini Mead’s pioneering study of Lapita decoration (Mead et al. 1975) was based on the pottery recovered by the Birks at Sigatoka and Yanuca and by Shaw at Natunuku.

Green’s (1963) revision of Gifford’s Fijian sequence had made him aware of the need for a restudy of Gifford’s pottery. He obtained funds from a University of Auckland grant programme focused on the Western Pacific for Gifford’s material to be sent out from California to Auckland (Green pers. comm., 2007), where it was studied by Shaw (1967), who had already worked with Palmer in Fiji, observing and recording contemporary pottery manufacture.

Tonga

Emory and Sinoto extended the Program’s reach to Tonga when, after consultation with Golson, they arranged for me to spend several months in Tonga in 1964. The ostensible aim was for me to assist Poulsen if necessary, or carry out work that would complement his. It would also assist liaison between Poulsen and the archaeologists working in Samoa. By July 1964, Poulsen was nearing the end of his fieldwork, with a high trained crew, and did not need assistance. He suggested that I should investigate some burial mounds—not those of royalty or chiefs, but ordinary mounds—and this I did (Davidson 1969b) (Figure 6). Nothing was known at that time of the nature of burial mounds beyond what McKern had written and Poulsen had found at his sites of To-2 and To-4. The large number of interments and the fact that two mounds of apparently

Figure 6. Jack Golson in typical pose, taking a close look at the stratigraphy of the burial mound To-At-2 at ‘Atele, Tongatapu in 1964. Author’s photograph.
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quite different size had been used in the same way for the burials of commoners were surprising. Permission was sought and obtained from the Prime Minister, Prince Tu'ipelehake, to remove the remains to New Zealand for long term study. We were fortunate that the young Michael Pietrusewsky chose to study these remains (Pietrusewsky 1969). They have been studied and restudied since.

At the conclusion of these excavations I conducted a short but intensive site survey, focusing on mounds and fortifications, and pinpointed the need for surveys of the latter before ditches and banks in village areas completely disappeared (Davidson 1964) (Figures 7 and 8). This was followed up by Green and John Terrell, who visited Tonga shortly afterwards and mapped fortifications on Tongatapu (Green 1967a: 106).

During the second phase of the Polynesian Program in the summer of 1966–67, Les Groube went to Tonga to pursue the study of fortifications. However, as he wrote, 'I was, like all archaeologists before me,8 seduced by the rich pottery remains along the lagoons' (Groube 1971: 297). Instead, he carried out an extensive area excavation on a large, low, pottery-bearing mound (Vuki’s mound) in Ha’ateiho Village—an area previously identified as worthy of study by Golson and Poulsen. In 1968, still as part of the Polynesian Program, Groube and Con Key carried out a reconnais-sance throughout the Tongan islands as far north as Vava’u, finding sparse remains of plain pottery throughout, but only two sites with significant amounts, one in Ha’apai and one in Vava’u (Groube 1971: 293).

After his experience at Vuki’s mound, Groube understood the complex nature of Tongan pottery-bearing deposits and used this knowledge to critique Poulsen’s (1967, 1968) sequence. Arguing that the deposits at Vuki's mound were closely comparable to Poulsen's To-6, and using radiocar-bon dates from his own site, he showed that the Tongan pottery sequence could be entirely compressed into the pre-Christian era. He thus sorted out one of the main points of difference between the Tongan and Samoan data as then known. His revision was elaborated on by Green (1972). However, Groube was writing before the discovery of the Mulifanua site in Samoa. He thought that Tonga had been occupied for centuries before the settlement of Samoa and ended his long and complex paper with the conclusions that:

The Polynesians became Polynesians sometime near the middle of the first millennium B.C., after 600 years of isolation in the remote archipelago of Tonga. The Polynesians, therefore, did not strictly come from anywhere: they became Polynesians and the location of their becoming was Tonga. (Groube 1971: 313)

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8 I was immune to this seduction. But as Helen Birks once said ‘Janet, you don’t know much about pottery, do you?’

Figure 7. Part of the ditch of the fortification of Kolote’ekiu, Tongatapu, in 1964. Kolote’ekiu had a double ditch, parts of which were almost completely filled in at the time. This can be compared with Figure 8. Author’s photograph.
The becoming of Polynesians had already been proposed by both Emory and Green, as noted above. Groube’s spin on the idea was that it took place in Tonga. The Mulifanua discovery challenged that view, but there are still some who would like to agree with the essence of Groube’s conclusion, even while changing the chronology. Unfortunately, Groube’s meticulous excavation of disturbances and three-dimensional recording of individual potsherds was not matched by a detailed publication of his results. Whereas Poulsen’s data are fully available, Groube’s are not, and his reconstruction of a huge whole pot remains a fading memory for those who were around at the time.

Groube’s research in Tonga brought to an end the fieldwork carried out in the Fiji/Western Polynesia area under the auspices of the two Polynesian Programs. Between 1963 and 1968 an enormous amount of work was carried out. Much of it was under the auspices of that program, almost all of it was part of a series of collaborative ventures in Pacific anthropology. Much of it (Green’s Samoan program, the Birks’ Sigatoka excavation, Poulsen’s work) would be published in detail, living up to McKern’s belief, cited above, that ‘… conclusions, even general remarks, are devoid of meaning when separated from the detail of listed phenomena.’

REVIEWING THE EVIDENCE

Just as the 10th Pacific Science Congress had provided an opportunity for reports on a range of work in Eastern Polynesia, there was now scope for reviews of Western Polynesian, Fijian and Lapita archaeology. The 11th Pacific Science Congress in Tokyo in 1966 was well attended by Pacific archaeologists and papers were presented on work carried out according to the recommendations of the previous conference. In the Fiji/Western Polynesia area, this included the Sigatoka Archaeological Program (Palmer 1968, still in the category of Melanesian archaeology), Tongan excavations (Poulsen 1968), Samoan fortifications and monumental architecture (Scott 1968) and West Polynesian prehistory (Green 1968). Although most of these contributions were primarily data papers, Green proposed a conceptual framework for the region extending from New Caledonia to East Polynesia. His review of the immediate origins of the Polynesians appeared in Emory’s festschrift the previous year (Green 1967b).

The Wenner-Gren sponsored symposium on Oceanic Culture History, organised by the Bishop Museum and held in Sigatoka in 1969, ranged even more widely but included papers on Settlement Patterns (Green 1970b, reviewing mainly evidence from Western Polynesia and the outliers),
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Figure 9. Pacific scholars at the 11th Pacific Science Congress in Tokyo took time out to visit the excavation of a Jomon site near Tokyo. From left to right facing the camera: Marion Kelly, Yosi Sinoto, Roger Green, ?, Kenneth Emory, Doug Yen. Photographer unknown.

shell artefacts (Poulsen, taking as a starting point his Tongan finds), Lapita (Golson 1971) and modern Fijian pottery (Palmer 1971). A field trip in the Sigatoka area included a pottery-making demonstration (Figure 10).

For me, an abiding memory of that conference was Bruce Biggs’ introduction to his paper:

The main purpose of the following discussion is to examine some of the implications of accepting that related languages can be sub-grouped according to a family-tree model. A secondary aim is to draw attention to dangers of the kind of eclecticism which reaches unwarranted conclusions in one field by invalid use of data from another. I refer specifically to the application of linguistic data to problems of prehistoric movements of people in Polynesia. (Biggs 1972: 143)

Biggs went on to temper these remarks. He referred to comments made by Alexander Spoehr three years earlier at the Science Congress in Tokyo (Spoehr 1968: 174) and added:

We are not being told by him simply to stick to our respective lasts. If we did it might turn out that the total problem of what happened in Oceanic prehistory might not be tackled at all. Synthesis is surely desirable and essential. We are being told, however, that if we want to use the other fellow’s last we had better know exactly what it is good for. (Biggs 1972: 143)

I have always remembered these comments, as I have watched the interplay of linguistics and archaeology in the study of the Polynesian Homeland, sometimes with amusement but sometimes with dismay.

FROM SIGATOKA TO THE JENNINGS VOLUME

After the conclusion of the Polynesian Prehistory and Culture History Programs, research into the archaeology of the Polynesian Homeland area became more individual and fragmented. New players entered the area and older players moved on (to Denmark, to the South-east Solomons, to England, or back to New Zealand); new research interests arose, particularly those of ecology and ethno-archaeology, although the old themes of ceramics and monuments continued to play a central role.

In Western Samoa, Jesse Jennings (based at the University of Utah) directed a program of field research in 1974 (Jennings et al. 1976), 1976 and 1977 (Jennings and Holmer 1982). Jennings was already a senior and highly respected figure in North American archaeology when he and Green were both on leave in Honolulu in 1965. Jennings
Janet Davidson was looking for a Pacific project and decided to build on Green's Samoan work.

Jennings' program involved intensive mapping and test excavations in the Mt Olo tract, adjacent to my Mulifanua survey of 1966, and the location and investigation of ceramic sites in Western Upolu and Manono. Jennings hoped to locate new 'Lapitan' sites, but although four ceramic sites were found, none contained decorated pottery. The fieldwork was reported in detail in the two monographs already cited, and the interpretation of settlement pattern data was taken further by Jennings et al. (1982). The ceramic studies essentially confirmed the nature of Samoan pottery as established by Green, but the excavations, particularly at Jane's camp, Potusa and Falemoa, produced more dietary evidence and shell artefacts (even a few fishhooks) than had been found during Green's program.

During this period, American Samoa remained neglected, apart from a pioneering National Park survey (Ladd 1970) and the doctoral research of Janet Frost (1978). Frost had been an undergraduate student of Jennings, but undertook her PhD at Oregon. She found no pottery on Tutuila and pointed to this lack and a greater quantity of stone tool material in 'early' sites as a difference between the western and eastern groups, suggesting that in the early years, American Samoa was utilised mainly for its stone resources, an interesting suggestion that has apparently not been further developed. She also pointed to the lack of very large mounds in American Samoa as a possible indication of social differences in later times.

In Tonga, interest shifted for a time to the northern parts of the group. Adrienne Kaeppler (1973) had found pottery in Ha'apai in 1967. I carried out a brief survey in Vava'u as part of the New Zealand Government's interdisciplinary expedition in celebration of the bicentenary of James Cook's first visit to New Zealand (Davidson 1971) (Figures 11 and 12). In 1970–1971 Garth Rogers, a PhD student in social anthropology at Auckland University, carried out a field survey on Niuatoputapu, finding pottery, including dentate stamped sherds, in several locations (Rogers 1974). This work was followed up in much greater detail in 1976 by Pat Kirch on a Bishop Museum expedition; the results were eventually published in full (Kirch 1988). Kirch (1980) also visited Vava'u on this trip and Tom Dye, who was his assistant, visited Niuafo'ou. Dye later carried out PhD research in Ha'apai (Dye 1987). Kirch and Dye included ethno-archaeological study in their work on Niuatoputapu (Kirch and Dye 1979). Thus archaeological understanding of the entire Tongan archipelago was expanded, although the impression remained that Tongatapu was archaeologically the richest area, as McKern, on less evidence, had asserted.
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Figure 11. The very large earth mound, known as Sia Longo, near the northern coastline of the main island of Vava’u in September 1969. One of the two access ramps faces directly across the island to the peak of Talau near Neiafu. Author’s photograph.

Figure 12. Tu’ifua ’Utoikamanu and my field assistants Teaupa Pohiva and Alisi Mafi listen to Lima, a matapule of Pangai in Vava’u in September 1969, during the recording of the partially cut beach rock slabs. Author’s photograph.
Research in Fiji was sporadic, but largely followed the directions established by Palmer. Everett Frost, also a former student of Jennings now at Oregon, studied hill forts on Taveuni for his PhD (Frost 1974); the Frosts were in Fiji in 1969 and attended the Sigatoka Conference. They later worked on Lauca (Frost and Frost 1979). Long time resident Aubrey Parke reported on ceremonial sites on Vanua Levu (Parke 1971, 1972). Parry (1977) began his series of studies of ring ditch fortifications along riverine drainage systems.

Simon Best's PhD research on Lakeba in the Lau Group (Best 1984) could be described as good research that started opportunistically. It arose out of a program on the Culture History of the Lau Islands, initiated by John Young of the University of Adelaide in 1974. Young decided he needed some archaeology, sought advice from Green, and initially engaged Garth Rogers and Mike Rowland to record archaeological sites and traditional histories in northern Lau. In 1975–76, Best worked with Rogers on Lakeba (Best 1977). However, the foundation for Best's subsequent work was laid by Green, who visited Lakeba, obtained the necessary permissions from Ratu Sir Kamisese Mara, and also raised the funds for further work (Best 1984: iv; Green pers. comm. 2007).

**Rotuma and the Rest of Western Polynesia**

Rotuma and the smaller islands of Western Polynesian were largely invisible archaeologically until the 1970s, or in some cases the 1980s. Although Niue, Tuvalu and Tokelau are generally included in Western Polynesia and are therefore considered here, the question of whether any of them were part of the Polynesian Homeland (as it was discussed at Tutuila in 2006) is still up for debate.

Archaeological research in Wallis (‘Uvea) and Futuna began with Kirch's ethno-archaeological investigations in 1974 (Kirch 1975, 1976, 1978, 1981). Kirch's ecological and ethno-archaeological focuses here and in Niutatoputapu heralded a new direction in the archaeology of the region, albeit one that has not been widely followed. Kirch's proposed return to the territory was blocked when it was closed to non-French researchers (Kirch 1988: viii). Research there was taken up by Daniel Frimigacci and other French researchers from the 1980s onwards. Ethnoarchaeology remained a strong theme (e.g., Frimigacci 1990).

Aubrey Parke, an administrator in Fiji, made surface collections and carried out limited test excavations on Rotuma during a four month period in 1964 (Palmer 1965a), but the results were not published. Rotuma was otherwise untouched by archaeologists until 1981, when Dick Shutler and Jamie Evrard went there in search of evidence of initial settlement (Shutler and Evrard 1991). In this they were unsuccessful, but they obtained a radiocarbon date of about 1000 BP and attempted to correlate this with oral traditions of Tongan arrival. The Birks on their way home from Tonga in 1959 stopped at Niue for one day, visited a couple of mounds and collected a charcoal sample from one that had been largely destroyed (Birks n.d.). This was subsequently dated (Birks and Birks 1974). No further archaeological work took place on Niue until Michael Trotter’s survey in 1974–75 (Trotter 1979). Trotter recorded 100 sites, including mounds, platforms and enclosures, middens and caves, many of which had been used for burial. Influenced by linguistic data and the apparent absence of pottery on Niue, and discounting the date previously published by the Birks, Trotter suggested settlement from Tonga about 1500 years ago. Research on Niue resumed only in the 1990s (Walter and Anderson 1995).

Best’s pioneering survey and excavations on the three Tokelau atolls of Nukunono, Fakaofo and Atafu took place in 1986 (Best n.d.). Although Sinoto prospected briefly in Tuvalu at one stage, no excavations were undertaken there until the 1980s (Kirch 2000: 179; Takayama and Saito 1987).

**The Jennings Volume**

*The Prehistory of Polynesia* (Jennings 1979), placed island-group by island-group reviews of Polynesian archaeology in the broader Oceanic context, considering language, physical anthropology, subsistence and ecology, settlement patterns and voyaging. By this time, Lapita research had moved on, with new work in New Caledonia, Vanuatu, and the Santa Cruz group as well as that already mentioned from Tonga and Fiji. Green (1979) was able to review evidence and interpretations over a wide area under a number of headings. Papers by Frost (1979) and myself (Davidson 1979) considered the evidence from Fiji and Tonga/Samoa. The smaller islands of the Polynesian Homeland area did not register, apart from Kirch’s pioneering work in Wallis and Futuna (Kirch 1979; Bellwood 1979).

Frost’s review of the Fijian evidence concentrated on ceramics, fortifications, and ceremonial sites, but his concluding discussion focused on the classification of Fiji as either Melanesian or Polynesian and the linguistic, physical and archaeological evidence bearing on this issue. Frost concluded that

…the physical, linguistic and cultural base to Fijian culture was one shared with ancestral Polynesians and different from that of Melanesians. While there is clear evidence of ceramic intrusion from Melanesia, of sociocultural diffusion of the sort noted by Hocart, and of Melanesian gene flow as pointed out by Howells and others, these apparently did not overwhelm the Polynesian vector of Fijian culture (1979:79–80).

My paper on Tonga and Samoa reviewed the evidence broadly under three chronological headings—The Early
Period, the Dark Ages (a term I borrowed from Poulsen) and the Recent Period. I argued that although the picture that had emerged in the previous 20 years was very different from what was imagined before, only the bare outlines were known and many changes could be expected to emerge from future research. Although by 2000 years ago the foundations of the later settlement pattern and economy had been laid in Samoa, at least, continuity with later periods was assumed, simply because there was no evidence for intrusion. Poulsen and my use of the term Dark Ages was not intended to imply cultural retrogression, merely a lack of clear evidence compared with what was available for earlier and later times. I also argued that there was still a real gap between the earliest evidence from Eastern Polynesia and that from Western Polynesia and that ‘Dendrogram models of linguistic relationships, faith in east-to-west migrations, and a handful of artefacts rather than firm archaeological evidence cement the relationship between East and West Polynesia in the first millennium AD.’ I even went so far as to suggest that on existing archaeological evidence at the time, Hawai’i could have been settled directly from West Polynesia (Davidson 1979:107).

Discussion

A feature of Polynesian archaeology in the early years was the collaborative approach to working in a largely unknown field. Pacific Science Congresses gave rise to research plans and the Bishop Museum, a key player from 1920 to 1969, was able to raise resources to carry them out. Although the strategies were not sophisticated (‘go there and find something’) a lot of valuable information was produced, and there was a strong collaborative feeling amongst the people involved, particularly during the Polynesian Prehistory and Culture History Programs. The work in the 1960s drew Fiji, Samoa, and Tonga (previously in the separate categories of Polynesia and Melanesia) together, while the growing investigation of Lapita sites throughout the Western Pacific, which has not been discussed here in any detail, provided a new dimension to thinking about Pacific prehistory and Polynesian origins.

Discoveries in the early decades were sometimes the result of intelligent strategies and sometimes purely serendipitous. Later researchers have tended to go back to known areas and sites found by previous workers, but there is always scope for a new look at landscapes to find new sites to answer new questions. Some further discoveries will also be serendipitous; large scale monitoring of infra-structure trenches in American Samoa has shown how beneficial this can be. Some of the problems encountered in the early years, particularly in dating the cessation of pottery use, still provide object lessons for current workers. The value of undisturbed ceramic deposits clearly sealed by mound fills or, better still, natural deposits, cannot be overemphasised. Also important are discrete, well dated occupation layers with significant amounts of artefactual and faunal material but no potsherds.

Some of the themes discussed in Tutuila in 2006 had already been prominent in the 1960s or earlier. Others were not thought of at the time. First settlement, of course, is always an issue. The primacy of settlement in Tongatapu within the Tongan group has generally been accepted by archaeologists working in Tonga, but the date of first settlement of Samoa remains almost as wide open now as it did in the 1960s.9

As I have shown, ceramics have been important throughout the period under review. In the 1950s and 1960s, it was hoped to use other material culture as well in developing sequences and studying regional variability (e.g., Green 1968, 1974). But the poor recovery of non-ceramic material (especially fishhooks) and the shift in interest in adzes from typology to manufacturing techniques and sourcing have conspired to reduce the role of material culture studies, other than ongoing pottery analyses. Moreover, full publication of well illustrated excavation reports is necessary for material culture studies to flourish. This applies equally to the consideration of similarity and difference in ceramics.

The importance of physical anthropological studies cannot be overemphasised, but the samples are still mainly limited to one large group of Tongans who lived in the last millennium, the group from Sigatoka dating to the first half of the previous millennium, and some single individuals from various contexts. There is so much more that could be learned about the health and diet of the people and about their genetic relationships.

The disjunction between the early archaeological remains in Eastern Polynesia and what has been found in the west is still striking. This is a problem that must ultimately be solved by archaeology—by good material from well dated sites on both sides of the line. It cannot be solved by linguistics and comparative ethnology. Despite the optimism expressed by speakers at Tutuila, the Dark Ages remain relatively unexplored, and far more archaeological work is needed to throw light on this period.

Although McKern expressed an opinion about the connection between monumental architecture and social organisation in Tonga, questions about the rise of traditional chiefdoms were not much in evidence during the period under review. Similarly, although every archaeologist who has ever been into the bush in Samoa has heard about the Tongan invasions, this appeared to many of us to fall into

9 One may still wonder why Tonga was called Tonga when, if Tonga was settled first, Samoa ought to be known as Tokelau. Horation Hale, philologist and ethnologist on the US Exploring Expedition, tackled the question of Tonga back in 1846 (quoted by Howard 1967:50–51). Hale thought that a distinction between Viti and Tonga originated in Fiji as an east/west distinction and was carried to Tonga by the Tonga people when the Viti group expelled them from Fiji.
McKern’s ‘fanciful’ group of traditions. From McKern onwards, archaeologists have used oral traditions where they could, and done so carefully. But there are pitfalls. In 1964, Samoans were consulting Krämer (1902, but in a mimeographed English translation available in the Nelson Public Library in Apia) in preparation for cases in the Lands and Titles court. In 1969 and 1977, Kirch (1980) and I, both with knowledgeable informants, were given differing accounts of burial structures in Vava’u. As time goes on, the collection of primary material will become more difficult.

Inter-island contacts and influences have always been a topic of discussion. Temper analysis and stone sourcing started with Gifford and are still flourishing. The work of Bill Dickinson over so many years, starting in Fiji and Samoa in the 1960s (e.g., Dickinson 1969, 1971), deserves acknowledgement here. But it has always been difficult to move from the archaeological data to a broader interpretation of contact versus isolation, or an understanding of the social reality behind a few archaeological examples of stone or pottery transported over long distances (Davidson 1977, 1978).

If understanding the nature and extent of inter-island contact on the basis of archaeological evidence is difficult, a topic such as the rise of the Tongan maritime chieftainship appears to me to fall largely outside the realm of archaeological investigation. The appearance of burial vaults of Tongan style in ‘Uvea, for instance, certainly seems to reflect Tongan influence (Sand 1993). But what of the mounds inferred to be residences? Large residential mounds are generally thought to be more typical of Samoa, although much more work is required to clarify the function of mounds. Archaeologists need to distinguish between the identification of Tongan influence and the further step of interpreting this as evidence of a Tongan maritime chieftainship.

Monumental architecture featured in much of the pioneering archaeological work and much was learned. It is good to see new techniques being applied to the problem of studying really large mounds. But I feel there is also a need for new reviews of monumental architecture across the entire Fiji/Western Polynesian area, drawing on the large amounts of data collected both during and after the period under review. And monuments, of course, must be seen as part of their wider archaeological and landscape context—as part of a settlement pattern.

‘Historical archaeology’ as such was of no interest during the pioneering period when, in this area as well as elsewhere in the Pacific, the focus was largely on ‘unspoiled’ indigenous cultures. However, historical sources were used in attempts to reconstruct settlement pattern changes (Davidson 1969a) and to develop estimates of population size (Green 1973). Whether archaeology can help to answer the questions raised on this theme at Tutuila remains to be seen.

Last but not least are issues of human subsistence and interaction with the environment. Although the recommendation of the first Pan-Pacific Scientific Congress in 1920 specifically mentioned horticultural sites and fish ponds as worthy of investigation—the latter particularly so—the contribution to these topics during the pioneering period was not great, and the area remains neglected. Only in Kirch’s work in ‘Uvea and Futuna was serious attention given to horticultural sites. All the detailed excavation reports from Gifford onwards went through the motions of faunal analysis, but mostly without enthusiasm. Again, Kirch’s work on Niuaotoputapu is an exception. Part of the faunal problem has been the lack of specialist identification (apart from Fowler 1955). The recent publication of some of David Steadman’s work on birds (Steadman 2006) may help to raise the profile of this neglected area.

CONCLUSION

Pioneering archaeological research in the area that is currently talked of as the Polynesian Homeland took place in a changing intellectual framework. Throughout the first half of the twentieth century it was considered that the Polynesians, as a distinct racial group, with distinct language, culture and traditions, entered the Pacific and then the geographical triangle of Polynesia from somewhere else—usually Asia. A Polynesian homeland in this sense might be better expressed by the term External Homeland. By the 1960s, a new sense had arisen—that of an Internal Homeland within the Polynesian triangle, where at least some of the typically Polynesian characteristics first made their appearance. But heading away from the Internal Homeland was the Lapita trail, leading to another kind of external homeland, the Lapita Homeland. In recent years, genetic studies have once again pointed to a still more remote external homeland, perhaps the Ultimate Homeland (short of Africa): an Austronesian Homeland, not merely of Polynesians but of all Austronesians.

These various kinds of homelands would not be a problem for Polynesians such as Maori, who have long spoken of a series of increasingly remote Hawaiki, or ancestral homelands (and for whom the most important homeland is one not yet mentioned—an Immediate or Eastern Polynesian Homeland). But archaeologists need to be very careful in defining exactly what kind of homeland they are talking about. Physical type, language, and cultural characteristics are not necessarily inseparable. The cases for a physical, linguistic and cultural bottle neck, through which the Lapita trail must pass before Polynesian-ness can be fully manifested, and for another similar bottle neck to Eastern Polynesia, need careful examining.

Although the obsession with Polynesian origins from the Bayard Dominick Expedition onwards provided the stimulus for much of the archaeological research, pioneering archaeologists in the Fiji/Western Polynesian area generally did what archaeologists do well—defining the range of field evidence in each island group and endeavouring
to identify settlement patterns; excavating in selected sites to obtain evidence about site function, diet, and material culture; establishing chronologies; and exploring regional variations. This, after all, was core business. Their efforts, often published in detail, laid a firm foundation for subsequent research.

It is important that future work does not lose sight of the need for well published basic data, and that projects concerned with homelands or, indeed, with later developments in homeland areas are framed with a clear understanding of what archaeology can and cannot do. Biological anthropologists, working with archaeologists, should be able to make huge progress in understanding the appearance of a Polynesian physical type. Archaeologists themselves have much still to do in documenting variation and change in material culture, monumental architecture, subsistence economy, and the interactions of people with their environment in the area of Fiji/Western Polynesia, before a satisfactory understanding of the past of an Internal Homeland is achieved.

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As noted above, McKern and subsequent researchers received strong support from the leaders of the Polynesian island groups in which they worked. As a young unmarried woman at the time, I owe a great deal to the many Samoans and Tongans who gave me hospitality, friendship and help with many aspects of my work. I am particularly grateful to Muta'aga Enosa, wife of the LMS pastor in Lotofaga Village, who looked after me so well in 1964 and again in 1966, and gave me a splendid introduction to the fa'asamoa. Fa'fetai tele lava.

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NATURAL AND CULTURAL DEPOSITS IN TATUBA CAVE, FJI ISLANDS: 1972 AND 2002 INVESTIGATIONS

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ABSTRACT

Tatuba Cave, located in the province of Navosa on Viti Levu Island, played a critical role in the Little War of Fiji, ca. 1875. It has also been the subject of two archaeological investigations, which sought to explore both the historic and prehistoric deposits within the cave. Previously unpublished summaries of excavations performed by Fiji Museum staff in 1972 are presented here, along with the results of more recent investigations by the author in 2002. These two investigations indicate that the cave was utilized for shelter as early as 2000 years ago, and sustained more permanent habitation ca. AD 1000. Geoarchaeological analyses aid in understanding the depositional history of the cave, which has deep deposits of guano and a number of intrusive burial features. Analyses of artifacts and ceramic vessels from Tatuba Cave indicate interaction with distant coastal populations, and trace the development of regional vessel styles.

INTRODUCTION

Limestone caves are known throughout the world as repositories of human history. This is also the case for tropical islands in the Indo-Pacific, as has been demonstrated in the investigation of Niah Cave in Borneo (Hunt and Rushworth 2005), Lene Hara Cave in East Timor (O’Connor et al. 2002), and elsewhere. Caves in the Fiji Islands have also provided a wealth of information pertaining to extinct fauna (Worthy 2001, 2004), and late Holocene occupations by humans (Anderson et al. 2000; Cochrane 2002). Tatuba Cave, which was investigated in 1972 by staff of the Fiji Museum (Palmer et al. 1973) and by the author in 2002 (Field 2003a, 2003b, 2004) is a large limestone solution cave located in the Sigatoka Valley, on the island of Viti Levu. Archaeologically, it is known mostly via rumor and brief citation by Parry (1987: 31) as a site of early occupation in the interior of Fiji. This paper summarizes the earliest archaeological research in the cave, which was described in an unpublished manuscript written by Palmer, Clunie and Moce (1973). This is followed by a description of the most recent examination of the cultural deposits in the cave by the author. This summary includes the results of geoarchaeological analyses, which reveal a complex depositional history for the cave, including natural erosion, diagenesis, and dramatic redeposition of deposits due to the excavation of post-holes, fire hearths, and human burials. The impact of these processes and events on the chronology of material culture from the cave is also examined.

HISTORICAL RECOLLECTIONS OF TATUBA CAVE AND RECENT GEOLOGICAL INVESTIGATIONS

Tatuba Cave is well known within Fijian oral histories and recollections. The yavusa Namataku (a patrilineal descent group) currently own the cave and the lands surrounding it, and their oral histories suggest that the site had long served as a fortified outpost in the interior (Figure 1). Mountain tribes from as far away as the Wainimala basin (approximately 50 km to the east) are reputed to have sought control of the site. The Namataku themselves were newcomers to the area, having left the Nadi region and won control over the cave sometime in the 18th century (Palmer et al. 1973). Continued connection with their Nadi relatives allowed for the influx of European muskets into the region in the 1820s, with Tatuba Cave serving as a distribution point. With firearms the Namataku expanded their domination of the Navosa region, and initiated raids against the Navatusila and Naqwâqwâ tribes in the upper reaches of the Sigatoka River.

The Nadi connection also brought the influence of missionaries into the area, and by the 1870s the Namataku had converted to Christianity and were supportive of the fledgling colonial government seated in eastern Fiji, and headed by the newly appointed governor A.C.H. Gordon. This allegiance, as well as their history of domination in the region, encouraged retributive attacks upon Tatuba Cave and the Namataku people at the start of the 1876 rebellion (i.e., ‘The Little War’, in which western highland tribes defied the new colonial administration) (Gordon 1879). According to Gordon’s notes from the military camen.
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paign and the oral histories from the Namataku, Tatuba Cave was attacked and besieged in April of 1876. The village surrounding the cave mouth was burned and the inhabitants defended themselves from within the fortified front and rear entrances of the cave. However, the siege did not last long, as government troops from Nasaucoke arrived the following day and routed the rebels (Clunie 1977: Plate 8; Palmer et al. 1973).

As part of new government policy following the Little War, the Namataku abandoned the cave after the battle and resettled nearby. A year later, Australian adventurer John Boyd explored the cave, and described the entrance as being ‘dry and spacious, the mouth defended by two strong walls overlapping each [other] and with loopholes for musketry’ (Boyd 1877, in Clunie 1986: 31). For the following century the cave lay relatively undisturbed. In the mid 1960s and early 1970s researchers from the Fiji Museum initiated the Sigatoka Valley Research project, which sought to investigate the archaeological remains of Fiji. The work of Bruce Palmer, Fergus Clunie, and Kolinio Moce resulted in detailed surveys of fortifications in the Sigatoka Valley that included Tatuba Cave (Palmer 1966, 1967, 1968), and two excavations within the cave in 1972 (Palmer et al. 1973). The team also collected a number of oral histories for the region, documented highland pottery production (Palmer and Shaw 1968), and made a record of previously unrecorded naga ceremonial sites (Palmer 1971).

