The BIRTH of POLYNESIA

An Archaeological Journey Through the Kingdom of Tonga

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Front cover: The cover illustrates a 900 BC Lapita ceramic sherd from Nukuleka, the first settlement in Tonga. The decorative motif, Tokelau Feletoa, continues to be applied to Tongan bark cloth today. Cover artwork and photo by Shane Egan, Kanokupolu, Tonga.

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Dedication

William R. Dickinson, Jackie Dickinson, and
Richard Shutler Jr., Lifuka, Ha'apai Airport, 1991.

This volume is dedicated to the memories of William R. Dickinson and Richard Shutler Jr. As colleagues, mentors, and pioneers in Oceanic Archaeology, they were integral members of Lapita archaeological studies in Tonga beginning in 1991.

Contents

Figures

Preface

It is hard to forget Tuesday May 30th, 1989. It was raining when I first stepped off an Air Pacific flight onto the tarmac at Fuamotu International Airport in the Kingdom of Tonga. I had been awarded a small grant from Simon Fraser University to visit the Kingdom to assess the possibilities for a research program. I could never have predicted that 34 years later I would still be doing fieldwork here. Nor could I have envisaged that I would spend almost 30 of those years in search of data for a book with the provocative title "The Birth of Polynesia". My goal and efforts in the pages to follow are to convince you this title is not at all an exaggeration.

A preface, by its nature, provides peripheral context to the story behind the story. As part of this, I confess, I did not start my career as someone interested in first settlement, Polynesia, or even ceramics. My origin story lay in New Brunswick, on the Atlantic coast of Canada, where I completed Bachelor and Master degrees at the University of New Brunswick by the mid-1970s. Immediately thereafter I packed up my family and headed west to Simon Fraser University in Burnaby, British Columbia to begin Doctoral studies on Northwest Pacific coast archaeology. Parks Canada subsequently offered me employment in 1978 as a historical archaeologist for the Klondike Gold Rush National Historic site. Based out of Winnipeg, I found myself in a city about as far from either the Atlantic or Pacific oceans as you can get in Canada, and that is a very long way in either direction. I assumed other positions over the next seven years, bouncing across the Canadian prairies from Manitoba, to Saskatchewan, to Alberta. Early in 1985, I received a momentous and what turned out to be life-changing telephone call from the Chair of Archaeology at Simon Fraser. The department needed someone to teach a field school in the summer of 1986, and otherwise fill in for a faculty member on leave for the coming year. In the midst of a prairie winter with temperatures in the -25° Celcius range, and truly missing the ocean, it was an easy decision to make.

As fate would have it, Richard Shutler Jr., had joined the Department of Archaeology as a faculty member while I had been roaming across the prairies. Richard had been with E.W. Gifford in 1952 at the site of Lapita in New Caledonia, this the eponymous type site for the Lapita complex as we know it today. He had carried out pioneering studies in several other areas of the Pacific as well. Richard retired in September 1986, after which his position was converted to an "Old World archaeologist," at least that is what the advertisement read. For whatever reasons hiring committees make illogical appointments, I became Shutler's replacement without having set foot in the Old World. Richard encouraged me to follow in his shoes as an Oceanist. In 1988, and at the suggestion of an anthropology colleague who had done his PhD in the Kingdom, Tonga became my focus. New tenure stream faculty at SFU are given small startup grants. My own included enough money to get me to Tonga, arriving in the rain on the 30th of May.

The 1989 project had a straight forward objective as I describe in the volume to follow. With little knowledge of South Pacific archaeology, I decided to stop in Honolulu on my way to Tonga to visit the B.P. Bishop Museum and examine their Tongan collections. It was there that I acquired a copy of W.C. McKern's 1929 publication "The Archaeology of Tonga" based on his surveys throughout the archipelago.[1] With that in hand, my goal was to relocate his sites and assess the possibilities for longer term research in one or another of the Tongatapu, Ha'apai, or Vava'u island groups. I was an archaeological tourist in the truest sense of the concept, without knowledge of Tongan culture, geography

1 Perhaps a portent for my own future, W.C. McKern's son, Thomas, was born in Tonga in 1920 during this survey. Tom McKern was on faculty at SFU and assigned as my interim PhD supervisor when I arrived in the fall of 1974. He passed away the day before we were to have our first meeting.

or, for that matter, its archaeological past. Yet the two months I spent in Tonga proved pivotal for my return and longer-term success. I made valuable contacts and friends, I visited and became acquainted with numerous islands from Tongatapu to Va-va'u, and I began to acquire an understanding of Tonga's archaeological landscape and its people. That experience allowed me to pen a successful research proposal to the Social Sciences and Humanities Research Council of Canada (SSHRC) for work between 1990 and 1992 in Ha'apai. The project's goals were to document and map the material expression of the dynastic Tongan chiefdom on the periphery of Tonga's political centre on Tongatapu. With the completion of that grant, a follow-up proposal was drafted and again submitted to SSHRC. The reviewers were far from kind, the proposal being rejected not once, but twice. Clearly SSHRC had enough of chiefly tombs, fortifications, and various other monumental sites in Ha'apai.

Rejection is never easy, but it pushed me along a quite different path, one resulting in this book. Tonga is on the western flank of the Polynesian triangle and strategically positioned for initial Lapita colonists migrating from the west. This was witnessed by Lapita site excavations on Tongatapu in the 1960s, on Niuatoputapu in the 1970s, and in Ha'apai in the 1980s, as to be examined. Our surveys for dynastic period sites in northern Ha'apai incidentally recorded and explored two new Lapita settlements as well. At the urging of Richard Shutler Jr., and with the encouragement of Roger Green at the University of Auckland, I drafted a research proposal focused on first settlement in Ha'apai, its adaptation to these islands, and its consequential impacts. I added considerable expertise to the study, inviting as collaborators the well-regarded geologist William R. Dickinson, Erle Nelson, a pioneer in AMS radiocarbon dating, as well as the seasoned veteran, Richard Shutler. David Steadman and Aubrey Cannon, both zooarchaeologists specializing in birds and fish respectively, joined later. All of this was a judicious move, I have not been without funding since. The results of these grants provide the data on which the ensuing chapters are based.

Acknowledgements

After a project as long as this one, I could almost write a book on the many individuals and agencies who have given support, service, or encouragement over the years. Above all else I must acknowledge the Tongan Royal family. The interest of King Taufa'ahau Tupou VI for the study of Tongan archaeology has been motivating. He, and Queen Nanasipau'u, have facilitated my work on several occasions, and on a few they have given me projects to undertake. In similar fashion, Princess Salote Mafile'o Pilolevu's enduring passion for Tongan history, both ancient and modern, is recognized. Her encouragement directly led to the installation of a Lapita gallery in the Tongan Museum at Haveluloto in 2001.

On my first visit to Tonga in 1989, the taxi driver at Fuamotu delivered me to Sela's Guest House, a modest accommodation with budget-priced rooms. While in Nuku'alofa, I have never stayed anywhere else. Sela, her husband Atolo and the rest of the Tuinukuafe clan became and continue to be my family. It always amazes me that, as one set of young children seem to grow up, in true Tongan fashion there is always another under foot in Sela's kitchen and living room. Tenisi Tuinukuafe, Sela's son, has been one of my closest friends for a couple of decades. He has worked with me in the field on Tongatapu and in Vava'u, he has assisted me with landowner and government impediments, and he has been a part of the Lapita quest almost from its beginning. Like Sela and Atolo, the late Siaosi and Nipa Vi, and their family, provided hospitality and support during a lengthy tenure in Ha'apai. Without their efforts, and that of Pilimi and Mele Halai, Vasa Vi, Pita Vi, and so many others, the Ha'apai project could not have been undertaken. The same can be said for Peau Halahingano of Pangai, Vava'u.

He was my guide in 1989 who quickly became an indispensable agent, logistics coordinator and expert field assistant for work in Tonga's northern islands. In more recent times, Shane and Chris Egan of Kanokupolu, Tongatapu have become close friends who have loaned me vehicles, stored equipment, and whose hospitality, enthusiasm, and kindness are greatly appreciated.

My longtime compatriot and former SFU colleague, Andrew Barton, can only be described as brilliant for his innovative solutions to so many field and laboratory problems. He was a dedicated and exceptional field worker for Ha'apai and Tongatapu, and a truly supportive friend. Among the several things Andrew has contributed to the program are the preparation of a 100 plus specimen comparative collection for fish bone analysis, and a fully comprehensive shellfish collection for the Kingdom. I also must recognize the many generations of former graduate and undergraduate students who served as field supervisors, teaching assistants for field schools in 1992, 2004, and 2014 or who worked in my SFU lab on Tongan materials. Among these are Arne Carlson, Shannon Wood, Rob Shortland, John Wolf, Sean Connaughton, Karine Taché, Jessi Witt, Alice Story, Kathleen LeBlanc, Kody Huard, Vienna ChiChi Lam, Megan Wong, Brea McCauley, and Travis Freeland.

All field research in Tonga has been conducted under numerous permits issued by the Tongan Cabinet and Prime Minister's Office. To have a request and proposal make its way to Cabinet is a time-consuming effort. The support received from individuals in the Prime Minister's Office, from the Tongan Traditions Committee and from other government ministries is appreciated. In particular, I want to single out assistance extended by Lord Vaea, secretary of the Tongan Traditions Committee, and Susana Faletau in the Prime Minister's Office and, later, Ministry of Immigration. I also acknowledge the continuous and substantial funding for my work by the Social Sciences and Humanities Research Council of Canada, including seven multi-year grants between 1990 and 2016. This support has been a privilege, and one I am honoured by and truly grateful for.

The preparation of this book and bringing it to completion has been a lengthy road. I acknowledge and thank the individuals who have helped along the way. Vienna ChiChi Lam prepared many of the maps and other illustrations throughout with both skill and creativity. Archaeological colleagues including Matthew Spriggs and Geoff Clark of the Australian National University, Seth Quintus of the University of Hawaii, Ethan Cochrane of the University of Auckland, and Sean Connaughton of Inlailawatash (Vancouver) have read various chapters and provided insightful comments. Jim Allen, formerly of the Australian National University, struggled through the manuscript with a fine-toothed comb adding much to the volume's readability. And Patrick Kirch (University of Hawaii) and Glenn Summerhayes (University of Otago) were the external reviewers who later told me of their roles. And ultimately, I am grateful to Cheryl Takahashi (Takahashi Design) who took the manuscript, formatted it into a book, and otherwise provided substantive professional advice.

I will have failed to identify many others who have been a part of or provided essential support to different projects over the past three decades. I apologize for these omissions; they are not intended as a slight. This is especially the case for the large number of Tongans who were employed on my excavation crews or in the field lab. They worked hard in their recovery of Tonga's ancient past, and to each I owe my utmost thanks.

Finally, I make continuous reference to Richard Shutler Jr., and William R. Dickinson throughout the book, both of whom are no longer with us. Words cannot do justice to the respect I have for each, and the collective impacts they have had on my career and the various field projects in Tonga. In sincere appreciation, I have dedicated this volume to Richard and Bill. In earlier times, they would be authors. I can only hope that the pages to follow will have met their critical approval. I also hope, in whatever place archaeologists and geologists eventually end up, they are together, with scotch in hand and a smile on their face thinking back on their remarkable careers.

Chapter 1

A Very Long Voyage

The story of the Polynesians is truly epic; the magnitude of their accomplishment is beyond astounding! The Polynesian triangle encompasses over two million km^2 of the earth's surface in the heart of the Pacific Ocean (Fig. 1.1). It is defined by islands on its apexes, with scattered others found throughout. It remains, nevertheless, an enormous expanse of ocean with all of the perils the high seas can bring. Seventeen hundred years before the advent of the Viking Age in Europe, the ancestors of the Polynesians sailed their canoes eastward, breaching the western flank of that triangle. The final and without doubt most difficult chapter in the human settlement of the globe had begun. By the 17th and 18th centuries AD when European explorers began to traverse Pacific waters, Polynesia was fully settled, and the chapter long over. Able Tasman, Jacob Rogeveen, Samuel Wallis, James Cook, and others encountered Polynesian societies with thriving cultures, complex political systems, and well-developed economies. Their close relationships in language, societal traits and physical appearance gave proof to the Europeans of a migration of substantial magnitude. In James Cook's estimation, this had covered almost a fourth of the circumference of the globe (Beaglehole 1969:354). Equally intriguing for the 18th-century European, Polynesians were distinct. With lighter skin colour and homogeneous physical traits, they formed a "race" set apart from others to the west in Melanesia. The whence of the Polynesians quickly captured the imagination of European intellectuals and the public alike.

Figure 1.1. The western Pacific highlighting the Polynesian triangle. Creative Commons Attribution-ShareAlike, original image Oceania_ISO_3166-1.svg: User:Tintazul.

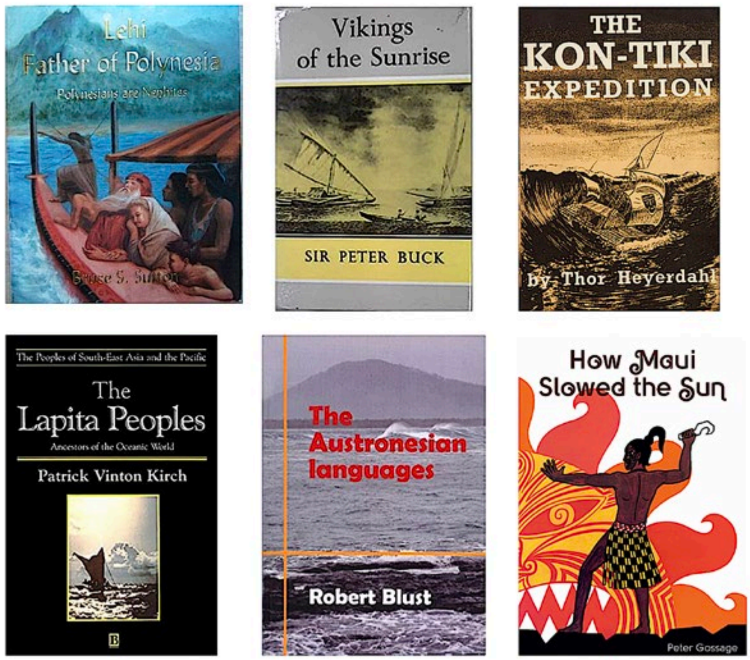

Figure 1.2. The many tales of Polynesian origins as witnessed on book covers. Lehi Father of Polynesia (Sutton 2001) presents the Mormon belief that Polynesians are Nephites with an origin in the Americas. References for the remainder are Buck (1938), Heyerdahl (1952), Kirch (1997), Blust (2009) and Gossage (2011).

Polynesian origin theories abound, some quite fanciful, others reasonably thought out (Fig. 1.2). At least a few involve complicated admixtures of races and exotic cultures from far distant homelands. Abraham Fornander in 1878 suggests it was India, where a pre-Vedic race mixed with a Dravidian race and then moulded itself to the Cushite-Arabian civilization (Kirch 2017). These people spread to Sumatra, to Timor, to Luzon and southward, eventually crossing the expanse of Oceania to reach Fiji, Tonga, and Sāmoa. Others, notably including the Maori scholar Sir Peter Buck (also known as Te Rangi Hiroa), ruled out any migration route through Melanesia given the lack of racial/cultural mixing of Polynesians with Melanesians. Buck (1938) favoured a Micronesian advance from the northwest by his "Vikings of the Sunrise." And a dramatically different origin, the Americas, was given by the famed Norwegian adventurer Thor Heyerdahl (1952) who in 1947 sailed westward from Peru in his balsa wood raft, the *Kon Tiki*, to prove it. Large numbers of Polynesians of Mormon faith continue to be taught by Church leaders that they are from the Americas, being the people of Hagoth who set sail from Nephite lands in AD 54 (Shumway 1992). Polynesian origin stories themselves are almost as varied, but typically incorporate a distant land to the west, *Pulotu* in Western Polynesia, *Hawaiki* in the Eastern island groups (Kirch and Green 2001). Then there is Maui, as colourfully portrayed by Disney Studios in the animated movie Moana. A demigod culture hero with a magical fishhook, Maui pulled up islands across Polynesia while raising the sky, slowing the procession of the sun, and otherwise providing necessities of life. The origins and history of the first Polynesians, at least into the 1950s, seem as confusing and contradictory, if not more so, than any from a global perspective.

Virtually all of these scenarios focus on ultimate origins, identifying the location from which the first Polynesians presumably came. Linguistic, archaeological, biological anthropological, and genetic studies over the past 50 years provide some clarity in this, as I will examine. But the objectives and underlying intent of this book are not about Polynesian origins in the sense of some far distant homeland. Its focus, rather, is on the birth of Polynesia through its earliest settlement within Polynesia. The Kingdom of Tonga strategically lies on the western flank of the Polynesian triangle, and it was the first group of islands in Polynesia that eastward migrating seafarers would encounter. Lapita ceramics, a distinctive type of decorated pottery, define that event and demarcate its history of settlement and expansion. My narrative, thus, starts with the landing of the first canoes on a very small islet at the entrance to the lagoon on the island of Tongatapu. It continues as people move around the lagoon and northward throughout the archipelago extending as far as Sāmoa. It ends with the infilling of an ancestral Polynesian homeland from which later migrations into Eastern Polynesia eventually were to be staged.