Explorations within and around the cave have documented a complex geological and archaeological feature. The cave system occurs within a substantial limestone outcrop that flanks the northeast side of the Sigatoka River, and is backed by the steep slopes of Talenalawe peak. Formed by the percolation of water through the limestone, the cave passages run roughly northeast-southwest, and has two main entrances that overlook the river. The higher entrance was barricaded with a stone wall at some time in prehistory, and its interior is relatively dry. This is the more ancient entrance, and its floor is covered with thick deposits of guano. Nesting and roosting in the cave by the insectivorous white-rumped swiftlet (Collocalia spodiopygia) and the sheath tailed bat (Emballanura semicaudata) over the ages has produced a flat floor within the cave that extends back as far as the light reaches (Figure 2).
lower wet entrance is the active drainage for the cave, and it lacks significant guano deposits. Its limestone floor contains an obvious and deep gutter, which has been carved by the steady flow of water along its surface. The morphology of dry and wet passages at Tatuba Cave, as well as the 'keyhole' shape to the cave passages, indicates recent uplift in the region (Nunn 1998:126). Surveys of the cave by biologists (Watling and Pernetta 1977) and speleologists (Gilbert 1984) indicate that several passages and chambers extend for approximately 420 m through the limestone, exiting to the northeast within a collapsed sinkhole on the ridgeline above the cave.

THE 1972 EXCAVATIONS

Palmer et al’s research (Palmer et al. 1973) documented a rich archaeological record for the Tatuba Cave locale. The site is surrounded by a network of stone walls, and is covered with 38 habitation mounds (yavu) of various sizes and shapes. These features were mapped by Palmer et al. in 1972, and re-mapped by the author in 2002. Central to Palmer et al’s research were the excavations within the mouth of the largest entrance to the cave. They placed a single 2 x 2 meter unit (AC1–2) approximately 2 meters east of the large stone wall that blocks the main entrance to the cave. Two additional units were extended to the immediate north and south of AC1–2, the adjoining walls maintained by 20 cm baulks. A fourth unit, Location B, was a 2 x 2 meter unit located approximately 14 m inside the cave passage, and alongside a scattered hearth feature (Figure 3). The excavation methods employed by Palmer et al. were focused on identifying cultural deposits, in particular occupational surfaces. Although they did not employ standard soil science descriptions (e.g., color, texture, inclusions), they did produce a series of plan diagrams that indicate the horizontal extent of different deposits at 10 cm intervals, and also the horizontal locations of some artifacts. They did not use sieving screens; artifacts were hand collected and sorted into bags based on their provenience within different spits or layers. However, these layers are not well defined, and without precise vertical and horizontal documentation (stratigraphic profiles were either not produced or have subsequently been lost), it is difficult to assess the depositional context of the layers.

Figure 3. Location of excavation units from 1972 (units ACc1–2, AC1–2, CD1–2, and Location B) and 2002 (TU 1).
Despite these problems, Palmer et al.’s excavations produced a rich collection of artifacts, and documented a series of occupation deposits and burials extending to a depth of 70 cmbs. In the AC1–2 units (including units ACc1–2, and CD1–2), Palmer et al. describe the upper levels (0–10 cm) of the cave fill as reddish-brown in color, with heavy charcoal flecking. Artifact density was high, consisting of ceramic fragments (plain, and decorated with tool impressing, crossed paddle impressing, incising, and appliqué), faunal remains, riparian clam and snail shells, wood fragments, European glass fragments, European beads, shell bracelets, pearl shell fragments (Pinctada margaritifera), pig tusk ornaments, adze fragments, and nutshells (Aleurites moluccana) that were probably used for candles. Several hearth features were encountered in each unit, and riparian clam shells (Batissa violacea) that were consumed as a food item were present in some of them. Post-hole stains were also noted in a number of locations. Between 10 and 20 cmbs, Palmer et al. encountered patches of eroded limestone within the compacted guano, and these increased in frequency as the excavation continued. Several of the hearth features also continued into the deeper levels. These contained ash and bamboo fragments, and limestone cobbles that may have served as pot stands. Palmer et al. suggest that the use of the cave at this level consisted of occupation and ornament manufacture, due to the frequent occurrence of hearths and fragments of shell bracelets, worked bone and ivory beads, glass beads, and fragments of pearl shell. Several large diameter post-holes also occur as new features in this level, suggesting the insertion of vertical beams into the cave sediment—perhaps an early wooden palisade.

The lower layers between 20–30 cmbs consisted of mottled brown fill with abundant limestone pebbles, and additional hearths emerged that extended several centimeters in depth. Decorated and plain ceramics were found throughout, in addition to chert flakes and cores, worked shell and bone, shell bracelets, and fragments of riparian clam and snail shells, and nutshells. The southern portion of CD1–2 contained disturbed deposits, and the remains of a human burial that had been interred against the wall of the cave. Palmer et al. noted upon excavation that the burial pit contained a very loose fill that dropped away to form a cavity, suggesting that the individual had been wrapped in mats that had since disintegrated. The placement of the burial also had cut into a bright orange layer of sediment that appeared to be sterile, and Palmer et al. surmised that this material was the remnants of an eroded limestone deposit. Continued excavation at depths of 30 to 40 cmbs in the other units produced fewer artifacts, but these included fragments of shell bracelets and a chert core, and a fragment of a pearl shell breastplate (civavanonono) (Figure 4). A number of hearths and a second burial continued into the deepest deposits within the AC1–2 and ACc1–2 excavations. Palmer et al.’s notes indicate a combination of disturbed and sterile deposits between 40 and 50 cmbs, with the deepest hearths cutting into the top of the sterile orange layer. These hearths contained fragments of bamboo, ash, and limestone cobbles. Plain and decorated fragments of ceramics were also recovered from the deposits immediately overlaying the sterile orange basal layer.

The deposits of Location B were similar to those of the AC1–CD1–2 units. Lenses of ash and charcoal were encountered at the surface, and artifacts were frequent. Shell bracelets, carved shell ornaments, pearl shell fragments, stone flakes, metal fragments, European glass fragments, and decorated ceramics were very common. Most notable was the high frequency of post-holes, which increased in frequency as the excavation progressed. However, after 35 cmbs ceramic and artifact frequencies dropped off, and patches of eroded limestone began to occur amongst the fill. At 40 cmbs, the orange sterile layer was encountered in the northeast corner of the unit, which extended to the south and west as the excavation continued in depth. A multi-
layered hearth was encountered near the center of the unit, and this extended into the orange basal layer to a depth of approximately 50 cmbs. This hearth contained post holes and wooden stake fragments, water worn cobbles, fragments of worked clamshell, and a ceramic fragment that had been impressed with the surface of a fiber mat. It is from this feature that a single fragment of a wood stake was removed and submitted for radiocarbon dating. The fragment (Gak 4311) returned a result of 1000 ± 70 years BP (Palmer et al. 1973). Although dates from the Gakushuin Laboratory are well known to be unreliable, with modern calibration the wood sample from this hearth deposit dates to between Cal AD 890 and 1190 (at 2σ) (Table 1).

In sum, the 1972 excavations at Tatuba Cave suggest that the inside of the cave may have been used as early as AD 890, and activities within it included cooking, tool manufacture, and ornament manufacture. The higher frequency of pearl shell, beads, and bone ornaments in the upper layers of the cave indicate that this activity was later, perhaps within the last 500 years. There is also evidence for fortification of the cave mouth with a wooden palisade, although some of the postholes may also have been parts of wooden racks that were used for storage, or even pig pens. Late use of the cave as a burial site is also indicated. However, it is important to note that due to the lack of stratigraphic profiling, our understanding of the depositional history of this site is hazy at best. The excavation of the site in 2002 sought to remedy this situation, and also corroborate the claim for occupations prior to AD 1500.

GEOAHRCAEOLOGICAL INVESTIGATIONS AT TATUBA CAVES, 2002

The excavation performed in 2002 was focused primarily on establishing a more secure chronological sequence for the occupation of the cave, and assessment of the depositional context of cultural deposits. Using the lower wet entrance to Tatuba Cave as a model, it was assumed that the main entrance to the cave would contain a similar ‘keyhole passage’ formation, and the deeper deposits would lie near the center of the cave chamber. A single 1 x 1 meter unit (Test Unit 1) was placed along the centerline of the cave, in hopes of reaching these deposits (Figure 3). During excavation, 10 cm arbitrary levels were used within identifiable natural stratigraphic layers, and deposits were sieved using a 1/8th inch mesh. The potential formation processes at the site were also investigated. Standard soil science terminologies and touch tests were used to describe the layers encountered, and samples were taken for later geoarchaeological analyses. These included the measurement of pH levels with a standard laboratory pH kit, calcium carbonate (CaCO3) content analyses using the loss-on-ignition process, and grain size distributions determined from hydrometer measurement of the fine fraction, and dry nested sieving of the sand fraction. These analyses were performed by the author in the sediment laboratory of the University of Hawai‘i, Manoa. Additional analyses including the determination of phosphorus (P), potassium (K), magnesium (Mg), calcium (Ca), sodium (Na), sulfur (S) and organic matter (O) were conducted at A & L Western Agricultural Laboratories in Portland, Oregon.

Figure 5 details the stratigraphic layers that were evident in Tatuba Cave. The complexity of the layers indicates the marked impact of human activities, but also provides an index for the natural depositional and erosional context of these deposits. The presence of guano also makes the conditions of the cave much more complex. Shahack-Gross et al’s (2004) study of bat and bird guano in archaeological contexts indicate that the decomposition of guano produces sulfuric acid, which can then leach through lower substrates and lead to the formation of authigenic minerals. In the case of limestone caves, acidic leaching can reduce

<table>
<thead>
<tr>
<th>Lab No.</th>
<th>Provenience</th>
<th>Material</th>
<th>Measured 14C Age BP</th>
<th>13C/12C Ratio</th>
<th>Calibrated Age Range Probability Distributions (1σ)</th>
<th>Calibrated Age Range Probability Distributions (2σ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GaK4311</td>
<td>Loc. B, 54 cmbs</td>
<td>Wood</td>
<td>1000 ± 70</td>
<td>?</td>
<td>970–1160 Cal AD</td>
<td>890–1220 Cal AD</td>
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<td>Wk-11137</td>
<td>TUI, Feature 1 (45–55 cmbs)</td>
<td>Wood Charcoal</td>
<td>968 ± 52</td>
<td>-28</td>
<td>1020–1160 Cal AD</td>
<td>1000–1220 Cal AD</td>
</tr>
<tr>
<td>AA50298</td>
<td>TUI, 50–60 cmbs</td>
<td>Wood Charcoal</td>
<td>1294 ± 40</td>
<td>-25.6</td>
<td>685–780 Cal AD</td>
<td>660–880 Cal AD</td>
</tr>
<tr>
<td>AA50294</td>
<td>TUI, 80–90 cmbs</td>
<td>Wood Charcoal</td>
<td>1993 ± 33</td>
<td>-26</td>
<td>20 Cal BC–80 Cal AD</td>
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<tr>
<td>AA50293</td>
<td>TUI 1, 130–140 cmbs</td>
<td>H. Bone intr. burial</td>
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<td>1510–1650 Cal AD</td>
<td>1480–1660 Cal AD</td>
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<td>-25.5</td>
<td>210–340 Cal AD</td>
<td>130–380 Cal AD</td>
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<td>-28.1</td>
<td>1650–1950 Cal AD</td>
<td>1640–1950 Cal AD</td>
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</table>

* All determinations were calibrated using the terrestrial calibration curve of Stuiver et al (1998), with 27 ± 5 years subtracted from the CRA to account for the southern hemisphere offset in 14C (McCormac et al. 1998).
† This date has been discarded from the chronology as it likely originated in a much later deposit that fell into the bottom of the unit following a wall collapse. The collapse occurred along the deposits of Layers VIII and IX, which were part of an intrusive burial.
limestone to a column of phosphates and clay minerals. This appears to have been the case for Tatuba Cave. Layers VI and VII are internally consistent and devoid of cultural deposits. Layer VII in particular has a very strong grade, and medium sized peds that were round and bubble-like in form. It was also lightly pigmented, with a Munsell color rating of 10YR 7/4 (very pale brown). Geoarchaeological analyses of samples from this deposit indicate the presence of an extremely small amount of calcium carbonate (1.8%) and a very acidic pH level of 3.5 (Table 2). The very high measurement for phosphates in samples from Layer VII also confirms that the deposit was once limestone.

Similarly, Layer VI was of course grade, had a CaCO₃ content of 2.5%, and a pH level of 4. This was the layer that Palmer et al. identified as ‘the orange basal layer’, which was devoid of natural inclusions and cultural deposits. The similarity of the laboratory results to Layer VII, the high pH and phosphate content, and low amount of calcium carbonate, as well as the color and texture of the deposit, confirm that this was also a limestone deposit that was weathered by acidic precipitation. The morphology of Layers VI and VII indicate that this was once the edge of a limestone bench that ran along the side of the cave. Evidence for the bench and gutter formation is also provided by Palmer et al’s profiles, which document the ‘orange

Figure 5. Profile of the south and west profiles of TU 1. Boxed numbers 1–10 indicate the location of samples taken from the wall profile that were used for geoarchaeological analyses.
basal layer’ in the deepest deposits of AC1–2 and CD1–2, but only in the northern corner of ACC1–2. Based on this evidence, it can be concluded that the benches ran along both cave walls at a depth of 20–25 cm below the current surface, leaving a gap between them that has filled in with natural and cultural deposits (Figure 6). The deposits within this gap are approximately 70–90 cm deep, and are represented in the profile by Layer V. Excavations within Test Unit 1 also suggest a deep gutter along the center of the cave passage, which contains a high quantity of limestone cobbles and extends to a depth of 2+ meters. In profile, this gutter extended vertically into the deepest levels of the excavation, and was identified as Layer IX.

Understanding of the erosional processes at work in the cave is critical, as there is a great potential for redeposition within a solution cave. The chronology of the deposits determined from AMS and standard radiocarbon dating serve as a guide to this process (Table 1). The deepest dated sample from Test Unit 1 is a piece of wood charcoal from Layer IX (sample AA50292, at 140–150 cmbs). This sample was recovered in association with ceramics, nutshell (*Aleurites moluccana*), and riparian snail shell (*Melanoides spp.*). This sample returned a result of 1802 ± 34 years BP, which calibrates to AD 210–340 (at 1σ). This date is similar in age to sample AA50294, which was retrieved from Layer Va, at a depth of 80–90 cmbs. This deposit also contained

<table>
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<th>Organic (%)</th>
<th>pH</th>
<th>CaCO₃ (%)</th>
<th>P* (ppm)</th>
<th>K (ppm)</th>
<th>Mg (ppm)</th>
<th>Ca (ppm)</th>
<th>Na (ppm)</th>
<th>S (ppm)</th>
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* Phosphorus was determined using the Weak Bray method.

Table 2. Results from geoarchaeological analyses.

Figure 6. Depositional sequence proposed for Tatuba Cave. Period T1 represents the period prior to human occupation in the cave, with deposits on the limestone benches and central gutter. It is proposed that periods T2 and T3 included cultural deposition, and acidic leaching that eroded the limestone benches. Natural and cultural deposition continued through period T4, and during this time the placement of hearths, post-holes, and burials bisected the layers and extended into the eroded limestone deposits.
Additional occupation in the following centuries probably consisted of a dry, loose deposit that extended horizontally over the sterile weathered limestone ledge (Layer VI), and also Layer V. Portions of this horizon are also evident at the base of Feature 1, which suggest that some of this deposit fell into the bottom of the fire-pit hole at the time it was created. Testing of samples of Layer IVa from directly beneath Feature 1 and at 25 cmbs indicate complex chemical transitions, including the leaching of sediments by guano-derived acids, and also the effects of extreme heat in Feature 1. However, the effects of the leaching were not as severe as has been observed for the lower portion of the profile. Overall, organic content ranged between 15.6–7%, CaCO₃ content ranged between 3 – 29 %, and pH was close to alkaline, with a values between 6 and 7.6. It seems probable that these values reflect the effects of cave’s hydrology, in particular the precipitation of carbonate-saturated water from the ceiling (Shahack-Gross et al. 2004:1268). Several locations on the cave floor could be identified as spots of ‘ceiling drip’, including several in the vicinity of Unit 1. The alkaline pH values and high CaCO₃ values in particular indicate that the influx of ceiling water into the surface deposits has buffered the acid that is being released during the degradation of the organic material in the guano.

Feature 1 consisted of an ash-filled hearth that was approximately 40 inches wide, and excavated into the sterile Layer VI to a depth of 55 cmbs below surface. Forty-one percent of the fill was CaCO₃ that was probably deposited in the hearth following the burning of organic materials over limestone cooking stones and pot stands. Organic content was also high at 14%, and pH was just alkaline at 7.8. A portion of a large ceramic cooking vessel was recovered from the hearth’s contents. In addition, the deposits contained 4 g of riparian clam and snail shell (Batissa violacea and Melanoides spp.), as well as the shell of a marine mussel, possibly Modiola tulipa. The spine of a large fish that could not be identified was also recovered from the base of the feature. This fish may have been imported from the coast, or be the remains of a large freshwater fish such as Kuhlia spp. or Anguilla marmorata, which are common in the Sigatoka River. Combined, these remains suggest the roasting or stewing of snails and fish. A large fragment of charcoal retrieved from the feature was submitted for ¹⁴C dating as sample Wk-11137, and returned a count of 968 ± 52 years BP (Table 1). After calibration, this result indicates that the burning event dates to between AD 980 and 1210 (at 20). This date is similar to that obtained for Location B during the Palmer et al’s excavations in 1972. Both dates were also obtained from features that were excavated into the sterile and weathered limestone deposits in the cave. Therefore, the earliest indisputable use of the cave for at least temporary habitation dates to ca. AD 1000.

The later centuries witnessed similar episodes of occupation. Layer IIIa-c extended as a horizon over Layer Iva-c, and was mixed to some extent with the ash and charcoal that capped Feature 1 in the southern end of the unit. This deposit had higher levels of CaCO₃ (19%) than the deposits below, but similar levels of organics (7%) and an alkaline pH (7.5). Directly above, Layer Iia-c was compact, and contained a high proportion of charcoal fragments and many thin lenses of ash. It also contained the most instances of post-holes, pits, and other disturbances, which extended deep into the lower layers. This layer is similar in pH value and organics to Layer III (7.6 and 7%, respectively), however, CaCO₃ content is much higher at 29%. These differences are likely due to the decreased age of the deposits, and the saturation of the deposits with carbonated-infused ceiling drip. The surface layer (Layer I) consisted of a dry, loose deposit that extended horizontally across the surface of the cave. Thin lenses of charcoal were evident during the excavation and in profile, although...
these were too fragile to be excavated individually. Loss on ignition analyses indicate that 24% of this deposit was CaCO$_3$, and 12.9% was organic matter.

ARCHAEOLOGICAL IMPLICATIONS

The complex process of acid leaching in the deposits of Tatuba Cave, as well as the influx of carbonate-infused precipitation implies a dynamic context for archaeological materials. Fragments of shell, bone, and tooth were collected from the uppermost layers of the cave (Layers I-III) and were also present in amounts less than 1g in Layers IV and V. This reduction in the earlier deposits may reflect the limited use of these materials during the earliest occupation of the cave (ca. 2000 BP), however, they also may indicate the effects of acidic leaching in the deeper deposits. It is possible that organic materials from the earliest occupation of the cave have long since dissolved. In contrast, the presence of shell, bamboo, and other organic materials dating to ca. 1000 BP indicates that leaching in the upper layers would have been slowed to some extent by periods of increased precipitation from ceiling drips. Overall, the geoarchaeological investigation of Tatuba Cave suggests that this was a very dynamic environment, with the potential for dramatic vertical movement of artifacts between the eroding benches and the cave gutter, and also the later placement of post-holes, fire pits, and intrusive burials.

This context makes the determination of cultural sequences much more difficult, as precise provenience may not be securely linked to a single depositional event. Perhaps the most temporally sensitive cultural items in Tatuba Cave are the ceramic items, which were recovered from both the 1972 and 2002 excavations. Palmer et al’s manuscript suggests that there was a great degree of diversity amongst the ceramics recovered from the cave. Although the dating of the deposits provided a firm date of AD 1000, Palmer’s notes record the presence of ceramic rims that he felt were ‘Lapita-like’, with tightly curved rim profiles and square lips. Although it is certain that these vessels are not Lapita, the continuity of ceramic attributes throughout Fijian prehistory is well documented elsewhere (Best 2002; Clark 1999; Cochrane 2004; Hunt 1980). He also noted the high frequency of the ‘Nakoro’ style, which refers to ovoid-bodied pots that are still manufactured at the remote highland village of Nakoro (Palmer and Shaw 1968). These vessels have tall rims that curve slightly outwards to form rounded or slightly pointed lips. The occurrence of these rim forms in the deeper deposits of the 1972 excavations suggested an antiquity of at least 1000 years.

Figure 7. Profile of ceramic rims from the 1972 and 2002 excavations. Darker shaded rims are those that were identified to be of the ’Nakoro’ style by Palmer et al. (1973) and by the author (2003). Figure reproduced from Field (2006).
The examination of the deposits of Tatuba Cave indicates that the cave has long been a location for human habitation and activity. The stratigraphic profile produced during the 2002 excavations reveals that its depositional history was also dynamic, resulting in the redeposition of cultural items into deeper parts of the cave. The earliest occupations probably occurred upon the raised limestone benches that run along the length of the cave. These benches (Layers VI and VII) have been heavily eroded by the precipitation of acids, which have been produced as a byproduct of the decomposition of organic matter within the heavy deposits of guano in the cave. Redeposition of deposits into the central gutter that ran along the length of the cave has produced a deposit that is full of rubble, voids, and displaced cultural deposits. Dates from Layer V and Layer IX are statistically indistinguishable, indicating that the earliest occupation in the cave occurred ca. AD 0.

Later occupation of the cave also utilized the eroded limestone benches (Layer VI), and these features were the locus for fire hearths, burials, and post-holes. Dating of the charcoal and ash from Feature 1 produced a date ca. AD 1000, which is similar to the dated hearth feature from Palmer et al’s Location B. Deposits within this hearth indicate that the inhabitants utilized local snails and marine mollusks as a food source, and may have also imported marine fish. By AD 1300 the cave was being used as a burial site, as evinced by the presence of human remains wrapped in fiber mat. The presence of post-holes extending from deposits dating to this period also indicates that the mouth of the cave may have been fortified during this period using a wooden palisade. The location of post-holes documented by Palmer et al. (1973) and also by the author indicate that large posts extended across the mouth of the cave, close to the current position of the rubble wall.

Geoarchaeological analyses provide a valuable assessment of the depositional history of Tatuba Cave. Although the studies presented here are not exhaustive, they provide a fuller glimpse into the life of the cave, and also help explain the quality and character of cultural deposits. The presence of several other limestone caves in the region (Malua cave, and the Nagalimare caves) may likely contain similar deposits, and would benefit from a similar or advanced approach. These analyses also suggest an element of caution, especially when attempting to discern a chronology based on ceramic styles; the potential for displacement within solution caves is very great.

ACKNOWLEDGMENTS

I am indebted to Bruce Palmer, Fergus Clunie, Kolinio Moce, and John Parry, who first investigated the archaeological resources of Sigatoka Valley and Tatuba Cave. I also wish to thank the elders and turaga ni koro of the villages of Malevu, Nayawa, Nakalavo, Naduri, Raiwaqa, Tawatawadi, Tonuve, Volinagerua, Sawene, Korovou, Nubuyanitu, and Korolevu, who kindly granted permission for fieldwork during 2001 and 2002. Research at Tatuba Cave would not have been possible without the blessings of Sawene and Korouv villages. My special thanks go to the Tui Namataku, Vilieme Vatureba, and the turaga ni koro of Sawene and Korovou villages, Epeli Kunavuli and Senivalati Dretoro. Aid and permits were also generously granted by The Fiji Museum, the Immigration Department, and the Provincial Office of Nadroga/Navosa. Housing was generously provided by Talatala Joeli Ratusala and Talatala Radini Sulueti Ratusala (CMF).

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AN EARLY FIRST MILLENIUM AD BURIAL FROM THE NASELALA SITE, CIKOBIA-I-RA ISLAND (NORTH-EAST FIJI)

Frédérique Valentin* · Christophe Sand† · Isabelle Le Goff‡ · Hervé Bocherens§

Abstract

This paper presents the results of the study of a human skeleton discovered on the island of Cikobia (north-east Fiji). The archaeological context of the burial as well as the study of the funerary behaviour are described using methods of field anthropology. Results of chemical analysis and macroscopic observations on bones and teeth allow discussing dietary patterns, isotopic data showing a strong component of vegetable aliments in the diet, and macroscopic data suggesting the possible impact of non-dietary factors on the dental condition. Regional comparisons with other burials in the Fiji/West Polynesian area help to place this study into its regional context, by highlighting the similarities in terms of body position and orientation, but also a series of specificities. This example shows the potential of bioanthropological studies in the reconstruction of the past societies of the region.

Introduction

Early prehistoric funerary sites are rarely the focus of archaeological excavations in the Fiji/West Polynesia region. Virtually none has been identified in Samoa, Uvea (Wallis) and Futuna, and only a few have been studied in Fiji. However, this category of remains, providing direct lines of evidence of human life and changes over time, is a crucial contribution to our understanding of past societies. Constituting a welcome addition to the current regional archaeological record, one burial dated to the beginning of the first millennium AD was discovered on the sand dune of Naselala in Cikobia-i-Ra island (North-East Fiji). This burial was excavated in 1999 during the course of a French/New Caledonian/Fijian collaborative project (Sand and Valentin 1998, Sand et al. 2000, Sand and Valentin 2002, Valentin et al. 1999, 2001). The archaeological findings are reported in this paper with a particular focus on two key aspects of prehistoric communities: the funerary and dietary behaviours, delineated using bioanthropological approaches. In an effort to synthesise the regional data available, the Naselala burial is then discussed in conjunction with the other earlier and pene-contemporaneous burials known in the Fiji/Tonga area.

The Naselala Burial

Archaeological Context and Dating

Cikobia-i-Ra is a 10 km long island located about 60 km north-east of Udu Point, the tip of the large island of Vanua Levu in eastern Fiji. The Naselala site (CIK 006) is located on the south coast of Cikobia, facing the only real lagoon of the island. The area is formed by a quaternary beach ridge, reaching about 5 m of maximal high (Fig. 1). This environment, near to the lagoon and sheltered from the main trade winds, appears to have attracted the earliest settlement of the island, with the discovery of a late Lapita occupation in stratigraphic context (Sand et al. 2000, 2002). In the course of excavation of a test-pit located about 25 m from the present seashore, a cranium was uncovered at 50–60 cm depths. The test-pit was enlarged to a total of nearly 3 square metres, leading to the excavation of an individual burial containing a complete skeleton. Following agreements with the local communities, the in-field study of the skeleton and the removal of bone samples for dating and chemical analyses were granted before the feature was reburied in situ. The study has identified an adult of unknown sex and age at death. In spite of weak indications, the Naselala individual does not seem to be a young adult (cranial sutures closure engaged, moderate dental wear, presence of osteophytosis on foot bone).

The depth of the burial and the poor preservation of the bones pointed to fairly old remains and permission was asked to date a tibia. The sample returned a 14C age of 1730 ± 40 BP (Beta-144335), calibrated AD 230–410. This
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Date places the finding at an early stage of the first millennium AD, a period marked by the transition from the Sigatoka to the Navatu phase in the Fijian ceramic chronology (Frost 1979, Clark 1999, Burley and Clark 2003, Burley 2005). In the Cikobia chronology, this time span marks the drastic reduction of shell and fish remains in the main seashore sites occupied during the preceding millennium, before a partial abandonment of these locales and a general movement inland. Still today, shell consumption is rare on Cikobia and most of the fishes caught by traditional nesting are of small size.

Funerary Behaviour

The poorly preserved skeleton (Figs 2 & 3) was found in a matrix formed of yellow sand containing potsherds, a few shells and fragmentary animal bones (fish and mammals). No grave pit and no dark black stains were detected in the surrounding. There were no recognizable grave goods, but some stones were observed in direct environment of the bones, particularly a large stone (17 x 35 x 23 cm) that had been placed just above the skull, maintained by a smaller stone.

The presence of a fine line of dark brown stains is sometime considered as the decomposition product of perishable material used to wrap the body prior the interment (Davidson 1969, Sand and Valentin 1991, Sand et al. 2006, Burley 1997). However, it remains unclear whether these black stains strictly derive from body wrapper decomposition or not. It had also been observed that black stains are absent in several Tongan burials in which slumping of the pit fill is interpreted as indicating the presence of a body wrapper (Spennemann and Franke 1994). Influences of other factors can equally be suggested, as fine silt percolation (Spennemann and Franke 1994) or traces of substances release in the soil surrounding the cadaver during decomposition (Dent et al. 2004).

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stone placed underneath. A reconstruction of the taphonomic history of the Naselala burial since the disposal of the cadaver to the recovery of the skeleton was conducted using the methods described by Duday (1995, Duday et al. 1990, Duday and Guillon 2006) to define the original body position and the potential use of body container.

Observations of the bone position were used to assess the initial attitude of the corpse that may differ from the final position of the bones owing to changes related to in-ground body decomposition conditions. Most of long bones were fragmented and without extremities, whereas other bones were almost disintegrated. Nevertheless, despite the poor general preservation, the analysis has shown that the Naselala burial is a primary inhumation, indicated for example by the general cohesion of the right hand bones. The corpse was originally disposed on the left side with the limbs in an hyperflexed position (Fig. 2). The left upper limb was strongly flexed, the hand palm touching the left check. Both legs were flexed on the thighs, with the right on the left. The body has been placed following an east/west axis, with the head to the east. The skull and the mandible that lay on the left side are slightly tilted backward. Because the cervical vertebrae are seen by their right side and curved backward, the head position can be regarded as initial, with the eyes originally turned towards the south.

Observations of the bone position, identifying possible restraining effects and re-locations, were employed to define the potential use of funerary containers made with perishable material decomposing slower than the body, as illustrated by the study of the deceased interred in the nearby Korotuku burial mound of Cikobia (Valentin et al. 1999, 2001). The evidence returned by the taphonomic analyse of the Naselala skeleton indicates that the inhu-

Figure 2. Sketch of the body original position and map of the burial of Naselala (Cikobia, Fiji). Notice the presence of a stone between the forearm and the knee.
formation was quickly filled up, the general cohesion of the skeleton being maintained (Fig. 3). However, the positions of the right ribs and of the left foot suggest a more complicated treatment, including the possible use of a body-wraper that has constricted the foot and created a void along the back. Restraining effects were observed around the thoracic cage and the feet. The right ribs appear at the back of the right humerus: they have collapsed backwards in an opening movement, indicating their fall against a perishable structure or the edge of a pit. The left foot is extended. Slightly disconnected from the tibia, the talus and the calcaneus are seen by their antero-medial aspects and the metatarsals show their inferior aspects. The first metatarsal parallel to the others metatarsals, appears to have been pushed backwards. The right foot, although poorly preserved, was probably parallel to the left. Re-locations of bones were observed, identified around the neck and the legs. Showing its posterior aspect, the right scapula, which was found along the neck, has slipped backwards. The right fibula is not at its primary location on the tibia: it had slipped along the posterior aspect of the tibia. Additionally, the left femur displays its postero-medial aspect while the left tibia shows its medial aspect, suggesting the possibility of the disarticulation of the knee. The re-locations of the right scapula and fibula outside of the initial volume of the cadaver, suggesting the body decomposi-

dition in an empty space, may support the hypothesis of the use of a body wrapper. Unfortunately, these indications are not fully decisive, due to the fragmentation and the disturbances caused by some stones.