This book is also about a research project, another long journey that has taken me over 30 years to complete. It documents the processes of discovery, from the search for Lapita settlements on numerous islands in Tonga, through excavations undertaken at several of these, and through different types of analyses offering insight on the earliest Polynesians. I narrate the encounters along the way that, in some sense, have shaped both the project and whatever success it has been able to attain. A substantial archaeological record is now accumulated by myself and earlier researchers. The collective of these data underwrites and fuels the story, identifying the events and historical processes that came to pass in the founding of Polynesia as we know it today.

My 30-Year Journey into Tonga's Earliest Past

When I first travelled to Tonga in 1989, I had no intention of carrying out research on Lapita settlement or exploring Tonga's role in Polynesian origins. My interest was in monumental architecture and other archaeological remains related to the emergence and political intensification of the later Tongan chiefdom. Between 1920 and 1921, William C. McKern and Edward W. Gifford were in Tonga as part of the B.P. Bishop Museum's Bayard Dominick Expedition. They travelled through the islands, documenting a range of archaeological sites as well as traditional culture, mythology, and place names (Gifford 1929). With a copy of McKern's (1929) *The Archaeology of Tonga* in hand, my plan in 1989 was straightforward. I would be an archaeological tourist, retracing his footsteps and gaining firsthand experience with Tonga's archaeological past (Fig. 1.3). Travelling on the interisland ferry MV Olovaha from Tongatapu, I went to the small islands of Ha'apai, and then onward to Vava'u (Fig. 1.4). On whatever island I found myself, I was welcomed and felt at home.

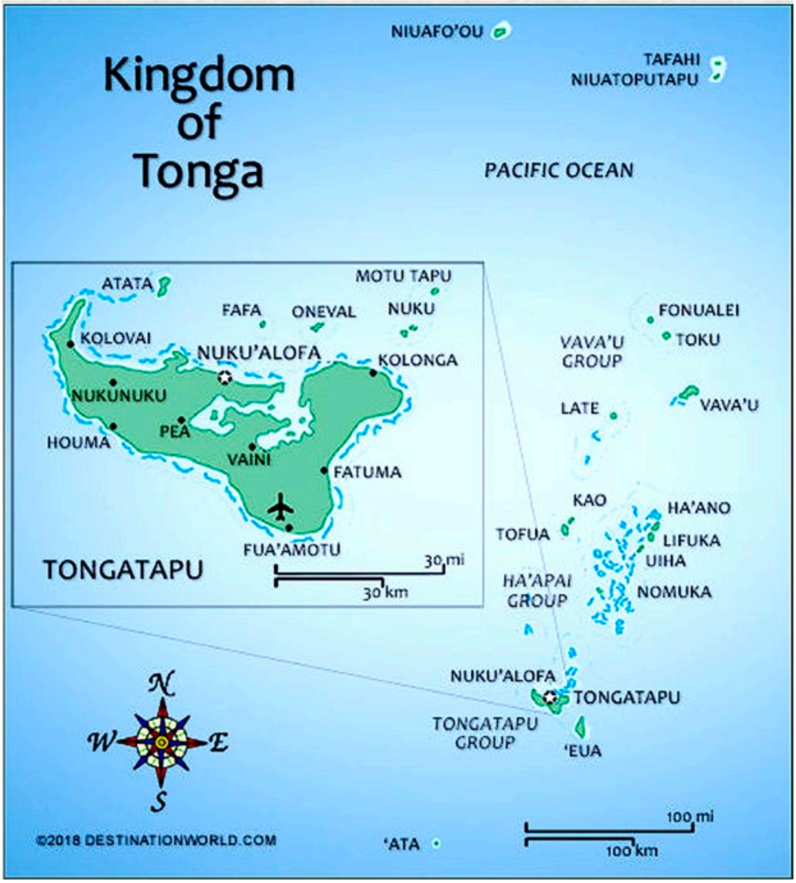

Figure 1.3. The islands of Tonga with inset of Tongatapu. Reproduction with permission, Destinationworld.

I became captivated by the geography, Tonga's people, their traditional culture, and by the Kingdom's ancient past. The 18th-century seafarer James Cook had been quick to label Tonga "The Friendly Islands". He was not wrong.

Tonga is a country of 169 islands positioned along a southwest to northeast orientation that, from outlier to outlier, is 750 km in length. In tracking McKern's path, I quickly realized that these islands are geologically and geographically diverse, ranging from cone-shaped volcanos to coral limestone formations and sand

Figure 1.4. Interisland ferry, MV Olovaha, at sunset. The view is from the Lifuka, Ha'apai wharf west to the volcanic island of Kao in 1989.

cays. I not only visited sites reported by McKern but I carried out additional surveys where I could. When opportunities arose, I recorded traditional history as recalled by island residents, and I began to appreciate Tongan society and its idiosyncrasies. For each of the islands and island groups, I evaluated the possibilities for archaeological study and identified the difficulties. A Professor in an anthropology class I now little remember told us that to study complex political entities you had to be on the outside looking in. This led me eventually to the islands of northern Ha'apai, where I received funding support for a project between 1990 and 1992.

Northern Ha'apai was an excellent choice. Monumental sites, including many not documented by McKern, were located and mapped with relative ease. Traditional history and traditional culture remained strong, in many cases little different from that written about by Gifford (1929) in the early 1920s. But more important to longer-term concerns, I began to encounter considerable numbers of sites with ceramics on their surface, or where ceramics were eroding from a midden edge. Tom Dye, an archaeologist from Hawaii, had recovered Lapita pottery from his excavations at Tongoleleka on Lifuka Island in 1986. I similarly found decorated Lapita pot sherds in 1990 at Faleloa on Foa Island and Pukotala on Ha'ano Island. The earliest chapter of Ha'apai prehistory became impossible to ignore. Richard Shutler Jr., a close colleague and friend, was invited to the project in 1991 to supervise investigations at the Faleloa site. He was an elder in Oceanic archaeology, as later described, and a person well-qualified to take on the task. So began my 30-year journey in tracking Lapita and later ceramic sites throughout the Kingdom.

Since that project with Shutler at Faleloa, other Lapita sites have been discovered and excavated in Ha'apai, in the northern islands of Vava'u, and on the principal island of Tongatapu. Most important among these was a reexamination of Moala's Mound on the Nukuleka Peninsula on the island of Tongatapu. The mound had been dug in the early 1960s by Jens Poulsen, a graduate student at the Australian National University. From his published PhD in 1987, it was evident that at least a subset of Moala's Mound Lapita ceramics was different from those we had been finding. Moala's Mound had a number of Lapita sherds with complex decorative motifs characteristic of "Western Lapita," as occurs further to the west in Melanesia. A larger project here in 2007, and another at the adjacent site of Hopoate in 2014 support the identification of Nukuleka as a founder colony for Tonga. It is at Nukuleka, as I document in Chapter 3, that Polynesian origins began.

The Book to Follow

I have been intending to write this book since the completion of my fieldwork on the Lapita settlement of Ha'apai in 1997. I could never seem to get started. To be honest, I am glad that has been the case. It is only now that I feel the Tongan data are comprehensive enough to provide a more complete picture of first Polynesian settlement and its aftermath. Over the three decades that have passed since I first picked up Lapita sherds in Ha'apai, so much more is known about Lapita peoples across Oceania. These discoveries and the related papers, reports, and volumes significantly inform the pages to follow. But most importantly, the discipline of archaeology at the time of this writing is far different than it was in 1991. Our abilities to interpret the past are substantially augmented by and transformed through major scientific advancements. Among these are developments in radiocarbon, uranium-thorium and other dating methods, in the use of geochemistry for sourcing lithics, in stable isotope analyses on bone, in ancient DNA applications, in bio-molecular studies, in remote sensing, in microscopy and microfossil research, in terrain imaging through LiDAR, in quantitative applications such as Bayesian statistics, and in the power of personal computers and the internet for research and communication. The possibilities for securely answering such fundamental questions as the where, when, how, and why of the first Polynesians could not be addressed otherwise.

I have struggled in my decision on how to write this book. A typical volume for an audience of archaeological colleagues lays out the research objectives, research methods, and follows through with data presentation, interpretation, and problem resolution. That approach serves little purpose here given the numerous projects undertaken, especially where much of the data are already published. I have chosen, instead, to write a narrative on Polynesian origins as they occur within Tonga, including my three-decade-long quest for its discovery. Chapter 2 sets the context for this narrative, providing archaeological, linguistic, and genomic data as they reflect upon the ultimate origins for the first Polynesians. Chapter 3 tells the story of the first arrival at Nukuleka and its archaeological discovery. It also documents the innovative use of planting pit cultivation, a critical part of the Lapita colonizing strategy, as I will later explain. Chapter 4 follows the expansion of settlement around Fanga'Uta Lagoon on Tongatapu over the next few generations in light of sea levels 1.2 to 1.4 m higher than today. It highlights excavated hamlets at Ha'ateiho on the central lagoon and Talasiu on the eastern side. Chapter 5 follows the Lapita movement north into Ha'apai, where single Lapita hamlets occur on no less than six of these islands. These sites were settled simultaneously, seemingly part of a strategic plan underlain by a territorial imperative. Additional, and again simultaneous movements into Vava'u, and even further north into Niuatoputapu and Sāmoa, are described in Chapter 6. The discovery of a volcanic glass source on Niuatoputapu, and the movement of this material throughout Tonga, attest to interisland voyaging and community engagement along the length of the archipelago. In Chapter 7, I examine ancestral Polynesian society as it has been defined within the subsequent Polynesian Plainware archaeological phase for Tonga, and elsewhere in Western Polynesia. Here, it has been argued, the Polynesian cultural template was forged, this later taken to East Polynesia with renewed migration. In this, I must forewarn, history begins to give way to debate over the integrity and timing of this transition, and the relevance of a linguistic model for its definition. Chapter 8 is my conclusion, where the three-decade-long project is framed within Eastern Lapita settlement in the Lau islands of Fiji as well as Futuna and 'Uvea further to the northwest. I also highlight issues in the Lapita settlement of Tonga with implications for understanding the Lapita migration on the broader scale of Oceania.

I would like the story of the first Polynesians to be accessible to Polynesians. By this I mean not just accessible via online open access publication, but accessible in the volume's readability. At the same time, if the discipline of archaeology is to seriously assess my claims for the Polynesian past, the narrative cannot be oversimplified. It must have support through verifiable proofs, and it must be contextualized within the prevailing literature and knowledge of the Lapita peoples as they migrated across Oceania. The latter typically clogs academic sentences with in-text citations. It also takes for granted an understanding of archaeological jargon that few, beyond the discipline, comprehend. Finding a medium between the two runs a risk of failing on both counts. In 1997 Patrick Kirch published a synthetic volume on *The Lapita Peoples*, this being penned in the middle ground as best as one might hope to do. In the preface to that volume, he speaks of writing a book for his non-archaeological colleagues, a synthesis grounded in field and laboratory data, but free of the "theoretical and paradigmatic posturing" all too often present in the academic literature. I too make that effort, promising no more than a history of the first Polynesians, and an account of the data on which this history is based.

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Chapter 2

The Broader Perspective of Oceania for Polynesian Origins

Research into Oceanic settlement is profuse, having a continuous course of academic inquiry over the past 60 or so years. If anything, these studies show there to be no single encompassing narrative for island colonisation. There are several, resulting in the considerable cultural and biological diversity across the Oceanic expanse. The French naval commander, Jules-Sébastien-César Dumont d'Urville, attempted to make sense of this diversity in 1832. He thus proposed a four-part division of the "Great Ocean" into Polynesia, Micronesia, Melanesia, and Malaysia (Dumont d'Urville 2003). Racist characterizations by Dumont d'Urville notwithstanding, these designations continue to stand as geographical referents, and they are widely employed by Pacific Island peoples today. Of importance to the volume at hand, he drew the Melanesian/Polynesian divide as a line between Fiji and the West Polynesian archipelagoes of Tonga and Sāmoa. His divide is based on 19th-century European perceptions of race, and its underlying assumption that Polynesian and Melanesian races had radically different origins (Burley 2013).

In the deep history of the Oceanic past, as we know today, there are two foundational episodes in the region's settlement history. The first occurred early, perhaps as early as 50,000 years ago when Australia and New Guinea formed a single continental landmass. This antiquity gave rise to considerable linguistic diversity in Western Melanesia, the collective broadly referred to as Papuan. Papuan is not a language family *per se* but a "group" where several phyla (family-level groups) are incorporated (Kirch 2017:6). The second episode took place more recently, sometime around three and a half millennia ago. This was an in-migration of Austronesian-speaking peoples, a language family whose origin is traced by linguists to aboriginal peoples in Taiwan. Austronesian seafarers were the first people to colonize islands eastward of the Solomon Islands chain, encountering a range of island types, environments, and ecologies without previous human presence. The earliest appearance of Austronesian-speaking peoples in Melanesia is defined by Lapita ceramics, these marked by a distinctive suite of impressed decorations applied with a dentate (comb-like) stamp. Long-standing archaeological research into this cultural complex cumulatively defines a Lapita ceramic trail, one starting in the Bismarck Archipelago off the north coast of New Guinea and extending to Tonga and Sāmoa on its far eastern end. The beginning of Polynesia is intricately enmeshed within the Lapita chronicle.

I provide here a synthetic review of research discoveries leading to our contemporary perspectives on Oceanic settlement. This importantly sets the stage and provides the context for chapters to come. The volume of research under review is immense, and any attempt to highlight aspects of it in a single chapter necessarily is selective. I offer my apologies in advance for any oversimplification, omissions, or errors in presentation. For the reader who might want more, there exist two substantial efforts in this respect. The first, *On the Road of the Winds: An Archaeological History of the Pacific Islands before European Contact* by Patrick Kirch (2017) is a comprehensive and highly readable volume on the Oceanic past, including its history of research. The second, *Archaeology of Pacific Oceania; Inhabiting a Sea of Islands,* is a broad-based archaeological account by University of Guam archaeologist, Mike T. Carson (2018).

Near and Remote Oceania and the Austronesian Expansion in Linguistics

The linguist Andrew Pawley and archaeologist Roger Green (Pawley and Green 1973) are the first to propose a distinction between Near and Remote Oceania as meaningful concepts to examine issues of first settlement (Fig. 2.1). Near Oceania includes the large islands to the west, from New Guinea along the Bismarck Archipelago to Makira in the main Solomon Island chain. These are large landmasses that, for the most part, are visible from one to the other, and where travel between is facilitated accordingly. With significantly lower sea levels in the Pleistocene, distances between islands were reduced even further. In fact, up to 8,000 years ago, the intervening continental shelf between New Guinea and Australia was dry, and the two were connected as the continental landmass of Sahul. A stage for the human settlement of Sahul had been set early, with people ultimately moving into the islands of the Bismarck Archipelago and further east through Near Oceania (Spriggs 1997).

Remote Oceania incorporates the Pacific islands beyond the main Solomon Islands chain, with some researchers including the more northern islands of Micronesia. The divide between Near and Remote Oceania is a 350 km wide ocean gap separating Makira on the main Solomon Islands from the Eastern Solomon outliers in the Reef/Santa Cruz group. This gap was sufficiently wide to limit eastward distributions of terrestrial faunas and floras in the past, with island biota increasingly impoverished as a function of distance. The gap impeded human settlement with the earliest archaeological sites in Remote Oceania dating to 1100 BC or later. All of the languages today in Remote Oceania belong to the Austronesian language family with ultimate origins in island southeast Asia. This Austronesian push into Remote Oceania is but an extension of a wider Austronesian expansion, one not only including Near Oceanic islands in the Bismarck Archipelago but throughout the whole of island southeast Asia.

Figure 2.1. Near and Remote Oceania. Settlement of Near Oceania occurs as early as 50,000 years ago by peoples whose languages are referred to as Papuan. Remote Oceania is not settled until ~3,050 years ago by Lapita peoples who are an expansion of the Austronesian language family from island Southeast Asia. Image is from Irwin (2017), licenced by Manatū Taonga Ministry for Culture and Heritage for re-use under the Creative Commons Attribution-NonCommercial 3.0 New Zealand License.

German linguist Otto Dempwolf (1938) was the first researcher to systematically study the Austronesian language family in depth. Dempwolf employed the comparative historical method, where sound correspondences between languages provide a basis for proto-language reconstruction. He also began to examine innovations, cases where sound shifts occur within the daughter languages. These allow for the definition of further groupings and subgroupings illustrating divergences. The outcome was an Austronesian language family tree. Dempwolf's results, with substantial expansion by Robert Blust (2009) and other researchers, graphically illustrate what Tim Denham (2018:49) refers to as one of the great "metanarratives" of global history. It provides a structure to the Austronesian expansion, and it defines historical relationships between the numerous peoples speaking Austronesian languages (Fig. 2.2).

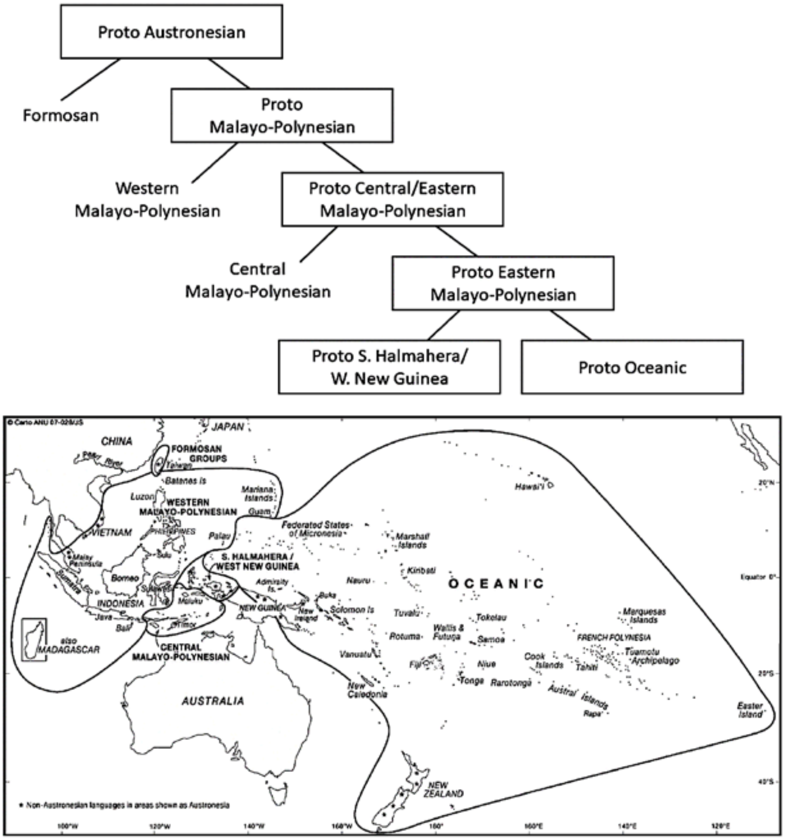

Figure 2.2. Primary branches of the Austronesian language family. The upper family tree is based on Robert Blust (1999). The primary branch distribution map is from Ross (2008) drawn by CartoGIS Services, The Australian National University, use by Creative Commons BY-SA License.

The ultimate origin for Austronesians derives from a Neolithic agricultural group somewhere on the southeast Asian mainland (Carson 2018). Approximately 5,000 to 6,000 years ago, these people crossed to Taiwan where the foundation language, proto-Austronesian, began to develop. Proto-Austronesian then diverged into the four highest-order linguistic groupings, with three of these continuing to be recognized in Taiwan as Formosan. People speaking the fourth, Malayo-Polynesian, moved south into the Philippines. This expansion was a prelude to, and put in motion, a series of subsequent migrations accounting for all but a small number of the over 1,000 Austronesian languages existing today. From the Philippines, as linguist Darrell Tryon (2006:38) describes, "one group moved south-west, through Borneo and later Sumatra and Java, with branches penetrating the Malay Peninsula, eastern parts of Vietnam and Cambodia." A second group went south into Sulawesi with continued migration diverging into the Seram-Ambon area and Timor, as well as Halmahera and Irian Jaya. From Irian Jaya, expansion occurred along the Papua New Guinea coast, eventually reaching the Bismarck Archipelago to form a staging ground for the peopling of Remote Oceania.

Exclusive of Remote Oceania, the Austronesian expansion encompassed major movements of people across vast distances within a sea of islands and diverse landscapes. We know that these areas already had been settled for a very long time. How, then, could the Austronesians accomplish this so successfully and so rapidly? Peter Bellwood (2006:108–114) highlights several factors, with the most critical being developments in two areas. The first is the advantages of an agricultural-centred subsistence economy. In Taiwan, proto-Austronesian language reconstructions and archaeological data suggest a focus on rice, millet, and sugar cane with the domestication of dogs and pigs. With an extension of Malayo-Polynesian people into the Philippines and a transition from sub-tropical to tropical environment, the agricultural complex dramatically expanded. The Proto Malayo-Polynesian vocabulary began to incorporate words for taro, breadfruit, banana, yam, sago, and coconut (Blust 1995). This generalized range of crops enabled population growth, and it is well suited for transplantation into other tropical regions. It further provided a competitive advantage for Austronesian colonists as they may have encountered existing groups of hunter/foragers. Bellwood notes that in cases where Austronesian expansion entered regions already settled by agriculturalists, such as mainland Southeast Asia, or in New Guinea, the outcome was far less successful.

The second of the developments was improved technology and knowledge for maritime exploration and migration. For Neolithic agriculturalists to reach Taiwan, pre-Austronesian peoples must have had some form of seafaring capacity. For proto-Malayo-Polynesian speakers in the Philippines, there exist several linguistic reconstructions relating to watercraft and maritime transport (Pawley 2007). The addition of a sail and outrigger float are perhaps the most significant according to Robert Blench (2016) (Fig. 2.3). Their effectiveness can be seen in the success of Austronesian seafarers to find and settle on the Mariana Islands by 1500 BC, an open ocean crossing of over 2000 km (Hung et al. 2011). Subsequent migration southward from the Marianas is also proposed as a second, or alternative route for Austronesian expansion into the Bismarck Archipelago (Carson et al. 2013).

Whether single or multiple migrations of Malayo-Polynesian speakers into Western Melanesia took place is currently in debate (Blench 2016). There occurs, nevertheless, but a single lower order subgroup of Malayo-Polynesian languages in this region, Oceanic. Proto-Oceanic is the common ancestor for some 450 Austronesian languages spoken in Melanesia, Micronesia, and Polynesia today. It also is the most intensively studied Austronesian linguistic subgroup relative to ancestral relationships and reconstructions. The Oceanic Lexicon Project of the Australian National University has published five volumes and made them available online.[2] These focus on technology and material culture (Vol. 1), the physical world including landscape and seascape (Vol. 2), plants (Vol. 3), animals (Vol. 4), and terms related to the human body and mind (Vol. 5). Additional volumes are being prepared for social organization and cosmology (Vol. 6) and grammatical categories plus addenda (Vol. 7). Collectively these works provide the language spoken in Near Oceania on the eve of expansion into Remote Oceania. It is the language of the people who made Lapita pots, and whose journey can be tracked eastward by those pots to the border of Polynesia. For Oceanic

2 https://openresearch-repository.anu.edu.au/handle/1885/106908

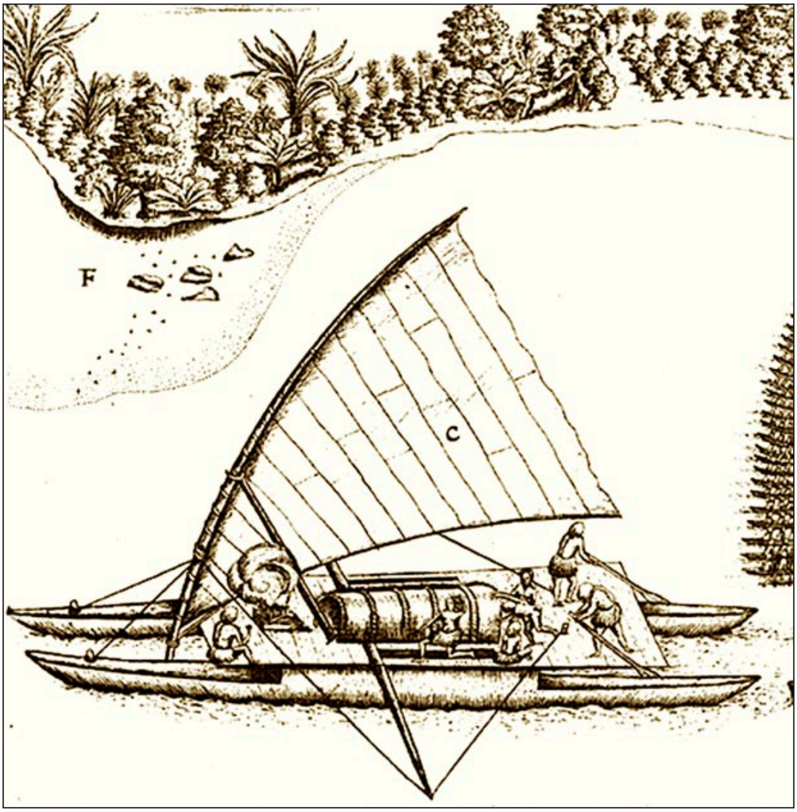

Figure 2.3. Tongan double hulled canoe with central platform, mast/boom rig, woven mat sail and steering oars. Partial segment of a 1642 drawing by Isaac Gilsemans, from ship diary of Abel Tasman. Wikipedia file: Tasman-dagvoek-a.jpg, Public Domain.

archaeologists, these sources provide potential insight and reference data that are impossible to acquire in any other way.

Of the proto-Oceanic terms important to both migration and first settlement in Polynesia, there are several worthy of note. The most important are an increasing sophistication in canoe building technologies and maritime navigation. Proto-Oceanic speakers had large double-hulled vessels with a central platform, a standard mast/boom rig with woven mat sails, and a steering oar (Pawley and Pawley 1998). In combination was a knowledge of the night sky, constellations, star paths and other wayfinding techniques (Osmond 2007). Sailing into the wind with an ability to return if landfall is not met allows for a rapid exploration and movement through Remote Oceania to the western flank of the Polynesian triangle (Irwin 1992). Proto-Oceanic speakers also brought with them a major suite of Oceanic plants (Ross et al. 2008) with a full understanding of how to propagate, cultivate, and harvest their yield (Osmond 1998).

With the focus of this volume on the birth of Polynesia, it seems moot to engage in a detailed discussion of the breakup of proto-Oceanic into its various lower order subgroups across Remote Oceania. One of these, proto-Central Pacific, is proposed as the common ancestor for Fijian, Rotuman, and Polynesian, three sets of languages that are closely related. Its point of origin is taken to be the Fijian Archipelago, the most likely landfall for the three as Lapita settlement expanded to the east (Kirch and Green 2001:56). Hypothetically, proto-Central Pacific then developed as a dialect chain from west to east with the eastern dialect moving to Tonga and the western one to Rotuma. As I will later examine, this needs to occur instantaneously, for the archaeological settlement of east and west Fiji and Tonga are very close in time. Perhaps more importantly, the settlement of Fiji and Tonga may be unrelated, while Rotuma is without Lapita occupation as currently understood. Trying to conceptualize early Lapita settlement and interactions in the Fiji/West Polynesian region through the concept of a proto-Central Pacific stage has been a difficult task.

The Archaeology of Lapita Peoples and their Movements in Remote Oceania

Edward W. Gifford and Richard Shutler Jr., are among the early pioneers in Oceanic archaeology (Fig. 2.4). In 1952, with their wives Delila Gifford and Mary Elizabeth Shutler, they formed a team to “fill in the gaps in the knowledge of New Caledonian archaeolo-

Figure 2.4. Edward Winslow Gifford (with pith helmet) and Richard Shutler Jr., in New Caledonia 1952. Photo, P.A. Hearst Museum, Berkeley. Attribution-NonCommercial-ShareAlike, 4.0 Creative Commons License.

gy" (Gifford and Shutler 1956:1). Over a period of seven months, archaeological surveys and excavations were conducted at several locales along the west and east coasts of Grande Terre (Fig. 2.5). At one locale on an isthmus of the Foué Peninsula near Koné, they encountered a "quarter-mile" of beach face with decorated pottery sherds and shellfish eroding out. Exploratory excavations at Site 13, as then designated, took place from 26 July to 2 August. Asking his Kanak excavation crew for the local name of the area being excavated, Gifford was given the response *Xapetaa* (Sand 1999:14). Either mishearing or Anglicising this (or perhaps both), he wrote in his field book for Saturday, August 2, 1952, "Lapita was name of village at this site" (Sand and Kirch 2002:146). The name, now applied to the first Austronesian-speaking peoples in Near Oceania, the first settlers of Remote Oceania, and their associated pottery assemblages, was so contrived.

Figure 2.5. Map of Grande Terre and associated islands New Caledonia with Site 13 identified. Map CAP 12-224 by CartoGIS Services, The Australian National University, use by Creative Commons BY-SA License.

The excavated ceramics from Site 13 are duly described in the published report, with elaborate and complex decorative motifs apparent in a photographic array (Gifford and Shutler 1956:147–148). Also included in this publication are radiocarbon dates that, for the first time, illustrated a considerable time depth (over 2500 years) for the settlement of Remote Oceania. Gifford and Shutler note the similarity of Site 13 ceramics with decorated pottery from the Isle of Pines in New Caledonia that, previously, had been linked stylistically by Avias (1950) to ceramics from Watom in the Bismarck Archipelago. In their concluding remarks, they (1956:95) further observe that their "potsherds" bear resemblances to "Tonga, Melanesian, Annamese and proto-Jomon" types. For Tonga, they were referring to the similarities of Site 13 decorated sherds with Lapita ceramics from Tongatapu excavated by William McKern (1929:Plate VI) in 1920 as part of the Bayard Dominick Expedition; Gifford had served as the lead anthropologist on that program. Likewise, Gifford (1951:Plate 19) collected dentate stamped Lapita pottery from Fiji in 1947, describing it as "roulette type incising." From these observations, Kirch (1997:8) suggests that the "disparate bits of evidence" finally were in place to define a common pottery style "spanning the ethnographic divide between Melanesia and Polynesia."

In the decade immediately following the Gifford and Shutler publication, a flurry of archaeological work was undertaken in several areas of Oceania. These projects provided an additional foundation upon which to frame an understanding of Lapita ceramics and the people who manufactured them. Jack Golson, then at the University of Auckland, was central to the effort. In 1957 he first carried out work on Tongatapu in Tonga with subsequent excavations at the St. Maurice site on the Isle of Pines, New Caledonia (Sand 2010:33). Golson was convinced that to understand the early settlement history of Oceania, one must comprehend the seemingly widespread, elaborately decorated ceramic style recovered at Site 13 and elsewhere. In 1961 he profoundly identified Lapita as a single early pottery tradition in the southwest Pacific, one representing a "community of culture" linking New Caledonia, Tonga, and Sāmoa. This, he argued (Golson 1961:176), was ancestral to Western Polynesian groups, but antedates the presence of Melanesian peoples in New Caledonia. Equally as important, he identified the critical need for field data to provide better and refined interpretations. Moving to the Australian National University, he began to dispatch students and encourage colleagues to survey for and conduct excavations at widespread Lapita sites on New Caledonia, at Watom Island in the Bismarck Archipelago, at Sigatoka and Natunuku on Viti Levu, Fiji, and, as I later discuss in detail, on Tongatapu in Tonga. In the Tongan case, much of this was undertaken by his PhD student, Jens Poulsen, in 1963/1964.

Golson's replacement at the University of Auckland was Roger Green, an archaeologist who would substantively contribute to an understanding of first settlement across Oceania as well as Polynesian origins. In the 1960s, Green became a "Polynesianist," carrying out surveys, excavations and settlement pattern studies in Mo'orea, Mangareva, New Zealand, Hawaii, Sāmoa, and Tonga (Kirch 2010). Western Polynesia, in his view, was the ancestral homeland for Polynesia, with later migration(s) into Eastern Polynesia emanating from here. Green also recognized that the ultimate origin for Polynesians was from the west, in island Melanesia. With ethnobotanist Douglas Yen, he subsequently initiated the Southeast Solomon Islands Project, with the first phase of fieldwork in the Reef/Santa Cruz islands between 1970 and 1972 (Green and Cresswell 1976). Green's field methods were rigorous, including block area excavation at three sites to expose settlement pattern data. His ceramic analyses similarly are noteworthy, providing insight and definition to the nature of Lapita ceramics and its design system. Green's approach to the past was holistic, integrating comparative historical linguistics, ethnography, and archaeology to tackle problems of origins, cultural reconstructions, and relationships. With linguist Andrew Pawley (Pawley and Green 1973), they literally merged Lapita with the Austronesian expansion into Oceania.

In 1979 Green published a landmark paper with the simple title "Lapita." It is brilliant in its synthesis and interpretation of an accumulating Lapita data set for the earliest colonists of Remote Oceania. Among a variety of topics, he includes a discussion of Lapita chronology, lays out common characteristics of Lapita settlements in Oceania, examines the nature of Lapita economy and exchange, speaks to the issues of Lapita origins, linguistic affiliation and voyaging, and presents an in-depth treatment of the Lapita ceramic series. The ceramic analysis focuses on shared decorative motifs between 18 different Lapita pottery assemblages from seven island groups across Oceania. For the first time, Lapita ceramics motifs were quantified and, employing a Jaccard coefficient of similarity, they are systematically explored for patterning between sites. A key result is the illustration of an east-to-west trend in distance decay in the Lapita design system, from the rather ornate curvilinear and fairly elaborate rectilinear design patterns of the western Lapita to the more simplified and generally more rectilinear forms of the eastern Lapita (Green 1979:42). Integrating vessel form complexity into the equation, he goes on to define Western versus Eastern decorative styles, the latter including sites in Fiji, Tonga, and Sāmoa. Later studies on regional variation in Lapita ceramics using substantially enhanced data sets now recognize a series of "provinces" or stylistic aspects, including Eastern and Western as well as Southern (New Caledonia), Far Western (Bismarck Archipelago), and South Papuan (Kirch 2017:81) (Fig. 2.6). The basis for a shared Eastern style between Lapita ceramics in Tonga and Fiji is questionable. Most early Fijian Lapita sites, with exception of those in the Lau islands, have Lapita ceramic assemblages falling within the Western province (Burley and LeBlanc 2015). The earliest Lapita ceramics in Tonga, from Nukuleka on Tongatapu, are similarly Western, as would be expected of a colonizing group (Burley et al. 2010).