Dietary Behaviour

Food consumption patterns of individuals like the adult found in the Naselala burial, and by extension subsistence strategies, can be directly approached with bio-anthropological studies, although zooarchaeological and archaeobotanical studies, constituting an indirect approach, provide reconstructions of food production systems. Thanks to the agreement provided by Fijian authorities and the Cikobia landowners, measurements of carbon and nitrogen stable isotopes signatures in the bone collagen and an assessment of the dental condition were achieved, enabling to document the dietary practice of the Naselala individual around the time of death.

Being a direct function of the diet, the chemical composition of the bone and teeth offers the possibility to reconstruct the prehistoric dietary patterns, as fulfilled on some prehistoric individuals excavated in the south Pacific islands (e.g. Leach et al. 1996, 1998, 2003, Ambrose et al., 1997, Cochrane et al. 2005, Valentin et al., 2006). In the present case, isotopic signatures of carbon and nitrogen have been measured in the bone collagen extracted from a phalanx. Collagen is a tissue that records mainly the protein fraction of the diet and allows identification of food resources and estimation of their relative proportions (Ambrose et al., 1997). Bone preparation and collagen extraction were performed according to Bocherens et al. (1997).2 The isotopic results are shown in Table 1. The collagen extracted from the Naselala bone is regarded as representative of prehistoric diet, since its chemical composition is diagnostic of well preserved collagen, with a C/N ratio in the range of 2.9–3.6 defined by DeNiro (1985) and nitrogen content well above 8% (Ambrose 1990). The isotopic signatures of the human specimen from Naselala is very close to those measured for the human individuals from the Korotuku burial mound, also located on Cikobia, but dated to the middle of the 19th century (Valentin et al. 2006). The comparison of the isotopic data from this Naselala specimen with those of possible food items and other Pacific human populations suggested a diet includ-

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2 Elemental and isotopic analyses were performed using a CHN elemental analyser coupled with an isotope ratio mass spectrometer. The sample from Naselala was analysed at the Department of Earth Sciences (University of Paris) and at the Institute of Evolutionary Science (University of Montpellier 2, France). The amounts of carbon and nitrogen are expressed as weight percent of collagen. The analytical precision is 0.1 ‰ and 0.2 ‰ for δ13C and δ15N, respectively. The isotope ratios are expressed for carbon as δ13C vs PDB (a marine carbonate) and for nitrogen as δ15N vs atmospheric N2: δX = (Rsample/ Rstandard)−1)x1000, where X stands for 13C or 15N and R stands for 12C/13C or 14N/15N.
The dental condition of the Naselala individual has been assessed using three criteria in relation with diet: macrowear, caries, calculus. These criteria have been recorded following recommendations of several authors (Brothwell 1981, Pot and Perizonius in Bouville et al., 1983, Hillson 1996). Only the twelve right teeth were scored, the twelve teeth of the left side, left in-ground, being not available for examination. The Naselala individual shows a slight to moderate occlusal macrowear, and traces of calculus deposition on most of the right teeth, but none of the observed teeth display caries (Table 2). In accordance with the classic bioanthropological views (Hillson 1996, Larsen 1997, Molnar 1972) and shellfish that contain grit for examination. The Naselala individual shows a slight to moderate occlusal macrowear, and traces of calculus deposition on most of the right teeth, but none of the observed teeth display caries (Table 2). In accordance with the classic bioanthropological views (Hillson 1996, Larsen 1997, Molnar 1972), which are adapted for all types of teeth from the molar schemes provided by Brothwell (1981). Dental decay was noted in terms of presence or absence by tooth and by location: occlusal, interproximal, cervical, or root surface. Caries were scored present when the lesion had completely penetrated the enamel. As recommended by several authors (Hillson 1996), it was judged by using a probe. Calculus deposits were recorded in qualitative terms, following the standards of Brothwell (1981).

The apparent contradiction between the two kinds of results may result from several factors. For instance, as the individual does not seem very young, non-dietary causes of variation of the selected dental criteria may have influenced the Naselala dental lesionnal pattern. Among these are the influence of genetic factors on the caries development and/or of a high level of individual oral hygiene, reducing the caries development.

**The Naselala Burial in Regional Context**

The discovery of an early first millennium AD burial in a north-east Fijian island is a welcomed addition to the archaeological record of this period, the early prehistoric burials recovered in the Fiji/West Polynesia region being relatively rare. Those excavated at Naitabale (Moturiki, Fiji) (Nunn et al. 2003, Kumar et al. 2004, Nunn et al. 2007), Yalobi (Waya, Yasawa, Fiji) (Pietrusewsky et al. 1997 a and b), Wakea (Lakeba, Lau, Fiji) (Best 1984, Houghton 1989a) and Pea (AK, Tongatapu, Tonga) (Poulsen 1987, Spennemann 1987, Houghton 1989b), are currently regarded as the earliest of the area. They all come from seashore context sites and are grouped in the first millennium BC. Table 3 shows their current chronological attribution and some of their descriptive features.

Another finding at Natunuku (Viti Levu, Fiji), regarded in the past decades as the oldest skeleton of the Pacific (Pietrusewsky 1985, 1989), appears today peculiar in terms of primary burial and some of their descriptive features.

### Table 1. Bone collagen isotopic data obtained from the sample of Naselala burial (Cikobia, Fiji) and in samples from other burials in the Fiji/West Polynesia region.

<table>
<thead>
<tr>
<th>Burial</th>
<th>Yield %</th>
<th>%C</th>
<th>%N</th>
<th>C/N</th>
<th>δC13</th>
<th>δN15</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pea</td>
<td></td>
<td>-13.4</td>
<td>11.7</td>
<td></td>
<td></td>
<td></td>
<td>Leach et al. 2003</td>
</tr>
<tr>
<td>Natunuku</td>
<td></td>
<td>-14.6</td>
<td>7.4</td>
<td></td>
<td></td>
<td></td>
<td>Leach et al. 2003</td>
</tr>
<tr>
<td>Sigatoka</td>
<td></td>
<td>-19.5</td>
<td>9.8</td>
<td></td>
<td></td>
<td></td>
<td>Leach et al. 2003</td>
</tr>
<tr>
<td>Wakea (196-28-D8 below complete burial)</td>
<td></td>
<td>-15.4</td>
<td>10.3</td>
<td></td>
<td></td>
<td></td>
<td>Leach et al. 2003</td>
</tr>
<tr>
<td>Wakea (196 ?)</td>
<td></td>
<td>-16.5</td>
<td>10.3</td>
<td></td>
<td></td>
<td></td>
<td>Leach et al. 2003</td>
</tr>
<tr>
<td>Naitabale*</td>
<td></td>
<td>43.1</td>
<td>15.287</td>
<td>3.29</td>
<td>-15.86</td>
<td>9.36</td>
<td>Nunn et al. 2007</td>
</tr>
<tr>
<td></td>
<td></td>
<td>42.41</td>
<td>14.35</td>
<td>3.45</td>
<td>-16.0</td>
<td>9.43</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>42.77</td>
<td>15.308</td>
<td>3.26</td>
<td>-15.82</td>
<td>9.8</td>
<td></td>
</tr>
<tr>
<td>Naselala (CIK 006E)</td>
<td>48.6</td>
<td>41.2</td>
<td>15.2</td>
<td>3.2</td>
<td>-16.2</td>
<td>10.0</td>
<td>present study</td>
</tr>
</tbody>
</table>

* Three measurements were made for this single individual.
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**Figure 4.** Comparison of collagen $\delta^{13}$C and $\delta^{15}$N values of humans from Naselala (this study) with those of humans from three islands from the Marianas Archipelago (Ambrose et al. 1997), Japanese hunter-gatherers from Sakhaline and Hokkaido consuming marine mammals (Minagawa and Akazawa 1992), and the end-members for possible dietary resources for south Pacific islands (average isotopic data calculated from (Ambrose et al. 1997, Leach et al. 1996, Yoshinaga et al. 1991, 1996), where $\delta^{13}$C values have been corrected for the effects of modern CO2 contamination by adding 1.5 ‰ to their $\delta^{13}$C values for terrestrial food resources (Friedli et al., 1986) and 0.86 ‰ for marine food resources (Böhm et al., 2002). The expected end-member collagen isotopic values have been calculated by adding the appropriate fractionation factors, i.e. 5 ‰ and 4 ‰ for $\delta^{13}$C and $\delta^{15}$N values, respectively. The dotted lines link the dietary end-members and create a polygon encasing the Naselala value, following Phillips and Gregg (2003).

<table>
<thead>
<tr>
<th>Upper teeth</th>
<th>M3</th>
<th>M2</th>
<th>M1</th>
<th>P2</th>
<th>P1</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carie (Hillson 1996)</td>
<td>absent</td>
<td>absent</td>
<td>absent</td>
<td>absent</td>
<td>absent</td>
<td>absent</td>
</tr>
<tr>
<td>Ccalculus (Brothwell 1981)</td>
<td>trace</td>
<td>trace</td>
<td>absent</td>
<td>absent</td>
<td>absent</td>
<td>trace</td>
</tr>
<tr>
<td>Macrowear (Brothwell 1981; Pot and Perizonius in Bouville et al. 1983)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lower teeth</th>
<th>M3</th>
<th>M2</th>
<th>M1</th>
<th>P2</th>
<th>P1</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carie (Hillson 1996)</td>
<td>absent</td>
<td>absent</td>
<td>absent</td>
<td>absent</td>
<td>absent</td>
<td>absent</td>
</tr>
<tr>
<td>Ccalculus (Brothwell 1981)</td>
<td>trace</td>
<td>trace</td>
<td>absent</td>
<td>present</td>
<td>present</td>
<td>abundant</td>
</tr>
<tr>
<td>Macrowear (Brothwell 1981; Pot and Perizonius in Bouville et al. 1983)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

**Table 2.** Data on the dental condition of the Naselala individual.

Over one hundred human burials have been uncovered in the Sigatoka sand dune on the south-west coast of Viti Levu (Fiji), either by erosion or archaeological excavations (Marshall et al. 2000, Wood et al. 1998, Best 1987, 1989, Crosby 1991, Hudson 1994, Burley 1997, 2005). Two distinct ancient cemeteries have been recognized in the eastern (cemetery 1) and western (cemetery 2) sections of the eastern part of the dune system. Both are associated with the Level 2 paleosol as Fijian Plainware and Navatu phase cultural assemblages. A direct dating of a cemetery 1 burial returned the result of 1870±70 BP (WK996B, human bone sample, FC1) (Best 1987). Additional burials associated with Level 2 were found spread further west. However complicating the picture given by this site, more recent burials associated with Level 3 are reported, forming a possible cemetery 3, lying above cemetery 2 (Wood et al. 1998), as well as late 19th and early 20th centuries interments (Marshall et al. 2000, Best 1989).
Comparing Funerary Behaviours

The general body positioning and orientation of the Naselala burial are reminiscent of those observed in the burials of the sites of Naitabale, Yalobi, Wakea and Pea, as well as in the pene-contemporaneous burials of Natunuku and Sigatoka. Table 3 summarises their main characteristics. As in the Naselala burial, the Wakea and Pea burials appear to be primary definitive flexed inhumations, following a general east-west axis. More complex treatment of the deceased can be suspected in some cases, as secondary deposit at Wakea indicated by the presence of several bones under the main burial and emptying of the burial (by a reduction process of a previous burial) or bone intrusion indicated by supernumerary bones at Pea. However, examination of Table 3 reveals also some distinctions. The Naselala body was laid on its left side while the bodies at Yalobi and Wakea were laid on their right side and the

<table>
<thead>
<tr>
<th>Site</th>
<th>Current chronological attribution</th>
<th>Sex and age at death</th>
<th>Treatment</th>
<th>Deposition mode</th>
<th>Body position</th>
<th>Body orientation</th>
<th>Body container</th>
<th>Architectural feature, grave goods</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pea</td>
<td>Late eastern Lapita (stratigraphical and archaeological considerations)</td>
<td>male adult 30–50 years</td>
<td>inhumation primary</td>
<td>on the right side, flexed</td>
<td>E/W, head to W</td>
<td>shallow pit/none</td>
<td>no pit detected/none</td>
<td>Large pit/orchard</td>
<td>Poulet (1980), Borrero (1987), Houghton (1999a)</td>
</tr>
<tr>
<td>Waya</td>
<td>Late eastern Lapita (stratigraphical and archaeological considerations)</td>
<td>adult</td>
<td>emploting of previous burial or intrusion</td>
<td>on the right side, semi flexed</td>
<td>E/W, head to W</td>
<td>shallow pit/none</td>
<td>no pit detected/none</td>
<td>Large pit/orchard</td>
<td>Poulet (1980), Borrero (1987), Houghton (1999a)</td>
</tr>
<tr>
<td>Naitabale</td>
<td>Late eastern Lapita (stratigraphical and archaeological considerations)</td>
<td>male 40–50 years</td>
<td>inhumation primary</td>
<td>on the right side, semi flexed</td>
<td>E/W, head to W</td>
<td>shallow pit/none</td>
<td>no pit detected/none</td>
<td>Large pit/orchard</td>
<td>Poulet (1980), Borrero (1987), Houghton (1999a)</td>
</tr>
<tr>
<td>Wakea</td>
<td>About 1200 BP (stratigraphical and archaeological considerations)</td>
<td>male adult 30–40 years</td>
<td>inhumation primary</td>
<td>on the right side, semi flexed</td>
<td>E/W, head to W</td>
<td>shallow pit/none</td>
<td>no pit detected/none</td>
<td>Large pit/orchard</td>
<td>Poulet (1980), Borrero (1987), Houghton (1999a)</td>
</tr>
<tr>
<td>Natunuku</td>
<td>About 1200 BP (stratigraphical and archaeological considerations)</td>
<td>male adult 30–40 years</td>
<td>inhumation primary</td>
<td>on the right side, semi flexed</td>
<td>E/W, head to W</td>
<td>shallow pit/none</td>
<td>no pit detected/none</td>
<td>Large pit/orchard</td>
<td>Poulet (1980), Borrero (1987), Houghton (1999a)</td>
</tr>
<tr>
<td>Sigatoka</td>
<td>1970 ± 70 BP (WK996B: (14C direct dating)</td>
<td>male adult over 50 years</td>
<td>inhumation primary</td>
<td>on the right side, semi flexed</td>
<td>E/W, head to W</td>
<td>shallow pit/none</td>
<td>no pit detected/none</td>
<td>Large pit/orchard</td>
<td>Poulet (1980), Borrero (1987), Houghton (1999a)</td>
</tr>
<tr>
<td>Naselala</td>
<td>1730 ± 40 BP (Beta 144335: (14C direct dating)</td>
<td>unknown sex adult</td>
<td>inhumation primary</td>
<td>on the right side, semi flexed</td>
<td>E/W, head to W</td>
<td>shallow pit/none</td>
<td>no pit detected/none</td>
<td>Large pit/orchard</td>
<td>Poulet (1980), Borrero (1987), Houghton (1999a)</td>
</tr>
</tbody>
</table>

Table 3. Summary data on the oldest burials excavated in the Fiji/West-Polynesian region.
body at Pea was on the back. The degree of flexion of the body is also variable. Naselala can be seen as intermediate between Wakea (displaying a moderate flexion of the elbows – the arm being on the side of the thorax – of the hips and of the knee), and Pea (exhibiting an hyperflexion of the elbows and of the lower limbs with the knee drawn up on the left side of the chest and the feet in front of the pelvis). The Naselala burial has no graves goods, as Wakea and possibly Yalobi, while shells were found at Naitabale, including a large Trochus maintaining the head, and an adze was found on the right elbow of Pea. The latter was interred in a pit over-sizing the body need, possibly initially wrapped in a supple container, as suggested by the numerous disconnections showed by the photo of the skeleton. Sepulchral pits were also observed for Naitabale and Yalobi, but not for Wakea, who shares this particularity with Naselala. These latter burials have in common as well the orientation of the head, globally towards the east.

In the Sigatoka cemetery 1, at least 61 burials (Marshall et al. 2000), in single or multiple primary definitive inhumations, were excavated. The skeletons were mostly east-west oriented, with the lower limbs systematically flexed. Grave goods were found in four cases. No sepulchral pit has been described but in 21 burials a covering of coral blocks or volcanic stone boulders overlaid the bodies. At cemetery 2, at least 20 burials (Marshall et al. 2000) display a similar pattern, although the cairn covering are absent. One occurrence of pit, with an irregular outline, is reported (Burley 1997), and the east-west orientation is less frequent. Because of the lower limbs flexions, Best (1989) suggests some possibility of trussing or the likelihood that the individuals buried at Sigatoka were wrapped in mats. However, the initial presence of bond is generally difficult to ascertain when a hypercontracted skeleton with the parallel long bones touching each others is recovered, because the peripheral pressure of the sediment can cause the progressive closing of the intersegmental angles (Duday 1995, Duday and Guillon 2006). On the other hand, the initial presence of a body-wrapper is difficult to certify, as the constraining effect on the head and on the shoulders, visible on the illustrations of several burials, could result from the effect of either the limit of the body wrapper or the edge of the sepulchral pit. It is thus difficult to ascertain a parallel with the Naselala burial, for which the presence of a body wrapper very close to the body is possible. Despite a general resemblance with those two groups of burials (no detected pit, no grave goods, single primary definitive inhumation, east-west orientation, hyperflexion of the knee), the Naselala burial shows a series of features that are rarely noticed at Sigatoka. In Naselala the head orientation is towards the east, opposite to the majority of the Sigatoka burials, as only one case of head towards the north-east is mentioned for cemetery 1. Another case has been reported for an isolated multiple burial, poorly preserved, found towards the west, far from the two Level 2 cemeteries (Crosby 1991, Marshall et al. 2000). Otherwise, this orientation exists in two more recent burials of Level 3 (Marshall et al. 2000, Burley 1997).

At Naselala, the body was placed on the side, a position which is very rarely observed (two cases) at Sigatoka, as the Level 2 -as the Level 3- burials were on the back. The Naselala individual presents a clear hyperflexion of the upper left limb, a feature seldom recorded in Sigatoka, as only four elbows are hyperflexed among the cemetery 1 burials (Best 1989), with the hands on or in front of the shoulder. An important flexion of the left forearm with the hand touching the shoulder has also been recorded in a grave of Level 3 (Marshall et al. 2000). It is worth noting that this forearm position has been recorded in second millennium AD burials excavated by Rechtman (1992) in Wakaya (East Fiji), and was very frequent in the Korotuku burial mound excavated on Cikobia island (Valentin et al. 1999, 2001, 2007).

The current analysis suggests a common funerary tradition shared by communities of eastern Fiji, distinguished in some characteristics from the standard practice observed at Sigatoka in Viti Levu. But the limited number of excavated sites limits the possibility of interpretation, as other potential explanations can be proposed, like differences related to the social or political status of the deceased.

Comparing Dietary Behaviour

Reconstruction of food patterns of first millennia BC/AD populations of the Fiji/West Polynesia region generally rely on zooarchaeological and archaeobotanical evidences as well as analyses of surface features and paleoenvironmental changes (Burley and Clark 2003). However, ‘the evolutions of the subsistence economies in this region have yet to receive the kind of attention they deserve’ (Burley and Clark, 2003: p. 239). Data collected on human remains recovered in the previously described funerary context contribute to partly fill up the gap (Kumar et al. 2004, Houghton 1989a and b, Nunn et al. 2007, Pietrusewsky et al. 1997b, Spennemann 1987, Visser 1994a and b). Considered in a regional perspective, the isotopic signatures measured in the Naselala individual display similarities as well as differences with those of the earlier and penecontemporaneous individuals recovered in other Fiji/West Polynesian contexts (Table 1). The Naselala individual exhibits similar isotopic values, and therefore similar diet, as several other earlier specimens, including two from Wakea (Leach et al. 2003) regarded to be dated to around 500 BC, and one from Naitabale (Moturiki Island, Fiji) dated to around 800 BC (Nunn et al. 2007). On the other hand the few pene-contemporaneous specimens differ in their isotopic signatures. One adult specimen from Sigatoka has an isotopic signature indicating a C₃ terrestrial diet (Leach et al. 2003). The specimen from Natunuku has an isotopic signature more representative of a significant contribution of marine shellfish and/or coral reef fish (Leach et al. 2003). These results, put in conjunction with the Naselala data, suggest that there is not a simple change of the dietary pattern over time in the Fiji/West Polynesian region. This variety of diets hints at possible influences of other factors on the food intake, as the status of the individual or the local environment.
On the other hand, the dental condition observed in the Naselala individual display few similarities with the data gathered in early skeletons of the Fiji/Tonga region as well as in pene-contemporaneous individuals of Fiji. As in the Naselala individual, calculus has been recorded in the Natunuku individual but not in the Yalobi individual (Pietrusewsky 1989, Pietrusewsky et al. 1997b). On the other hand, the Naselala individual pattern of dental health contrasts with the pattern displayed by the earlier burials and by the pene-contemporaneous burials in dental occlusal macrowear and decay occurance. Unlike for the Naselala individual, a marked dental attrition has been noticed in the Yalobi and Pea individuals (Pietrusewsky et al. 1997b). A high level of dental wear has also been observed in the pene-contemporaneous individuals of Natunuku (Pietrusewsky 1989, Pietrusewsky et al. 1997b), and Sigatoka where 94% of the population from cemetery 1 (Best excavation) display an excessive dental attrition in both sexes suggesting an abrasive diet in the whole group (Visser 1994 a and b). In addition high frequencies of carious teeth, dental abscressing and premortem tooth loss are reported for the individuals recovered from Naitabale (Nunn et al. 2007), Yalobi (Pietrusewsky et al. 1997b), Wakea (Houghton 1989a), and Pea (Houghton 1989b), as well as for those from Natunuku and Sigatoka (cemetery 1). These observations highlight the distinctiveness of the dental condition of the Naselala individual, despite the small size of the observed sample. Its particularity may result from the impact of non-dietary factors, including genetic factors, rather than its dietary behaviour alone.

CONCLUSION

The excavation of an early first millennium AD burial in Cikobia-i-Ra and its general bioanthropological study has given the opportunity to highlight the complexities of the mortuary treatments that were in place in the Fiji/West Polynesian triangle during the first half of the prehistoric chronology. The dating of the Nasalala individual to a period of cultural transition in the region and the identification of a series of similarities as well as differences with other pene-contemporaneous burials, allows in the conclusion to draw a series of interesting points that will need further research. Regional comparisons have identified a number of traits that are shared between the Naselala individual and other east Fiji burials, pointing to a possible discrete sub-regional tradition in this part of the archipelago. The isotopic data are consistent with the archaeological data from Cikobia-i-Ra, confirming that at the beginning of the first millennium AD a progressive shift from significant consumption of shellfish to a main reliance on tubers was taking place. This change just at the Fijian transition period from the Sigatoka phase to the Navatu phase, while pottery disappears in West Polynesia (Kirch 2000), is not matched currently in the other sites of the region, underlining regional diversity and probably also a major sampling bias. Finally, a whole avenue of questions remains on the possible link between the isotope signature of the Naselala individual and social status variations, and/or on the relationship between the absence of caries combined with a significant intake of vegetable food and the influence of genetic factors on the caries development in the group members of this person.

To answer to all these questions we would need a larger comparative sample, something that will only be possible through a general development of intensive archaeological programs in the region, coupled with high profile in situ bioanthropological studies of burial remains.

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TOOLS OF THE ANCESTORS?
EVIDENCE FOR CULTURALLY MODIFIED HUMAN BONE
FROM TONGAN SKELETAL ASSEMBLAGES

Alice A. Storey*

ABSTRACT

Scattered and fragmentary human remains in Pacific archaeological contexts were once assumed to be proof positive of cannibal activity. Only recently have intensive studies produced a definitive set of diagnostic criteria to identify the archaeological signature for cannibalism in the prehistoric Pacific. Careful examination of fracture types, mortuary practice, medical treatment, and the use of human bone for tool manufacture are necessary to fully evaluate a collection of human bone for tangible evidence of cannibalistic activity. A detailed analysis of four discrete assemblages of fragmentary human remains collected from the Ha'apai Islands in Tonga led to the identification of a human fibula fragment which had been modified and heavily used, likely as a sailing or thatching needle. This is one of only three tools of human bone recovered from in situ Lapita associated archaeological deposits in the region. The presence of human bone tools in Lapita aged deposits in Tonga and Fiji and mortuary evidence for the removal of long bones from the cemetery site of Teouma in Vanuatu, warrants further study of assemblages of scattered human remains recovered across the Pacific to search for tools of human bone. It also suggests that cutmarks and patina observed on human remains within assemblages of scattered human remains may be interpreted as something other than cannibal refuse.

INTRODUCTION

Accounts of cannibalism in the Pacific have added to the modern mystique of the islands and have become part of a pop culture view of the dark side of paradise (Sanborn 1992, Troost 2004). Anthropophagy, or the process of feeding on people, in most cases and particularly in Tonga, was practiced in instances of severe food shortages (Martin, 1991: 88–89). Cannibalism is as unlikely to have been a daily part of island life as the pronouncement that it never existed anywhere (Arens 1979). Examination on a case by case basis for the existence of cannibalism in the prehistoric Pacific is required using both ethnographic (Barber 1992, Goldman 1970, McLaughlin 2005, Wetherell 2003) and archaeological evidence (Cochrane et al. 2004, DeGusta 1999, Pietrusewsky et al. 2007, Spennemann 1987a, Steadman et al. 2000). This must be examined within a framework of normal mortuary ritual, medical practices, warfare and the post interment procurement of human bone for the manufacture of tools. This paper summarizes a project undertaken in 2000 examining four assemblages of scattered human remains from the Ha’apai Islands, Kingdom of Tonga (Storey 2001). It has been updated to include the important contributions to the study of Oceanic cannibalism in the past seven years. This study shows that the scattered human remains from Ha’apai are not the product of cannibals but instead arose through processes which disturbed primary interments. These are most likely associated with dynamic and continuous site occupation but may in part be due to exhumation of specific skeletal elements destined for use as tools. During the course of the analysis a human fibula exhibiting evidence of both cutmarks and polish was identified from Lapita associated skeletal material. It is one of only two tools of human bone recovered in situ in Tongan archaeological contexts. 

Evidence for cannibalistic activity in the South Pacific is often drawn from ethnographic histories, such as those for Vanuatu (Fox 1979), Easter Island (McLaughlin 2005), Fiji (Thomas 1886), Hawaii (Salmond 2003), New Guinea (Wetherell 2003), Henderson Island (Goldman 1970) and New Zealand (Cook et al. 1784). The attribution of prehistoric cannibalism has been widely applied to scattered human remains in midden deposits as in Tonga (Poulsen 1968), Fiji (Best 1984, Gifford 1951), the Marquesas (Kirch 1973, Kirch 1984), and Easter Island (Ayres et al. 2000, Skjølsvold et al. 1994). While some of these assemblages may indeed be indicative of cannibalism, few have been intensively studied. Specific examination of suspected cannibal refuse has only been undertaken in seven instances, five of them in Fiji (Cochrane et al. 2004, DeGusta 1999, 2000, Pietrusewsky et al. 2007, Spennemann 1987a), one in

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the Cook Islands (Steadman et al. 2000) and one in Papua New Guinea (Stodder 2005).

This project presented a unique opportunity not only to study Tongan archaeological remains to understand the processes that create assemblages of fragmentary human bone but also allowed for the examination of four contemporaneous deposits from different islands. The Ha’apai Islands assemblages came from the sites of Pukotala on Ha’ano Island (Ha1), Tongoleleka on Lifuka Island (Li7), Vaipuna on ‘Uiha Island (Ui4) and Mele Havea on Ha’afeva Island (HF1). The material was collected from the 1995 and 1997 Ha’apai Islands Lapita Project excavations (Burley 1996, 1997).

PHYSICAL EVIDENCE FOR CANNIBALISM

The unique toolkits and cultural/behavioural assemblages of the prehistoric Pacific preclude the direct application of diagnostic criteria used to identify cannibalism in the Southwest of the United States (Kantner 1999, Turner and Turner 1999, White 1992). Using the available published literature examining cases for Oceanic cannibalism, a list which is specific to the Pacific has been assembled. Evidence for cannibalism includes:

1. Intermingling of faunal and human remains (Steadman et al. 2000).
2. Similar butchering/dismemberment of humans and animals (Stoddar 2005).
4. Evidence for most or all of the following: bite marks, burning, crushing, cut-marks, fragmentation, incipient fracture cracks, peeling, percussion pits, random striae and weathering. Elements exhibiting cut marks should exceed 5% of the assemblage (DeGusta 2000).
5. Burning of elements or heat exposure with rates of burning exceeding 10% of the assemblage (DeGusta 2000, Pietrusewsky et al. 2007).
9. Disarticulation or processing marks at the articular ends of bones, particularly long bones (Cochrane et al. 2004, Spennemann 1987a).

Figure 1. Map of Polynesia showing location of Tonga. Inset: the major island groups of Tonga
HA’APAI ISLANDS: GEOGRAPHY AND CHRONOLOGY

The Ha’apai island group is the central group of islands in the Kingdom of Tonga, separated from the other two groups, the main island of Tongatapu and the northern Vava’u group, by approximately 100 to 110 km of ocean (Figure 1). The islands are incorporated in a labyrinth of fringing and off-shore barrier reefs that provide an abundance of seafood for local subsistence, both in contemporary and prehistoric times (Poulsen 1977). Many of the Ha’apai islands owe their present topography to the uplift of these reef complexes by tectonic forces (Dickinson and Burley 1994).

Five periods are distinguished in the Tongan chronology; Lapita (ca. 2850–2650 BP), Plainware (ca. 2650–1550 BP), Formative/ A-ceramic/ Dark Ages (1550–750 BP), Classical Tongan Chiefdom (750–150 BP) and the Historic Period (Burley 1998, Burley et al. 1999). For the purposes of this project material associated with Stratum I deposits was categorized as A-ceramic or Formative period, Stratum II the Plain Ware period and that from Stratum III from Lapita. Exceptions are intrusive features and materials which are noted in Burley’s 1996 and 1997 field reports.

The Lapita period (2850–2650 BP) in Tonga is thought to have begun with first settlement of the region circa 2850 BP and is indicated by the appearance of decorated ceramics (Burley and Dickinson 2001). It is speculated that the first settlement was established on the large island of Tongata-pu (Burley and Dickinson 2001, Poulsen 1977). The Lapita people are thought to have had a mixed horticultural and marine focused economy based on the recovery of vegetable peelers, shell scrapers and land-snails associated with gardens (Burley 1998: 355). The Lapita period in Tonga is significant for several reasons; most importantly is its place as the boundary at which eastward Lapita expansion came to an end. The Lapita period of Tongan prehistory ended with the cessation of decorated pottery manufacture approximately 2650 BP.

The Plainware Period (2650–1550 BP) in Tongan prehistory is demarcated in archaeological terms by a sharp change in the types of pottery being manufactured and used. These plain ceramics reflect a complete termination of decorative application and an extreme reduction in the variety of vessel types (Burley 1998). As time progressed, adze forms also began to change (Kirch 1984). Plainware sites are much larger than Lapita settlements and can be found on almost every makatea type island in the archipelago (Burley 1998, Kirch 1984). These rapidly expanding populations likely spurred intensification of agriculture (Burley 1994).