In the 40 plus year aftermath since Green's publication, the Lapita complex, its origins, its migration as marked by a ceramic trail, and its peoples have become dominant foci in Oceanic archaeology. There have been numerous projects, exciting discoveries garnering broad public interest, abundant PhD dissertations, frequent monographs and, as an ever-increasing accumulation of data occurs, considerable debate. Beginning in 1988 (Spriggs 1990), there also has been a Lapita Conference where, every three to four years, Lapita scholars assemble to present new data and ponder relevant issues. To review the full spectrum of Lapita studies and what has been accomplished requires a book unto itself; indeed, even by 1997, Patrick Kirch (1997) was able to write an ethnographic-like volume on *The Lapita Peoples: Ancestors of the Oceanic World* including nine chapters and 352 pages. There are, at present count, almost 300 known Lapita sites, or at least sites where decorated Lapita ceramics are present, spanning the Bismarck Archipelago to Western Polynesia (Bedford et al. 2019). Here I highlight but a few of these projects or discoveries as they substantively impact current interpretations or are important for the chapters to come.

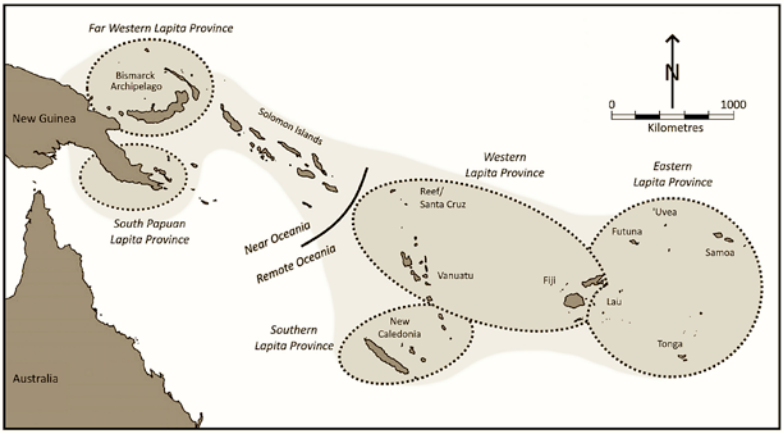

Figure 2.6. Lapita ceramic provinces as currently defined for Oceania.

Despite Green's (1979:45) assertions that the Bismarck Archipelago was the homeland from which the Lapita migration into Remote Oceania emanates, there had been little archaeological study of this region up to the 1980s with the exception of West New Britain (Specht 1974). Australian archaeologist, Jim Allen, sought to change that in a substantial way in 1983, proposing a program where he, and multiple teams of colleagues, would begin to explore different areas/islands in the region with common goals and a common logistical network. Given the name "Lapita Homeland Project," six overarching research questions were set, with individual studies having the leeway to follow whatever way their data might take them (Allen and Gosden 1991). The Lapita Homeland Project was to be more than Lapita though, also integrating concerns for late Pleistocene/early Holocene occupation as well as post-Lapita settlement for "regional and chronological contexts" (Allen 1991:3). A total of 19 projects involving 25 qualified archaeologists was carried out between May and September 1985; several continued in subsequent years. The vast amount of new data, and the ensuing collaborations, continue to influence Lapita archaeology into the present (Allen 2021). Yet as Allen (1991:6) concludes, the project also makes it clear that the events taking place in the Bismarck Archipelago associated with Lapita ceramics "were more complicated than we have so far acknowledged, and they require more robust explanatory models than we are currently using". Here he refers to the question of whether Lapita peoples, and their ceramics, are a true migration from island Southeast Asia passing through the region (the express train model). Or, alternatively, is the Bismarck Archipelago a homeland in which the Lapita complex emerges as an *in situ* indigenous development? An indigenous origin model in this sense allows for the economic, technological, and cultural adaptations necessary for expansion into Remote Oceania.

Issues of express train versus *in situ* origins notwithstanding, Lapita Homeland project data, or those resulting from follow-up projects, contribute unique insight into at least two other aspects of the Lapita narrative. The first relates to the form and nature of Lapita settlement pattern as it occurs in Near Oceania. Excavations at Talepakemalai on Eloaua island in the Mussau group by Patrick Kirch (2022a) and at the Apalo site on Kumbun Island in the Arawe group by Chris Gosden (Gosden and Web 1994) encountered wet deposits with anaerobic preservation of wooden posts. At both sites, these were driven into strata having marine sediments and other characteristics indicative of intertidal contexts. The posts are supports for elevated platforms on the reef or lagoon upon which houses had been constructed (Fig. 2.7). This type of stilt-house construction continues in different areas of coastal Melanesia today, not the least being Eloaua Island (Kirch 1997:174). Settlement on the reef confers significant advantage. It impedes the ever-present swarms of biting insects, especially including malarial mosquitoes; it also incorporates cool ocean breezes to abate the heat and humidity of the Bismarck Archipelago equatorial climate. Intertidal stilt house construction has since been documented or proposed for several other Lapita sites in both Near and Remote Oceania (Sheppard and Walter 2009; Nunn and Heorake 2009).

Lapita site excavations across Oceania from the time of Gifford and Shutler illustrate subsistence economies with strong focus on nearshore resources. Coastal site locations underscore this,

Figure 2.7. Stilt house built on reef edge, Vunaniu Village, Viti Levu, Fiji. Photo by Paul Geraghty 1982 with permission.

including small sand cays, back beaches on lagoons, and in other locales where shellfish remains and other marine faunas dominate site deposits (Nunn and Heorake 2009). In recognition, Les Groube proposed a migration and settlement model where Lapita peoples were driven by the search for new resources to support a lagoonal/maritime economy. To Groube (1971:312), they were coastal nomads, "Oceanic strandloopers" who "expanded ahead of colonisation by agriculturalists." The Strandlooper model has been in debate ever since. Green acknowledged the importance of marine resources for Lapita subsistence in his 1979 paper, but goes on to challenge Groube, promoting horticulture as the mainstay of Lapita subsistence. He argued this through the indirect evidence of artifact types such as shell scrapers or peelers as well as site features, presumably for use in breadfruit fermentation. He also acknowledged proto-Oceanic linguistic reconstructions where words for different cultivars are present (Ross et al. 2008). The Lapita Homeland project recovered direct evidence for horticulture that Green did not have. In the same waterlogged deposits preserving house posts at Talepakemalai and Apalo were thousands of seed cases, endocarps, husks, and other plant materials. Species identifications of these remains allowed Kirch (1997:205) to report that from "a total of 28 economic plants for which we have Proto Oceanic terms, no less than 15 are now attested by archaeobotanical remains." Unfortunately, soft tissue starchy plants including yams, taro, banana, and breadfruit did not survive.

Archaeologists analyzing Lapita ceramics typically work with assemblages of very small pieces, not complete pots. Bringing interpretation to these sherds beyond a description of partial motifs is a truly difficult task. Occasional large fragments illustrate the complexity of Lapita vessel forms and the richness of decorative applications and motifs. They also provide potential insight into the social/ritual context for at least a subset of this industry. The early 1970s excavations in the Reef/Santa Cruz group, for example, literally put a face to the Lapita cultural complex, with Roger Green's (1979:28) illustration of a large shoulder sherd with a human-like face on its surface (Fig. 2.8) (also see Spriggs 1990). Almond eyes framed by eyebrows, a projecting nose, and a smile are central to an elaborate series of other painstakingly applied designs on that specimen. Lapita decorative application on this pot, and others recovered by Green, seem to go beyond the aesthetic. Similar types of ceramics are present at Talepakemalai (Kirch 1997:137–140). The most ornate of the face motifs appear on cylinder stands and open bowls with pedestal feet, both suggesting a formal role for presentation. Are these images, as Patrick Kirch (1997:143) asks, "representations of human beings, living or dead, real or mythical?" Could at least some of the vessels on which they occur be ancestor pots with specialized roles within Lapita ritual practice?

The ritual role for elaborately decorated Lapita ceramics is explicit in two more recent discoveries. Salvage excavations by

Figure 2.8. Lapita face ceramic motif on a large jar from site SE-RF-2, Nenumbo Village, Reef Islands. Photo courtesy of the Anthropology Photographic Archive, Department of Anthropology, University of Auckland.

Christophe Sand (1999) at the Lapita site (Site 13) in New Caledonia in October of 1995, found two very large pots buried in a pit with large fragments of other pots beneath, around, and over them as a protective cover. Both have their bases intentionally broken, possibly if not probably as a ceremonious act in their interment. Hypothetically, this act may have released the essence of the pots, whatever that may have been. Even more impressive for insights into the ritual side of Lapita lifeways and its interrelationship with ceramics was the 2003 discovery of a Lapita cemetery on the south coast of Efate Island, Vanuatu. Following five field seasons of work between 2004 and 2009, 60 "mortuary contexts" with 80 individuals were exposed and documented in detail (Bedford et al. 2010). A series of 72 brilliantly decorated Lapita vessels are present and in association, including six that are more or less complete. Some of the pots are part of funerary practice or offerings, but others appear to be only partially buried, possibly as grave markers for those in the cemetery. Lapita burial rites at Teouma are complex, with repeat "visits" and other practices removing, rearranging, and sometime grouping skulls and other skeletal elements into secondary contexts. In one case a skull occurs within a carinated Lapita pot with the mouth of the pot then covered by an upturned flat-bottomed dish (Fig. 2.9). In another, three crania had been removed from their original interment(s) and placed across the chest of an adult skeleton. There are too few Lapita burials across Oceania to extend the complexity of burial patterns at Teouma to Lapita peoples at large (Valentin 2010). That ornately decorated Lapita pots represent far more than a ceramic style, however, is difficult to deny.

Chronologies for Lapita settlement in Near and Remote Oceania are constantly under refinement. This results from a plethora of new dates as new excavations occur or as previously excavated sites are given reassessment. Yet it also is a consequence of revolutionary developments in radiocarbon dating technology and protocols, as well as analytical techniques to help constrain age ranges for archaeological events. An estimate for Lapita settlement in the Mussau islands is documented by Patrick Kirch (2022b) between 1800 and 1500 BC with the remainder of the Bismarck Archipelago occupied in the interval 1500 to 1200 BC (Rieth and Athens 2019). A period of sustained settlement in the region seems to occur prior to Lapita colonists moving eastward into Remote Oceania. In a reanalysis of the radiocarbon chronology for the Reef Santa Cruz Islands with a reconsideration of dates from Vanuatu, New Caledonia, and Fiji, Peter Sheppard and colleagues (2015:35) identify 1050 BC as the earliest beginning point for that migration. They also illustrate continuous colonization of islands eastward as far as Fiji, this taking place over a period of 100 years or less. The rapid nature of colonization throughout Remote Oceania is revealing. It is not a "wave of ad-

Figure 2.9. Teouma Lapita burial with cranium placed within an elaborately decorated pot with dentate stamping. Photo courtesy of Stuart Bedford, Matthew Spriggs and Vanuatu Cultural Centre, Port Vila.

vance" driven by settlement, population growth, and expansion. Rather, it occurred within the lifespan of but a few generations. It involved long-distance voyages from the Bismarck island homeland, and there appears to have been leap-frogging around the central Solomon Islands (Sheppard 2011). Talasea obsidian from New Britain occurs in earlier Lapita sites of the Reef Santa Cruz Islands, Vanuatu, New Caledonia, and Fiji suggesting sustained contact and return voyaging after the initial migration. That connection ends no later than 850 BC (Sheppard et al. 2010).

Lapita is largely defined by elaborately decorated ceramics with the decline of this industry in different island groups marking the end of this phase in Oceanic archaeology. Matthew Spriggs (1997:152-–62 lists several possible explanations as to why, ranging from the breakdown of trading systems to regional adaptation and isolation to socio-political transformation. To this, I will add, that whatever ritual or prestige behaviours these ceramics represent at Site 13, Talepakemalai, or Teouma, these too must have changed. No doubt different factors came to play in different areas. What we can say with certainty is that the end of Lapita pottery begins no later than 750 BC in some areas and, within two or so centuries, it all but disappears across Oceania. In the various archipelagoes of Remote Oceania, most archaeologists have argued for population continuity from the Lapita peoples into the present. That these arguments can be challenged is taken up in subsequent discussion of genetics.

Biological Anthropology and Genomics in the Search for Polynesian Origins

By the late 18th century, European explorers in Oceania began to recognize and comment upon the physical and cultural diversity of the peoples they encountered. Dumont d'Urville in 1832 drew a physical boundary between the islands of Melanesia and those of Polynesia based on his observations, as I earlier note. In Dumont d'Urville's words "the Melanesian race … is itself only a branch of the black race from Africa, and the swarthy or coppery Polynesian race …. is only an offshoot of the yellow race from Asia" (Dumont d'Urville et al. 2003:173). The physical homogeneity of Polynesians, and their distinctive variation from peoples Dumont d'Urville categorized as Melanesian, appeared to be visible and definable. In large part, this set the agenda for biological anthropology in Oceania throughout the 20th century.

The earliest concerns of biological anthropologists almost completely centred on racial categorization and racial mixing. In the late 19th century, the focus was on skeletal remains, particularly crania collected during the earlier era of European exploration. This "craniology," as Michael Pietrusewsky (2012) of the University of Hawaii summarizes, resulted in several printed catalogues providing measurements and a description of cranial traits, including pathologies and unusual anatomic features. Insightful results, on the other hand, are few. In tandem, racial categorization studies then turned to living populations through collection of somatological data (skin colour, hair type, nose and lip forms, nostril size, etc.). The Bishop Museum's Bayard Dominick scientific expeditions throughout Polynesia in 1920, for example, had somatological components where volumes of data were collected for Sāmoa, Tonga, the Society Islands, the Cook Islands, the Marquesas, and Hawaii. In Tonga alone, the sampled population includes 121 men and 104 women from across the archipelago (Fig. 2.10) (Sullivan 1922). Integrating these data in 1924, Louis R. Sullivan concludes in the journal *American Anthropologist* that Polynesians are in no sense a uniform "racial type." Rather the Polynesian type is an "abstract concept," the composition of which includes four distinct elements—two being "Caucasoid," one "Negroid or Melanesian," and the fourth being mixed with some "Negroid" and "Mongoloid" characters (Sullivan 1924:25). Pietrusewsky (2012) rightfully notes that this "fixation with racial typology" contributed little to an understanding of "the biological variability of the inhabitants of the Pacific Islands or their origins." In hindsight, it all seems rather absurd.

The widespread documentation of skeletal remains however provided a data set for a new era of biological anthropologists emerging in the latter half of the 20th century. Armed with superior statistical applications and the advent of computer technology, they began to carry out sophisticated comparative analyses across a range of traits. Most studies consistently grouped Polynesians as distinct from Melanesians while some further identified Polynesian affinities with peoples of Southeast Asia (Pietrusewsky 2005). Studies of Polynesian skeletal remains also defined a suite of features potentially distinguishing Polynesians from other groups. Notable is the "rocker jaw," where the lower mandible rocks back and forth when placed on a level surface (Howells 1973). In review of these data, Philip Houghten (1996:138) concludes that Polynesians are "distinctive among *Homo sapiens*" and

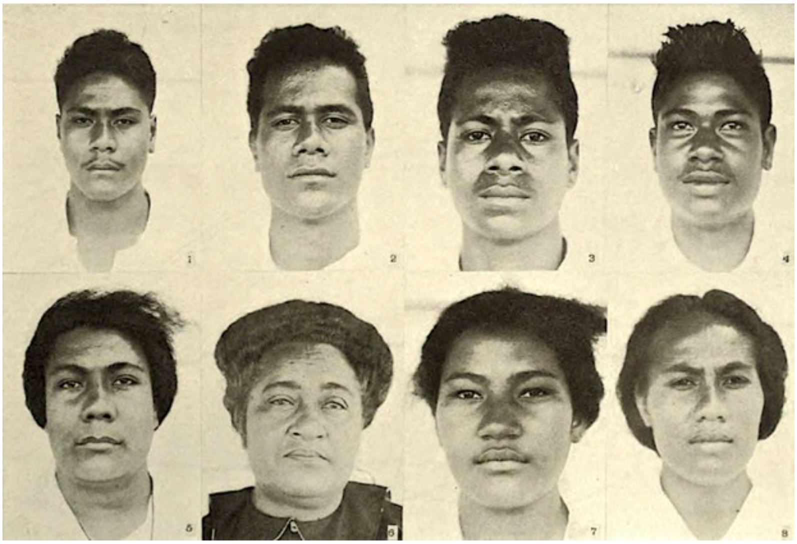

Figure 2.10. Tongan "forms of lips". Illustration is Plate XXXVI-B, Louis R. Sullivan (1922) Tongan Somatology, Public Domain, B.P. Bishop Museum.

goes on to identify cranio-facial and other features of, in his view, a homogenous phenotype. A phenotype is an individual's observable traits derived from genetic composition and environmental factors. By comparison, Houghten further notes that the "hallmark" of peoples in Melanesia is biological diversity, a situation rendering the term Melanesian to no more than a "geographic statement." He attributes Polynesian sameness to evolutionary processes of natural selection and genetic drift.