The Plainware phase of Polynesian prehistory in Tonga, ended abruptly circa 1550 BP and is followed by the Formative or A-ceramic period (1550–750 BP). As Burley (1998: 359) described this as defined by another dramatic and hard to explain transition in ceramics – the abandonment of pottery technology altogether. The era which is delineated by this change is also known as the Tongan ‘Dark Age’ (Davidson 1979). Due to this complete lack of ceramic manufacture in this period documentation of archaeological sites and their chronology becomes increasingly difficult. The features associated with A-ceramic deposits consist mainly of earth ovens or umu which may become more important due to the absence of ceramics for cooking (Bellwood 1987). These features are problematic for interpretations of lower stratum and cultural occupations as they intrude upon previous occupation layers and intermix assemblages.

THE SITES

Archaeological excavations and survey suggest that only one small village-based Lapita site was established on each of the Ha’apai islands (Burley 1994). Stratigraphic and Radiocarbon evidence both indicate a long history which spans from early Lapita through Plainware and A-ceramic occupations, and contemporary villages can still be found on these primary settlement sites (Burley 1994, Burley et al. 1995, Burley et al. 1999, Shutler et al. 1994). The Ha’apai assemblages studied here came from the sites of Pukotala on Hā’ano Island (Ha1), Tongoleleka on Lifuka Island (Li7), Vaipuna on ‘Uiha Island (Ui4) and Mele Havea on Ha’afeva Island (HF1) (Figure 2).

The Pukotala site, Hā’ano Island, is located to the northeast corner of the modern village, two metres above current sea level and 300 metres in from the coast line (Dickinson and Burley 1994). It is believed that the site was on the shoreline at the time of initial occupation and a decrease in mean sea level of 1.6 to 2 m explains its inland location today. Between the 1995 and 1997 excavations 36 human skeletal elements were identified from excavated material. The site of Tongoleleka is located on an aeolian ridge in the modern village along the southwestern edge of Lifuka Island and was notable for the abundant fauna recovered from the deposits (Burley 1996). Human remains representing one adult and one child were found in association with Plainware pottery in Level IIb and were reburied without study. The archaeological site of Vaipuna on the island of ‘Uiha was found to the back of the village in the bush (Burley 1996a). Like the site at Pukotala, the Lapita component on ‘Uiha Island was found to be 400 m inland from the modern shoreline (Burley 1996a). This indicated a drop in mean sea level since settlement. Only four human skeletal elements have been identified from the 13.5 m² excavations at Vaipuna and two of those were recovered from features. The site of Mele Havea is located in Ha’afeva village on the island of Ha’afeva. It is thought that due to its small size the island of Ha’afeva was the last of the Ha’apai islands to be settled (Burley 1998). It was initially discovered during surveys on the island in 1996, 145 m from the modern shoreline. The stratigraphy of the Mele Havea site is very well defined with clear breaks between cultural stratum. The excavations at Mele Havea resulted in the recovery of 74 fragments of human bone which could be positively identified.
Recent Advances in the Archaeology of the Fiji/West-Polynesia Region

Evaluating the Tongan Assemblages

Each of the four Tongan assemblages were examined to determine if the fragmentary nature of the human bones was due to natural or cultural processes. While all assemblages of human remains were found in midden contexts which included faunal remains, the animal bones were not available for concurrent study and no comparison of density, taphonomy or similar butchery/cutmarks can be included. Most of the human assemblages did not include articular ends of longbones which could be examined for butchery marks. As most elements were broken the first task was the examination of the taphonomic history for each assemblage to evaluate evidence for how the bones became fragmentary in the first place.

Fracture Pattern Analysis

Analysis of the fracture patterns was essential to evaluate both natural and cultural processes which may have resulted in the fragmentary assemblages of human remains collected from Tonga. An analysis of both ancient
and fresh breaks was undertaken to form a comparative study of breaks from known agents, such as post excavation breakage or damage, to those of unknown cultural or natural agents. The first step was the gross identification of anatomical elements. Elements were also categorized as either fragmentary (less than 90% of the element intact), good (90 to 99% of the element intact), or excellent (the element was whole and undamaged or nearly so). This system was arbitrarily chosen to categorize the assemblages and resembles the strategy employed by Turner and Turner (1999). Most elements from the assemblages were categorized as fragmentary. The sites of Tongoleleka had more elements categorized as excellent than other sites (Table 1), mainly due to the size of the Tongoleleka assemblage but perhaps owing to the presence of other undisturbed interments at the site. During this stage of analysis fracture types were also recorded using Marshall’s (1989: 14) criteria (Table 2). Unless there was sufficient evidence to suggest that bone breakage was through human agency, the natural explanation for the breaks was applied. Many elements included more than one fracture type and each was recorded and categorized as aged or fresh based on the colour of the bone exposed on the broken surface. Many elements were examined microscopically. Long bones and fragments of long bones were carefully inspected for marks diagnostic of human modification and while some samples were very rich in skeletal elements (e.g. Tongoleleka 1995 at 321 identified and catalogued fragments), others were quite poor (e.g. Vaipuna 1997 at seven elements).

Once all data on fracture types were recorded some patterning emerged. Vaipuna and Pukotala did not have sufficient numbers of elements to provide suitable sample sizes for analysis and were not included leaving only the Tongoleleka and Mele Havea sites for study. In Tongoleleka stratum one deposits were found to have mainly longitudinal (28%), and spiral fractures (25%), stratum two had relatively high frequencies of longitudinal (20.8%), flake (19%), and spiral fractures (16.6%) and finally stratum three was observed to have significant numbers of flake (19%) and longitudinal fractures (16.6%). The Mele Havea sample was similar with stratum two deposits for Tongoleleka, dominated by spiral (31.9%) and flake fractures (16.6%). Stratum three elements were also observed to have high incidences of spiral fractures (43.8%).

Table 1. Degree of fragmentation from observed in the Tongan assemblages. Fragmentary (less than 90% of the element intact), good (90 to 99% of the element intact), or excellent (the element was whole and undamaged or nearly so) adopted from Turner and Turner (1999)

<table>
<thead>
<tr>
<th></th>
<th>Mele Havea (HF1)</th>
<th>Pukotala (Ha1)</th>
<th>Tongoleleka (Li7)</th>
<th>Vaipuna (Ui4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>I</td>
</tr>
<tr>
<td>Fragmentary</td>
<td>5</td>
<td>55</td>
<td>17</td>
<td>2</td>
</tr>
<tr>
<td>Fragmentary/Delicate</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Good</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Excellent</td>
<td>1</td>
<td>8</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Burned</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 2. Ancient fracture types observed in the assemblages defined using Marshall’s (1989:14) criteria. An inventory of modern breaks from the largest assemblage Tongoleleka was also taken for comparative purposes.

<table>
<thead>
<tr>
<th></th>
<th>Pukotala (Ha1)</th>
<th>Mele Havea (HF1)</th>
<th>Tongoleleka (Li7) 1995</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
<td>IIb</td>
</tr>
<tr>
<td>Flake</td>
<td>2</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Spiral</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sawtoothed</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>V-Shaped</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Perpendicular Irregular</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Perpendicular Smooth</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Longitudinal</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Articular</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Numerous</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Stepped</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Depressed</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>None</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
Features which were identified separately from the main stratum were found to have more v-shaped fractures. This is clearly different from deposits which did not have intrusive features. It is possible that the act of digging umu, which accounts for most features noted by the excavators, caused this damage as elements were struck by instruments used for digging or compacted by stones used in earth ovens. However, the incidental burning and fragmentation of remains as a result of intrusive umu should not necessarily be attributed to the actions of cannibals. Using established criteria for the relative concentration of burned human bone within an assemblage (DeGusta 2000, Pietrusewsky et al. 2007) and the careful consideration of site stratigraphy and unintentional cultural modification of the site an appropriate determination of the intentionality of evidence for burning on human bone can be hypothesized.

Many authors associate longitudinal fractures with weathering in archaeological samples (Chamberlain 1994, Haynes 1981, Marshall 1989). However, Shipman (1981) found that longitudinal fractures are often caused by trampling of dried bones. Spiral fractures are also associated with trampling (Fiorillo 1989; Marshall 1989), as is splintering (Marshall 1989), striations (Fiorillo 1989) and pitting (Marshall 1989) on the bone. Bones which had been weathered significantly did not have these striations and pits even after trampling (Fiorillo 1989). Flake fractures are related to a myriad of taphonomic processes from trampling and water transport to diagenesis (Irving et al. 1989). While the data on trampling is derived primarily from studies of African assemblages where large herding vertebrates often disturb sites, the long term occupation of the Ha'apai island sites studied might also result in trampling and soil compaction through both heavy human traffic and digenetic movements (Irving et al. 1989, Marshall et al. 1989). The comparison with modern breaks in the 1995 Tongoleleka assemblage indicates that breaks related to excavation and transportation are mainly flakes (26.7%), with equal frequencies of spiral and longitudinal fractures (18.6% each) (Table 2), the very types which suggest trampling as the agent of fragmentation. It is interesting that modern breaks echo ancient fracture patterns as the acts of heavy site pedestrian traffic and digging is indicated for both.

Alternative explanations of processes which may have lead to the fragmentation of these remains include rummaging in middens by medium sized domesticates, such as pigs and dogs and disturbance of burials by humans for the removal of bones. The digging through midden materials by animals may indeed serve to fragment some assemblages (Spenneman 1990) but no evidence for gnawing by pigs, dogs or rats was observed on the bones from the Ha'apai assemblages and so is discounted in this case. Studies of remains in the Arctic suggest that fragmentation of human remains may be related to disturbance of primary burials while the bones still contain significant levels of collagen. It has been proposed this may result in fractures which emulate those of cannibalised assemblages (Knüsel and Outram 2006:265). It is argued that the retrieval of bones from skeletonised bodies for ceremonial reasons, or tool use may create scattered fragmentary assemblages. This type of disturbance has been described not in terms of taphonomy but as a secondary mortuary practice (Simon 1992, Simon and Steffian 1994). While in some cases this may be true, in neither Guam (McNeill 2002, 2005) nor Vanuatu (Bedford et al. 2006, Buckley et al. 2005) did the removal of skeletal elements from primary interments result in the fragmentation and scattering of human remains.

It was noted by Mariner (Martin 1991:395) that most Tongans were familiar with the positions and articulations of major bones and it seems unlikely that people who did understand the configuration of the skeleton would disturb the burials any more than was necessary. Much more work is required to determine if fragmentary, scattered human remains in Pacific archaeological sites may be the result of disturbance of primary interments for the removal of specific elements.

Tongan Mortuary Practises

Studies of fragmentary human remains should include an evaluation of common burial rites to interpret the taphonomy, assemblage and norms associated with them to differentiate a case for cannibalism from primary or secondary mortuary practise (DeGusta 2000, Steadman et al. 2000, Stodder 2005). Prehistoric burials from Lapita and Plainware occupation periods are not commonly encountered in the Pacific and only a handful of intensive osteological studies exist for prehistoric Tonga (Davidson 1969, Pietrusewsky 1969, Spenneman 1987c). As a result an understanding of historically documented burial practices is important to interpretations of the assemblages.

In Tongan society several social classes are recognized; Ti'i (Kings/ Paramount Chiefs), Hou'ëiti (High Chiefs), Eike (Chiefs), Matapule (the attendants of Chiefs), and Tua (commoners) (Gifford 1929, Kirch 1980). The rank one had in life affected not only how they were buried and mourned, but also their place within the afterlife. There is some debate as to the method of interment for the tua or commoner class after death. Cook was informed that there was no particular place or spot for the burial of the lower classes (Frazer 1968), yet their burial mounds were classified by McKern (1929:31) as being small, like European graves. Burials of the common class have also been described as sand mounds (Burley 1995), and have been found in familial plots or under the floors of family houses (Gifford 1929) and in midden deposits (Burley 1995). Midden burials may be part of Lapita mortuary custom as burials both from Waya Island and Lakeba, Fiji, human remains were recovered near or from within midden deposits (Pietrusewsky 2007:55).

As populations increased on an island, settlements expanded and the presence of discrete burials in archaeologically defined middens does not necessarily indicate
purposeful interment in trash heaps. The Ha’apai island sites are in the same location as the original Lapita settlement and as they expanded their settlements the placement of houses and other areas on top of previous middens was probable. Whether midden internments were purposeful or not, later disturbance of these creates scattered and fragmentary human remains. These may be interpreted as evidence for cannibalism when more careful examination points to site disturbance through natural and cultural processes.

Modification to the Bones

All fragments from the four Ha’apai assemblages were examined for signs of modification by humans including burning, crushing, cutmarks, bitemarks and percussion pits. Debates surround the interpretation of some modifications particularly burning of elements, which may occur through later intrusive earth oven features (Spennemann 2003). Other potential means of alteration and behaviours which could possibly mimic cannibalism in the Tongan archaeological record include surgery, amputation, autopsies and injuries incurred during warfare.

Tongan medicine employed one of three methods for the treatment of illness; invocation, sacrifice and external operations (Martin 1991: 453). All members of society were familiar with the positions and articulations of major bones and laypeople were known to perform autopsies on the dead to ascertain the level of piousness of their kinsmen. Tongan surgeons were trained exclusively in Fiji, achieved a chiefly rank (Martin 1991) and would hone their skills and understanding of human anatomy by dissecting unclaimed dead from battles (Ferdon 1987). Tools used for these operations included shell and bamboo knives, the latter being sharper and more precise and reserved for delicate incisions (Ferdon 1987: 145). In the Tongan case it would be very difficult to differentiate defleshing for the purpose of scientific or religious curiosity from that for dietary or ritualistic purposes.

According to the ethnographic record of Tonga major amputation of limbs was rare but the amputation of fingers was common. The amputation of a portion or more of the little finger was a customary means of appealing to the Gods to cure an ailing relative of superior rank (Ferdon 1987). During Mariner’s time on the islands he observed that most adults had lost both little fingers through this practice (Martin 1991: 249). After amputation fingers could be buried or, in a reported instance where the digit was retained by the owner, kept in the roof of their house (Ferdon 1987: 149). The fate of the appendages post-amputation may have interesting archaeological consequences in terms of whole assemblages. Amputations should be osteologically unambiguous as those which did not result in death will appear to have healed over, leaving a bone which is smaller and less dense than the bone on the other, intact side (Shipman et al. 1985).

The weapons employed for warfare may also be important in interpreting unusual marks observed on human bone. Definitive evidence for death as a direct result of warfare is rare in Oceania, with few assemblages for which weapons are reported in situ with burials (Buckley 2000, McNeill 2002). The type of weapon and material used may leave scratches or cuts on bone which may mimic those left though cannibalistic activities; particularly when shell and bamboo were used for surgical tools, weapons and means of dismemberment. The Tongan weapons of war included the club, bows and arrows, and sometimes knives. Arrows were manufactured from cane and sported barbed points made of wood or bone and Tongan surgeons were well acquainted with techniques for their extraction (Martin 1991: 390–392). Linton (1926:128) reported that Samoans and possibly Tongans took the heads of their enemies but did not present any archaeological evidence to support this. Unclaimed dead were dealt with in a variety of ways, this included exploratory surgery and in some cases cannibalism (Ferdon 1987).

Overrepresentation of Old and Young Individuals

The presence of an unusually high number of juvenile or elderly individuals may be interpreted as evidence for cannibalism at a site (Kantnar 1999, Steadman et al. 2000). The Tongoleleka assemblage included identifiable juvenile and perhaps elderly individuals. Twenty-two elements were found which had either unfused or incompletely fused epiphyses. All were from the 1995 Tongoleleka sample. Subadult elements (defined using Schwartz 1995) were found in all three stratum at the following frequencies; Stratum I two elements (6.9%), Stratum II 14 elements (8.8%) and Stratum III six elements (15.4%). Of all the elements recovered, twelve (54.5%) were from phalanges. This may be due to the overall preservation potential (Shipman 1981) of phalanges, but their dominance in this category may also indicate finger sacrifice from children.

Evidence for elderly individuals was even less abundant with only two elements from Stratum II which exhibited bony changes indicative of arthritis. The first was a middle phalanx which had spurs of additional bone on the molar surface of the shaft, one of which is directly associated with the distal articular surface. This sort of change is indicative of arthritic remodelling (Steinbock 1976). A distal phalanx of the great toe was observed to be oddly twisted with additional bone remodelling. While this may be an instance of traumatic arthritis, it is more likely indicative of rheumatoid arthritis (Roberts and Manchester 1995). As neither young nor old individuals appear to dominate site contexts and all were found in a place where primary internments were found, their existence does not support a case for cannibalism at Tongoleleka.

Overrepresentation of Particular Skeletal Elements

The presence or absence of particular skeletal elements has been regarded as an indicator for cannibalism. DeGusta
(2000) examined the number of discrete elements from his Vunda middens and compared these with the Navutu midden material which he believed to constitute strong evidence for cannibalistic activity (DeGusta 1999). He found that the burial middens contained more specimens from the axial skeleton than from the appendicular, while the cannibal refuse showed the inverse. Steadman et al. (2000) found in their assemblage, from Ana Manuku, that all bones were present but hand and foot phalanges were slightly overrepresented with cranial bones being underrepresented.

All identifiable elements from the Ha'apai assemblages are listed as nISP (number of identified specimens) values for each stratum in Table 3. These have been divided into axial and appendicular for comparison with DeGusta (1999, 2000) with a general listing of the type and quantity of specific skeletal elements encountered (Storey 2001). No patellae or complete cranial elements were identified from any of the collections. Most striking in all assemblages, perhaps with the exception of Stratum II at Tongoleleka, is the absence of the long bones of the arms and legs and the innominate bones. The underrepresentation of longbones and intact crania may be taphonomic, or result from the usefulness of these elements for tool manufacture (Clunie 1987, Spenneman 1986, 1987b). The rarity of fragments of innominate bones cannot be explained at this time. Only the Tongoleleka site can be positively identified as a place of prehistoric burial due to the presence of two fully articulated individuals at the site.

**TOOLS OF HUMAN BONE**

For which human bone is the material of manufacture have been found in New Zealand (Barber 1992), the Solomon Islands (Buckley 2000), the Mariana Islands (McNeill 2005) and Easter Island (McLaughlin 2005) Fiji (Best 1984, Clunie 1986, Clunie 1987, Spennemann 1986, Spennemann 1987b) and Tonga (Spennemann 1987b). Barber's (1992: 270) investigations into Māori cannibalism documented the use of human remains (principally teeth) as neck and ear ornaments. These included the remains of enemies, but also those of friends worn in memorial, a use one might appropriately designate as friendly manufacture. Objects used for important ceremonial functions, such as forks for the feeding of those under sacred restrictions (tapu) or bowls used for the preparation of medicines indicate a preference for kin over enemies (Barber 1992: 271). Human bone thatching and sailing needles are best known from the Lau group where they were said to be missing from burials in the Marianas. These bones were found to constitute strong evidence-based utilitarian functions, rather their function lies within the ritual or judicial realm (McNeill 2002: 179).

Arm and leg bones, and occasionally crania are reported as missing from burials in the Marianas. These bones were specifically targeted with all the bones of the hands, feet, pelvis and even the patellae left in context and articulation with the rest of the skeleton (McNeill 2002, 2005). Within the burial environment it would take only 40–50 months for sufficient degradation to remove ligaments holding joints together, allowing for particular elements to be easily extracted from primary internments (Spennemann 2003).

In the case of sailing and thatching needles, found in Fiji and Tonga, the only vertebrates in the tropical Pacific which would provide sufficiently sized bones for their manufacture were whales and humans (Spennemann 1986). In Fiji, at least, cannibal victims are thought to be the source of this material and the word saulaca is used for both the tibia and sailing needle (Spennemann 1986: 93). No tools from the main islands of Fiji have been recovered from archaeological contexts and so their prehistoric/historic associations are unknown. This may suggest that a lack of specific elements such as long bones or crania may be indicative of tool manufacture as opposed to cannibalism, particularly in Tonga where no examples of trophies, like those in Fiji, featuring longbones have been found (Spennemann 1987a). Spennemann (1987b: 48) believed that human bone sailing/thatching needles documented from Fiji were of a 'Tongan-type' as Fijian sailing needles were best known from the Lau group where they were said to have been made by Tongans.

Tools of human bone have been identified from two Lapita aged Tongan contexts, one from the Ha'ateiho site on Tongatapu and the other from Tongoleleka, Ha'apai Islands. The Ha'ateiho human radius sailing needle (Figure 3) is currently on display at the Tongan National Museum and has not been thoroughly analysed for this study. In the course of examining the 1995 Tongoleleka human bone assemblage, fragments of another tool were found which had an unusually high polish and cutmarks, likely from a bamboo tool. This shaft fragment which was tentatively identified as a fibula was associated with Stratum III or Lapita age remains. The surface was very smooth and had a patina which was likely created through use (Figure 4). It also had several wedge shaped, short and shallow cut marks which were not observed on any other element (Figure 5). One edge of the element had a very smooth break which did not conform to any taphonomic breaks observed in other samples. Unfortunately, the artefact was broken in several places, many fragments of which could not be found. It is possible that the tool was broken
Table 3. All identifiable elements listed as NISP (number of identified specimens) values for each site and stratum.

<table>
<thead>
<tr>
<th>MELE HAVEA (HFI)</th>
<th>No Stratum</th>
<th>Stratum I</th>
<th>Stratum II</th>
<th>Stratum II</th>
<th>Startum III</th>
<th>Total</th>
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<tr>
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<td>4</td>
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<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
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<td>4</td>
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<td></td>
<td></td>
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<td>3</td>
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<tr>
<td>Leg Bones</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
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<tr>
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<tr>
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<td>2</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Ass. Phalanges</td>
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<td></td>
<td>2</td>
<td></td>
<td></td>
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<tr>
<td>Innominates</td>
<td></td>
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</tbody>
</table>

| PUKOTALA (Ha1)   |            |           |            |            |             | 15    |
| Axial Fragments  |            |           |            |            |             |       |
| Cranial          | 3          | 2         | 0          | 3          |             |       |
| Ribs             | 1          | 1         | 1          | 3          |             |       |
| Vertebra         | 1          |           |            |            |             |       |
| Appendicular Fragments |       | 21        |            |            |             |       |
| Scapula/Clavical|            | 1         |            |            |             |       |
| Arm bones        |            |           |            |            |             |       |
| Carpals/Metacarpals |        | 1         | 1          |            |             |       |
| Hand Phalanges   | 2          | 1         | 4          |            |             |       |
| Leg Bones        |            |           |            |            |             |       |
| Tarsals/Metatarsals |        | 1         | 1          | 2          |             |       |
| Foot Phalanges   | 1          |           |            |            |             |       |
| Long Bones       | 1          | 1         | 1          | 1          |             |       |
| Ass. Phalanges   | 1          |           |            |            |             |       |
| Innominates      |            |           |            |            |             |       |

| TONGOLELEKA (Li7) 1995 & 1997 Excavations |            |           |            |            |             | 114   |
| Axial Fragments  |            |           |            |            |             |       |
| Cranial          | 2          | 8         | 1          | 2          |             |       |
| Ribs             | 1          | 8         | 36         | 4          | 5           |       |
| Vertebra         | 3          | 5         | 30         | 1          | 8           |       |
| Appendicular Fragments |       | 151       |            |            |             |       |
| Scapula/Clavical|            | 1         | 1          | 3          | 1           |       |
| Arm bones        |            | 1         | 8          | 2          |             |       |
| Carpals/Metacarpals |        | 1         | 1          | 20         | 1           | 3     |
| Hand Phalanges   | 1          | 20        | 1          | 5          |             |       |
| Leg Bones        |            | 3         | 1          |            |             |       |
| Tarsals/Metatarsals |        | 1         | 4          | 8          | 3           |       |
| Foot Phalanges   |            | 16        | 2          |            |             |       |
| Long Bones       | 5          | 14        | 1          | 2          |             |       |
| Ass. Phalanges   | 1          | 9         | 1          | 1          |             |       |
| Innominates      | 1          | 3         | 6          |            |             |       |

| VAIPUNA (Ui4)    |            |           |            |            |             | 2     |
| Axial Fragments  |            |           |            |            |             |       |
| Ribs             |            |           |            |            | 2          |       |
| Appendicular Fragments |       | 2         |            |            |             |       |
| Fibula           | 1          |           |            |            |             |       |
| Innominate       | 1          |           |            |            |             |       |
before its deposition in the Tongoleleka site. The element also showed some signs of burning but it could not be determined whether this was purposeful or the result of later disturbance. Cut-marks resulting from surgical procedures or dissection were ruled out by the presence of the heavy patina. Since the element was incomplete it is not possible to determine whether this is a thatching needle similar to those described by Spennemann (1987b) or Best (1984) or some other type of tool. However, the deliberate modification is evident and the patina suggests prolonged use of the item.

**DISCUSSION**

It has been shown that in Tonga, there are several cultural processes which could result in the modification of human bone which are not products of cannibalistic activity. These possible modifications, such as surgery, injury in warfare or the manufacture of tools from human bone, combined with dynamic/continuous site use may create assemblages of fragmentary, burned bone. Barber (1992: 276) found that in many cases ‘the presence of broken or fragmentary human bone in occupation contexts was assumed to be proof sufficient for a claim of cannibalism, especially where a spatial association with ovens could be demon-

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**Figure 3.** Human Radius Sailing Needle from the Lapita deposits at Ha‘ateiho. Currently held at the Tongan National Museum.

**Figure 4.** Patina observed on human fibula from Tongoleleka, magnified to show edge (scale = 5 mm).

**Figure 5.** Cut mark on the human fibula from the Lapita stratum in Tongoleleka (scale = 5 mm).
strated.’ This paper has presented the analysis of assemblages of human remains in the Ha’apai Islands of Tonga and shown that cannibalism is an unlikely explanation for the creation of these assemblages. The presence of human remains in a midden context is no longer proof positive for cannibalism as instances of primary burials within middens have been reported here and elsewhere (Burley 1995, DeGusta 2000, Trotter 1974). The taphonomic analysis and examination of elements present in each sample was imperative to the understanding of prehistoric site formation and use. At the Tongoleleka site taphonomy of all three stratum suggested that trampling, by both humans and animals, was the main modifier of human bone. However, it was noted that damage in Stratum III might also be consistent with the digging of intrusive pits. As two intact burials were found in the overlying Plainware stratum of the site and earth oven pits were also evident this accounts for at least some of the fragmentation. These observations are consistent with the observations of Davidson (1969) at ‘Atele; that mortuary areas are heavily used and while burial pits are not deep, they do intrude upon lower deposits. More research is needed to understand the archaeological signature of the disturbance of primary internments for the retrieval of bone for raw materials. Some studies suggest this might serve to create fragmentary assemblages (Knüsel and Outram 2006) but in Pacific archaeological contexts burials are generally undisturbed save the removed elements (McNeill 2002, 2005).

Only one site provided evidence for juvenile or elderly individuals and as these were also in association with formal burials their presence cannot be inferred to be evidence for anthropophagy. The juvenile elements found did not correlate significantly with stratigraphy. The majority of these elements were phalanges or loose phalangeal epiphyses. If these are not simply disturbed burials they may represent finger amputation as a sacrificial offering. The density of skeletal elements does not suggest an over representation of elements and is like that presented by DeGusta (2000) for Vunda, where taphonomy, not cannibalism, created the fragmentary skeletal assemblage. Missing elements are more likely to have been removed for tool manufacture than to be the result of cannibalistic activity.

The human modified fibula was recovered from the only Ha’ateiho site on Tongatapu and Best’s (1984) highly polished human femur tool also was recovered from a Lapita aged context suggesting tools of human long bone may be a part of the Lapita cultural complex. If this is so then other Lapita sites should provide evidence for human modified bone or the removal of long bones from primary internments.

In the late Lapita site of Dori, New Ireland, Golson (1991:246) reported the occurrence of a burial which was complete except for some fragmented long bones which were recovered from the upper layers. These were later analysed by Spenneman and found to be burned and as well as broken. It was concluded that these elements were either deliberately smashed as part of a cremation rite or disturbed by later intrusive features. Various bone elements are also missing from the burials at Kainapirina, Watom but it is suggested this is taphonomic as opposed to purposeful (Green and Anson 2000). When considered with evidence for missing elements, particularly forearms, from the largest known Lapita burial site Teouma, in Vanuatu, (Bedford et al. 2006, Buckley et al. 2005), a possible relationship may be hypothesized between missing elements and tool production in the Lapita era. Further studies of scattered human remains from across the Pacific, particularly from Lapita contexts is warranted to see if this is more than a mere coincidence. Parallel studies of tools of human bone from Chamorro contexts suggest that these tools may go far beyond the utilitarian and may be seen to contain the power of the ancestors (McNeill 2005). If this is also true of Lapita tools of human bone it is important that we understand their true distribution and function in prehistoric societies.

Although cannibalism was not found to have been an agent of modification in any of the Tongan samples discussed here, this does not negate its existence in Tongan history. Indeed cannibalism is reported in the contact era literature (Martin 1991, 88–89) but it appears to have been an exceptional practice, only undertaken in times of extreme food stress. The notion of food-stress as the motivating factor for periodic prehistoric cannibalism is suggested not only for Tonga (Gifford 1929) but also for Easter Island (McLaughlin 2005), Henderson Island (Weisler 1994), and Mangareva (Goldman 1970).

In future all claims of cannibalism should be evaluated using the criteria now established, and all the other possible ways in which human bone may be intentionally modified. The detailed study of assemblages of human remains scattered in middens will be important to understanding the true prehistoric distribution of cannibalism, its timing and ecological setting. Perhaps more importantly it may reveal further information about tools made of human bone and their role as objects impregnated with the spirit of the ancestors particularly in the early periods of Pacific exploration and settlement.
ACKNOWLEDGEMENTS

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REFERENCES


Recent Advances in the Archaeology of the Fiji/West-Polynesia Region


Tongan influence in historic Sāmoa has been well documented (Gunson 1993; Barnes and Hunt 2005). However, not all Tongan influence need have been brought to Sāmoa by Tongans. We argue that Samoans were quite capable of importing desirable ideas and technology from Tonga for themselves. Recently, we have attempted to illustrate this using the example of the Samoan fale āfolau, which appears to have been imported from Tonga, by Samoans, and then modified to fulfill the purpose of a Christian chapel (Barnes and Green 2008). The case of a unique fort at Uliamoa in Sāmoa, provides another possible example of indigenous Samoan agency in technology importation from Tonga. In addition, we attempt here to identify and name the specific Samoan individual responsible for this importation. However, caution must be stated as this speculative paper is only intended to put forth a hypothesis and, hopefully, spark interest in its testing. Firmer dating of the fort’s construction and a sequence indicating the frequency of its use, along with the analysis of the area’s oral traditions, are necessary before any reliable conclusions can be reached.

The Samoan ‘olo

Samoan fortifications have been generally characterized as large defensive structures used as temporary refuges during times of war. These ‘olo or forts were usually located inland from coastal settlements, often found on ridgetops (Green 2002), and often featured a ditch and bank formation spanning across a ridge from gully to gully (Davidson 1974: 240). Williams (Moyle 1984: 244) confirmed this general description in 1832:

...each party generally provides itself with a strong ola [‘olo] or fort. This is composed of cocoa nutt [sic] trees placed about six feet deep in the ground and standing 18–20 feet high. They generally select a high mountain as the place to erect their fort. To this they remove their property, wives, and children erecting temporary huts of cocoa nutt leaves inside.

Williams later talks of the army of the A’ana district which ‘had taken to their fortress on the mountain and Mālietoa’s army was encamped beneath forming a kind of blockade’ (Moyle 1984: 126). This was the A’ana fort of Mafafa1 (figure 1), at the western end of the island of ‘Upolu, also described by Wilkes (1970 vol 2: 151) in 1841, nine years after it had been sacked. Mafafa serves as a good example of a typical Samoan ridge fort not yet adapted for gun warfare (Best 1993). This is consistent with the evidence given by Williams in 1830 and 1832 that guns were rare in Sāmoa (although keenly sought) and that the indigenous warfare that involved forts like Mafafa was not yet gun-based (Moyle 1984: 242).

1 The LMS native missionary party, after visiting Satupa‘itea in 1831 and now on their way back to Sapapāli‘i, upon reaching the east coast of Savai‘i, witnessed across the narrow sea channel between the islands unmistakable evidence that signaled the destruction of a fort on Upolu. In his journal Williams recorded their observations (Moyle 1984:128):

On our return home turning a point of land we were startled at beholding at Ana [A‘ana] the seat of war the mountain in a blaze & concluded that Malietoa & Manono had succeeded in taking the fortress of the poor Ana people which proved to be the case.

The ‘point of land’ that Williams refers to is the Tafua peninsula that lies on the overland route from Satupa‘itea to Sapapāli‘i. Once this peninsula is crossed at Salelologa, Upolu and specifically the area where Mafafa fort is located, becomes visible. It is fairly clear that the ‘mountain in a blaze’ witnessed by the native teachers from Savai‘i was Mafafa fort burning after it was sacked by the forces of Mālietoa.
The Tongan kolo

The most common prehistoric fortification (kolo) in Tonga was a ring-ditch formation (figure 2). This was achieved by digging a continuous enclosing ditch with the resulting earth piled around the inside to form an encircling mound with palisades on top (Burley 1998). Mariner (Ferdon 1987:274–5) described the fort at Nukualofa as having a typical ring-ditch formation with raised platforms, camouflaged pitfalls, and a reed fence, which surrounded...
the palisades and gave protection against spear and club attack. The fort at Nukualofa was considered the strongest fort on Tongatapu at the time and serves as a good model of pre-artillery fort design in Tonga. When this fort was attacked by Finau in 1806, the shot of Mariner’s canons easily penetrated the fencing, careened inside the fort, and caused havoc for the defenders (Martin 1981: 81–84). This strongest fort in Nukualofa fell handily to Finau in the first use of organized artillery in Tongan warfare.

ULIAMOA: A TONGAN FORT IN SÄMOA

Fortification design in West Polynesia has been suggested as a diffusionary process originating in Fiji and spreading to Tonga and finally Sāmoa (McKern 1929: 82) or as independent, or Fijian influenced, innovations in each region (Best 1993; Green 2002). We will concentrate on a more recent diffusion of gun-adapted fortification design from Tonga to Sāmoa. We believe we can show at least one example of a fortification design introduced to Sāmoa from Tongan in the historic period and possibly even the individual most responsible for its introduction.

Firearm use became widespread in Tongan warfare towards the end of a long period of civil war, 1780–1845 (Campbell 1992). Adaptations to artillery had to be made in traditional fort design after the fort at Nukualofa fell in 1806. Later Tongan forts were specifically designed for gun warfare (Ferdon 1987: 276). Gun-adapted forts in Tongatapu still featured a wooden post outer wall, as other material suitable for fort building was scarce. However, Wilkes (1985: 14), writing in 1840, described a new ‘loophole’ adaptation in Tongan fort design:

They [forts] are...formed by thick cocoa-nut [sic] posts, set firmly and closely in the ground...they likewise have a number of hollow logs buried in the wall, and set obliquely, serving as loop-holes, through which they may have a cross-fire at their enemies as they approach. The loop-holes can only be used for muskets, and have been introduced since the natives began to use firearms, or since the time of Mariner, as he makes no mention of them.

These loopholes are quite similar to the holes built into the stone walls at Uliamoa (see below) and probably served the same purpose in gun warfare. Interestingly, Parry (1977: 30) quotes William Lockerby, a sandalwood trader in Fiji in 1808, as mentioning similar holes in the walls of a Fijian fort for shooting arrows.

Introduction of firearms came comparatively late to Sāmoa. Wars in the time of the missionary John Williams’ arrival in 1830, 24 years after the introduction of firearms to Tongan warfare, were still generally fought with club and spear, guns being very rare (Moyle 1984: 242). Platt (1835–36) noted that Samoans were still building forts in 1836 designed to repulse spears and not guns. These were the typical ridge top forts like Mafala (figure 1), along with 28 others listed and described by Davidson (1974: 240–41) for Savai’i and ‘Upolu, a record that was further amplified to upwards of 45 indigenous forts in total by Green (2002: 315–316) for the entire Samoan Island group.

In contrast, by 1849, it appears that gun-adapted fort construction had become widespread. Erksine (1967: 75) in describing the newly constructed fort at Mulini’u, complete with loopholes, wrote in 1849:

...we strolled to the palisade which had been run across the neck of land a few hundred yards from the point, and formed the land defense of the fort. It resembles somewhat the New Zealand pah, being upright posts of cocoa-nut wood, with an external ditch, but of little strength. The entrance was tolerably well constructed, as a kind of circular bastion or redan, with flank defences and a few loopholes for musketry made of hollow wooden pipes, which they say are copied from the Tongans.

This time lag in the implementation of gun warfare in Sāmoa allowed a Tongan influence, which had evolved with artillery for more than two decades before Sāmoa, to established a presence in Samoan fort design.

Possible earlier Tongan influenced fortification sites have been recorded on ‘Uplou in Sāmoa west of Luatuanu’u (Davidson 1969b: 204) and a typical Tongan ring-ditch fort at Paia on the north coast of Savai’i (Buist 1969: 59). However, we will concentrate on a striking example of both Tongan introduction and Samoan innovation, the fort at Uliamoa. In assembling the known corpus of Samoan forts, Green (2002) identified just these three as probable examples of Tongan influence that stood in contrast to the usual pattern of Samoan fort design before the gun-based wars of the 1840s and after.

Uliamoa is a site located inland of Satupa’itea on the south side of Savai’i (figure 3). It is known to have been inhabited in early historic times but later abandoned (Watters 1958: 4). The old village is located on high land on the west bank of a spur of the Ta'efaga stream. The large fortified enclosure at Uliamoa is unique in Sāmoa for many reasons including its location very near the village as opposed to a ridgetop refuge, its stone construction, and its ring ditch design. The fort is comprised of a 2–3 meter stacked stone wall forming a closed circuit but interrupted by a series of rounded, fortified entrances, or ‘pinwheels’. The fort is ringed by a ditch, the excavated earth forming an embankment for the outer wall (figure 4). Along the encircling stacked stone wall, many small openings are built in, reminiscent of the previously described ‘loopholes’, which allow for small arms fire (figure 5). Davidson (1969a), in appraising its design, pointed to the Tongan connection of its gun ports, citing McKern (1923). The eleven ‘pinwheel’ structures built into the encircling wall are a unique innovation in West Polynesian fortification. It would appear that in Uliamoa we have a fort whose basic design (in
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ringditch structure, gun modification, and proximity to the village) came from Tonga but was adapted by Samoans in the form of unique pinwheel structures and its stone construction (stone being readily available in Samoa but not Tongatapu). In the case of Uliamoa, we may even be able to identify the individual responsible for its introduction and innovation.

LILOMAIAVA, TUINAULA AND SAIVA’AIA: MANY NAMES, ONE REMARKABLE LIFE

We would now like to engage in a bit of historical detective work and attempt to identify a specific individual that served as an agent of knowledge transfer from Tonga to Sāmoa. The key figure in the introduction of Tongan gun fort design (and possibly fale āfolau chapel design as well; see Barnes and Green 2008) to Sāmoa appears to have been Lilomaiava, a Samoan chief from Savai’i. Lilomaiava is the paramount chiefly title of the Palauli district in Savai’i. This particular Lilomaiava appears to be known by at least two other names, Saiva’aia and Tuinaula.

Dyson (1875: 12) wrote of an early Samoan convert to Wesleyan, named ‘Saiva’aia’. He describes Saiva’aia as a chief from Savai’i who visited Tonga in 1828 and returned to spread the Wesleyan form of religious practices or Tongan lotu in the villages of Tafua and Salelologa on Savai’i prior to the introduction of the LMS Tahitian/Cook Island style of lotu in 1832. Dyson (1875: 12) was quite pleased with the potential of Saiva’aia’s missionary work in Sāmoa, commenting ‘The young vine cast her slim tendrils over Savai’i.’

Another early Samoan convert to Wesleyan recorded was Tuinaula (also called Teoneula by Williams). Tuinaula appears to have played a role in some of the most important events in Sāmoa during the 1820s and 1830s. We first learn of him as a chief from Satapuala in Upolu that accompanied the Samoan prophet/shaman Siouvili, or Joe Gimlet, on a voyage that introduced the most successful early native form of Christianity to Sāmoa. These two left Sāmoa in the mid-1820s on a voyage that took them first to Tonga in an indigenous canoe and then to the Societies in the vessel Snapper where they would have been exposed to the splinter Māmaia movement which attempted to combine Christianity with traditional Tahitian religion. After possible excursions further afield, Siouvili returned to Sāmoa to begin his own form of Christianity that gained adherents before Williams arrived (Freeman 1959). Tuinaula went first to Tonga, where he was related to the king of Tonga, and was converted to the Wesleyan faith (Gunson 1993, Dyson 1875: 13). We next hear of Tuinaula from Williams in 1830 where he had joined up with the many of the inhabitants of A’ana district and was holed up in the Mafa fort opposing Mālietoa Vainu’upo (no doubt due to his affiliation with both A’ana and the Wesleyan faith). Williams expressed concern for the safety of this early convert to Christianity as he had heard of Tuinaula’s journey to the Societies. Williams extracted a promise from Mālietoa not to harm him. Upon Williams’ return to Sāmoa in 1832, some of the native LMS missionary teachers whom he had brought to Sāmoa made a journey through the war devastated district of A’ana. Here they met Tuinaula, who had managed to unobtrusively leave the Mafa fort (see footnote 1). While recovering from wounds sustained in the fighting, Tuinaula, fearing Mālietoa’s retribution, next left for Tonga where he felt his safety could be guaranteed (Moyle 1984: 74,128). Dyson (1875: 13) has also recorded the arrival of Tuinaula, now called the ‘leading chief of Satupa’itea’ in Tonga in 1831 between his being in the Mafa fort in 1830 and again in 1832. At that time, he was there to request Wesleyan missionaries for Sāmoa,

Figure 3: Map of the Samoan archipelago showing the location of Uliamoa fort
although the Wesleyans could spare none. After his retreat to Tonga in 1832 to recover his health and, undoubtedly, to wait out the tense political situation there, Tuinaula eventually returned to Sāmoa to become the ‘head and soul of the lotu toga [Tongan or Wesleyan religion] in Satupaitea’ (Dyson 1875:14). The Wesleyan missionary Peter Turner claimed that Tuinaula converted as many as 65 Samoan villages between 1833–1835 (Tippett 1971:118–9).

Williams, upon his arrival in Satupa’itea in 1832, met the high chief Riromaiava [Lilomaiava], who had been converted to Christianity in Tonga and had already erected a small chapel in Satupa’itea (Moyle 1984:165). This appears to have been none other than Tuinaula. Williams had never actually met Tuinaula before. Williams would not have personally known him and therefore may not have recognized him by the name Tuinaula. Indeed, Tuinaula, Saiva’aia and Lilomaiava may all have been the same person. Kramer (vol 1 1994: 245) records that about this time in the 1820s and 1830s, the holder of the Lilomaiava title in Palauli was ‘Saipa’ia’. This may represent a transcriptional mistake on the part of either Dyson or Kramer in the correct spelling of Saiva’aia. The fact that Tuinaula is sometimes recorded as hailing from Satapuala (D. Freeman 1959, Dyson 1875:13) is not surprising, as there are deep connections of the Lilomaiava family in that village (Kramer vol. 1 1994:245). Indeed, Gilson (1970:82) asserts that Lilomaiava and Tuinaula are the same person while Moyle (1984:74 fn124) claims the same for Tuinaula and Saiva’aia. It would appear that this is but one man with an extraordinary life.

Lilomaiava (a.k.a Tuinaula/Saiva’aia) may be directly responsible for the gun-adapted ringditch fort at Uliamoa. Missionary Peter Turner (1992) visited the inland hamlet of Uliamoa in 1836 and reports a chapel there but did not mention a fortification. Indeed at this time, there would be no need for a defensive structure in that area. However, as the paramount chief of the Palauli region, Lilomaiava would have been intimately involved in the conflict of 1843 described by Lundie (1846:278):

‘Towards the conclusion of 1843 we expected a serious war. For some months a disagreeable excitement was kept up, dispatching heralds, mustering forces, etc…The cause of the hostilities was an insulting speech that some of the base people of Palaui…had uttered against some haughty chiefs of [Sapapāli’i]…The offending party fled and their enemy soon laid the land waste; not a house was spared, except the missionary’s, and a few chapels that even the lawless seemed afraid to touch. Breadfruit trees, coconuts, indeed everything of use, was plundered or destroyed, and Palaui is at present desolate.’

This invasion of Palaui by a stronger warring party from Sapapāli’i and other villages on that coast, no doubt also fueled by the London Missionary Society (LMS) influence at Sapapāli’i and the Wesleyan influence at Palaui, is confirmed by other missionary observers of the time (Hardie 1844, McDonald 1844). The impending devastation of the Palaui area may have necessitated the construction of a defensive fort. As paramount chief of Palaui, Lilomaiava could have built the kind of ring ditch, gun-adapted fortification design he would have seen in Tonga in order to defend the area against the army of Mālietoa, which now possessed guns (Moyle 1984:242). However, to date, no excavations have taken place at Uliamoa, following Scott’s (1969) brief survey without in depth enquiries at that time about its history. Scott’s report, however, did yield a plan map (figure 4) and an informative architectural sketch of its overall layout and features in three dimensions. As a result we currently have neither further archaeological evidence, such as historical artifacts, to assist in dating the

Figure 4: The fort at Uliamoa (from Scott 1969:84)
original building of the fort, nor a stratigraphic record of occupations within it to indicate on how many occasions in it was in fact in use during the historically well-attested local wars of the mid 19th century Sāmoa for which it was presumably constructed. Therefore, the conjecture presented in this paper has been an exercise in mostly library research. Before any solid conclusions about the fort’s origin can be reached, not just archaeological evidence, but also the still extant oral history about the fort from the inhabitants of Satupa’itea and Palauli must be carefully collected and analyzed (see Tupua 2002: 30–32 for a first step in this direction). In the meanwhile, we hope this brief paper will excite interest in doing just that.

Having made our disclaimer on the speculative nature of this paper, we have outlined here a plausible conjecture which suggests an indigenous agency for warfare technology transfer in early historic Sāmoa by a Samoan who had spent time in the late 1820s and 1830s in Tonga. While the technological introduction of guns to the region, which necessitated a modification of fort design from the indigenous hilltop ridge-fort to ringditch gun-fort, was European, we argue that, in at least one case, the technological transfer of a unique gun-adapted fort design ideas was completely indigenous. In Lilomaiava (a.k.a. Saiva’aia and Tuinaula) we see an early historic example of how pre-contact Samoans could have gone out to seek innovations to bring back to Sāmoa, rather than having innovations intruded upon them by outsiders.

ACKNOWLEDGMENTS

We would like to offer our sincere gratitude to Dr. David Addison for leading the way in a revival of interest in Sāmoan archaeology, and particularly for his support, encouragement, and hospitality towards a new generation of researchers interested in the region. This brief paper was greatly aided by insightful discussions with Janet Davidson, Tim O’Meara, David Burley, Tala Asaua, Alex Morrison, and Tim Rieth. Faafetai lava i Lau Susuga Alisa Leota-Small i faaliliu upu.

REFERENCES


Figure 5: A gunport hole in the stacked stone wall of Uliamoa fort (taken by Barnes, 2005)


Hardie, C., ms 1844. Letter from Sapapali'i dated March 11, 1844. LMS South Sea Letters, Box 17, Folder 6, Jacket B. Microfilm in Alexander Turnbull Library, Wellington.


ABSTRACT

This paper presents a discussion of marine reservoir research in Samoa. Two new ΔR results of known-age, pre-1950 shells from Tutuila Island, American Samoa, are given, and extant ΔR values obtained from both archaeological (Cleghorn and Shapiro 2000; Kirch 1993) and known-age, pre-AD 1950 shellfish (Phelan 1999) are evaluated. We suggest that a ΔR value of 25 ± 28 14C yrs is currently the most suitable for the Samoan Islands. This analysis highlights that careful selection of samples is required when undertaking ΔR research.

INTRODUCTION

A plant or animal that obtains carbon from a marine source (or reservoir) yields what is termed an ‘apparent age’. The surface ocean (down to around 200 m depth) has an apparent 14C age that is, on average, 400 years older than the terrestrial (atmospheric) reservoir. This is known as the marine reservoir effect and is caused both by a delay in the 14C exchanged between the atmosphere and ocean, and by the mixing of surface waters with upwelled, 14C-depleted deep ocean water (Stuiver et al. 1986: 982). This reservoir effect is automatically corrected for when a marine shell conventional radiocarbon age (CRA) is calibrated using the modelled marine 14C calibration curve (e.g., Marine04: Hughen et al. 2004). This calibration curve represents a global average of the surface ocean 14C as it changes over time. Local and regional deviation from this global average, however, complicates the calibration of marine samples. To account for this deviation a local correction factor, or ΔR—the difference between the modelled 14C age of surface water and the actual 14C age of surface water at that locality—needs to be determined. This can be calculated from contemporaneous terrestrial/marine samples, or from marine samples collected prior to AD 1950, whose age of death is known precisely (i.e., annually banded corals, shells and/or otoliths of surface dwelling fish) (e.g., Kalish 1993; Dye 1994; Guilderson et al. 2004; Petchey et al. 2004).

Data collected over the last decade (see Reimer and Reimer 2007) suggest that ΔR values from pre-AD 1950 marine proxies in the Pacific region vary significantly both geographically and over time. However, the limited number of available ΔR values and a lack of guidelines governing the selection of appropriate ΔR values for each island, have been continuing problems for the accurate calibration of dates on marine shell and other animals that subsisted on marine resources. The few available calculated ΔR values obtained from archaeological terrestrial/shell pairs seem to support both geographical variation (Petchey et al. 2005) and chronological change (Ingram 1998; Deo et al. 2004; Culleton et al. 2006), but in general the difficulty of locating undisputed near-contemporaneous paired samples has resulted in scepticism over many ΔR values obtained in this way.

In this paper, we attempt to address this problem for the Samoan Archipelago (see Figure 1), and present two new ΔR results for Tutuila, American Samoa obtained from known-age, pre-AD 1950 shells. These results are compared to published ΔR values from this region based on known-age samples (Phelan 1999) and extant ΔR values calculated from archaeological charcoal/shell samples (Kirch 1993; Cleghorn and Shapiro 2000) (Tables 1 and 2).

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† Samoan Studies Institute, American Samoa Community College. American Samoa

1 A conventional radiocarbon age is obtained from a radiocarbon measurement following the conventions set out by Stuiver & Polach (1977). A CRA must be calibrated to determine a calendar age. By convention, the symbol BP means ‘conventional radiocarbon years before AD 1950’, whereas the symbols cal BP or BC/AD are used to express calibrated radiocarbon ages.
BACKGROUND: PREVIOUS SAMOAN ΔR RESEARCH

In order to calibrate shell radiocarbon ages obtained during excavations at To‘aga, on Ofu Island in eastern Samoa, Kirch (1993: 87) calculated a ΔR correction factor that was a weighted average of empirically determined ΔR values from the mid-Pacific islands of Eniwetok, Hawai‘i, Tahiti and Moorea (Society Group). This value (ΔR = +100 ± 24 14C yrs) was far from ideal due to the wide geographical spread of the values used, but it produced consistent calibrated 14C results for charcoal and shell from the same excavation level of the site (see Table 2 for sample details).

Phelan (1999) would later use the To‘aga shell/charcoal pair to calculate a ΔR value of -230 14C yrs for the site. However, this value was at odds with three ΔR values Phelan obtained from known-age, pre-AD 1950 shells from ‘Upolu, western Samoa, which resulted in a weighted mean of +57 ± 23 14C yrs (see Table 1). Phelan (1999: 100) suggested this discrepancy indicated either: a difference in the surface ocean 14C activity between western and eastern Samoa; that there had been a change in the regional oceanic processes over time; or a problem of association between the two archaeological determinations from To‘aga.

Also recognizing the need for a Samoa-specific ΔR value, Cleghorn and Shapiro (2000: 31, 83, 84) selected a terrestrial/marine pair from Fagå Village, Ta‘u Island, eastern Samoa to calculate a regional ΔR value (see Table 2 for sample details). They concluded that when calibrated the charcoal was only 25 years older than the shell, which suggested to them that no, or minimal ΔR correction factor was needed in eastern Samoa.

Despite a recommendation by Kirch (1993), Cleghorn and Shapiro (2000) and Phelan (1999) that the Samoan ΔR needed further investigation, there has been no attempt to address this problem within the Samoan Archipelago until now.

METHODOLOGY

Samples selected for ΔR research must conform to a number of strict prerequisites:

1. The marine sample must have been collected live, or the date of death independently validated. For pre-AD 1950, known-age shells this can best be demonstrated by the presence of museum documentation, the fleshy remains of an animal, or valves in articulation with intact ligaments. For archaeological shell samples, the shell should be the remains of food (as opposed to the remains of some industry or part of a natural beach deposit).

2. The geographic location where the samples were collected must be known.

3. The marine sample must be identified to genus level, and the dietary and habitat preferences of that genus must closely represent that of the reservoir you are investigating (e.g., open ocean, estuarine, etc.).

4. For historic proxies, the date of collection must be known and be before AD 1950 (i.e., prior to detonation...
<table>
<thead>
<tr>
<th>Location</th>
<th>Lab. No.</th>
<th>Family, Genus, Species †, ‡</th>
<th>δ^{13}C ‡‰</th>
<th>Year Collected</th>
<th>CRA (Rs(t)) + error</th>
<th>Marine modeled age (Rg(t))</th>
<th>∆R (yr) Rs(t) – Rg (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faga'itua, Tutuila Island</td>
<td>Wk-19682</td>
<td>Cardiidae: Fragum fragum (SF)</td>
<td>2.981</td>
<td>1933</td>
<td>460 ± 19</td>
<td>456 ± 23</td>
<td>4 ± 19</td>
</tr>
<tr>
<td>Pago Pago, Tutuila Island</td>
<td>Wk-19683</td>
<td>Veneridae: Antigona reticulata (SF)</td>
<td>2.568</td>
<td>1865</td>
<td>500 ± 20</td>
<td>480 ± 23</td>
<td>20 ± 20</td>
</tr>
<tr>
<td>'Upolu (?)</td>
<td>Wk-6383</td>
<td>Turbinidae: Turbo petholatus (H)</td>
<td>2.0</td>
<td>1882</td>
<td>550 ± 40</td>
<td>474 ± 23</td>
<td>26 ± 40</td>
</tr>
<tr>
<td></td>
<td>Wk-6384</td>
<td>Strombidae: Strombus pacificus (H)</td>
<td>2.1</td>
<td>1882</td>
<td>500 ± 40</td>
<td>474 ± 23</td>
<td>26 ± 40</td>
</tr>
<tr>
<td></td>
<td>Wk-6385</td>
<td>Strombidae: Strombus lentiginosus (H)</td>
<td>3.2</td>
<td>1882</td>
<td>560 ± 40</td>
<td>560 ± 40</td>
<td>86 ± 40</td>
</tr>
</tbody>
</table>

* The Tutuila samples are first published here, the 'Upolu samples are from Phelan (1999) and provenance is uncertain.
† Diet preferences (in brackets): SF = suspension-feeder; H = herbivore.
‡ Venerids may live for more than 40 years (Beesley et al. 1998: 356) and Cardiidae generally less than 10 years (Beukema 1989). Because mollusc shells are built up over their entire life the margins of the shell will be younger than the hinge. In the case of Wk-19683 we have sampled no more than 5 ‘circuli’. Therefore, when calculating the marine modelled age for these shells we have assumed that the carbon was fixed into the shells close to the year of collection for Wk-19682 and Wk-19683 where outer rings were sampled. The limited data available for reef gastropods suggests that most live >5 years and some may reach 20 years of age (Frank 1969: 237). Because whole shells were dated in the case of Wk-6383, Wk-6384 and Wk-6385 we have used an average of the Marine04 data (Hughen et al. 2004) points over a 10 year period prior to the collection date. Where necessary we have interpolated between the 5-year increments in the Marine04 ages.
¶ δ^{13}C reported relative to the VPDB standard with a precision of 0.2‰.
§ The uncertainty in the radiocarbon age is used for the ∆R uncertainty since the marine model error is now included in Marine04 (pers. comm. P. Reimer Jan 2007). No Suess correction has been applied to these calculations due to uncertain effect of anthropogenic 14C in the southwest Pacific (Druffel and Griffin 1993).

Table 2. Radiocarbon data for paired charcoal/shell samples from archaeological sites in Samoa.

<table>
<thead>
<tr>
<th>Lab. No.</th>
<th>Location</th>
<th>Material</th>
<th>δ^{13}C ‡‰</th>
<th>^14C CRA ± error (BP)</th>
<th>Marine modelled age (Rg(t))*</th>
<th>∆R (yr) Rs(t) – Rg (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta-109584</td>
<td>Fagā Village (AS-11–1), Feature Complex B, Ta’u Island, Manu’a Group (Cleghorn and Shapiro 2000).</td>
<td>Charcoal unidentified</td>
<td>-29.0</td>
<td>700 ± 50</td>
<td>1116 ± 28</td>
<td>-75 ± 55</td>
</tr>
<tr>
<td>Beta-132436</td>
<td>To’aga, Ofu Island, Manu’a Group (Kirch 1993).</td>
<td>Archiade sp. (SF) †</td>
<td>3.4</td>
<td>1040 ± 50</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Beta-35603</td>
<td>Unit 28, Transect 9</td>
<td>Charcoal unidentified</td>
<td>-28.4</td>
<td>2600 ± 170</td>
<td>2926 ± 173</td>
<td>-155 ± 190</td>
</tr>
<tr>
<td>Beta 35604</td>
<td>Unit 28, Transect 9</td>
<td>Tridacna maxima (SF) †</td>
<td>1.7</td>
<td>2770 ± 80</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

* An estimate of the atmospheric calibration curve error (INTCAL04: Reimer et al. 2004) over the 1σ span of the radiocarbon age was used to derive the calculated marine modelled age (Rg(t)), whereby, atmospheric age a = √(δ^{13}C age^2 + average of calibration curve error^2).
† Diet preferences (in brackets): SF = suspension-feeder (Beesley et al. 1998: 333).

4 Circuli are concentric ridges formed on the surface of bivalve shells by the periodic addition of material to the edge of the shell. They become crowded together at the annuli (Almeida and Sheehan 1997) and should not be confused with annuli. Growth rings (or annuli) on the surface of bivalve shells represent periods of growth cessation, which are often interpreted as yearly rings associated with changing season. However, they can be caused by a variety of environmental and biological causes and their annual relationship is less certain in locations without seasonal extremes (Jones 1989).

5 For ^14C purposes the boundary between the Southern and Northern Hemispheres atmosphere is considered to lie along the thermal equator or the Inter-Tropical Convergence Zone (ITCZ) during the respective growing seasons (McCormac et al. 2004: 1088). Because Samoa lies at the limit of the South Pacific Convergence Zone which merges with the ITCZ to the west we have opted to use the Northern Hemisphere calibration curve (INTCAL04: Reimer et al. 2004) for the terrestrial calibrations, though this is likely to fluctuate seasonally and over time.
of thermonuclear devices). For archaeological ΔR research, the paired charcoal sample is used to verify the collection date of the shell, therefore the charcoal must be short-lived (e.g., twig from a short lived species or nutshell, both of which have <10 yrs inbuilt age6).

The ΔR for a specific location 's' can be calculated from known-age shells, collected prior to atmospheric bomb testing using the formula: \( \Delta R(s) = R_g(t) - R_s(t) \), where \( \Delta R(s) \) is the difference between the global average (\( R_g(t) \)) and the actual \(^{14}C \) activity of the surface ocean at a particular location (\( R_s(t) \)) at that time. When calculating ΔR using charcoal and shell \(^{14}C \) results from archaeological sites the standard approach is to convert the \( \sigma \) age range of the terrestrial \(^{14}C \) value to a model marine \(^{14}C \) age (\( R_g(t) \)) using the relevant calibration curve data (e.g., Marine04: Hughen et al. 2004)(see Ulm 2002 for methodology). This value is then subtracted from the paired marine shell CRA (\( R_s(t) \)) and the ΔR standard error is calculated by the formula: \( \Delta R_\sigma = \sqrt{\sigma_R^2 + \sigma_R^2} \).

Even when samples are carefully selected according the prerequisites listed above, there are a number of uncertainties in the accuracy of any ΔR calculation due to the postulated time of carbon uptake before collection, the influence of diet, habitat and short-term fluctuations in the water masses. When calculating the amount of uncertainty added to the ΔR value introduced by the non-uniform \(^{14}C \) content of the shellfish, the standard approach has been to calculate the standard deviation (\( \sigma \)) in the unweighted mean (i.e., the empirical standard deviation = \( \sigma / \sqrt{n} \)) and compare this to the weighted mean, taking the larger of the two as the ΔR uncertainty (±) following the recommendations of Bondevik and Gulliksen in Mangerud et al. (2006: 3241) where the Chi squared (\( \chi^2(n-1) \)) test is used to test the internal variability in a group of ΔR values. If the \( \chi^2(n-1) > 1 \) the group has additional variability beyond measurement uncertainty, and the additional variance (\( \sigma_{ext} \)) and uncertainty are calculated and applied to the ΔR (Table 3). When \( \chi^2(n-1) \leq 1 \) the weighted mean is used (see Mangerud et al. 2006: 3241–2 for explanation).

We obtained two known-age pre-AD 1950 shells from the Australian Museum (Table 1). The sample from Faga’itua (Museum acquisition number = AM:C061233; Cardiidae: Fragum fragum) was obtained by Ted Dranger who was stationed in the Pacific between 1925 and 1935 (Schwengel 1957). John Brazier collected the shell sample from Pago Pago (AM:C015564; Veneridae: Antigonia reticulata) during the South Seas Expedition in 1865 (Iredale 1931). All samples had the remains of hinge ligaments indicating either live, or near live collection. Both Cardiidae sp. and Veneridae sp. are suspension-feeding shellfish (Beesley et al. 1998: 328, 356). Suspension feeders generally consume suspended phytoplankton and dissolved inorganic carbon from seawater and, therefore, should reflect the surface ocean reservoir conditions (Tanaka et al. 1986).

From each of these shells we removed a 5 mm cross-section perpendicular to the edge of the shell across multiple increments of growth to avoid intra-shell variations in \(^{14}C \) (Culleton et al. 2006, Petchey in prep) and provide an average value over a maximum period of five years (i.e., one increment in the Marine04 dataset).

**RESULTS**

**Pre-AD 1950, Known-age Shells**

The results of ΔR calculations for the pre-AD 1950, known age shells are shown in Table 1. The weighted mean of the two Tutuila ΔR values is 12 ± 14 \(^{14}C \) years with no additional uncertainty in the ΔR (Table 3). Recalculation of the previous values obtained by Phelan (1999) using the current calibration dataset (Marine04: Hughen et al. 2004) results in a weighted mean for 'Upolu of 63 ± 23 \(^{14}C \) years—again with no additional uncertainty.