Over the past two and a half decades, biomolecular approaches to the question of Polynesian origins, migration, and the relationship of Polynesians with Melanesians have come to the fore. Appropriate conditions for DNA preservation in skeletal remains in the tropical Pacific are poor and, until recently, the technical capacity to sequence whatever degraded DNA that might be present has been limited if not impossible. Geneticists accordingly turned to modern-day descendant populations to identify a genomic trail employing both mitochondrial DNA (maternal lineage) and Y chromosome DNA (paternal lineage). These studies are abundant and, while the results are sometimes contradictory, there is a consistent progression forward. Elizabeth Matisoo-Smith (2015) presents a synthetic overview of this research, including a review of sampling bias that frequently occurs. The large-scale movement and mixing of people across Oceania as a consequence of "blackbirding" (slave trade) and relocation during the 19th century Pacific Island labour trade are two. That said, researchers have been able to identify a maternal, mitochondrial blueprint with ubiquitous occurrence in Polynesia (Melton et al. 1998). Labelled the "Polynesian motif," it succinctly demarcates Haplogroup B4a1a as the common genetic ancestor. In translation, this ancestral group is Asian in origin but also occurs in Taiwan, Island Southeast Asia, and elsewhere in the Pacific. Paternal ancestry documented in Y chromosome DNA, on the other hand, appears to be contrary. Polynesian men typically trace their genetic stock to haplogroups linked with the earliest settlement of Near Oceania, including Papuan-speaking peoples (Kayser et al. 2006). The consequence implies a potential period of stable settlement for Lapita peoples in Near Oceania, where Papuan men were marrying into Lapita communities before migration into Remote Oceania. An alternative possibility resulting in a similar pattern is suggested by Matisoo-Smith (2010:183). She postulates that a "generally Asian-derived group arrived in Near Oceania…. picked up local men, [and moved] … on out into Remote Oceania."

Ancient DNA and the Lapita Peoples

To account for the variation in physical appearance between Melanesian and Polynesian peoples, most early archaeologists including Jack Golson and Roger Green were convinced of additional post-Lapita migration(s) in Oceania. This, then, would explain the "more 'Melanesian' phenotype that is found in Vanuatu, New Caledonia and to a lesser extent in Fiji" (Spriggs 1997:159). The migration also was correlated with the appearance of incised and applied relief decorated ceramics occurring in sites from the Bismarck Archipelago extending eastward to Fiji. From the mid-1980s onward, most archaeologists working in Oceania began to eschew the concept of migration as an explanation for human variation and cultural diversity, especially where it was identified by changes in ceramic form (Marshall et al. 2000). The idea of an incised and applied relief ceramic tradition in Near Oceania extending into Remote Oceania subsequently was discredited (Bedford and Clark 2001). Rather, long-term *in situ* population and cultural continuity typically were argued. Different processes, including adaptations to changing environments and sea levels, would underlay regional distinctions. The Melanesian/Polynesian divide, in consequence, became a paradox (Burley 2013). If the Reef/Santa Cruz islands, Vanuatu, New Caledonia, Fiji, and Tonga were settled by the same Lapita peoples, and there exists population continuity from that point onward, how could such diversity between Melanesians and Polynesians possibly occur? This was not just an academic debate. I well recall the rebuke I received after telling a Tongan audience that their Lapita ancestors probably came from Fiji. Tongans, I was tersely informed, "do not look like Fijians at all"!

I earlier note that biomolecular approaches to the Lapita settlement of Remote Oceania and Polynesian origins through skeletal remains have been limited. The preservation of aDNA in tropical environments is poor, and the ability to extract and sequence DNA was all but impossible. Ancient DNA, at least that with any antiquity, was off the table. A radical transformation in aDNA sequencing occurred in the early 2000s with the development of high throughput "next-generation" sequencing methods in tandem with innovative extraction and amplification techniques (Linderholm 2016). Highly degraded aDNA strands can now be analyzed providing rapid, comparatively inexpensive, and substantially expanded sequencing of both mtDNA and nuclear DNA. For archaeologists throughout the globe this has been revolutionary in rewriting aspects of the human past, or in providing startling new insights into our most ancient ancestors. In Oceania it allows aDNA sequencing of skeletal remains from a number of areas, including Lapita burials from the Teouma site in Vanuatu and the late Lapita site of Talasiu in Tonga. The results, when combined with genomic data, provide new detail on an old narrative for Lapita settlement of Remote Oceania. The paradox of a Melanesian/Polynesian divide seems resolved in the process.

Simultaneous studies published in 2018 by archaeo-geneticists Cosimo Posth and Mark Lipson with respective colleagues were able to sequence three Lapita burials from Teouma as well as two others from Talasiu. Further incorporated into the analyses are later skeletal remains from Vanuatu as well as contemporary genomic data. Both Vanuatu and Tongan Lapita DNA match closely, as expected given archaeological considerations of the Lapita migration (Fig. 2.11). As we also expect based on comparative historical linguistics, Lapita aDNA illustrates an ancestry closely tied to Island Southeast Asia. The surprise in this, however, is that neither the Teouma nor Talasiu individuals have close genetic linkages to Papuan-speaking peoples in Near Oceania. The Lapita migration into Remote Oceania had been undertaken by Austronesian speakers who "passed by the Papuan-ancestry population they encountered in New Guinea, the Bismarck Archipelago, and the Solomon Islands with minimal admixture" (Lipson et al. 2018:1). Notably, the same interpretations are presented coincidentally by Frédérique Valentin in a comparative study of craniofacial features of Lapita skeletal remains at Teouma (Valentin et al. 2016). Without admixture, the Lapita DNA data support an "express train" model, one where Lapita peoples arrive in Near Oceania and, without pause, spread rapidly eastward (Diamond 1988).

Of related and equal significance in these results, the aDNA of post-Lapita peoples in Vanuatu clearly indicates subsequent migrations. In both studies, Lapita colonisers at Teouma are replaced in a genetic sense by Near Oceanic Papuans between ca. 750 and 350 BC. Whether this occurs through incremental absorption of Papuan groups into Austronesian-speaking settlements over time (Posth et al. 2018) or represents an outright

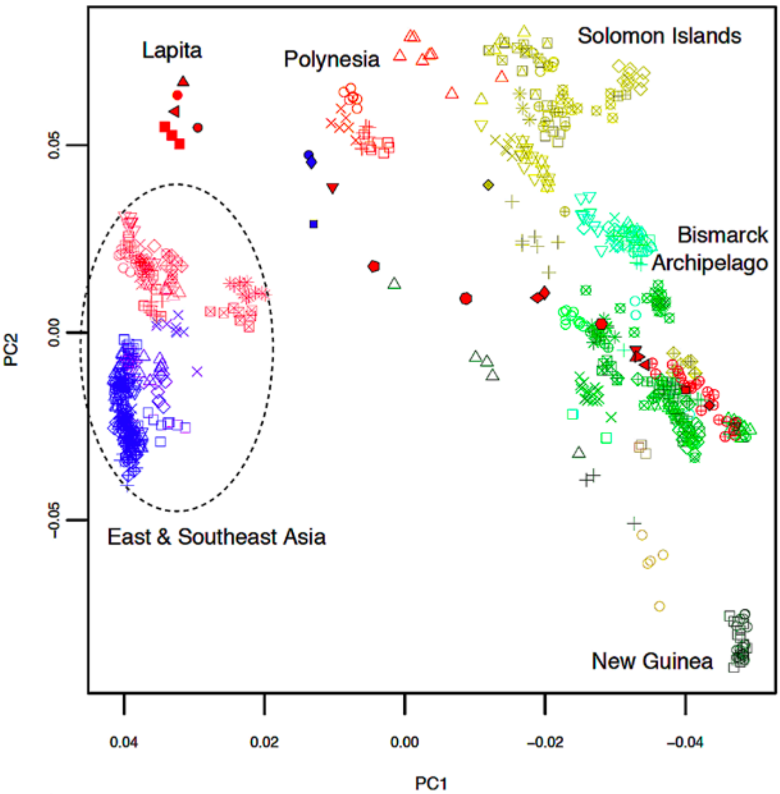

Figure 2.11. Genetic distribution of ancient and modern individuals in East/Southeast Asia and Oceania. Genetic relatedness is expressed along Principal Component 1 (horizontal). Orange symbols represent Tonga, red symbols represent Vanuatu. Reprinted by permission from Springer Nature, Nature, Ecology and Evolution (Posth et al. 2018).

population replacement (Lipson et al. 2018) is open to question. For Tonga the circumstance and aDNA story are different. There is no early, nor major Papuan intrusion, leaving unbroken genetic continuity. As Posth et al. (2018) describe, "present-day Tongans have substantial Lapita ancestry, with a minor component of Near Oceanian admixture."[3] Descendant peoples in Tonga, in

3 The minor component of Papuan ancestry is hardly suprising given the close relationship of Tonga and Fiji through much of prehistory.

a biological sense, are a remnant vestige of the Lapita colonizing group who voyaged eastward into Remote Oceania. The Polynesian phenotype is an outcome of this ancestry, if not the actual physical manifestation of ancient Lapita peoples.

Even with additional aDNA from Teouma burials (Lipson et al. 2020), sample sizes in these studies are small, and interpretations are not without criticism. Can we really construct a history of such magnitude from the ancient DNA of so few people? On the one hand, DNA leaves little room for debate relative to the individuals it is drawn from. The results, as well, are not presented in isolation but with comparison to a larger archive of more recent and contemporary DNA. On the other hand, as Lisa Matisoo Smith questions (Bedford et al. 2018), what if the Lapita migration is undertaken by a heterogeneous population of Austronesian and Papuan peoples? A few individuals from Teouma and Tonga might represent only one of the sides in a complicated narrative. But ever so enticing, the aDNA evidence explains and is remarkably consistent with phenotypic variation across the Melanesian/Polynesian divide.

The Lapita Landscape in Oceania on the Eve of First Polynesian Settlement

Patrick Kirch and Roger Green (2001) vigorously champion an approach to the Oceanic past where data from archaeology, linguistics, comparative ethnography, and biological anthropology are analysed through a method of triangulation, and where intersections of these data provide compromise and insight. Preceding interpretation of the Lapita archaeological complex by linguists, archaeologists, and geneticists have common threads but, in some areas, there are disagreements. Before turning to first settlement of Polynesia in Tonga, it seems valuable to highlight agreed upon points of history leading up to the final phase of the Lapita story—the birth of Polynesia.

Some archaeologists seriously question the direct association of the Austronesian language family with Lapita peoples (Terrell et al. 2001). To the contrary, and emphatically so, Patrick Kirch (2017:91) characterizes the linkage between Lapita and the Oceanic substage of Austronesian in Remote Oceania as "ironclad." Lapita is the "foundation culture" and all of the languages in Remote Oceania today are of proto-Oceanic derivation. And even if one argues a far more complex situation with population replacement and secondary migration now evident in genetics, this is not the case for Polynesia. In Tonga, linguistics, genetics, and archaeological data clearly converge with unbroken continuity since first Lapita landfall. The ultimate origin for the ancestors of people who made Lapita pottery is traced back to Taiwan and the dispersal of the Austronesian language family some 4,000–5,000 years ago. This fact is key, as it positions the settlement of Near and Remote Oceania into the larger frame of global history. It also is key in so far as linguists have deciphered the proto-Oceanic lexicon. We now have the language Lapita peoples spoke as they spread across Oceania. This is a powerful tool through which to interpret aspects of the past.

I will not retrace the potential routes by which Austronesian speakers made their way into the Bismarck Archipelago. Suffice it to say there is contentious debate. That Austronesian migrants are present in the Mussau Islands sometime before 1500 BC is significant. Continued expansion into Remote Oceania does not occur until 1050 BC, indicating a Lapita occupation lag in Near Oceania of at least 450 years. How this Austronesian group interacted with or avoided pre-existing Papuan peoples during this time can be but speculated upon. Papuan speakers in the Bismarcks have been interpreted as hunter, gatherers, and foragers, but also practising arboriculture if not other early forms of horticulture (Kirch 2017:69–71). Their archaeological record is scant, but settlements are present in interior and coastal locales. The Austronesian colonists, on the other hand, were seafarers, maritime-focused, and with long-developed agricultural practices. The Proto-Oceanic linguistic and archaeological data richly illustrate this. Their settlement locales are almost exclusively coastal, including small offshore islands and on coastal features such as tombolo or sand spits; some employ stilt house structures built over the reef. The Austronesian settlement landscape, thus, seems complementary to that being projected for the Papuans, potentially averting competition, interaction, and consequential conflict.

To characterize Lapita settlement in Near Oceania, Roger Green (1991) formulated a "Triple I Model," including "intrusion, innovation and integration." Innovation, in Green's sense, was formative through adaptation to the Near Oceanic environment, and in the development of a Lapita cultural complex with its distinctive ceramic assemblage. This, in his view, was antecedent to and essential for the successful colonization of Remote Oceania. Integration through intermarriage with Papuan speakers in this model conflicts with recent aDNA results. But what if the Austronesian expansion into Near Oceania was not a single migration, but many, these taking place at different times over the 450 years between the first Lapita settlements in Mussau and those in Remote Oceania? Later migrations may have voyaged beyond previously settled areas, ultimately crossing the line into Remote Oceania. Matthew Spriggs (1997:99–100) presented just this scenario 25 years ago to account for phenotypic differences in the Melanesian/Polynesian divide. To Spriggs, there were two streams of Lapita peoples, the "stay at homes" who interbred with Near Oceanian Papuans, and those who migrated across Oceania to settle as far east as West Polynesia. The dominance of Austronesian languages in Near Oceania today is the consequence. What we can say with some certainty is that the interaction of Lapita peoples in the Bismarck Archipelago with colonists in Remote Oceania continued to exist until at least 900 BC. The proof is Talasea obsidian from New Britain, this occurring in Lapita sites in the Eastern Solomon outliers, Vanuatu, New Caledonia, and Fiji. In the latter, obsidian transport involves a distance exceeding 3,000 km (Ross Sheppard et al. 2013).

The exploration and settlement of Remote Oceania beyond the Reef/Santa Cruz Islands into Vanuatu, New Caledonia, and Fiji appear instantaneous in an archaeological sense, occurring sometime within the century 1050 to 950 BC. In the terms of Peter Sheppard and colleagues (2015:35), this undertaking encompasses "a few generations" of Lapita peoples at the most. Not only did this migration establish landfall in these far-flung island groups, but multiple site locations in each attest to continuous exploration and expansion. In Fiji, for example, we have been able to document with limited systematic survey no less than eight Lapita settlements dating to 950 BC or slightly earlier occurring on Viti Levu, Vanua Levu, as well as central islands in the Koro Sea. All have complex decorated Lapita ceramics correspondent with those of the Reef/Santa Cruz Islands, Vanuatu, and New Caledonia, three incorporate Bismarck Archipelago obsidian, and all conform well with the coastal fringe Lapita settlement pattern in Near Oceania. The rapidity of this expansion necessarily raises questions about the settlement process, the number of sailing canoes, the size of the Lapita population in the Bismarck Archipelago, and the motivations underlying the search for new land. Archaeologists are only beginning to think through the implications. There is little doubt, however, that Remote Oceania had a sparsely settled landscape on the eve of expansion into Polynesia. But we also can say that interisland and long-distance voyaging long had been a way of life.

Comparative historical linguistics provides a highly ordered chart of language relationships resulting from the breakup of Proto-Oceanic across the breadth of Oceania. Linguists model these as dialect chains where differentiation ultimately occurs, leading to neatly packaged and spatially progressive subgroups of Proto-Oceanic. Given the complexities of the Lapita migration, the rapidity with which it is undertaken, and what is now known about Lapita genetics, it is hard to understand some aspects of the model as construed. This is particularly true for proto-Central Pacific, the substage of Oceanic developing first in Fiji and spreading as a dialect chain into Rotuma and Tonga. Without shared lexical innovations, I interpret the concept as a hypothetical stage lacking much in the way of evidence. It is a linguistic necessity tying together three sets of clearly related languages that, collectively, vary from other subgroups of Oceanic. One cannot dispute the linguistic relationships of Fijian, Tongan, and Rotuman. But whether these illustrate a common founder settlement in Fiji with subsequent dispersal is in question given archaeological data. Alternatively, can these relationships not represent different colonisation events emanating from a common origin to the west, perhaps even into the far west of Near Oceania or beyond? What the linguists also tell us is that the southeastern Fijian islands of Lau are closely related to peoples in West Polynesia prior to the development of proto-Polynesian. That linguistic association is given the name proto Tokalau Fijian (Geraghty 1983). The archaeological record in Lau does in fact illustrate this, with ceramic assemblages in Lau all but identical to later Lapita ceramics throughout Tonga.

Prior to ca. 900 BC, the many islands of Tonga and other areas in West Polynesia were pristine, where marine, reefs, and foreshore resources were plentiful, and where bird life was diverse and abundant in tropical forest cover. This was about to change with the arrival of the first Lapita canoes at Nukuleka, a small islet at the entry to Fanga 'Uta Lagoon on the island of Tongatapu. That story and its aftermath, can now be told.