When pooled, the weighted mean for all the pre-AD 1950, known-age Samoan shells is 25 ± 12 \(^{14}C \) years, but \( \chi^2/(n-1) = 1.31 \) indicating non-uniform \(^{14}C \) content. An additional uncertainty has therefore been added to the ΔR mean value to give 25 ± 28 \(^{14}C \) years (Table 3).

**Archaeological Shell/Charcoal Pairs**

ΔR values obtained from archaeological terrestrial and marine samples from the sites of To'aga and Faga‘itua Village have been recalculated using the Marine04 (Hughen et al. 2004) and IntCal04 (Reimer et al. 2004) calibration datasets (see Table 2). Despite the large standard errors associated with the archaeological ΔR values and apparent consistency between the two results (\( \chi^2/(n-1) = 0.16 \)), when compared to the pre-AD 1950, known-age shells, additional variability beyond measurement uncertainty is indicated (\( \chi^2/(n-1) = 1.54 \) (Table 3).

**DISCUSSION**

The ΔR value from To‘aga, originally calculated by Phelan (1999) as -230 \(^{14}C \) yrs is very different to the new value calculated in Table 2 (ΔR= -155 ± 190 yrs). Phelan (1999:100) followed the methodology for calculating ΔR as laid out by Stuiver and Braziunas (1993: 153, Figure 15B), whereby the charcoal \(^{14}C \) age was converted to a model marine \(^{14}C \)
The 14C content of shellfish is tied closely to the peculiarities of habitat and diet (Tanaka et al. 1986; Hogg et al. 1998). It has been well documented that herbivores and deposit feeders can give anomalous ∆R values due to the intake of detrital matter, especially in areas with limestone geology (Dye 1994; Spennemann and Head 1998; Petchey et al. 2004, Petchey in press). Phelan considered this to be of minimal concern for the three pre-AD 1950, known-age herbivorous shellfish used in his study because the geology of ‘Upolu and the Samoan Archipelago is entirely volcanic in origin, and the only geological carbonates available are Holocene (<10,000 year old) beach sands (Keating 1992). However, it is by no means certain that the 14C content of herbivorous shellfish will stand up to the scrutiny of ∆R analysis, and the digestion of Holocene beach sands by herbivorous species may account for the variability seen here.

Geographical and Oceanic Variation

The ∆R variation seen between eastern and western Samoan pre-AD 1950, known-age shells could also represent geographic variability (and possibly also the archaeological ∆R values from the Manu’a Group which are separated from Tutuila by 150 km). Significant ∆R variation has been noted over short distances in the Bismarck Archipelago (Petchey et al. 2004), which are attributed to upwelling associated with current reversals. ∆R variation within incrementally sampled marine shells has also been noted in areas of upwelling and varying riverine input (e.g., along the Californian coastline (Culleton et al. 2006) and the Galapagos Islands (Druffel 1987)). However, Samoa is encircled by the South Pacific Gyre. This circulatory system creates relatively stable surface water conditions at the centre (Rougerie and Wauty 1993) and reliable published ∆R values from the South Pacific region tend to be fairly uniform (Petchey in press), but there are currently too few 14C values to effectively evaluate the true extent or cause of ∆R variability in the Oceania region. The possibility of large-scale eddies, similar to that suggested for variable ∆R conditions in the Hawaiian Islands (Petchey in press), may also be a concern.

Stratigraphic Problems and Limitations of the ∆R Calculation Technique.

In the case of archaeological pairs, the samples used in the ∆R equation must belong to near-penecontemporaneous events (Stuiver & Braziunas 1993) (though see Petchey et al. 2005 and Jones et al. 2007) for an alternative approach to calculating ∆R value that does not require the dated events to be tightly constrained). This ∆R requirement is a minimal concern for the three pre-AD 1950, known-age sample pairs presented here. However, the use of Stuiver and Braziunas’ (1993) Figure 15B resulted in a margin of error that is not immediately apparent from the original ∆R value. The recalculated ∆R for Töaga is similar from Tutuila collected 68 years apart (χ2/n-1) = 0.34). We think that there are a number of problems with the available data that are more instrumental in causing the variation seen, as discussed below.

Change over Time

One possibility is change in 14C over time in response to changes in ocean circulation and climatic conditions. This has been documented in banded coral records (Druffel and Griffin 1999; Guilderson et al. 1998) and from archaeological ∆R studies (Deo et al. 2004; Ingram 1998; Reimer et al. 2002). It is possible that the variation seen in the data presented here may reflect a change over the last 3000 years, but the three known-age, pre-AD 1950 samples from ‘Upolu collected during the same period (1882) show greater variance (χ2/n-1 = 0.65) than the two samples from Tutuila collected 68 years apart (χ2/n-1 = 0.34). We think that there are a number of problems with the available data that are more instrumental in causing the variation seen, as discussed below.

Table 3. ∆R Statistics

<table>
<thead>
<tr>
<th>Description</th>
<th>No.</th>
<th>Dietary preference</th>
<th>∆R pooled + error (E)</th>
<th>χ2/(n-1)</th>
<th>∆R with external variance*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tutuila, eastern Samoa</td>
<td>2</td>
<td>Suspension feeders</td>
<td>12 ± 14</td>
<td>0.34</td>
<td>No variance</td>
</tr>
<tr>
<td>‘Upolu, western Samoa</td>
<td>3</td>
<td>Herbivores</td>
<td>63 ± 23</td>
<td>0.65</td>
<td>No variance</td>
</tr>
<tr>
<td>All pre-1950, known age Samoan shells</td>
<td>5</td>
<td>–</td>
<td>25 ± 12</td>
<td>1.31</td>
<td>25 ± 28†</td>
</tr>
<tr>
<td>Archaeological and pre-1950, known age shells</td>
<td>7</td>
<td>–</td>
<td>20 ± 12</td>
<td>1.54</td>
<td>29 ± 81†</td>
</tr>
</tbody>
</table>

* The additional variance (σ2ext) is obtained by subtracting the 14C measurement variance from the total population variance and obtaining the square root, e.g. σ2ext = √(σ2pop - σ2meas).
† The uncertainty given includes the additional variance and is calculated by √(E2∆R pooled + σ2ext).

The ∆R value must belong to near-penecontemporaneous events to be tightly constrained. This ∆R requirement is a minimal concern for the three pre-AD 1950, known-age sample pairs presented here.
common hindrance when using archaeological shell/charcoal pairs from the Pacific where the stratigraphy is often complex and sites used over many centuries. Moreover, the statistical methodology of Bondevik and Gulliksen used here to compare the Samoan ∆R values needs to be evaluated further using archaeological pairs from other localities.

Charcoal Inbuilt Age

Explicit in the notion that the samples must be near contemporaneous is that the target event and the age determined by the charcoal sample (or Rg(t)), must have no offset in age (c.f., a robust determination [Mook and Waterbolk 1985]). The notion of inbuilt age in charcoal is a well-recognised 14C problem (e.g., Anderson and Clark 1999; Kirch 1993: 87), however, Pacific archaeologists rarely identify their charcoal because of the lack of suitable Pacific wood reference collections, and rarely incorporate any inbuilt age into the subsequent chronological interpretations. A recent study of radiocarbon determinations from the Cook Islands by Allen and Wallace (2007) has demonstrated that uncalibrated, identified charcoal species can give radiocarbon results that are on average 64 14C yrs older than short-lived nutshell samples, with the more disturbing prospect that some unidentified samples could be 300 or 400 years too old. Neither the charcoal sample from To‘aga nor the sample from Fagā were identified to the species level. If we assume the possibility of an average 64 years of inbuilt age in these samples the ∆R would be closer to that of the pre-AD 1950, known-age samples.

CONCLUSION

We currently recommend the use of a ∆R value for Samoa of 25 ± 28 14C years derived from five known-age, pre-AD 1950 marine shells. Additional research into archaeological shell/charcoal pairs from Samoan sites is needed before any firm conclusions about change over time in ∆R can be made. Suspension-feeding shell samples from ‘Upolu are currently being analysed in order to test whether geographical variation or shell dietary preferences are the likely cause of minor ∆R variation between eastern and western Samoan Islands.

ACKNOWLEDGEMENTS

We wish to thank Ian Loch (Malacology collections supervisor at the Australian Museum) for enabling access to the shells used in this study. Tim Rieth (International Archaeological Research Institute Inc. Honolulu) provided details about the Fagā Village samples, Paula Reimer (Queens University, Belfast) gave advice on ∆R calculation methods and Sean Ulm (University of Queensland) provided valuable comments. An anonymous reviewer also offered useful comments.

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Recent Advances in the Archaeology of the Fiji/West-Polynesia Region


HOW DARK ARE THEY? THE SĀMOAN DARK AGES, ~1500–1000 BP

Timothy Rieth* and David J. Addison†

ABSTRACT

The period from ~1500-1000 cal BP has been noted as a Dark Age in our understanding of Samoan prehistory. Research agendas have focused on earlier pottery-bearing deposits and investigations of later monumental architecture. This has resulted in the Dark Age not as a historical reality but an artifact of archaeological research efforts. We examine seven general attributes of 18 archaeological deposits from across the Samoan Archipelago that date to this period. The results indicate a degree of variation in assemblages with respect to the types of artifacts present and associated architecture. Pottery is rare during this period and only present at three of the earlier deposits, suggesting that pottery production had ceased by ~1200 cal BP. Although our current knowledge of this period is still limited, the present synthesis of evidence offers minimal support for the 'formative' characteristics hypothesized by some researchers and used to explain the development of a hierarchical social structure and monumental architecture in later prehistory.

INTRODUCTION

Thirteen hundred years after initial colonization and settlement in the Sāmoan archipelago, the period from ~1500-1000 BP has been noted by archaeologists as a poorly understood Dark Age with little associated archaeological material (Davidson 1979: 94–95; see also Poulsen 1974 for Tonga). The lack of data from this Dark Age is recognized as resulting, at least in part, from the dearth of pottery associated with many of these deposits, thus providing limited surface and subsurface indications. The paucity of pottery may also have affected previous research objectives that focused on early pottery-bearing deposits and later monumental architecture. As Green (2002: 140) notes, 'without pottery to easily alert us to habitation layers in the interval between AD 500 and AD 1000, most dates falling between these intervals relate to traces of agricultural practices found at the base of later more substantial occupation features.' In this sense, the Dark Age is not a historical reality, but rather, this gap in knowledge appears to be an artifact of archaeological research agendas. Temporally bookended by earlier pottery-bearing deposits and later monumental architecture, no research program has specifically focused on this portion of the archaeological record (see Spennemann 1986 for an exception). However, a number of deposits dated to this time can provide a general characterization of this interval. Such a generalization provides an initial basis for comparison with earlier and later sites and assemblages.

A review of the Sāmoan Dark Age is an important step towards integrating and analyzing the archaeological data generated during the last several decades, particularly that which stems from cultural resource management (CRM) projects in American Sāmoa. Most archaeologists working in the region realize the term Dark Age is a practical shorthand for discussing a period for which we lack sufficient data. However, to avoid a fallacious reification of this term as an accurate description of a particular interval of Sāmoan prehistory, light must be shed on the archaeological record of the latter half of the first millennium. If the archaeological record is viewed as exhibiting variability in the differential persistence of particular attributes of material culture through time and space, then a detailed understanding of the entire sequence is necessary for explanations of the temporal and geographical changes. For our understanding of Sāmoan prehistory to expand we must remove any 'Dark Ages' from our data.

Recently, Rieth and Hunt (2008) synthesized the published and unpublished radiocarbon dates from Sāmoa, applying a chronometric hygiene protocol to determine their reliability in terms of provenience and their accuracy and precision in the dating of an archaeological target event. From this analysis and subsequent data (Addison and Asaua 2006), 53 radiocarbon dates calibrated to this

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period have been accepted (Table 1). These dates represent 18 areas from the islands of Savai’i, ‘Upolu, Tutuila, Ofu, and Tā’ū (Figure 1).

Seven attributes were recorded for each deposit: location, architectural features, ceramics, lithic artifacts, shell and/or coral artifacts, faunal remains, and other associated features (Table 2). Attributes were recorded in gross terms to provide baseline data about these deposits. Location was recorded as coastal or inland, with an arbitrary boundary of 200 m from a shoreline delimiting coastal areas. Architectural features include platforms, pavings, mounds, walls, paths, and postholes. Ceramics were recorded as present, absent, secondarily deposited, or unreported. Lithic artifacts were recorded as present, absent, secondarily deposited, or unreported and include basalt flakes, obsidian flakes, and formal basalt artifacts (e.g., adzes, graters). Shell and coral artifacts were recorded as present, absent, secondarily deposited, or unreported and include fishhooks, peelers, modified shell fragments, net weight sinkers, and other formal artifacts. Faunal remains, including vertebrate and invertebrate remains, were recorded as present, absent, secondarily deposited, or unreported. Other associated features include earth ovens, which are defined as pit features containing charcoal, ash, and fire-altered stone, other combustion features, other pit features, and burials. Each deposit is described below and is followed by a synthesis and discussion of the assemblage of sites.

1 The protocol was designed to be as inclusive as possible while still providing a critical analysis of each radiocarbon date. Protocol criteria were adapted from Spriggs (1989), Spriggs and Anderson (1993), and Smith (2002). Deposits excavated from the Cog Site (SU-17-165), Falefā Valley, Lu‘atu‘u, and Vailele areas of ‘Upolu have calibrated dates within the 1500–1000 cal BP range, but were rejected for a variety of reasons. See Rieth and Hunt (2008) for in-depth explanations of the protocol and criteria.

Savai’i

Pulemelei

The Pulemelei Mound is within the Letolo Plantation at inland Palaual on southern Savai’i. The mound is part of an extensive distribution of surface features that Jennings, et al. (1982) divided in five village wards. Two dates of ~1200–1000 cal BP were obtained from charcoal concentrations beneath the stone fill of the Pulemelei Mound (Martinsson-Wallin, et al. 2005). Any cultural material associated with the clay sediment excavated from below the mound remains unreported. One of the radiocarbon samples dates charcoal from an earth oven. The samples pre-date construction of the large Pulemelei Mound and are not associated with any earlier architectural features.

‘Upolu

SU-17-91, Tulaga Fale

Site SU-17-91 is part of Ward C of the extensive settlement recorded during the Mt. Olo survey (Hewitt 1980a; Holmer 1980a) at inland western ‘Upolu. Excavation through a large stone platform (Platform 2) revealed three combustion features within the stratum underlying the surface architectural feature. One pit, Pit A, contained charcoal, stones, and fire-reddened sediment at its base and provided a date ~1200–900 cal BP (Hewitt 1980a: 44). One basalt flake was recovered from another combustion feature that can be stratigraphically correlated with Pit A. No other cultural material was associated with these features, although lithic artifacts and invertebrate faunal remains were associated with the platform. It is unclear how long after the use of the combustion features the platform was built.

Figure 1. Map of the Samoan Islands showing all sites dating to 1500–1000 cal BP.
Site SU-17-483, the Apulu household unit (HHU), is part of the Mt. Olo survey area (Holmer 1980b). The primary component of the site is a large stone platform, although the entire Apulu HHU includes multiple platforms bounded by stone walls and walkways. Charcoal from the base of a large oval pit dated ~1300–1000 cal BP. The stone platform is partially superimposed over the feature, while no cultural material was associated with the pit.

Site SU-17-552 is a star mound located in Ward B of the Mt. Olo survey area (Hewitt 1980b). A charcoal sample obtained from the sediment underlying the star mound dates ~1700–1400 cal BP. A basalt adze was recovered from the surface of the same stratum; but its relationship with the dated scattered charcoal is unclear. The star mound post-dates the charcoal in this stratum by an undefined period of time.

### Table 1. Sites with Cultural Deposits Dating between 1500–1000 cal BP.

<table>
<thead>
<tr>
<th>Lab No.</th>
<th>Site</th>
<th>Provenience</th>
<th>CRA</th>
<th>Calibrated Age BP (2σ)</th>
<th>Calibrated Age BC/AD (2σ)</th>
<th>Reference</th>
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</thead>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>UGA-1985</td>
<td>SU-17-91, Tulaga Fale</td>
<td>Pit A</td>
<td>1115 ± 75</td>
<td>1260–1200 (4.4%), 1190–910 (91.0%)</td>
<td>690–750 AD (4.4%), 760–1040 AD (91.0%)</td>
<td>Hewitt 1980a; Jennings &amp; Holmer 1980</td>
</tr>
<tr>
<td>UGA-1990</td>
<td>SU-17-483, Apulu HHU</td>
<td>Base of pit</td>
<td>1205 ± 70</td>
<td>1280–970</td>
<td>670–980AD</td>
<td>Holmer 1980b; Jennings &amp; Holmer 1980</td>
</tr>
<tr>
<td>TUTUILA</td>
<td></td>
<td></td>
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<tr>
<td>Wk-13049</td>
<td>AS-31-116, Pava’ia’i</td>
<td>Fea. 253, TU 2, L. I/2</td>
<td>1564 ± 41</td>
<td>1540–1360</td>
<td>410–590AD</td>
<td>Carson 2005</td>
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<tr>
<td>Beta-165151</td>
<td>AS-31-131, Faleniu</td>
<td>Fea. 106, TU 1, L. II/1</td>
<td>1020 ± 50</td>
<td>1060–790</td>
<td>890–1160AD</td>
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<td>Wk-15844</td>
<td>AS-31-171, Pava’ia’i</td>
<td>Location 1, L. III</td>
<td>1561 ± 32</td>
<td>1530–1380</td>
<td>420–570AD</td>
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<td>Beta-15019</td>
<td>AS-34-34, Maloata</td>
<td>TP 1, L. IV</td>
<td>1240 ± 80</td>
<td>1300–980</td>
<td>650–970AD</td>
<td>Ayres &amp; Eisler 1987</td>
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<tr>
<td>Wk-11501</td>
<td>Áfono</td>
<td>BT-12, L. VII</td>
<td>1195 ± 41</td>
<td>1260–1200 (11.1%), 1190–1050 (76.6%), 1040–980 (7.7%)</td>
<td>690–750 AD (11.1%), 760–900 AD (76.6%), 910–970 AD (7.7%)</td>
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<td>Wk-15685</td>
<td>Áfono</td>
<td>Waterline Trench, 90 cmbl</td>
<td>1213 ± 33</td>
<td>1260–1200 (16.9%), 1190–1050 (78.5%)</td>
<td>690–750 AD (16.9%), 760–900 AD (78.5%)</td>
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<tr>
<td>Wk-15690</td>
<td>Áfono</td>
<td>Profile 4, L. V</td>
<td>1287 ± 34</td>
<td>1300–1170 (93.8%), 1160–1140 (1.6%)</td>
<td>650–780 AD (93.8%), 790–810 AD (1.6%)</td>
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</table>
Table 1 continued.

<table>
<thead>
<tr>
<th>Lab No.</th>
<th>Site</th>
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<th>Calibrated Age BC/AD (2σ)</th>
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<tr>
<td>Wk-13001</td>
<td>Fatu ma Futi</td>
<td>TU-1 (Phase I), L. IV</td>
<td>±1630</td>
<td>1660–1670 (1.0%), 1620–1400 (94.4%)</td>
<td>260–280 AD (1.0%), 330–550 AD (94.4%)</td>
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<td>Wk-13002</td>
<td>Fatu ma Futi</td>
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<td>±1397</td>
<td>1400–1240 (93.2%), 1210–1180 (2.2%)</td>
<td>550–710 AD (93.2%), 740–770 AD (2.2%)</td>
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<td>Wk-18522</td>
<td>Fatu ma Futi</td>
<td>TU-40, Spit 7</td>
<td>±1341</td>
<td>1310–1230 (85.0%), 1210–1180 (10.4%)</td>
<td>640–720 AD (85.0%), 740–770 AD (10.4%)</td>
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<td>Wk-18526</td>
<td>Fatu ma Futi</td>
<td>TU-40, L. IV</td>
<td>±1339</td>
<td>1310–1230 (83.8%), 1210–1180 (11.6%)</td>
<td>640–720 AD (83.8%), 740–770 AD (11.6%)</td>
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<td>Wk-18323</td>
<td>Laulii</td>
<td>Profile 6, L. V</td>
<td>±1280</td>
<td>1300–1130 (93.6%), 1110–1090 (1.8%)</td>
<td>650–820 AD (93.6%), 840–860 AD (1.8%)</td>
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<td>Beta-94528</td>
<td>Malaeimi</td>
<td>Unit 7W, Stratum III</td>
<td>±1200</td>
<td>1290–960</td>
<td>660–990 AD</td>
<td>Suafo’a 1998</td>
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<tr>
<td>Wk-12993</td>
<td>Vaipito</td>
<td>Trench 1, East Baulk</td>
<td>±1451</td>
<td>1510–1460 (4.1%), 1420–1280 (91.3%)</td>
<td>440–490 AD (4.1%), 530–670 AD (91.3%)</td>
<td>Addison &amp; Asaua (2006)</td>
</tr>
</tbody>
</table>

**OFU**

| Beta-35924      | AS-13-1, To‘aga                                | Transect 5, Unit 15, L. II | ±2100 | 1810–1440               | 140–510 AD                | Kirch 1993                  |
| Beta-35600      | AS-13-1, To‘aga                                | Transect 5, Unit 17, L. IIIb | ±1190 | 1270–960                | 680–990 AD                | Kirch 1993                  |
| Wk-14534        | AS-13-1, To‘aga                                | Anchor A-17, L. III  | ±1105 | 1130–1100 (1.5%), 1090–930 (93.9%) | 820–850 AD (1.5%), 860–1020 AD (93.9%) | Addison & Asaua (2006)      |

**TA‘Ū**

| Beta-154147     | AS-11-1, Fagā                                  | L. V, beneath Burial 5 | ±1240 | 1280–1060               | 670–890 AD                | Shapiro & Cleghorn 2002     |
| Beta-104536     | AS-11-1, Fagā                                  | Seaward-Inland Transect, TU 1, L. VIII | ±1100 | 1180–920                | 770–1030 AD               | Cleghorn & Shapiro 2000     |
| Beta-104539     | AS-11-1, Fagā, Fea. Complex S, Fea. S-3        | TU 5, L. II           | ±1090 | 1240–1200 (1.6%), 1190–890 (88.0%), 880–790 (5.8%) | 710–750 AD (1.6%), 760–1060 AD (88.0%), 1070–1160 AD (5.8%) | Cleghorn & Shapiro 2000     |
Site AS-31-116 includes 25 stone walls, 11 terraces, nine mounds, one stone enclosure, and one surface artifact scatter in Pava’ia’i immediately inland of the Tāfuna Plain (Carson 2005: 106). Excavations through a stone retaining wall for a terrace produced two dates calibrated ~1600–1400 BP. The charcoal samples were obtained from beneath the terrace retaining face, pre-dating its construction. Three pottery sherds were recovered from the same layer as the charcoal samples, but it has been suggested that the cultural deposit may be in a secondary context (Carson 2005: 111). No other cultural material was associated with this deposit.

Site AS-31-171 is another site located in Pava’ia’i village. Five radiocarbon samples dating to ~1700–900 cal BP were obtained from three locations throughout the village (Addison et al. 2005; Addison and Asaua 2006). Four of the dates were obtained from a stratum capped by an intact volcanic ashfall (Addison et al. 2005). Three of the four dates, dating ~1700–1400 cal BP, came from charcoal concentrations with no associated cultural material. One sample, dated ~1700–1400 cal BP, is associated with a Polynesian Plainware deposit. No other cultural material was recovered.

<table>
<thead>
<tr>
<th>Provenience</th>
<th>Location</th>
<th>Architecture</th>
<th>Ceramics?</th>
<th>Lithic Artifacts?</th>
<th>Shell and/or Coral Artifacts</th>
<th>Faunal Remains?</th>
<th>Other Associated Features?</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAVAI’I</td>
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<td>‘UPOLU</td>
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<tr>
<td>SU-17-91, Tulaga Fale</td>
<td>Inland</td>
<td>(pre-dates stone platform)</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>Probable earth oven</td>
</tr>
<tr>
<td>SU-17-483, Apulu HHU</td>
<td>Inland</td>
<td>(pre-dates stone platform)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Large oval pit feature</td>
</tr>
<tr>
<td>SU-17-552, Ten Points</td>
<td>Inland</td>
<td>(pre-dates star mound)</td>
<td>-</td>
<td>?</td>
<td>-</td>
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<tr>
<td>TUTUILA</td>
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<tr>
<td>AS-31-116, Pava’ia’i</td>
<td>Inland</td>
<td>(pre-dates terrace)</td>
<td>Secondary deposit?</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>AS-31-171, Pava’ia’i</td>
<td>Inland</td>
<td>-</td>
<td>+</td>
<td>-</td>
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<td>-</td>
<td>-</td>
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<tr>
<td>AS-31-131, Faleniu (multiple locations)</td>
<td>Inland</td>
<td>(pre-dates terrace)</td>
<td>-</td>
<td>-</td>
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<td>-</td>
<td>-</td>
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<tr>
<td>AS-34-34, Maloata</td>
<td>Coastal</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
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<td>-</td>
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<tr>
<td>Afono</td>
<td>Coastal/Inland</td>
<td>? Possible gravel paving, postholes</td>
<td>Secondary deposit</td>
<td>?</td>
<td>-</td>
<td>-</td>
<td>? Burials?</td>
</tr>
<tr>
<td>Amaua</td>
<td>Coastal</td>
<td>-</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>Auito</td>
<td>Coastal</td>
<td>-</td>
<td>+</td>
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<td>+</td>
<td>?</td>
<td>?</td>
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<tr>
<td>Fagamalo</td>
<td>Coastal</td>
<td>? Possible gravel paving</td>
<td>-</td>
<td>?</td>
<td>-</td>
<td>?</td>
<td>-</td>
</tr>
<tr>
<td>Fatu ma Futi</td>
<td>Coastal</td>
<td>+ Postholes, gravel paving, stone alignments</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Lauli’i</td>
<td>Coastal</td>
<td>+ Gravel paving</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+ Burials</td>
</tr>
<tr>
<td>Malaeimi</td>
<td>Inland</td>
<td>-</td>
<td>?</td>
<td>?</td>
<td>-</td>
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<td>-</td>
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<tr>
<td>Vaipito</td>
<td>Inland</td>
<td>+ Terrace</td>
<td>-</td>
<td>?</td>
<td>-</td>
<td>-</td>
<td>? Possible earth oven</td>
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<tr>
<td>OFU</td>
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<td></td>
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<tr>
<td>AS-13-1, To’aga</td>
<td>Coastal</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>Earth oven</td>
</tr>
<tr>
<td>TA’U</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AS-11-1, Fagà</td>
<td>Coastal</td>
<td>(pre-date paving and platform)</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>
Recent Advances in the Archaeology of the Fiji/West-Polynesia Region

AS-31-131, Faleniu

Site AS-31-131 includes 77 terraces, 57 walls, nine platforms, eight mounds, two stone rings, and one stone enclosure in Faleniu inland of the Tāfuna Plain (Carson 2005: 121). Excavations at two features produced radiocarbon dates ~1100–800 cal BP. One sample dated a charcoal lens, identified as an ash dump, within earthen terrace fill at Feature 40 (Cochrane, et al. 2004: 191). No other cultural material was associated with the charcoal feature. The second date was obtained from excavations through an earthen filled terrace, Feature 106. The sample directly underlay the terrace retaining edge, and was from a non-ceramic stratum overlaying a ceramic bearing deposit. Carson (2005: 127) states that the radiocarbon date range ‘equals or pre-dates the non-pottery-bearing terrace construction, and it equals or post-dates the deposition of the eroded pottery in the underlying layer.’ No other cultural material is directly associated with this deposit.

Addison and Asaua (2006) list another five dates from Faleniu village, which are calibrated at ~1600–1000 BP. Associated artifactual and stratigraphic information has yet to be published.

AS-34-34, Maloata

Site AS-34-34 is located in Maloata Valley on the northwest coast of Tutuila. Pre-contact and historic features and surface artifact scatters are distributed along the shoreline of Maloata Bay and in the valley proper (Ayres and Eisler 1987: 32). Excavations along the lower valley floor revealed a lithic-artifact-bearing deposit dated ~1300–1000 cal BP (Ayres and Eisler 1987: 72). Several basalt flakes, fire-altered stone, and charcoal are associated with this radiocarbon date. No other artifacts or features were recorded.

Āfono

Six dates calibrated ~1300–900 BP have been obtained from cultural deposits in Āfono Village located along the northeast coast (Addison and Asaua 2006). Two of the dates (Wk-11500 and Wk-11501) are from charcoal in superimposed strata that each contained a single ceramic sherd, however, both strata are interpreted as being in secondary contexts. The remaining dates from Āfono are from the center of the modern village and indicate continuous habitation since ~1300–1000 BP. The cultural deposits associated with these dates include stone pavings, postholes, combustion features, lithic artifacts, and burials.

Amaua

One charcoal sample from excavations at Amaua Village along Faga‘itua Bay along the south shore of Tutuila dates ~1200–800 cal BP (Eisler 1995: 21). The charcoal was obtained from sediment directly underlying a human burial, although there is no direct evidence for association between the charcoal and the burial. This date cannot be firmly associated with a particular event or cultural material.

Aūto

A cultural deposit containing plainware pottery and shell ring/bracelet fragments in Aūto Village along the south shore at Faga‘itua Bay has a single radiocarbon date calibrated ~1300–1200 BP (Addison and Asaua 2006). This deposit underlies a stratum with a large amount of basalt flakes.

Fagamalo

The lowest cultural stratum at Fagamalo Village, located along the northwest coast adjacent to Maloata Bay, dates ~1400–1000 cal BP (Addison and Asaua 2006). There is a possible coral gravel paving in this stratum, but proximity to the beach raises the possibility of natural deposition of the gravel, such as during storm events. No other cultural material is reported from this deposit. This stratum is below a deposit with large amounts of basalt flakes.

Fatu ma Futi

Fatu ma Futi, located along the south shore at the western side of Pago Pago Harbor, has been extensively excavated and provides a large suite of radiocarbon dates (Addison and Asaua 2006). The earliest deposits span ~1600–1000 cal BP and contain gravel pavings, stone alignments, postholes, fire-altered stone, lithic artifacts, and invertebrate and vertebrate faunal remains. The initial cultural strata appear to represent the occasional use of a newly formed beach for marine resource procurement. Overlying these deposits is a stratum with evidence of large-scale lithic manufacturing. Interestingly, the entire sequence at Fatu ma Futi is aceramic.

Lauli‘i

Lauli‘i is a similar coastal setting to Fagamalo, however located along the southeastern shore. A single date calibrated ~1300–1100 BP from the basal cultural deposit at Lauli‘i has been obtained (Addison and Asaua 2006). This deposit contains at least one burial, and perhaps architectural features such as a gravel paving, postholes, and hearths. No portable artifacts or midden have been reported.

Malaeimi

Malaeimi Valley is located at the northern edge of the Tāfuna Plain. A radiocarbon date calibrated ~1300–1000 BP has been obtained from the valley (Suafo’a 1998); however, no detailed provenience information correlating the radiocarbon dates with the cultural material, which includes abundant lithic artifacts and pottery, has been published.
A single radiocarbon date, calibrated ~1500–1300 BP, has been obtained from a cultural deposit at Vaipito far in the interior of Pago Pago Valley (Addison and Asaua 2006). The Vaipito date comes from a terrace fill stratum in a 2000-year sequence of superimposed terraces. The ~1500–1300 cal BP deposit is stratigraphically bracketed by an underlying plainware pottery-bearing stratum dated ~2000 cal BP and a superimposed stratum with evidence of large-scale basalt tool manufacture dated ~700 cal BP (Addison and Asaua 2006). No artifacts or midden were recovered from the mid sequence deposit. This site provides evidence that by the start of the dark ages people had already been living far inland on Tutuila for ~500 years.