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Chapter 3

First Landfall at Nukuleka

Nukuleka today is a small isolated fishing village on a peninsula of land that defines the northeast entrance of the Fanga ʻUta lagoon system on the island of Tongatapu (Fig. 3.1). Most of the village is low and flat, where terrain elevation barely rises 1.5 m above mean sea level. Inland of the village are the *api uta*, farm plots where people grow taro, yam, and other crops for family use or for sale in the Nuku'alofa market. Fronting the village along the peninsula's western shore is a sea wall of large packed stones. This provides a shoulder to the village's solitary access road, and it provides the only protection this road has from being submerged in extreme high tides or during summer storms. Fifty families were registered as resident at Nukuleka in 2016, perhaps a bit high when one counts the number of houses in actual use. In its configuration, churches, and the day-to-day routines of the people, Nukuleka is like most other villages on Tongatapu. To many, Nukuleka seems a strange location for the significance I now ascribe to it for Oceanic settlement. It is the site of first landfall for Lapita peoples in Tonga, and in that we can identify it as the birthplace for all of Polynesia.

How do you know it is Nukuleka? is a question I am commonly asked. The short answer, simply put, is that the archaeological record recovered from Nukuleka over the past half-century is like no other in Tonga, Sāmoa, or elsewhere in Polynesia. It is the archaeological record of a founder colony with three significant distinctions (Burley et al. 2010). First, Nukuleka has a collection of decorated Lapita ceramics with motif designs and vessel forms

Figure 3.1. The Fanga'Uta Lagoon system on Tongatapu with the Nukuleka Peninsula at its entrance. Nukuleka is the site of first landfall and a founder settlement for early Lapita peoples in Tonga. Google Earth image, 2020.

all but identical to those from early Lapita sites in Fiji, Vanuatu, and the Reef/Santa Cruz Islands. These conform to the Western Lapita ceramic province, as they should for a founder colony in Tonga. All other Lapita sites on Tongatapu, Ha'apai, Vava'u, Niuatoputapu, or Sāmoa are deficient in this respect. Second, this ceramic assemblage incorporates a number of vessels where the paste and the composite sand temper are foreign to Tonga (Burley and Dickinson 2010). We do not know where these pots come from yet, but an origin in the west is guaranteed. And third, Nukuleka has the earliest securely dated archaeological record in Western Polynesia (Burley et al. 2012). This is based on radiocarbon dating of charcoal from the earliest occupation context, and on uranium-series dating of coral artifacts embedded in beach sands as the settlement began to form. Beyond each of these, there are still other aspects of the artifact assemblage and settlement structure to provide support for my claim. In the chapter to follow the details of this site, its archaeology, its role as a founder colony and its people are provided.

An Archaeological History of Nukuleka

The discovery of Nukuleka as a site with Lapita ceramics goes back to 1963. To gain insight into Tongan ceramic chronology, Jens Poulsen, a PhD student at the Australian National University in Canberra, was sent to Tonga by his supervisor, Jack Golson. Golson was in the formative stages of defining the Lapita ceramic complex as a common ancestral culture for settlement in Remote Oceania with Tonga as an integral part. Dentate-stamped Lapita ceramics had long been known for Mangaia Mound in Nuku'alofa, these illustrated in 1929 by William McKern (1929:123) in his *Archaeology of Tonga*. Golson returned to the mound in 1957 carrying out test excavations, and in 1959 he dispatched a team to conduct a more extensive project (Golson 1961). Poulsen's PhD work, as envisioned, was to be a widespread and substantial effort. First, his plan was to carry out an archaeological survey across Tongatapu to discover and document a range of sites where ceramics were present. He then would select a number of these for excavation to provide the data for a Tongan ceramic sequence. Once in Tonga, Poulsen quickly realized that the earliest sites, those with decorated pottery, dominantly if not exclusively occurred along the shores of the Tongatapu lagoon. He discovered a concentration of these on the western lagoon within the villages of Pea, Ha'ateiho, and Tokomololo. Responding to a report that decorated pottery also was present at Nukuleka on the eastern lagoon, he subsequently found ceramic sherds "all over the peninsula and on the sand flats at low tide" (Poulsen 1987:23). One site, a low mound in the yard of Atungia Moala in the southeastern corner of the village, particularly caught his interest for its abundance of decorated pottery and shell covering the surface. Moala's mound, accordingly, was recorded as To 2 in Poulsen's designation scheme.

Poulsen's project in Tonga extended from December 1963 to September 1964 with excavations occurring at six sites. One month was spent excavating at Moala's Mound, largely focusing on a 1 x 15 m trench running from the mound centre to its northern edge. As he was to discover, the mound had been artificially built over top of a "kitchen midden" with mound fill consisting of materials dug from the midden edge, as well as large volumes of shell brought from elsewhere. His excavations encountered "eight to ten" graves with coral sand fill in the centre, these succinctly identifying the reason for mound construction.[4] The Nukuleka project recovered a large collection of ceramics and other artifacts, including a total of 1,396 decorated sherds. After transport of these and other archaeological materials back to Canberra, it was another three years before Poulsen completed his PhD (Poulsen 1967). His dissertation provides a detailed and fine-grained analysis of Tongan ceramics among other things. From this, he concludes that the decorated wares in Tonga had close similarities to the Lapita ceramics of Fiji, New Caledonia, and Watom Island in the Bismarck Archipelago. Poulsen also illustrated a transition from earlier Lapita wares to plainwares, with dentate stamp and other decorative applications disappearing. He sought appropriate materials for radiocarbon dating in the field, and placed significant stock in the reliability of his radiocarbon results for chronological interpretation. Radiocarbon dating methods in the early 1960s were still in an early stage of development and prone to error, as I later explain. These problems led Poulsen seriously astray, with his analyses extending the period for decorated ceramics in Tonga to the 4th century AD, and the continued use of plainware ceramics to as late as the 16th to 17th centuries AD. Les Groube (1971:303–306), also working

4 Burials in coral sand within mounds are post-1000 AD in age (Burley 1998). The individuals buried within the Moala Mound graves were quickly extracted and reburied elsewhere by local residents.

on Tongatapu in the late 1960s, cogently rejected both interpretations in consideration of his own data and regional comparative analyses. The eventual publication of Poulsen's dissertation in 1987 rectified these problems and, using ceramic styles, he was able to associate Moala's Mound with the earliest period of settlement on Tongatapu.

My own interest in Moala's Mound was stimulated by a reading of Poulsen's published dissertation in the early 1990s. We were beginning to excavate Lapita sites in the northern Ha'apai group, and we were recovering a fair volume of decorated ceramics with motifs typical of Roger Green's (1979) Eastern Lapita wares. These included simplified and open dentate stamp designs, albeit with the occasional find of something a little more elaborate. When comparing the Ha'apai ceramics to illustrations of those from Moala's Mound (Poulsen (1987:129–137), there were differences, some quite striking. Poulsen illustrated many of the same open motifs with crescents, squares, and simplistic designs, but there were others with tightly configured complex motifs akin to Green's (1979) Western Lapita ceramic series. One, in fact, seemed to represent an earspool or headdress element famously present on ceramics with Lapita face designs from sites in the Bismarck Archipelago and the Reef/Santa Cruz Islands. The sheer volume of decorated sherds from a 1 x 15 m trench at Moala's Mound also seemed different, being far greater than the case for sites in Ha'apai.

Completing my study of Lapita sites in Ha'apai in 1997, I applied for and received funding to continue the research program on Tongatapu. In part, my plan was similar to Poulsen's. I wanted to conduct a systematic survey of the lagoon shore, particularly those areas yet to be examined by an archaeologist. I would then select a sample of Lapita sites to conduct excavations at. But I also wanted to relocate and undertake additional test excavations at Poulsen's Lapita sites. A central research question for Ha'apai focused upon the impacts of first settlement on small island tropical ecologies. Excavations accordingly employed fine-mesh sieves (3.2 and 1.6 mm) and water washing of sediments to recover tens of thousands of fish, bird, and turtle bones. Typical of his time, Poulsen had used a larger mesh size and his recovery of fauna, particularly fish, was all but negligible, and certainly not comparable. Prior to the beginning of fieldwork, I spent a month and a half in 1998 as a Visiting Research Fellow at the Australian National University where I was able to examine firsthand Poulsen's ceramics and other collections. By then it had been reported that Moala's Mound was destroyed, being bulldozed in the mid-1980s for construction of the Nukuleka primary school (Spennemann 1986:42). Returning to Vancouver from Canberra, I stopped in Tonga to work out logistics and government relations for the impending project, and I carried out a brief reconnaissance, including a visit to Nukuleka for the first time. Moala's Mound may have been destroyed, but there might be other sites in the vicinity with potential for study. I recall entering the village with my assistant, Tenisi Tuinukuafe, and stopping the first man we came upon, asking him for instructions to Atungia Moala's house. His response was apologetic and subdued, as he told us Atungia had passed on. He nevertheless agreed to take us to the location of his former home. We walked through the village to its southeastern corner, the general location Poulsen had described for the site. Then, suddenly, the totally unexpected came into view. The house was fully intact, and in its yard was Moala's Mound, unchanged as far as I could see since 1964 (Fig. 3.2).

The 1999 field season in Tonga was a busy one. Our geologist Bill Dickinson and his wife Jackie mapped the Lapita-age paleo-shoreline along the lagoon (Dickinson 2007). Survey work was undertaken in several areas, and we began to reinvestigate Poulsen's sites at Ha'ateiho (To 5) and Moala's Mound (Burley et al. 2001). The Moala's Mound project was to be exploratory, to assess the spatial boundaries of the site beyond the mound *per se*. Test excavations, I was hoping, would also recover faunal samples comparable to the ones from Ha'apai as well as provide charcoal for additional radiocarbon dates. Six 1 x 1 m excavation units were dug, only one being positioned on the mound. There is no need to get into the details of the 1999 excavations other

Figure 3.2. Moala's Mound 1998. The mound is the slight rise in the central part of the photograph. The corner of Atungia Moala's house is on the far left.

than to say they illustrate a more extensive site than Poulsen described, and reaffirmed my interpretation of ceramic motif complexity. Relative to the latter, a large segment of a Lapita jar with an incised overlapping triangle motif and notched rim was excavated from the mound top test unit (Fig. 3.3). This was all but indistinguishable from early Lapita ceramic vessels in New Caledonia and the Reef/Santa Cruz Islands. Also important in 1999 was the recovery of a small number of ceramic sherds manufactured from a light tan to whitish clay. Poulsen (1987:135) identified 43 of these from his excavation, proposing a foreign origin for the lot, but where petrographic analysis by Bill Dickinson in 1978 suggested otherwise. Bill had analysed minerals and other constituents of tempers in these sherds using a high-powered microscope, finding nothing to suggest an exotic source. Like Poulsen, I was struck by the white to tan paste sherds. They appeared in marked contrast to the brown to reddish-brown fabric of other Tongan pottery. I consequently asked Bill to revisit this work with the additional samples from our excavations. As reported in a paper in the *Proceedings of the National Academy of Science*

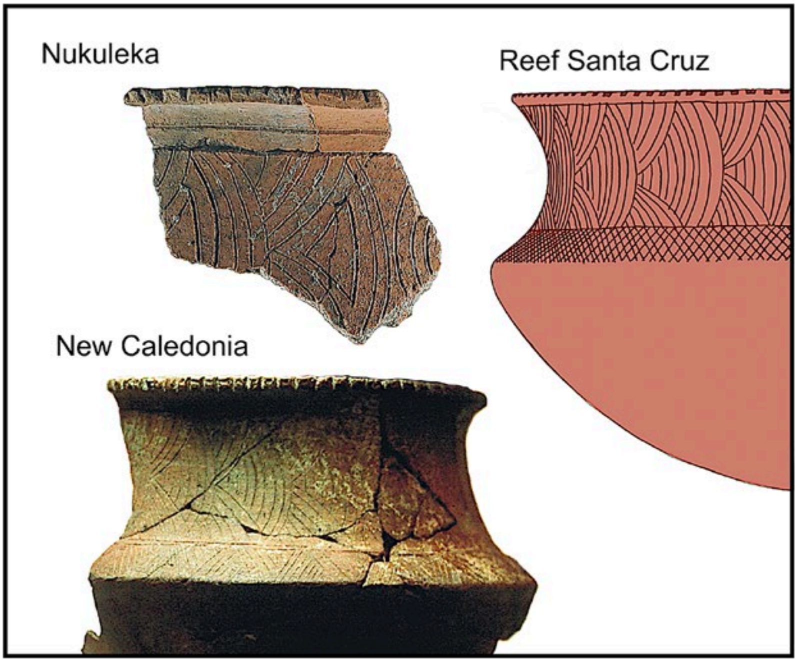

Figure 3.3. Incised overlapping triangle motif and notched rim vessel recovered from a 1999 excavation unit on the top of Moala's Mound. The Nukuleka sherd is all but identical to pots recovered from early Lapita sites in the Reef/Santa Cruz Islands and New Caledonia.

in 2001, and later discussed in detail, he had erred (Burley and Dickinson 2001). The sherds, including those sent by Poulsen, are in fact foreign to Tonga, and they support the identification of Nukuleka as a founder colony. Jens Poulsen passed away without knowing how correct he truly had been.

The project at Nukuleka in 1999 left more questions than answers. I returned to Tongatapu in 2001 to continue the lagoon shore survey, also including a small amount of additional work at Nukuleka. Poulsen's descriptions of ceramics and shell on the surface of gardens or eroding from other contexts across the peninsula are fully appropriate. But strangely, undegraded ceramics erode from the contemporary beach south of the village and they are present in test excavations where the matrix otherwise is a mix of storm beach rubble. Bill Dickinson's mapping project in 1999 securely established sea levels as 1.2–1.4 m higher at first Lapita landfall on Tongatapu (Dickinson and Burley 2007). The current beach at Nukuleka, the areas with beach rubble, and even the lower levels of archaeological deposits of Moala's mound must have been submerged at the time of Lapita occupation or, at the very least, they occurred within the intertidal zone (Fig. 3.4). How could that be? In retrospect, the explanation should have been obvious. The first Lapita houses were not on the back beach above high tide, but on stilts within tidal range or in the offshore shallows of the lagoon. Making it even more obvious, this type of stilt house construction was already documented for early Lapita sites at Mussau and the Arawe Islands of the Bismarck Archipelago (Gosden and Webb 1994; Kirch 1997). Not seeing the forest for the trees, to use the age-old idiom, it took us until 2015 to come to the same conclusion for Nukuleka (Burley 2016). At the same time, we were able to document Nukuleka not as a peninsula of land at first settlement, but a small sandy islet separated from the mainland.

My intent in returning to Nukuleka in 1999 and 2001 was not to carry out major excavations but to gather samples and position Poulsen's discoveries within their broader context. With other projects on Tongatapu, and limited time, this was only partially accomplished. What we did learn from our survey and additional test excavations is that Western Lapita ceramics, as well as the tan paste sherds, largely occur within mound deposits. The mound, thus, is one of, if not the earliest settlement on the Nukuleka Peninsula. Then, in 2003, tragedy struck. The Australian National University storehouse burnt down during an uncontrollable bushfire on the outskirts of Canberra with the vast majority of its archaeological contents lost. This, unfortunately, includes virtually all of Poulsen's materials from Tonga. Thoroughly convinced of Nukuleka's significance for Polynesian origins, I began to contemplate yet another project with that as its focus. This project, implemented in 2007, was to be far more than scattered test pits; it was to incorporate a major exca-

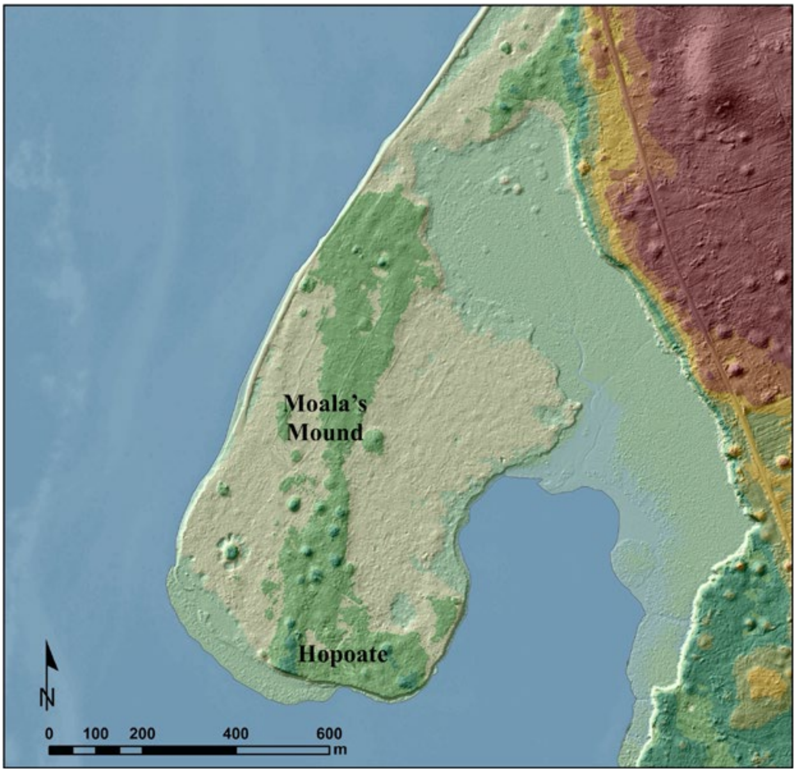

Figure 3.4. LiDAR digital elevation model of Nukuleka Peninsula showing topographic relief at 1 m intervals. The lightest green on the shore is mangrove at sea level, the light brown is an elevation between 0 and 1 m above sea level while the central green areas are between 1 and 2 m. The peninsula formed as a sand spit ultimately separated from the mainland. With sea level 1.2 m higher than today, the hook of the spit (green) would form the islet first encountered by Lapita peoples. The small bumps are late prehistoric burial mounds.

vation of mound deposits (Burley et al. 2010). In 2007 we also continued the survey where a second locale on the Nukuleka Peninsula having Western-style Lapita ceramics was discovered. This was at Hopoate, a farm plot on the southeastern shore of the peninsula. Another sizeable excavation was carried out here in 2014 (Burley et al. 2018). These projects provide substantive insight into first landfall and its aftermath in the settlement of Nukuleka.

Re-excavation of Moala's Mound 2007

I planned the re-excavation of Moala's Mound for June and July 2007. This was in partial response to the loss of Poulsen's collections but, more importantly, excavation would provide a range of new data for site interpretation. Among these would be samples for radiocarbon dating, faunal remains comparable to Ha'apai, additional tan paste sherds for petrographic analysis, additional ceramic vessels with Western Lapita motifs, and exotic materials to identify homeland origins for the initial colonists. On June 12 as I was departing for Tonga, I visited Richard Shutler to say goodbye, he having excavated with us in Ha'apai in the 1990s and at Moala's Mound in 1999 and again in 2001 (Fig. 3.5). Richard had an amazing career in Pacific archaeology, one spanning well over 50 years of work from his project with Gifford in New Caledonia in 1952, to Vanuatu, to Micronesia, and well beyond. I spoke to him of my optimism and excitement for the field season to come, and of the questions we were trying to resolve. As much as Richard wanted to be with us, he had developed health problems that were not so easily resolved. On June 28th, two weeks after we arrived in Tonga, I received a telephone call that he had passed on. That he was with us in spirit through the ensuing weeks of the project, I am certain.

The 2007 project was not to be piecemeal, I wanted to understand how the site had formed, I sought a sizeable assemblage of materials to provide insight, and the plan was to carry out a large block excavation where units would be dug simultaneously (see Burley et al. 2010). I had four graduate students from Simon Fraser University to assist with the excavations and to run a full-time field laboratory. The Nukuleka town officer, Steven Feao, was field foreman for a locally hired crew of six, and three others were employed as field laboratory assistants. A longtime colleague, Dr. Frédérique Valentin from the University of Paris, was to join the team. And I brought my family with Theresa, my wife, also working in the field laboratory. Moala's Mound is not

Figure 3.5. Richard Shutler Jr., undertaking test excavations at Nukuleka 1999.

the largest field project I have undertaken in my career but it certainly was a sizeable undertaking.

We rented a five-bedroom house across from the beach at Makaunga, it a short distance down the road from Nukuleka. The outside patio proved to be an excellent space for the lab, and we had considerable room for storage. Long before we arrived, I had come to agreement with Sosaieti Vailala and his wife Sapate, the resident owners of the house and yard in which Moala's

Mound occurred. They agreed to lease me a part of their yard for the duration of the project, Sosaieti would work as a field assistant, and Sapate was to cater the daily lunch. I don't think either could have conceptualized just how disruptive our backyard excavation was going to be. Visualize a hole the size of a small swimming pool being dug with hand trowels and buckets by a large crew of men within 15 m of your house, and you get the picture. Beyond the noise and intrusion of day-to-day work, even the slightest gust of wind sent finely sieved sediment through the fixed open louvers of the Vailala living room, or soiled the just washed clothes Sapate had hung to dry. And all of this for what, not gold coins or other types of treasure, but small bits of *maka umea* (cooked clay) carefully collected and placed into large plastic bags. I can only imagine their relief when we were done and finally on the airplane home.

Where to dig is one of the most critical decisions for any excavation project. Poulsen's 1960s trench had started in the centre of the mound stretching 15 m northward to its edge (Fig. 3.6). On the mound top he encountered graves, something I wanted to avoid if at all possible. Tongans are not skittish about human bone, but as I knew from Ha'apai, we would be to blame for any unexpected illnesses or deaths in the village if burials were present. I decided, then, to focus on the southeast section of the mound. It was far enough away from the mound centre to avoid the burial pit, and it was in the area where our 1999 test unit had recovered the Western Lapita sherd. Considering the results from Poulsen's trench on the opposite side of the mound, block excavation was expected to document mound fill accumulation as it moved from the edge toward the higher elevation of the middle. Beneath this we would be able to expose the *in situ* "midden horizon" as defined by Poulsen. Materials within the fill could be expediently excavated since they are in secondary context; the midden horizon would be more carefully excavated with greater control. A 5 x 6 m excavation was eventually completed as also a small number of test excavations elsewhere in the mound vicinity (Burley et al. 2010).

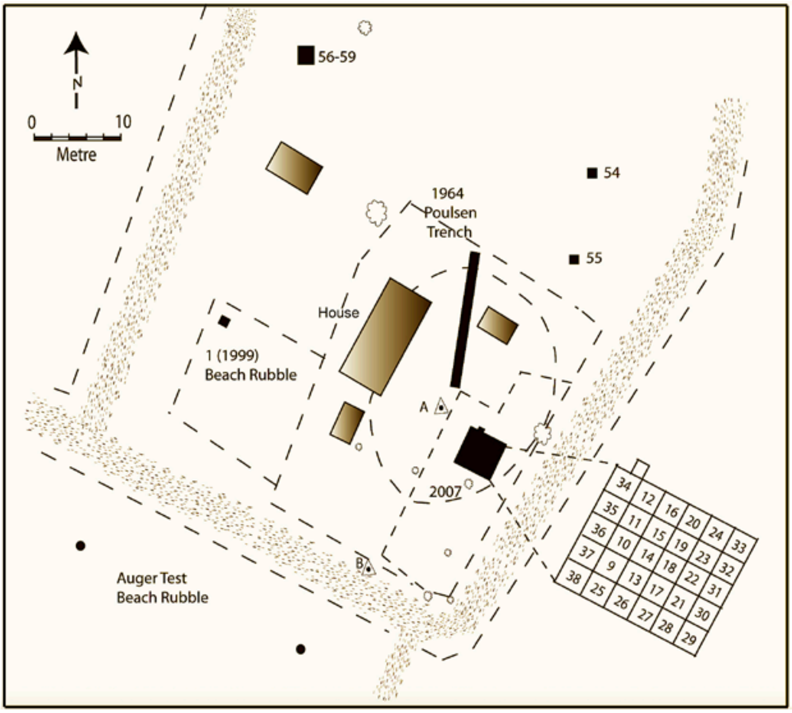

Figure 3.6. The 2007 excavations at Moala's Mound, Nukuleka. The approximate mound limits are delineated by the circular dashed line. Straight dashed lines are fences. The 2007 excavation block occurs in a section of the mound planted in garden. The 1964 Poulsen trench location is projected based on his descriptions. The elevation of A is 1.3 m above B, the graveled road surface.

My prediction of what we would find given Poulsen's stratigraphic illustrations turned out to be misguided, or at least partly misguided (Fig. 3.7). With exception of the two rows of units in the northwestern block area (9-12, 25, 34-38), there is no *in situ* midden horizon. The excavation of fill to form the mound centre had removed it all. Underlying coral sands in places also were dug into, and these had been redeposited as intermixed sand lenses within the fill. And to make the situation even more confusing, midden from even further to the east beyond the mound was piled on the previously dug out area, possibly to extend mound size after the central core was complete. No less than 20 m^2 of

Figure 3.7. Moala's Mound excavation profile of units 38, 25-29 (Fig. 3.6). The slanted strata illustrate the original mound slope as fill was added to the mound core. Karine Taché, a project field supervisor, provides scale.

our 30 m^2 block excavation had managed to dig anything but fill, a rather disturbing realization when eventually it became apparent. Not everything is discouraging though, most of the mound fills are midden matrices from within the same site. Ceramics and other artifacts from secondary deposits appear little different from those of the *in situ* midden horizon. My later analysis of decorated ceramics for the 10 northwestern units with underlying midden explains why (Burley et al. 2010:134–135). The occupation deposits beneath Moala's Mound are almost exclusively of Lapita age. Evidence for a continuous occupation into later prehistory beyond mound construction and historic period settlement does not occur. The disparate assemblages in the fill and mound can be treated as homogeneous for the Lapita phase. In his ability to fit and glue together ceramic fragments from the fill and mound horizons, Poulsen (1987:24) came to the same conclusion.

The archaeological assemblage recovered from Moala's Mound in 2007 is profuse. It includes 39,517 ceramic sherds with 3,870 of these decorated. The number of decorated sherds is well beyond the most abundant Lapita assemblage from Ha'apai; in fact, it is almost three times as abundant! Decorative applications predominantly are dentate stamp, but incised lines, shell edge impressions, shoulder or rim notches, and appliqué modelling occur in combination or alone. Beyond ceramics, 566 other artifacts were unearthed, most being typical of Lapita phase assemblages from elsewhere. There is a range of items from industrial type tools such as adzes, chisels or abraders, to the tiger cowrie caps (dorsa) still employed in the Tongan octopus lure. We were interested in and did recover different types of "shell valuables," including bracelets, rings, beads, drilled plaques, and the preforms from which these items were manufactured. In *The Lapita Peoples*, Patrick Kirch (1997:252–255) identifies these as "key components" in Lapita exchange, with their integration into a sophisticated network of trade relations and interisland interactions. Their historic counterparts are present in the *kula* exchange system of the Massim, as described by the Anthropologist Bronislaw Malinowski (1961), or in *bata*, the shell bead money manufactured and still traded by peoples of Langalanga Lagoon on Malaita in the Eastern Solomon Islands (Guo 2006). For Lapita shell valuables in Tonga, I am not so sure. That is not to say there is an absence of trade, but all Lapita sites in Tonga have abundant evidence not only for the presence of shell valuables, but for their manufacture on site. The items may have been valuable; whether they have an integrative symbolic role within the Eastern Lapita region is open to question (see also Szabo 2018). At the beginning of the 20th century a Japanese anthropologist produced a series of glass plate photos of indigenous Chuukese (Micronesian) men and women (Intoh 1999). Almost the entire suite of Lapita bracelets, rings, and beads that we had been digging up are displayed (Fig. 3.8). They do not occur in pictures of ceremonial regalia nor ritualized trade. Instead they are in the hair and ears of everyday people seemingly doing

Figure 3.8. A photograph UMUT 8216: 1915 of Chuuk Island man wearing hair and ear adornments, by Japanese Anthropologist Akira Matsumura. Published as Plate 52 by Intoh (1999). Image courtesy of the University Museum, University of Tokyo. Upper right includes conus shell plates and long units with drilled perforations for stringing together. On lower right are shell disk beads, shell rings, circlet fragments, and thick tridacna shell ring fragments

everyday things.[5] They are objects of common adornment, certainly with value to the people who are adorned, but without the overt special status that archaeologists implicitly assume.

I had hoped our excavations at the mound would find some type of exotic material or artifact through which we could trace a homeland origin for the colonizing group. Additional tan paste sherds had been anticipated, and 87 of these representing no less than 15 pottery vessels were added to the collection (Burley and Dickinson 2010). Conceivably obsidian from the Bismarck Archipelago or volcanic glass from northern Vanuatu might have

5 Of course it always possible that the photographer had these individuals wear their traditional valuables for the photographs.

made its way to Tonga, each with a distinctive elemental signature for geochemical verification. The two small flakes of volcanic glass pulled from the excavation sieves were from neither, these being of Niuatoputapu origin from far to the north of Tongatapu (Burley et al. 2011). The geochemistry of andesitic basalt artifacts provides little of note beyond interaction with people in the Lau islands in southeastern Fiji, islands we already knew were closely related. There is one artifact in this assemblage that nevertheless stands out. It is a bivalve shell scraper, unrecognized in the field, but identified several years later from near the bottom of a column sample we had taken for shellfish identifications (Fig. 3.9). When brought to me by the student doing the shellfish analysis in 2013, I was stumped. It was obviously a scraper, with well-worn and rounded edges, but the type of shell was unlike anything else in the column or in any of the other analyses we had done for Tonga. I photographed the specimen and put out an email query to my colleagues for help. A response from Johnson Seeto, then a research assistant at the University of the South Pacific in Suva was quick in return. Johnson had done shellfish analysis from Bourewa on Viti Levu, a site with complex Lapita ceramic motifs and a probable founder settlement for Fiji (Nunn 2007). The Tongan specimen, as Johnson wrote, is the valve of *Batissa violacea*, a river mussel common today in the larger river systems of Viti Levu and Vanua Levu in Fiji. I am more than a little embarrassed by this; I had collected *Batissa violacea* for our comparative collection from the Sigatoka market on Viti Levu, and on occasion I ate them at village feasts while working in Fiji. But the one we have from Moala's Mound is three times larger, thicker, considerably heavier, and it does not have the blackish purple colour of the *kai* sold in the markets today. The hinge structure is the tell-tale clue notwithstanding. This freshwater mussel may not have been with the earliest Lapita colonizers at Moala's Mound, but it had been brought from Fiji or elsewhere as part of a tool kit not long after.

The one-page summary I wrote in my field book at the end of the 2007 project lacks the excitement I had conveyed to Richard

Figure 3.9. Opposite sides of a river mussel (*Batissa violacea*) shell scraper. This specimen was excavated at Nukuleka as part of a shell column sample in 2007. *Batissa violacea* is foreign to Tonga, its closest source being river systems on Vanua Levu or Viti Levu, Fiji.

Shutler two months earlier. We met our goals in the recovery of tan paste sherds and ceramics with complex Lapita motifs, in the recovery of charcoal samples for radiocarbon dating, in the acquisition of faunal data, and in our understanding of the processes impacting the early archaeological occupation. It was disappointing that we had not found materials from some distant homeland, but little could I predict what analyses of these data might eventually determine.

Dating First Settlement

In 1949, what is probably the single greatest advancement in the history of archaeology was offered to science by a University of Chicago chemist, Willard Libby (1952). This is radiocarbon dating, a technique capable of accessing a radiometric clock (^{14}C) present in all living organisms that begins to tick on death. While capable of dating all organic matter, in archaeology the technique was applied initially to wood and wood charcoals. Radiocarbon dates provide absolute measurement in years before present, or BP in standard archaeological conversation. The immediate impact for a rewriting of world history was quick and astounding. Edward Gifford and Richard Shutler's (1956) early acquisition of radiocarbon dates for the Lapita site (Site 13) in New Caledonia is a good example, where an antiquity of at least 2500 years for first peoples in Remote Oceania was determined. Chronologies for the settlement and culture histories of other Oceanic islands were quick to follow.

The 1949 version of radiocarbon dating is sound in overall principle but oh so problematic with 70 years of retrospective hindsight (Jull 2009). Radiocarbon years are not calendrical years, and to convert them to calendrical dates requires correction using a calibration scale that is still under refinement.[6] Applications of radiocarbon dating to charcoals, shell, and bone also require subtle and some not-so-subtle corrections for a variety of other factors. The technologies for measurement were in an infancy stage, with problems of accuracy given as statistical estimates with standard errors in the hundreds of years. And equally important, most archaeologists had no clue on what to sample, how to sample, problems of sample contamination, and critical implications for interpretation. For Oceania, controversies over radiocarbon dates have been central to archaeological inquiry throughout the last half century, at times resulting in prickly debate. Only within the past couple of decades have we truly begun to appreciate the complexities of Libby's contribution with ever-increasing concern for getting it right. I also think I am speaking with consensus in saying that we are still not there yet, at least for the level of precision most of us seek. I offer this introductory caution in part for upcoming discussion of the Nukuleka archaeological record, but also for similar considerations in chapters to follow.

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6 Radiocarbon years are varied in length as a result fluctuations over time in the amount of ^{14}C in the atmosphere. The calibration scale has been created through the dating of materials with independently known ages, especially including tree rings.