**Vaipito**

**Ofu**

**AS-13-1, To'aga**

Site AS-13-1 is located on the To'aga coastal flat along the southeast shore of Ofu Island. Four dates from the extensive excavations undertaken at To'aga date to the period of interest (Kirch 1993). Three of these four dates, calibrated ~1500–1300 BP and ~1300–900 BP, date aceramic cultural deposits. The fourth, and earliest, date calibrated ~1800–1450 BP, provides the youngest age for ceramics at To'aga (Kirch 1993: 89). Nearly all of these dates are associated with invertebrate midden deposits, with some including small amounts of vertebrate faunal remains (Nagaoka 1993). Along with the pottery, an unfinished shell fishhook and an echinoid spine abrader were recovered from one of the deposits. Additionally, one date was obtained from a subsurface ‘ili’ili paving, while another date predates construction of a surface platform (Kirch and Hunt 1993b: 56, 61). No lithic artifacts, discounting fire-altered stones, were derived from the Dark Age deposits.

More recently, an additional date calibrated to this interval has been obtained from To'aga (Addison and Asaua 2006). A large earth oven feature in close proximity to the current beach provided a date of ~1100–900 BP. The top of the oven is more than one meter below the surface, and its location relative to the coast suggests that by ~1000 cal BP the To'aga coastal flat had perhaps attained its present shoreline.

**Ta'ū**

**AS-11-1, Fagā**

Site AS-11-1 is located on the Fagā coastal flat along the north coast of Ta'ū Island. Five radiocarbon dates calibrated within the period under study have been obtained from archaeological investigations at Fagā. One date calibrated ~1300–1050 BP was obtained from charcoal removed from a bulk sediment sample stratigraphically associated with a human burial (Shapiro and Cleghorn 2002: 61–65). It is not apparent how this sample dates the interment or any other specific cultural material or event. The four remaining dates were obtained from excavations across the coastal flat carried out by Cleghorn and Shapiro (2000). All of the dates fall within ~1300–800 cal BP, dating aceramic cultural deposits containing numerous lithic artifacts, including basalt adzes, flakes, an anvil, and a hammerstone, one shell fishhook, and vertebrate and invertebrate faunal remains. These deposits represent the earliest occupation of Fagā identified thus far.

**A summary of the Dark Ages**

The Dark Age period, ~1500–1000 cal BP, has been given considerable socio-cultural significance that presently has little basis in the archaeological record (see also Smith 1999, 2002). From a culture-evolutionary perspective, this must be an important time during which an initial Ancestral Polynesian Society developed into a later hierarchically organized chiefly society. Burley and Clark (2003: 240) state that ‘it was here [during this period] that the foundations for late prehistoric Polynesian polities were forged.’ Because of its formative significance, they suggest that evidence for increased political hierarchy, group divisions, and competition should be archaeologically apparent. Green (2002: 140) is wary of terming this a ‘formative’ period for later socio-cultural developments, but postulates that there was a general continuity within Sāmoan culture with an expanded settlement and use of the landscape. Smith’s (1999, 2002) review of the West Polynesian archaeological record pre-dating ~1000 BP identified the loss of dentate-stamped decoration and complex vessel forms (e.g. Lapita ceramics) as the primary change in material culture during approximately 2000 years. Her results are supportive of general continuity in the archaeological record preceding construction of large field monuments beginning ~1000 BP. This review is complementary to Smith’s analysis as it focuses specifically on the centuries immediately preceding a major change in the record, and includes previously unavailable data.

In terms of the archaeological record, this period is bracketed at one end by cultural deposits most often characterized by their pottery and at the other end by later monumental architecture and expansive settlements. Archaeologists have noted that an absence of pottery has made identification of these deposits difficult (Burley and Clark 2003: 240; Green 2002: 140), while also noting that little research has been tailored specifically to the examination of this portion of the archaeological record (Burley 1998: 380–381; Burley and Clark 2003: 240). For this reason, the 18 sites from across the Sāmoan islands that have deposits dating to this period were characterized.

The following paragraphs will summarize the attribute data presented in Table 2. General observations and patterning of the archaeological record are suggested by the data. Coastal and inland locations were occupied during
this period, and may include a variety of architectural features. Lithic artifacts are present, although at a lower frequency than may be expected, with well-dated major lithic manufacture coming only after the Dark Age. Pottery is very infrequent in these deposits, and only occurs at the earliest end. Invertebrate and vertebrate midden has been recorded from some deposits, although few detailed analyses have been conducted.

With respect to location, these sites represent a variety of locales glossed as ‘coastal’ or ‘inland.’ However, using these general categories, coastal sites have been identified on Ofu and Ta’u with inland sites at Sāva’i and ‘Upolu. Both coastal and inland sites have been recorded on Tutuila.

All of the dates from Sāva’i, ‘Upolu, and Ta’u provide terminus post quem dates for different surface architectural features (stone platforms, paving, star mound, and large stone mound), but they do not provide direct chronological information regarding architecture during the period ~1500–1000 cal BP. In this case, Tutuila provides three directly dated architectural features from Fatu ma Futi (pavings, alignments, and postholes), Lau‘ili (paving), and Vaipito (terrace), with two additional possible gravel pavings and postholes from Fagamalo and Afono.

Surprisingly, only four cultural deposits at SU-17-91 (Tulaga Fale), AS-34-34 (Maloata), Fatu ma Futi, and Fagā contain lithic artifact assemblages. Shell artifacts have been recorded at Áuito, Fatu ma Futi, To‘aga, and Fagā, while faunal remains have been collected from Fatu ma Futi, To‘aga, and Fagā. The most common associated features are earth ovens and burials.

The ceramic evidence gathered in this review has implications for the chronology of pottery production and use in Sāmoa. Only three of the 18 sites contained primary ceramic deposits. Two of these deposits, AS-31-171 (Pava’ia’i) and Áuito are on Tutuila, while the third is the To‘aga site on Ofu. Chronologically, To‘aga provides the earliest date range from ~1800–1450 cal BP followed by AS-31-171 (~1700–1400 cal BP) and Áuito (~1500–1200 cal BP). Based on this review, the presence of pottery in deposits from ~1500–1000 cal BP is rare. Clark (1996: 451) has proposed that ‘pottery was widely used in Samoa through the first half of the first millennium A.D. [and during] the next few centuries pottery use declined, even disappeared at some locations,’ although it may have continued up to 1300–1600 A.D. The present data suggest a very limited distribution of pottery by ~1500 cal BP, which is approximately in line with the earlier proposals by Green and Davidson (1974; Green 1974) and Kirch and Hunt (1993a).

Although very little detailed information from most of the Dark Age cultural deposits has been reported, the data from To‘aga and Fagā are important exceptions. Comparison of the results of the analyses from the To‘aga and Fagā assemblages demonstrates a significant degree of spatial variability between nearly contemporaneous deposits within the small, closely grouped islands of Manu‘a. The To‘aga deposits from this interval begin with pottery, which quickly drops out of the sequence, and contain abundant vertebrate and invertebrate faunal remains, some non-lithic artifacts, and no lithic artifacts. In contrast, the deposits from Fagā have produced numerous basalt artifacts including formal tools, retouched and polished flakes, and manufacturing flakes along with invertebrate and vertebrate midden. Future comparisons between the assemblages throughout the archipelago are needed to explain changes in Sāmoan culture during this time. Publication of the extensive excavations at Fatu ma Futi will further this end.

Our current knowledge of the archaeological record in Sāmoa during the period ~1500–1000 BP is extremely limited, yet it offers minimal support for the ‘formative’ characteristics hypothesized by Burley and Clark (2003: 240). Barring three primary pottery-bearing deposits, pottery is absent from most locales, suggesting that it is during these centuries that pottery production ceases in many, if not all, communities in the archipelago. Identifying changes in associated or contemporaneous material culture during this period requires further analysis. For the two sites that do have an appreciable amount of analyzed cultural material dating to this time, significant variability in these assemblages is noted. Comparable data sets are needed from across the island group to expand our understanding of group interaction, lithic/bone/shell/coral artifact technologies, subsistence strategies, and settlement. Although presently painted in broad brush strokes, a methodology that documents variability in the archaeological record, at a number of scales, will be necessary to analyze change in material culture through time and space. It is only with such data that we can begin to explain processes of culture change and complexity.

REFERENCES


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SAMOAN PLAIN WARE CERAMICS OF TUTUILA ISLAND, AMERICAN SĀMOA: SOME THOUGHTS ON THEIR SPATIAL AND CHRONOLOGICAL DISTRIBUTION

David J. Addison* · Jeffery Toloa† · Tuipuavai Tago† · Siaki Vaueli†

ABSTRACT

The last decade has seen big changes in understandings of the amount and distribution of plainware ceramic sites on Tutuila. This paper reviews this new evidence and discusses the spatial and temporal distribution of sites. We suggest that the argument for late ceramics on Tutuila is weakened by recent discoveries and that the idea of ceramic use ending in the ~AD 400–800 period is strengthened. At the early end, we find few convincing data currently available to support ceramic sites outside the one known for 'Upolu has been unsuccessful and we question the utility of continuing to posit their existence in models of Samoan prehistory. Inland settlement on Tutuila was not a late-period phenomenon; ceramic-bearing strata at several sites indicate inland settlement by ~200–100 BC. The minimal and rare decoration on Tutuila ceramics was not confined to the earliest period and likely continued to the end of ceramic use on the island.

INTRODUCTION

Almost three millennia ago people using Lapita1 pottery spread over a 4500 km distance from the Bismarck Archipelago to Sāmoa. This major event in Pacific prehistory represents the beginning of humanity’s colonization of the last major unpopulated area of the earth – Remote Oceania. The Mulifanua site on 'Upolu, dating to ~1050–650 BC marks the easternmost extent of Lapita exploration (Petchey 2001).

Green and Davidson’s foundational work on Samoan archaeology established the initial chronology and found that Samoan Plain Ware characterized the 'Upolu sites dating to ~100 BC–AD 300 (Green and Davidson 1974b). Green noted that the ‘continuity between Lapita and the Plain Ware assemblages’ was based on ‘general technological resemblances’ and the evidence was ‘not very impressive’ (Green 1974: 249). Yet at the time it was the best ‘case in Western Polynesia for continuity between the ancestral Lapita horizon and the Polynesian cultural complex which developed from it in the course of the next 2000 years’ (Green and Davidson 1974b: 224). The relationship (or lack thereof) between Lapita and subsequent cultural traditions remains a fundamental issue in West Polynesian archaeology.

The conventional model holds that Sāmoa was occupied from this time onward and sees Lapita as directly ancestral to the current Samoan populations and cultures (e.g., Clark 1996, Green 2002, Kirch and Hunt 1993b). A similar scenario is widely accepted for all of West Polynesia (except Niue, Tokelau, and Tuvalu, the initial colonization of which was clearly later) and is closely linked to the constructions of Ancestral Polynesian Society (Kirch and Green 2001 and sources therein). Critiques of this scenario have been few (but see Smith 1995, Smith 2002, Terrell 1989, Terrell et al. 1997). Smith’s detailed examination of the evidence for continuity indicates that more work is needed before a strong evidence-based argument for continuity can be made (Smith 2002). Crucial in assessing continuity in the region will be robust data sets from both undecorated components of Lapita assemblages and assemblages of Polynesian Plain Ware.

As late as 1996, Clark and Michlovic could write that ‘Aoa was the ‘only ceramic residential site known for Tutuila’ (Clark and Michlovic 1996:164). The last decade has seen an explosion in the documentation of plainware sites, with more now known on Tutuila than on any other island in the West-Polynesia region. Below, we present summary information on these new sites and discuss some aspects of their spatial and chronological distribution. Most of these collections await detailed analysis, and there is little data in this paper to address the Lapita-to-plainware issue. However, we contend that bringing attention to the

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1 Although we acknowledge the ongoing discussion of whether there is a ‘Lapita cultural complex’ and what constitutes it, we do not wish to engage in it here and hence adopt the conservative definition of ‘Lapita’ as dentate-stamped pottery.
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Summaries of Samoan prehistory can be found in Clark (1996) and Wallin et al. (2007). Samoa in regional context is discussed in Burley and Clark (2003). Some current topics on Tutuila are reviewed by Addison and Asaua (2006b). Dates in this paper are reported at 2σ and use the calibration in the original publication unless otherwise noted. Dates reported here for the first time are calibrated with OxCal v3.10 (Bronk Ramsey 2005) using the Northern Hemisphere curve (Reimer et al. 2004) for reasons discussed elsewhere (Addison and Asaua 2006a, Petchey and Addison this volume).

CERAMICS IN SAMOA

The first ceramics in Samoa were found at Vailele (Figure 2) on 'Upolu in 1957 by Golson. His work as part of the Tri-Institutional Pacific Program represented the first modern archaeology in Samoa and gave an initial indication of the richness of the archipelago's record (Golson 1959, Golson 1969). At the 10th Pacific Science Congress in Honolulu in 1961, archaeologists decided to follow up this program with a coordinated approach to investigating the region’s prehistory – the Polynesian Culture History Program.

Green took Samoa and led an international team on a multiyear research project on the islands of 'Upolu, Apolima, and Savai'i, building on Golson's initial discoveries. That work (Green and Davidson 1969, Green and Davidson 1974a) laid the foundations of subsequent discussions of Samoan prehistory. The project found ceramic sites on 'Upolu (Green and Davidson 1969, Green and Davidson 1974a) and Apolima (Peters 1974). Their initial results suggested pottery manufacture in Samoa from ~100 BC–AD 300 with ceramics sites spread throughout 'Upolu in both inland and coastal locations (Green and Davidson 1974b).

As the project was ending, Lapita pottery was discovered at Mulifanua on 'Upolu (Jennings 1974). Based on the rapidly accumulating dates for Lapita from other archipelagos, Green and Davidson inferred the Mulifanua deposits dated to 'around or before 800 B.C. ' (Green and Davidson 1974b: 224). Subsequent radiocarbon dates of ~930–800 BC confirmed their initial estimate (Petchey 2001: 67). Green and Davidson noted that the first 600–800 years of Samoan prehistory were represented only by the Mulifanua deposits, with 'securely dated habitation layers…not known until the first century A.D.' (Green and Davidson 1974b: 224).

To date, all known pottery in Samoa is Samoan Plain Ware, except that from Mulifanua. As well as its minimal decoration, Samoan Plain Ware is characterized by simple vessel shapes. So far, only open mouthed globular to subglobular bowls and cups have been documented. Rims are simple and flat or rounded (e.g., Figures 5, 6, & 7).

Figure 1. Samoa's location in the Pacific. Base map courtesy of Peter Minton (http://www.evs-islands.blogspot.com).
Jennings and colleagues’ research on ‘Upolu and Manono in the 1970s found additional Samoan Plain Ware sites on those islands. Complexities of stratigraphy and dating make the pottery’s exact chronological position difficult to interpret, but it probably dates to the ~550 BC–AD 450 period (see reviews in Rieth 2007, Smith 2002).

On Savai’i, additional ceramics have been found at the Pulemelei site (Martinsson-Wallin et al. 2007), and Ishimura (Ishimura and Inoue 2006) has found ceramics in excavations at the Si’utu site originally found by Buist (1969).

The first ceramics on Tutuila were found in 1980 at the Tataga Matau basalt quarry by Jeff Clark (1980). In 1986 Clark and Herdrich found several ceramic sites at ‘Aoa (Clark and Herdrich 1988). This same year, two ceramic sites were found in Manu’á – at the To’aga Landfill on Ofu Island (Figure 3) and at Ta’u Village on Ta’u Island (Hunt and Kirch 1987; Hunt and Kirch 1988). Kirch, Hunt and colleagues (Kirch and Hunt 1993c, Kirch et al. 1990) spent three field seasons at To’aga excavating deeply stratified cultural deposits overlying a beach dated by non-cultural shell to ~1950–1350 BC (calibration after Rieth et al. in press, Table 1). These deposits were argued to ‘span virtually the entire three-millennium-long sequence of Samoa’ (Kirch and Hunt 1993a:2). The interpretive paradox at To’aga was that, although the dates indicated occupation contemporaneous with the Mulifanua Lapita site (or even predating it), no dentate-stamped pottery or vessel shapes characteristic of known Lapita assemblages were found at To’aga. Still the researchers felt ‘certain that the island of Ofu, and the To’aga site, were settled by the end of the second millennium B.C. as part of the process of discov-
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ery and colonization of the Fiji-West Polynesia region by Lapita populations' and that an in situ Lapita occupation was 'situated on a beach ridge inland' of their excavations 'and now buried under several meters of talus and colluvium' (Kirch 1993: 91). They proposed that the full range of artifacts at To'aga indicated continuity of settlement from Lapita times onward (Kirch and Hunt 1993b).

Best subsequently found another ceramic site on Ofu at Va'otō (Best 1992a), and Clark spent two seasons excavating there (Clark 1994). Clark also more locations on Tāū (Clark 1990). Herdrich and colleagues found two sites with sherds inland of Tāū Village (Herdrich et al. 1996). ASPA (American Samoa Power Authority) archaeologists later found additional ceramic sites on Ofu between To'aga and Va'otō. Ceramics are now documented for most of Ofu’s south coast. Manu'a has yet to be systematically explored for additional ceramic sites. There are extensive archaeological sites at inland locations on each island, and it is likely that their simpler geomorphological context would favor sherds being visible at the surface, were systematic surveys to be undertaken.

Clark (1994) found the first sherds on 'Aunu'u Island (Figure 2). Best’s subsequent testing indicated intact Samoan Plain Ware deposits there (Best 1992b). GIS modeling indicates this as a likely spot for early settlement (Morrison et al. in review [expected 2008], Morrison et al. 2007), and a sampling strategy for finding Lapita-aged beaches has been proposed (Rieth et al. in press).  

TUTUILA CERAMIC SITES  

While Hunt and Kirch were finding ceramics in Manu’a, Jeff Clark was beginning three seasons of fieldwork on Tutuila (Clark 1989, Clark 1992, Clark 1993a, Clark 1993b, Clark and Herdrich 1988, Clark and Herdrich 1993). Two of the research goals of the Eastern Tutuila Archaeological Project were finding Lapita sites on Tutuila and understanding the relationship of geomorphological processes to site visibility on the island (Clark and Herdrich 1988: 9–10). Clark found Samoan Plain Ware2 at four locations – minimal ceramics at three locations and some 878 sherds at ‘Āoa (Clark and Michlovic 1996). The dates associated with the ‘Āoa ceramic deposits were interpreted as ‘contemporaneous with the Lapita site of Mulifanua, starting at ca. 3000 BP’ (Clark 1993b: 325) and comparable to the earliest dates at To’aga. However, as at To’aga, the hallmarks of Lapita ceramics – dentate stamping and complex vessel forms – were absent.

Many more sites have been found in the two decades since Clark’s initial discovery of ceramic sites on Tutuila (Table 2). Most of these discoveries have been the result of contract archaeology associated with development on the island and done in compliance with US federal historic preservation law. A majority of these have been found during archaeological work associated with construction by ASPA. Much of this work remains unreported and an attempt will be made here to give at least some indication of the wealth of that unreported material. Most of the new sites are on western Tutuila and associated with the Tualauta County Sewerline construction project. Before discussing these sites, we will mention the ones on the rest of the island (for locations see Figure 4). The following villages are arranged roughly east to west.

Utumea  

In 1998, excavations associated with an ASPA waterline found subsurface ceramics at Utumea and Aganoa (Moore and Kennedy 1999). A total of 217 sherds was found at Utumea. Calibrated dates range from 414 BC–AD 100. While these dates are plausible for Samoan Plain Ware deposits, site stratigraphy and chronology are poorly understood. These sherds have not been analyzed.

Table 1. Chronology of Sāmoa ceramics.

<table>
<thead>
<tr>
<th>Initial settlement**</th>
<th>Plainware ends</th>
<th>Earliest inland ceramics sites</th>
<th>Data source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green and Davidson by 800 BC</td>
<td>AD 300</td>
<td>300 BC–AD 100</td>
<td>‘Upolu</td>
</tr>
<tr>
<td>Kirch and Hunt</td>
<td>by 1000 BC</td>
<td>AD 400–500</td>
<td>—</td>
</tr>
<tr>
<td>J. Clark and Michlovic ca. 1000 BC</td>
<td>AD 1600</td>
<td>—</td>
<td>‘Āoa</td>
</tr>
<tr>
<td>Wallin, Martinsson-Wallin and G. Clark* yet to be definitively established</td>
<td>AD 500</td>
<td>‘Upolu 400 BC–AD 30</td>
<td>Savai'i 100 BC–AD 200</td>
</tr>
<tr>
<td>Data herein ~500 BC</td>
<td>AD 600–700</td>
<td>350 BC–AD 0</td>
<td>Tutuila</td>
</tr>
</tbody>
</table>

* (Wallin et al. 2007) ** See critical evaluation of Sāmoa colonization-period dates elsewhere (Rieth et al. in press, Rieth 2007).

2 None of the pottery from anywhere in American Samoa deviates from the simple vessel form and minimal decoration characteristic of Samoan Plain Ware.
Table 2. Ceramic sites in American Sāmoa. NA=not assigned. Dates are as listed in original reports. For multiple dates from the same site the earliest end of the earliest date and latest end of the latest date at 2σ are listed.

<table>
<thead>
<tr>
<th>Site No.</th>
<th>No. of sherds</th>
<th>Name/Location</th>
<th>Visibility</th>
<th>Date at 2σ</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS-11-59</td>
<td>minimal</td>
<td>Inland of Ta’ū Village</td>
<td>Surface</td>
<td>–</td>
<td>Clark 1990, Herdrich et al. 1996</td>
</tr>
<tr>
<td>AS-11-73</td>
<td>2,434</td>
<td>To’aga</td>
<td>Subsurface</td>
<td>–</td>
<td>Herdrich et al. 1996</td>
</tr>
<tr>
<td>NA</td>
<td>~20</td>
<td>Between To’aga and Va’oto</td>
<td>Subsurface</td>
<td>–</td>
<td>ASPA Archaeology files</td>
</tr>
<tr>
<td>AS-21-5</td>
<td>878</td>
<td>Áoa</td>
<td>Subsurface</td>
<td>1505–245 BC</td>
<td>Clark and Michlovic 1996</td>
</tr>
<tr>
<td>NA</td>
<td>&lt;100</td>
<td>‘Āuto</td>
<td>Subsurface</td>
<td>AD 640–770</td>
<td>ASPA Archaeology files, Addison and Asaua 2006a</td>
</tr>
<tr>
<td>AS-22-44</td>
<td>217</td>
<td>Utumea</td>
<td>Subsurface</td>
<td>414 BC–AD 100</td>
<td>Moore and Kennedy 1999</td>
</tr>
<tr>
<td>AS-23-22</td>
<td>minimal</td>
<td>Álega</td>
<td>Surface</td>
<td>–</td>
<td>Clark and Michlovic 1996</td>
</tr>
<tr>
<td>NA</td>
<td>2</td>
<td>Áfono</td>
<td>Subsurface</td>
<td>AD 650–970</td>
<td>ASPA Archaeology files, Addison and Asaua 2006a</td>
</tr>
<tr>
<td>AS-25-62</td>
<td>1</td>
<td>Fatu-ma-Futi</td>
<td>Subsurface</td>
<td>–</td>
<td>Kaihillwa et al. 2005</td>
</tr>
<tr>
<td>AS-25-65</td>
<td>~1,000</td>
<td>Vaipito</td>
<td>Subsurface</td>
<td>350 BC–AD 10</td>
<td>ASPA Archaeology files, Addison 2004, Addison and Asaua 2006a</td>
</tr>
<tr>
<td>AS-25-66</td>
<td>~2,000</td>
<td>Fo’isia</td>
<td>Subsurface</td>
<td>370 BC–AD 130</td>
<td>ASPA Archaeology files, Addison 2004, Addison and Asaua 2006a</td>
</tr>
<tr>
<td>NA</td>
<td>minimal</td>
<td>Puna</td>
<td>Surface</td>
<td>–</td>
<td>Addison, pers. comm.</td>
</tr>
<tr>
<td>AS-32-16</td>
<td>many</td>
<td>Ásufou (Vainu’u)</td>
<td>Surface</td>
<td>–</td>
<td>ASHPo files</td>
</tr>
<tr>
<td>NA</td>
<td>minimal</td>
<td>Ásufou</td>
<td>Surface</td>
<td>–</td>
<td>D. Herdrich, pers. comm.</td>
</tr>
<tr>
<td>AS-32-7</td>
<td>8</td>
<td>Malae’ōa</td>
<td>Surface</td>
<td>–</td>
<td>ASHPo files, Ayres et al. 2001</td>
</tr>
<tr>
<td>AS-34-10</td>
<td>1</td>
<td>Tataga Matau</td>
<td>Surface</td>
<td>–</td>
<td>Clark and Michlovic 1996</td>
</tr>
<tr>
<td>AS-34-10</td>
<td>1</td>
<td>Tataga Matau</td>
<td>Surface</td>
<td>–</td>
<td>ASPA Archaeology files</td>
</tr>
<tr>
<td>NA</td>
<td>minimal</td>
<td>Leone</td>
<td>Surface</td>
<td>–</td>
<td>Clark and Michlovic 1996</td>
</tr>
<tr>
<td>NA</td>
<td>15</td>
<td>Tāfuna</td>
<td>Surface</td>
<td>–</td>
<td>Shapiro and Cleghorn 1994</td>
</tr>
<tr>
<td>AS-31-34</td>
<td>~5,000</td>
<td>Malae’imi</td>
<td>Surface</td>
<td>AD 800–1200**</td>
<td>Ayres et al. 2001</td>
</tr>
<tr>
<td>NA</td>
<td>~2,000</td>
<td>Faleni, various sites</td>
<td>Both</td>
<td>AD 70–665</td>
<td>ASPA Archaeology files</td>
</tr>
<tr>
<td>AS-31-94</td>
<td>1</td>
<td>Faleni</td>
<td>Subsurface</td>
<td>–</td>
<td>Cochrane et al. 2004</td>
</tr>
<tr>
<td>AS-31-97</td>
<td>2</td>
<td>Faleni</td>
<td>Subsurface</td>
<td>–</td>
<td>Cochrane et al. 2004</td>
</tr>
<tr>
<td>AS-31-99 &amp; 100</td>
<td>2</td>
<td>Faleni</td>
<td>Subsurface</td>
<td>–</td>
<td>Cochrane et al. 2004</td>
</tr>
<tr>
<td>AS-31-102</td>
<td>23</td>
<td>Faleni</td>
<td>Subsurface</td>
<td>–</td>
<td>Cochrane et al. 2004</td>
</tr>
<tr>
<td>AS-31-115</td>
<td>1</td>
<td>Pava’i’a’i</td>
<td>Surface</td>
<td>–</td>
<td>Cochrane et al. 2004</td>
</tr>
<tr>
<td>AS-31-106 &amp; 116</td>
<td>8</td>
<td>Pava’i’a’i</td>
<td>Surface</td>
<td>–</td>
<td>Cochrane et al. 2004</td>
</tr>
<tr>
<td>AS-31-126</td>
<td>4</td>
<td>Kokoland</td>
<td>Surface</td>
<td>–</td>
<td>Cochrane et al. 2004</td>
</tr>
<tr>
<td>NA</td>
<td>~100</td>
<td>Kokoland various sites</td>
<td>Surface</td>
<td>–</td>
<td>ASPA Archaeology files</td>
</tr>
<tr>
<td>NA</td>
<td>~1,000</td>
<td>Kokoland M-2 Data Recovery</td>
<td>Subsurface</td>
<td>360–50 BC</td>
<td>ASPA Archaeology files</td>
</tr>
<tr>
<td>AS-31-127</td>
<td>5</td>
<td>Faleni</td>
<td>Subsurface</td>
<td>–</td>
<td>Cochrane et al. 2004</td>
</tr>
<tr>
<td>AS-31-127</td>
<td>5</td>
<td>Faleni (‘Ulu Tree)</td>
<td>Subsurface</td>
<td>730–230 BC</td>
<td>Cochrane et al. 2004</td>
</tr>
<tr>
<td>AS-31-129</td>
<td>2</td>
<td>Mēsepa</td>
<td>Subsurface</td>
<td>–</td>
<td>Cochrane et al. 2004</td>
</tr>
<tr>
<td>AS-31-130 &amp; 131</td>
<td>124</td>
<td>Faleni</td>
<td>Subsurface</td>
<td>–</td>
<td>Cochrane et al. 2004</td>
</tr>
<tr>
<td>AS-31-132</td>
<td>9</td>
<td>Pava’i’a’i</td>
<td>Surface</td>
<td>–</td>
<td>Cochrane et al. 2004</td>
</tr>
<tr>
<td>AS-31-136, 140, &amp; 141</td>
<td>23</td>
<td>Pava’i’a’i</td>
<td>Surface</td>
<td>–</td>
<td>Cochrane et al. 2004</td>
</tr>
<tr>
<td>AS-31-142</td>
<td>2</td>
<td>Pava’i’a’i</td>
<td>Subsurface</td>
<td>–</td>
<td>Cochrane et al. 2004</td>
</tr>
<tr>
<td>AS-31-171</td>
<td>33</td>
<td>Pava’i’a’i Red Ash profile</td>
<td>Subsurface</td>
<td>AD 250–540</td>
<td>Addison et al. 2006</td>
</tr>
<tr>
<td>AS-31-171</td>
<td>~1,000</td>
<td>Pava’i’a’i R-6 Data Recovery</td>
<td>Subsurface</td>
<td>AD 540–650</td>
<td>ASPA Archaeology files</td>
</tr>
<tr>
<td>NA</td>
<td>~1,000</td>
<td>Pava’i’a’i Malae</td>
<td>Subsurface</td>
<td>210 BC–AD 80</td>
<td>ASPA Archaeology files</td>
</tr>
<tr>
<td>NA</td>
<td>&lt;100</td>
<td>Pava’i’a’i various</td>
<td>Surface</td>
<td>–</td>
<td>ASPA Archaeology files</td>
</tr>
</tbody>
</table>

* Beta-1974 calibrated with the 2004 marine curve (Hughen et al. 2004 and using a ΔR of 25±28 (Petchey and Addison, this volume).
** The publication includes this date with no indication of its calibration protocol.
Aganoa

At Aganoa, Moore and Kennedy found 1984 sherds during excavation. A single date calibrates to 796–174 BC. As at Utumea, stratigraphic and chronological relationships are unclear at this site. Analysis was done on 783 of the Aganoa sherds. The only decoration was ‘incised grooves in a crisscross pattern on the upper surface (face) of the lip’ of two rim sherds (see Moore and Kennedy 1999:103–110). Eckert has examined 895 of the Aganoa sherds for temper analysis. She noted the presence of grog temper, 15 sherds with red slip, and 4 (3 triangles and 1 disk) deliberately shaped sherds (Eckert 2006:67). Further excavations by Eckert, Pearl, and students at Aganoa in 2006 significantly increased the sample of sherds and publication of their results should provide a better understanding of the site’s stratigraphy and chronology. At To’aga, red slip was considered an indicator of the earliest deposits (Kirch and Hunt 1993c) and the shaped sherds are reminiscent of the sherd disks from Mulifanua.

‘Āoa

Sherds were initially discovered in a stream bank at ‘Āoa. Subsequent excavation over two seasons resulted in an assemblage of 878 sherds (Clark and Michlovic 1996). Lower ceramic-bearing strata date to BC 1505–245. Dates from upper sherd-bearing strata date to AD 1297–1657. Clark suggested the possibility of ‘pottery use a thousand years or so longer than previously thought’ at least at some locations on Tutuila (Clark and Michlovic 1996:164). We return to this topic below. Clark also noted sherds at another location at the west end of ‘Āoa bay (Clark, pers. comm.).

‘ Āuto

ASPA archaeologists found fewer than 100 sherds during installation of a septic tank in ‘Āuto. A date of AD 640–770 is associated with the sherds (Addison and Asaua 2006a). More work is needed at the site to determine the context of these deposits and their chronological associations.

Ālega

Clark found three surface sherds at a mountainside site (AS-23-22) at Ālega although none was found at the coastal flat below (Clark 1992). These sherds may well be in secondary context and indicative of primary ceramic-bearing deposits at the ridgetop.

Āfono

Two sherds were found below deep colluvial deposits at Āfono. They come from the interface between the colluvial deposits and underlying wetland deposits (ASPA Archaeology files; Addison 2004) and date to AD 650–970 (Addison and Asaua 2006a).

Fatu-ma-Futi

One sherd was found during excavation at Fatu-ma-Futi (Kailihiwa et al. 2005). It was deep in terrigenous deposits at the bottom of a steep slope. Habitation features are described for the ridge above (Addison et al. 2008) and the sherd is probably from there. Extensive excavations on the Fatu-ma-Futi coastal flat revealed rich cultural deposits but no ceramics (Addison and Valentin 2006). Dates

Figure 4. Location of ceramic sites on Tutuila (* indicates sites with incised rims).
from these excavations go back to AD 330–550, although the main cultural deposit is slightly later (Addison and Asaua 2006a). Inbuilt sample age or other reasons may account for the earliest date (Addison et al. 2008).

Vaipito

Vaipito is a far inland section of Pago Pago Village less than 500 m from the mountain pass to Fagasā. The ceramic deposit is located at the lowest level of a terrace that was repeatedly rebuilt and heightened over some two millennia (Addison 2004). Excavation in the terrace initially revealed just two sherds. Later sewerline construction that cut into the base of the terrace exposed a deposit from which ~1000 sherds were recovered. The deposit is interpreted as an ancient hill-slope below a habitation area from which refuse was thrown. Many large sherds (~10 cm in a dimension) and the presence of in situ articulated sherds suggest very little disturbance of this deposit before it was covered by later terrace-building activities. The stratum with the ceramics dates to 350 BC–AD 10 (Addison and Asaua 2006a).

Fo’isia

The Fo’isia site is about 100 m from the Vaipito site and at the same elevation far inland in Pago Pago. During sewerline construction ASPA Archaeology personnel noted abundant sherds adjacent to the sewerline in the heavy-equipment spoil of a terrace being excavated for house construction. An intact pottery-bearing stratum was located in the cut hillside. Stratigraphic excavations were done back from the cut face. There was a thin ceramic-bearing deposit on top of basal rock and capped by a thick aceramic deposit with little cultural material of any kind. Five dates unambiguously associated with the ceramics range 370 BC–AD 130 (Addison and Asaua 2006a). The depositional context appears to mirror Vaipito – refuse thrown on a hillside and subsequently covered, with little post-depositional disturbance. Many of the sherds measure >10 cm in one dimension. About half of the ~2000 sherds from this site were collected from the disturbed spoil. Apparently most of the deposit was removed by the heavy equipment, because archaeological excavations showed a narrowing deposit further into the hillside. Several pecked-stone pounder fragments were found in situ with the ceramics. Others came from the spoil. This kind of artifact, so characteristic of East Polynesia, is only known in West Polynesia from the Fo’isia site (Addison 2004).

Puna

Addison has found a few sherds around his house in the Puna section of inland Faleniu. He has also noted basalt tool fragments, basalt flakes, stream-pebble paving and ovoid foundations in the general area (Addison 2008). There has been no systematic archaeological work in the area.

Āsufou

Results are in preparation from Eckert and students’ 2006 and 2007 excavations at the ceramic site of Vainu’u at the inland village of Āsufou. Herdrich previously noted isolated sherds in another part of Āsufou (Herdrich, pers. comm.).
Malae'imi

Surface sherds were found at an inland terrace site in Malae'imi (American Samoa Historic Preservation Office site files; Ayres et al. 2001). It is unclear whether these are derived from a ridgetop primary deposit and thus in secondary context.

Leone

Clark mentions finding an isolated surface sherd at Leone (Clark and Michlovic 1996: 164). Because of late-Holocene pyroclastic deposits, deposits older than ~AD 1200–1400 in Leone are likely capped by meters of ashrock (Addison and Asaua 2006a). Hence, further ceramics at Leone are likely to be found only at sites on non-Leone-Volcanic-Series substrates (i.e., they will be on mountain slopes).

Tataga Matau

Clark found one surface sherd at the massive inland basalt quarry site of Tataga Matau (Clark and Michlovic 1996: 164). Toloa, Tago, and Addison also found one surface sherd on a ridgetop at Tataga Matau (ASPA Archaeology files).

Tualauta Sewer Project Ceramic Sites

Tualauta County stretches from Nu’uuli to Leone and encompasses all of the Tafuna Plain (Figure 4) and much of mid-to-late-Holocene volcanics of Tutuila (Leone Volcanic Series). The interior of Tualauta is highly dissected 1.0–1.5 million-year-old mountains. The Leone Volcanics added the gently sloping land between the steep mountains and the Tafuna Plain. This plain is rocky, with lava or ashrock often at the surface and rarely covered by more than a meter of soil. ASPA began a large sewerline project in Tualauta County in the mid 1990s to protect the important aquifer under the Tafuna Plain. All ceramics known from the county are the result of archaeological work associated with the Tualauta County Sewerline Project. Initially, a series of companies was contracted to do aspects of this work. In 2002, ASPA decided to develop an internal archaeology unit to conduct archaeological investigations in-house. From 2002–2006 this unit was directed by Addison.3

During the initial phase of the sewerline project, archaeological surface and subsurface surveys found 75 sherds (Shapiro and Cleghorn 1994). Of these, 15 were from a cluster of sites in Tafuna. The other sixty were from a site in Malae'imi. Epi Suafo'a (now Suafo'a-Tau'ai) conducted further excavations at the Malae'imi site, collecting ~5000 sherds. This remains the largest collection from any site in American Samoa, by a factor of two. The site has not been fully reported (but see Ayres et al. 2001), and although Ayres et al. suggest a date of AD 800–1200, stratigraphic and chronological associations at the site cannot currently be evaluated.

Several small surface scatters of sherds were found over three field seasons of survey on the Tualauta Sewerline Project by Taomia and a team from the University of Oregon (Taomia 2001a, Taomia 2001b, Taomia 2002). No sherds were collected during these surveys. Subsurface survey at these sites by shovel test pit was done by Cochrane and colleagues (Cochrane et al. 2004) of the International Archaeological Research Institute, Inc. (IARI). The lack of correspondence between surface indications and subsurface deposits found by Cochrane's team highlights the importance of construction monitoring as a significant component of site discovery. It is impossible to know how many other ceramic sites have gone unrecorded on Tutuila for lack of archaeological monitoring of major construction activities. Cochrane's analysis of the project's 42 surface and 264 excavated sherds suggests differences between sites in temper grain size (Cochrane 2004). Results of further excavations by IARI at some of these sites in 2001–2002 are in preparation.

Further ceramic sites were discovered in the Tualauta Sewerline Project area after ASPA decided to conduct archaeological investigations 'in-house'.

Tafuna

ASPA Archaeology noted a few surface sherds during survey on land of Fonoti, west of the sites located by Shapiro (Shapiro and Cleghorn 1994).

Malae’imi

During reconnaissance survey after Hurricane Heta, an ASPA Archaeology crew noted sherds on the surface in the area between the Tafuna ceramic sites (Shapiro and Cleghorn 1994) and the Malae’imi site (Ayres et al. 2001).

Kokoland4

Sherds have been found in surface contexts in Kokoland since Taomia’s initial survey of the area (Site AS-31-126, Taomia 2001a: 39). Cochrane found at total of 4 sherds from 11 subsurface survey units with no identified subsurface deposit (Cochrane et al. 2004: 337–342). ASPA Archaeology gives priority to fieldwork over analysis and publication. Addison left ASPA in 2006, partly in protest over this issue. Part of the purpose of this paper is to make summary results available. Addison hopes to be permitted access to the ASPA Archaeology material in future to contribute to the full reporting of this work.

3 Because of workload and inadequate resources, ASPA Archaeology gave priority to fieldwork over analysis and publication. Addison left ASPA in 2006, partly in protest over this issue. Part of the purpose of this paper is to make summary results available. Addison hopes to be permitted access to the ASPA Archaeology material in future to contribute to the full reporting of this work.

4 Following the usage at ASPA (and hence on the ASPA Archaeology notes and bags), we use the term 'Kokoland' to refer to an area that is larger than what many Tutuila residents would call Kokoland. As used here, the term refers to areas that are more properly parts of Malae’imi, Mēsepa and Faleniu.
Chaeology has found about 100 sherds from a variety of sites in Kokoland.

An intact ceramic deposit was found during monitoring of construction trenching midway between Sites AS-31-126 and AS-31-127 (also called 'Ulu Tree Site, see below). Subsequent excavations called 'Kokoland M-2 Data Recovery' were done in 2006 with the assistance of Winterhoff and the University of Oregon field school. This 2 x 2 m excavation recovered sherds from a cultural deposit buried by almost 2 m of aceramic deposits. A date5 of 360–50 BC came from the same stratum as the ~1000 excavated sherds.

Proximity (~100 m) and radiocarbon results suggest contemporaneity of these sherds and the sherds from the 'Ulu Tree Site. These two sites also typify the site visibility problems in Tualauta. 'Ulu Tree is on a lava outcrop with sherds visible at the surface and only ~50 cm of sediments. Kokoland M-2 Data Recovery is in a low spot where alluvial and other depositional processes have resulted in a thick cap over the ceramics and no pottery visible at the surface.

These two sites are also typical for Tualauta in that the ceramic deposits are highly constrained horizontally. Two surface surveys (Cochrane et al. 2004, Taomia 2001a) and systematic subsurface testing (Cochrane et al. 2004) failed to find the intact subsurface deposit at the 'Ulu Tree Site. At the Kokoland M-2 ceramic site, construction trench monitoring showed that the ceramic deposit extended for a length of less than 10 m in the trench.

Faleniu

Some 2000 sherds have been collected by ASPA Archaeology from a variety of surface and subsurface contexts in Faleniu. Currently, more ceramic sites are known for Faleniu than anywhere else in American Sāmoa. Some of these sites are capped by a red ash layer with only aceramic strata above (as described for Pava’ia’i, Addison and Asaua 2006a, Addison et al. 2006). Dates for such deposits in Faleniu are in the AD 70–665 range (Addison and Asaua 2006a).

Two rim sherds with incised lips were found at one such deposit located at the Faleniu-Pava’ia’i border. A piece of unidentified charcoal6 dates this deposit to the AD 330–540 range (Addison and Asaua 2006a). As noted by Addison and Asaua, this is much later than generally thought for decoration on Samoan Plain Ware – in fact, it suggests that limited decoration continued until near the end of ceramic use in Sāmoa.

THE 'ULU TREE SITE

The 'Ulu Tree Site is a component of Site AS-31-127. Taomia’s team first noted surface ceramics at Site AS-31-127 in 1997 (Taomia 2001a: 38). Three of Cochrane’s 11 subsurface survey units yielded a total of only five sherds, no discernible subsurface deposit, and in two units modern material (e.g., metal, glass) was in the same context as the ceramics (Cochrane et al. 2004: 343–348). The presence of a subsurface deposit at this Faleniu Village site was indicated when sherds were noted in the rootmass of an 'ulu (bread-

6 For many of the ASPA dates on unidentified charcoal, a half piece of the dated sample has been archived for future identification and/or dating.

Figure 6. Representative rims from sites in Kokoland.
Recent Advances in the Archaeology of the Fiji/West-Polynesia Region

fruit) tree uprooted during Hurricane Heta. Very limited excavation (50 x 60 cm) by ASPA Archaeology confirmed the subsurface deposit and resulted in a collection of 259 sherds from both surface and excavation. In visual inspection of the sherds during her ceramic analysis of this small assemblage, Eckert notes the diversity of tempers (Eckert and Pearl 2006). She is working on a detailed petrographic analysis of the assemblage. A date\(^7\) of 730–230 BC is associated with the sherds. This is the oldest date anywhere in Tutuila County (or anywhere on Tutuila outside of 'Ao). Allen and Wallace (Allen and Wallace 2007) have documented up to 300 years of inbuilt age for unidentified wood charcoal at Aitutaki in the Cook Islands. If this degree of inbuilt age is common in tropical Pacific environments, it may help explain this anomalously early date at the 'Ulu Tree Site. Alternatively, the date could simply be a statistical outlier. The period of use of the 'Ulu Tree sherds is likely at the most recent end of the calibrated range, or even more recent (see discussion of Kokoland M-2 Data Recovery above).

Mēsepa

This site is in Faleniu Village. Sherds are visible on the surface just inland of the bridge at Mēsepa along the stream bank. One incised rim sherd was found there by Tago and Addison in 2006. The presence of multiple modern Tongan graves directly adjacent to the sherd find location and the lack of any cultural deposit visible in the stream-cut bank suggests that the surface sherds are from a subsurface deposit disturbed by grave construction.

Pava'ia'i

Taomia noted surface sherds at a few sites in Pava'ia'i (Taomia 2001b). Cochrane's subsurface survey collected a few sherds but found no intact subsurface ceramic deposit (Cochrane et al. 2004). It was only during construction trench monitoring that subsurface ceramic deposits were found in Pava'ia'i. The first of these was Site AS-31-171 where a ceramic deposit was found capped by a layer of red ash and with aceramic deposits above that (Addison et al. 2006). A date on multiple pieces of unidentified charcoal from this deposit calibrates to AD 240–540 (Addison et al. 2006: 10). A total of 33 sherds were collected from the ceramic stratum.

Winterhoff and the University of Oregon field school assisted ASPA Archaeology to excavate near the AS-31-171 deposit. Approximately 1000 sherds were collected. A date\(^8\) of AD 540–650 came from the stratum containing the sherds. Shovel testing suggested that the ceramic deposit is tightly constrained horizontally (~15 m diameter).

A rich ceramic deposits was found ~2 m below the village malae at Pava'ia'i during construction-trench monitoring. Approximately 1000 sherds were collected from this context. A date on coconut endocarp from this deposit calibrates to 50 BC–AD 80 (Addison and Asaua 2006a). The deposit extended no more than 10 m along the trench.

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\(^7\) WK-19408, 2400±36 BP on unidentified charcoal.

\(^8\) WK-19502, 1467±36 BP on unidentified charcoal.
TUTUILA CERAMIC CHRONOLOGY

Previously, only one site on Tutuila – 'Åoa – has been used in ceramic chronology models for Sāmoa. The other data come from sites in Manuʻa and islands in Independent Sāmoa. Table 1 summarizes the various models that have been proposed.

Earliest Ceramics

Mulifanua is the only site with dentate-stamped Lapita pottery, so it could be considered the oldest, but equally old dates come from Ofu and 'Åoa. These dates have been critiqued and their relevance discussed elsewhere (Rieth et al. in press, Rieth 2007, Rieth and Hunt, in press, Smith 2002). Here, we will only point out that each site poses interpretive challenges and that the dates cannot be accepted uncritically. More data are needed from each site before these issues can be resolved.

As noted, the earliest dates from strata with ceramics are from 'Åoa and are interpretively problematic. As seen in Figure 8, Beta-48049 is anomalously early when compared with the dates for Tutuila ceramic strata. The same is true if only the coastal site dates are compared. We suggest that this date is not an accurate reflection of the age of the ceramics at 'Åoa because of inbuilt age in the sample or other problems. Subtracting 300 years for inbuilt age (Allen and Wallace 2007) would make it interpretively the same date as the other early 'Åoa date (Beta-48911) and in line with the other earliest dates for Tutuila ceramics.

Atmospheric data from Reimer et al (2004); OxCal v3.10 Bronk Ramsey (2005); cub r:5 sd:12 prob usp[chron]

<table>
<thead>
<tr>
<th>Sample</th>
<th>Date BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>AutoWK-18325</td>
<td>1329±30BP</td>
</tr>
<tr>
<td>FalenuiWK-18314</td>
<td>1416±31BP</td>
</tr>
<tr>
<td>PavaiaiWK-19502</td>
<td>1467±36BP</td>
</tr>
<tr>
<td>FalenuiWK-18315</td>
<td>1482±31BP</td>
</tr>
<tr>
<td>FalenuiWK-18321</td>
<td>1639±31BP</td>
</tr>
<tr>
<td>PavaiaiWK-14532</td>
<td>1657±58BP</td>
</tr>
<tr>
<td>FalenuiWK-18320</td>
<td>1871±31BP</td>
</tr>
<tr>
<td>Fo'isiaWK-15032</td>
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<tr>
<td>PavaiaiWK-18327</td>
<td>1979±31BP</td>
</tr>
<tr>
<td>Fo'isiaWK-15031</td>
<td>2004±43BP</td>
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<td>2460±110BP</td>
</tr>
<tr>
<td>AoaB-48049</td>
<td>2890±140BP</td>
</tr>
</tbody>
</table>

Figure 8. Radiocarbon dates for Tutuila strata with ceramics. Coastal sites are 'Åoa, Utumea, Aganoa, and 'Åuto. "B." =Beta Analytic; "WK." =Waikato Radiocarbon Dating Laboratory.
As noted earlier, the context of the Aganoa and Utumea dates is problematic. However, if we temporarily accept them as dating the ceramics at those locations, we have the earliest ceramics on Tutuila at Aganoa, Utumea, and Āoa on eastern Tutuila and at Faleniu (‘Ulu Tree) on the west side. The dates from these sites are interpretively contemporaneous and fall in the ~800–300 BC range. The wide standard deviations on these dates make interpretation difficult. However, the lack of both dentate stamping and complex vessel forms that are the hallmarks of Lapita ceramics suggest that the actual date of these deposits is at the latter end of their range. A conservative estimate of the first ceramics (and hence, first settlement) on Tutuila would be ~500 BC, after the replacement of Lapita ceramics by Polynesian Plain Ware (see also discussion in Smith 2002:142–4). This removes the interpretive dilemma at Āoa where there are Mulifanua-aged dates but no Lapita sherds. A similar case could be made for To’aga.

Geomorphology and ‘Hidden’ Sites

The geomorphological arguments for why the earliest (and Lapita) sites are hidden in Sāmoa have been reviewed elsewhere (Addison and Morrison, in press, Green 2002), but a few comments are warranted here.

On western Tutuila, Clark was unable to find sites comparable in age to Āoa (Clark 1991b). To account for this distribution, he suggested the possibility that Tutuila was tilting, with the western end of the island subsiding and the eastern end uplifting (Clark and Herdrich 1988:10). We now know that early sites on the western end of Tutuila are likely covered in meters of ash from the Leone Volcanic Series, produced by eruptions as recently as 1400 years ago (Addison and Asaua 2006a, Addison et al. 2006). Other evidence suggests that Tutuila has been tectonically fairly stable with neither subsidence nor uplift as major factors (Dickinson 1997).

Āoa showed that subsidence was not hiding early sites on eastern Tutuila as at Mulifanua, neither were they buried under meters of colluvium as at To’aga. In Clark’s model, major change in eastern Tutuila shorelines was due to regional patterns of sea-level change. The earliest sites should be located on gentle slopes near former embayments or wetlands associated with the mid-Holocene high sea stand.

The last few decades of archaeological research on Tutuila have been informed by understandings of the possibility of massive geomorphological change. Despite this, if sites earlier than ~500 BC are hidden on Tutuila under many meters of colluvium at the backs of coastal valleys, or in other geomorphologically difficult locations, they remain to be found. The fact that there are now several sites on Tutuila dating to a few centuries after Lapita suggests that either early sites are not all hidden or that the few centuries preceding 500 BC were a time of rapid geomorphological change whose tempo dramatically declined by 500 BC, with relative stability for the last 2.5 millennia. The former may be the more believable scenario.

The Samoa case could appear analogous to Vanuatu where archaeologists also searched for Lapita sites in vain for decades (Bedford 2006). We think that Vanuatu’s much more complex geology and geomorphological processes make it less than comparable to Sāmoa.

A program of searching for sites dating to before 500 BC has been proposed for 2008–2009 (Rieth et al. in press). This search is informed by GIS modeling of palaeo shorelines and desirable locations for initial settlement (Morrison et al. in press). This project will address questions of the timing and characteristics of initial settlement on Tutuila and ‘Aunu’u (Addison and Morrison in press).

Early Inland Settlement

Figure 9 presents dates from inland ceramic sites on Tutuila. The earliest date is from the ‘Ulu Tree Site (wk-19408). Subtracting 300 years from this date for inbuilt age makes it contemporaneous with the nearby date from Kokoland (wk-19504) and in line with the other earliest inland ceramic dates. The Kokoland date and several of the Fo’isia/Vaipito dates have bimodal distributions because they fall on a flat section of the calibration curve. If the later portion of the distribution on these dates is accepted, then they, the ‘Ulu Tree date, and the date from the Pava’ia’i Malae are interpretively contemporaneous. This means people were using five widely spaced inland sites on Tutuila by ~200–100 BC. Green has estimated Tutuila’s maximum population at ~6500 (Green 2007). Models of population growth on newly colonized islands would allow this size population to develop in the centuries between 500 BC and 200–100 BC (Kirch and Rallu 2007). Population pressure then could be one reason why people were using inland areas this early (assuming that the first Tutuilans preferred living at the coast).

Although Pearl dated three ridgetop sites to AD 1300–1400 and argues that initial settlement of Tutuila’s mountains was in response to the transition from the Little Climatic Optimum to the Little Ice Age (Pearl 2006), the evidence presented here and elsewhere suggests use of inland areas at least a millennium earlier (Addison and Asaua 2006, Ayres et al. 2001). There are eight other inland sites with ceramics that remain undated. Of these, three are on ridgetops (Tataga Matau and two at Asufoi), and another four have ceramics in secondary context that likely come from adjacent ridgetops (Āfono, Fatu-ma-Futi, Ālega, and Malaeloa). The number of inland ceramic sites discussed in this paper reinforces the argument that use of mountains on Tutuila was widespread and early.
Cessation of Ceramic Use

Clark’s excavations at ‘Aoa yielded deposits ranging from 1505–245 BC at the bottom to AD 1307–1657 near the top (Clark and Michlovic 1996:162). Significantly, there is a ~1500 year gap in the midsection of the deposit (Figure 10).

Although noting the stratigraphic complications, Clark and Michlovic suggested the possibility of late ceramic use on Tutuila. They accepted ‘the possibility that our conclusions may require revision as additional work is completed’ (Clark and Michlovic 1996:164). When the ‘Aoa ceramics were excavated two decades ago, this was the ‘only ceramic residential site known for Tutuila’ (Clark and Michlovic 1996:164). With the increase in available data on ceramic sites of Tutuila, it is time to begin the revision that Clark and Michlovic foreshadowed.

The latest ceramics in non-problematic stratigraphic and chronological context are at ‘Auto and the Faleniu/Pava’iai border (Table 2, Figure 4). These date to the ~AD 600–700 period, and if the most recent end of the ‘Ato date is added, then AD 800 (this latter date has been proposed for the cessation of ceramics on Niuatoputapu [Kirch 1988: 246]). At each of these Tutuila sites it is conceivable that the charcoal dated is from continued use of the sites for a couple of centuries after the cessation of ceramic use, and that the date of ceramic cessation is in the ~AD 400–500 range.10

A similar date can be argued for Tonga (Burley and Connaughton pers. comm.). The earliest deposits at Fatu-ma-Futi date to this period (Addison 10 Afono is excluded because of lack of context for the two sherds found there. The Afono dates are good for infilling of a palaeo-wetland, but questionable for association with a primary ceramic deposit.

10
et al. 2008). The fact that no pottery was found in extensive excavations at Fatu-ma-Futi (Addison and Valentin 2006) further reinforces a ~AD 400–500 cessation date.

In either case, with more than forty ceramic sites now known from Tutuila, there is no evidence of ceramics past AD 800 in an unambiguous context (see also discussion in Rieth and Addison, this volume). Several sites are now documented with post-AD-800 aceramic deposits on top of earlier ceramic deposits. This also argues against late ceramic use on Tutuila.

Much of the area covered by the Leone Volcanics has minimal sediment deposition. Aside from pockets of low-lying areas, the only deposition is from cultural processes, organic matter, and airborne material from explosive volcanic eruptions. Consequently there is often up to two millennia of artifactual material in a matrix less than 50 cm thick. This matrix has been subjected to vertical movement by planting, posthole digging, and a variety of other natural and cultural processes over the same long time period. Hence, finding deposits in unambiguous primary context is a challenge. The presence of a discernable layer of red ash has been very useful in this regard. Although often broken up and mixed with later material, where this ash layer is intact it insures a known ‘prior to’ age for underlying deposits. On other parts of the island, there are also very old deposits near enough to the surface to be disturbed by cultural digging, for example at Aganoa and Utumea (Moore and Kennedy 1999).

Another point calling into question a very long plainware sequence is the lack of change in Tutuila ceramics. For Vanuatu, Bedford has argued the implausibility of people making the same style of pots for an extended period (Bedford 2006). If this principle holds for Sāmoa and no temporal variability is shown for Samoan Plain Ware, we may find the plainware chronology further shortened.

The idea of late ceramics in Sāmoa would be definitively established by finding ceramics in a late context that is clearly sealed by overlying deposits and which does not have underlying ceramic deposits from which the sherds may be derived.

Decorated Pottery – Only Early?

Kirch and Hunt considered incising as indicative of only the earliest ceramics at Tōāga (Kirch and Hunt 1993c). Incised rim lips are now known from three sites on Tutuila (Aganoa, Fale-niu-Pava’ia’i, and Mēsepa). The Fale-niu-Pava’ia’i border site is one of the latest contexts for ceramics on Tutuila. As mentioned above, it is possible that the charcoal from the site postdates the ceramics, but the possibility must be considered that minimal and very rare decoration continued until the end of ceramic use on Tutuila. Notable are the large collections from early contexts at Vai-pito, Fo’isia, Kokoland M-2, and Pava’ia’i Malae where no decorated sherds were found. For regional comparison, ‘Upolu has notched rims in late context (Green and Davidson 1974a), and there is late incising on ‘Uvea (Christophe Sand pers. comm.).

Spatial Distribution

Sampling on Tutuila has been heavily biased towards Tualauta County. This is because of the proactive role of ASPA in pursuing archaeology connected with its Tualauta County Sewerline Project.11 Much of the Tāfuna Plain and adjacent lowland slopes have been fairly thoroughly searched for surface sites. Hence we have a reasonably accurate understanding of where surface ceramics are located.12 In addition, many kilometers of construction trenching (usually down to bedrock) have been thorough-

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11 Largely due to the concern and foresight of then ASPA leaders Utu Abe Malae, Fonoti P. Perelini, and Michael Dworsky.
12 Our repeated visits to some sites through successive phases of construction work suggest that often important elements of a site are initially missed because of changes in vegetation, slight surface disturbance, and the like, so that more ceramic sites surely remain to be found in areas surveyed by ASPA.
ly monitored by ASPA Archaeology. This monitoring has given a good sample of subsurface ceramic locations (at least of those accompanied by a cultural layer noticeable in the trench walls). Earlier we noted that Cochrane’s systematic subsurface testing showed how little correspondence there is between surface remains and intact subsurface deposits on this part of Tutuila. The same pattern holds for the construction trench monitoring.

It can be noted from Figure 4 that the Tualauta ceramic sites are all on the lowland slopes at the very margins of the Tāfuna Plain proper. Extensive surface survey and construction trench monitoring on this lava delta have uncovered no ceramics. As a corollary, no dates from the Tāfuna Plain, except at its inland fringe, are more than 1000 years old (Addison and Asaua 2006a). Major parts of the Tāfuna Plain may have been formed by lava flows associated with the most recent pyroclastic deposits on the island at ~AD 600–800 (Addison and Asaua 2006a, Addison et al. 2006). This would explain the distribution of ceramic sites.

The earliest ceramic sites are at the coast, with inland sites following a few centuries later. These early coastal sites are on eastern Tutuila. Because of coastal geomorphology associated with the Leone Volcanics, it is unlikely that coastal locations appropriate for early settlement existed in much of western Tutuila (Morrison et al. in press). Narrow coastal plains not affected by the Leone Volcanics appear to have formed as habitable areas only after ~AD 500–700 (Addison and Asaua 2006a). Hence, it is unsurprising that the earliest sites are at the slightly elevated localities of Āoa and Aganoa. In the Morrison et al GIS modeling, the lack of good coastal habitation locations may also be helpful in understanding why there was apparently such rapid movement to inland areas.

CONCLUSION

In a little over a decade, the number of ceramic sites documented for Tutuila has risen from a handful to over 40. Although the outlines of a spatial and chronological picture are beginning to emerge, detailed analysis of the vast bulk of these ceramics remains to be published. Particularly useful will be analyses that attempt to differentiate stylistic and functional traits in the ceramic assemblages and that assess temporal and spatial differences in the distribution of such traits. This will be critical in addressing regional questions such as the replacement of Lapita pottery by Polynesian Plain Ware and attendant issues relating to the construction of an Ancestral Polynesian Culture, its location and timing.

Detailed analysis of the existing collections will also allow a range of questions about the interactions on Tutuila to be addressed. Geochemical characterization of clays in Tutuila sherds also offers the possibility of identifying where pottery was made on the island and comparing where it was finally deposited in the archaeological record. Eckert’s work on temper suggests the utility of this form of analysis for understanding aspects of ceramic production and exchange. Her preliminary studies have shown consistent use of at least two kinds of temper in the sherds from Aganoa (Eckert 2006). At the ‘Ul’u Tree Site, Eckert’s identification of several different tempers suggests complex relationships (Eckert and Pearl 2006). There is a rich potential for further studies of this sort.

The idea of an early ‘thin-fine ware’ and a later ‘thick-coarse ware’ has not been touched in this paper; addressing it will require analysis of the existing collections. In particular, the relatively tight chronology and capped-and-undisturbed nature of the deposits at Fo’isia, Vaipito, Kokoland M-2, and Pava’ia’i Malae should add some resolution to this question.

The earliest part of the Tutuila ceramic chronology remains to be adequately defined (Addison and Morrison in press). In the last few years, advances in understanding geomorphological processes on Tutuila have set the stage for informed prospection for the earliest sites.

Regardless of what may be learned from the analysis of Samoan Plain Ware on Tutuila, data on Polynesian Plain Ware assemblages from the West-Polynesia region are needed. Especially useful would be comparisons with assemblages from Lau, Tonga, ‘Uvea, and Futuna. Discussion at the Archaeology of the Polynesian Homeland Conference suggested individualised plainware traditions for these islands or archipelagos. Currently there is little evidence of the transport of pots, or even transport of ideas about vessel shape. Evidence for transport of lithics remains extremely thin in the post-Lapita period of the region as well. This leaves archaeologists to argue interaction from reconstructions of language and culture, and to posit exchange of perishable items in the absence of hard material. Clearly, much more archaeological work needs to be done to sort out these questions. Published analyses of plainware assemblages would be a good start. Without more data from the region, Tutuila will sit alone and discussion of regional dynamics will remain conjectural.

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