Notwithstanding Poulsen's problem with his initial dating of Moala's Mound, Groube (1971) acquired six *anadara* shell "net sinkers" from the site's earliest deposits and submitted these to the Australian National University Radiocarbon Laboratory in 1970. They gave an averaged radiocarbon age of 3090 ± 95 BP that, when calibrated and corrected employing modern standards, provides a date range of 1004–792 BC at 95.4% probability. One date is hardly a definitive statement, even in 1971, but it suggests a substantial degree of antiquity for Lapita pottery at Moala's Mound. I have never been a big fan of marine shell radiocarbon dates; they require corrections for marine reservoir effect, hardwater influences, and individual species variation (Petchey and Clark 2011). Early in the Tongan research program, I alternatively chose to date wood charcoals, including four samples from the lower occupation deposits at Moala's Mound. With these latter dates falling between a maximum range of 1013–771 BC after calibration (95.4%), and in their apparent verification of the shell date, I was pleased (Burley et al. 2010). But wood charcoal unidentified to species, as assertively proclaimed (Nunn and Petchey 2013), can be problematic, perhaps even more so than marine shell. Without wood species identifications, the "Old Wood Effect," as it is labelled, forever casts its shadow, no matter how many dates you have, nor how consistent the results may be. Old wood in this case refers to heartwood from a long-lived tree, and if that is what you are dating, it adds decades if not centuries to the event you are trying to date. I was fortunate in the case of Moala's Mound, one of the four samples from the lowest level of the site comes from the shell of an unidentified nut. There is no old wood here, the nut had lived no longer than the single season it took to grow. The calibrated range for this sample of 1009–825 BC (95.4%) is truly secure, even though it incorporates a 184-year temporal interval.

I attended the Lapita conference in Apia, Sāmoa, in 2011. This was a meeting of between 90 and 100 researchers, most with a common interest in learning about new discoveries or on-going analyses for the Lapita settlement of Oceania. It was morning tea during one of the meeting days when I spoke with a long-time colleague and friend, Professor Marshall Weisler of the University of Queensland in Brisbane. Marshall has varied interests in the Pacific from Hawaii to Micronesia but with a strong background in archaeological science. He told me of his efforts with another colleague, Jian-xin Zhao, at University of Queensland to apply uranium thorium (U/Th) dating to corals found in archaeological sites from Hawaii (Weisler et al. 2006). U/Th is another radiometric dating technique developed in the 1960s when it was largely applied to speleothems. The Hawaiian sites are relatively recent in age, but the precision of his coral dates with plus/minus ranges of three to four years is beyond spectacular. And to make it even better, the ages already are at a 95.4% confidence interval. Marshall was interested in seeing how U/Th would work on older sites, and he asked if I had found coral files in any of my Lapita excavations in Tonga. I had indeed; the 2007 excavations at Moala's Mound alone had recovered 50 of these (Burley et al. 2010). Coral files are branch segments of staghorn (*Acropora*) corals with rasp-like surfaces formed by corallites. When freshly harvested from the reef, they provide a file-like artifact for smoothing or shaping of wood or shell. As they are used, the corallite wears down leaving a distinctive pattern of use. If we could date these, we would be directly dating artifacts not charcoal bits with an assumed association to their archaeological context. I told Marshall I would send him samples to experiment with.

I guess I was not expecting much to come from this, but eventually got around to sending 16 coral files from the 2007 excavations, most from the mound, but a few from one of the adjacent test units (Fig. 3.10). U/Th dating of corals is a bit of a tricky business, since degradation can alter coral chemistry over time and significantly impact the integrity of dates. To account for that, Zhao, a geochemist and environmental scientist, established a double dating protocol for suspect samples where adjacent 1 cm segments from a specimen were individually dated to ensure comparability at 95.4% probability. Of the 16 samples sent, 13 met protocols and provided U/Th dates. Marshall sent me the

Figure 3.10. *Acropora* staghorn coral file abrader illustrating natural corallite surface and opposite surface where abrasion has produced use-wear. This sample is from Nukuleka and dated using U/Th at the University of Queensland.

results by email which I quickly glanced through. The results seemed an acceptable mix but, almost unbelievably, each had a standard error of no more than 6 to 10 years with calibration! Using proveniences and stratigraphic position for the samples, I then plotted the dates for the mound (Fig. 3.11). My mouth literally dropped open, each of the 11 mound dates was in perfect stratigraphic order, a very rare occurrence in most archaeological contexts. The lowest sample, one from beach sand beneath the site, provided the oldest date of 896–880 BC. The radiocarbon date on the nutshell, the one with a 184-year calibrated interval, also had been taken from the same beach sand. When I plotted the U/Th date against the calibration probabilities for the nutshell date, it was positioned dead in the middle (Burley et al. 2012). As I later described on the radio show, "An Academic Moment,"

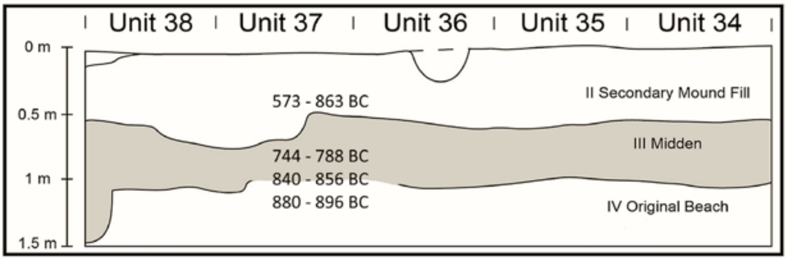

Figure 3.11. U/Th dates on coral file abraders plotted against stratigraphy of northwest profile 2007 (see Fig. 3.6). The bottom-most date range is from a single specimen recovered in beach sand below the midden. The date range for the Strata III/IV transition is also a single specimen. Other samples are averaged to give an age for Stratum II and III. Samples from secondary mound fill are out of context and, hence, provide a broad range.

the sand beneath Moala's Mound is the original beach on which the first peoples into Polynesia had walked—we now knew exactly when that occurred, and it was verified through completely independent dating methods. U/Th dates have now been acquired for coral files from other Lapita sites on Tongatapu, Ha'apai, and Vava'u (Burley et al. 2015). These provide insight into the timing and processes of Tongan settlement in discussions yet to come. None are as early as the dates from Nukuleka, a significant result for claims of first Polynesian landfall.

The Hopoate Project 2014

In retrospect, the 1999 project at Moala's Mound had been deficient, requiring a more thorough and systematic survey of the Nukuleka Peninsula shoreline than it was given. That field season was not just about Nukuleka though, there were several on-going projects on the lagoon shore that more than filled the days we had scheduled for work. The broader survey was not initiated until 2007 when the mangrove-fringed coastline was walked at low tide and where bush gardens stretching back from that coast were more closely examined. Walking through mangrove thicket is not the most pleasant of tasks but it was one ultimately leading to a quite significant discovery. Shellfish midden with scatters of ceramic fragments occur along much of the southern and southeastern shore attesting to an early occupation much more extensive in scale than previously considered. Active erosion along one 300 m segment had created a scarp where shell midden and occupation features are evident in the exposed face, and where eroded ceramics are present on the intertidal beach (Burley et al. 2010:139). On the western end of the scarp, a small sandspit is present and the mangrove thins along the coastal fringe. Here, to the front of the *api uta* known as Hopoate, was an unusually dense concentration of decorated Lapita sherds. But more importantly to us, at least a few had the complexity of the Western motifs occurring at Moala's Mound. This discovery occurred in the final days of the 2007 field project, leaving exploration of Hopoate through test excavations for yet another project.

Shane Egan is an Australian expat who, with his wife Chris, own the Blue Banana, a small tourist resort at Ha'atafu on the western tip of Tongatapu. Shane is an interesting and engaging individual who tries to surf daily and, among other things, maintains an acute interest in Tongan archaeology and early history. He also walks beaches and collects ceramics and various other archaeological specimens. With our excavations at Moala's Mound highlighting the Lapita settlement at Nukuleka in the press, it wasn't long before he discovered the material scattered along the mangrove shore, and particularly at Hopoate. I have never had much time for unscrupulous collectors, but it is impossible to characterise Shane as one of these. He collects only that which has eroded, he keeps a meticulous catalogue of what he picks up, and he built a small museum at his resort to put the better pieces on display.[7] After examining those pieces in 2010, I made note in my field book that he now had acquired a "better collection"

7 The Blue Banana resort, including the Museum, was catastrophically destroyed by a tsunami wave generated by the explosive eruption of the Hunga Tonga–Hunga Ha'apai volcano on 15 January 2022.

of Western Lapita sherds from Nukuleka than I had excavated in 2007 from Moala's Mound. It was time to go back to Hopoate and implement a testing project to sort things out. The 2010 tests were done using a 4-inch diameter bucket auger, a tool very much like a post hole digger. Bucket augers do not provide a lot in the way of stratigraphic visibility, but they can expediently determine the depth, extent, and sometimes the nature of archaeological deposits on a site. Those dug at Hopoate were able to quickly isolate one area along the shore where densely packed shell extended to over 2.1 m in depth. A finely decorated sherd with the hallmarks of Western Lapita style was recovered from the lower-most auger deposits here.

Projects in archaeology can develop slowly, and the one planned for Hopoate took another three years to come to fruition. It is not that I lost interest, but other research commitments in Fiji and Jamaica had to be accommodated, and my university responsibilities for teaching and administration kept me in Vancouver for most of the year. Thus, it was not until 2014 that funding was secured, and we could tackle Hopoate. Thinking through this project in the interim, I was continually puzzled by the over 2 m depth of the Hopoate midden in an area roughly estimated as 6 x 6 m in size. By contrast, adjacent archaeological deposits were no more than 50 to 60 cm in depth, and this also was the case across the erosional face of the shoreline scarp. I planned the 2014 project as part of a Simon Fraser University field school in South Pacific archaeology. With 19 undergraduate students and a graduate student teaching assistant, the field school was taught partly on the Simon Fraser campus, partly at the University of South Pacific in Suva, Fiji, with the final four weeks spent in Tonga at Hopoate. The Hopoate team additionally included two graduate student field supervisors, a field laboratory supervisor, and upwards of 15 field assistants hired from Nukuleka. Again, we rented a house and field lab, this time in Nukuleka, with students transported daily to the site from their Guest House accommodations in Nuku'alofa. All things considered, this was a far more sizeable effort than the one in 2007. This

Figure 3.12. Simon Fraser University field school students excavating trench at Hopoate 2014. View is to the east. The 2 x 2 m unit is to the north. Sterile coral sand is beginning to be exposed in the western end as well as a large intrusive post hole feature.

time, though, we were on the shore of an isolated bush garden with no one to disturb. And the owner of the property, Pita Vi, a Tongan living in Australia, was supportive. His long-term vision is to build a resort, and anything we might find relative to first Polynesian landfall could enhance its marketability.

The objectives for the Hopoate project were similar to those at Moala's Mound. They include concerns for faunal data, materials for radiocarbon or U/Th dating, ceramic recovery, and the acquisition of exotic items reflecting upon origins. Rather than a mound, we were investigating a shell-packed depression over 2 m in depth. To identify the nature of whatever the feature might be, it needed to be cross sectioned with a trench rather than excavated into with a block excavation (Fig. 3.12). Once the 2010 auger

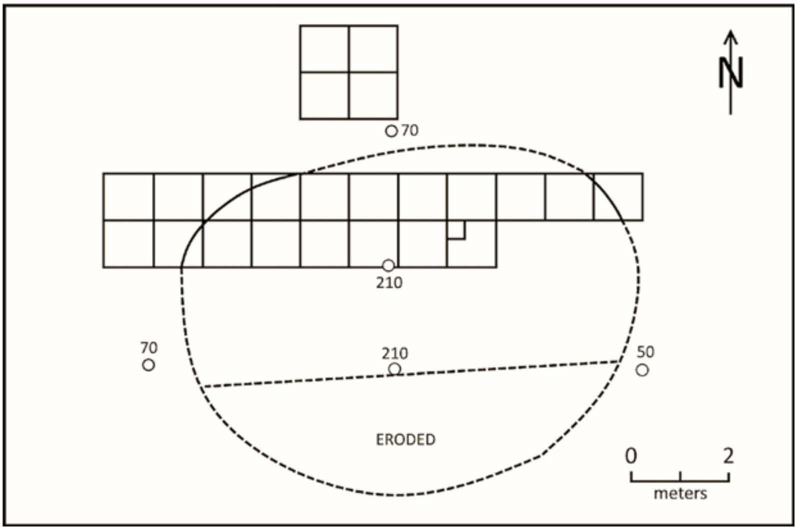

Figure 3.13. Excavation plan at Hopoate outlining former extent of pit feature. Dashed lines are projected based on stratigraphic profiles and excavated edges. Small circles represent auger tests with numbers being depth of cultural deposits in cm.

tests were relocated, theoretically we would be able to re-identify the area of concern and orient the trench appropriately. I say theoretically because trying to find a 4-inch diameter hole dug in 2010 and filled in, even with GPS coordinates and an army of students, not only took a while, but required additional auger testing in the search. An 11 m long trench eventually was laid out along an east/west orientation with excavation of the initial 1 x 1 m units done in tandem (Fig. 3.13). We also excavated a 2 x 2 m unit north of the expected periphery of the feature to examine the surrounding deposits. The top 50 to 70 cm of the trench excavation crossed a homogeneous archaeological matrix of mixed midden with high shell content, abundant rock, fragmentary ceramics, vertebrate faunas, and assorted other artifacts. In these upper deposits, the ceramics are small and degraded, characteristics indicative of trampling or secondary deposition or both. As we continued excavation, coral sand was encountered in the end units of the trench, defining the edge of the depression with inward sloping sides. This was not a natural feature but one intentionally excavated and then filled in. This hole became clearly defined in profile with continued excavation eventually encountering a thick deposit of gray crumbly sand in the bottom. Coral sand without archaeological material was reached at a maximum depth of 2.2 to 2.3 m.

Six weeks of excavation involving almost 40 individuals and, finally, we were able to define a hole in the ground (Fig. 3.14). To the general public, archaeology must at times seem hopeless. Based on the edges of the hole as they cross the trench, stratigraphic profiles on either side of the trench, and results from the original auger tests, the pit is elliptical in shape extending 9 m east to west with a projected south-to-north span of 7 m. A full 2 m of the latter had eroded out accounting for the large volume of ceramics on the beach. At the time of its excavation and use, there was no associated occupation around its perimeter that we were able to detect. It was only after the pit had been filled in that a shell midden occupation horizon in the 2 x 2 m unit was laid down, and this extended across the top of the infilled pit. The plan for residential occupation in this area as reflected in the presence of large postholes in the upper deposits seems the most likely reason for the pit being filled. As later reported in a publication of the results (Burley et al. 2018), the scale of the pit and its associated features are without precedent in Lapita archaeology. It truly was big.

In working through the possible functions this pit might have served, there is only one with any degree of logic. It had to be an aroid planting pit as employed today on the atolls of Micronesia for the cultivation of swamp taro (*Cyrtosperma merkusii*) and in some cases taro (*Colocasia esculenta*). Dug into calcareous sands on islands without a freshwater source, these types of pits access the Ghyben-Hersberg lens, a freshwater zone that sits on top of tidal-induced seawater (see Kirch 1994). Root bundles for the taro plants are wrapped, set in the lens, and heavily mulched with organics to provide the appropriate nutrients. Marshall Weisler, the colleague who was instrumental in U/Th dating at Moala's

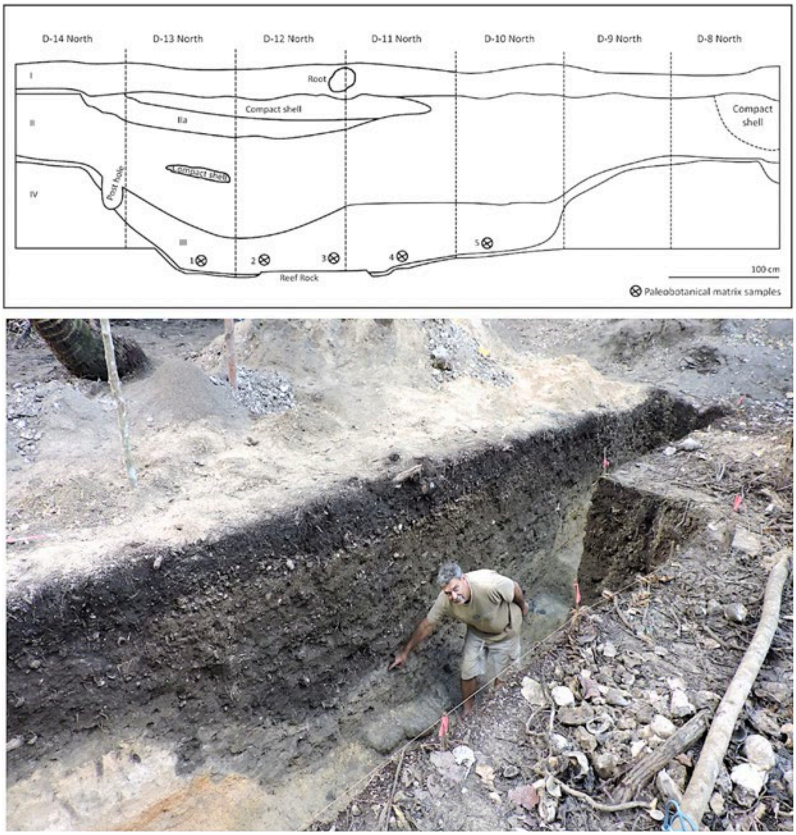

Figure 3.14. North face profile of Hopoate excavated trench illustrating aroid planting pit. Small circles with numbers in upper drawing are sample locations for paleo-botanical analyses. Lower photograph has author pointing to gray crumbly sand stratum in pit bottom.

Mound, is one of the leading experts on planting pit cultivation and its antiquity in Micronesia (Weisler 1999). His opinion was unequivocal, Hopate is fully consistent with pits he has documented in the Marshall Islands (Weisler 2001), albeit a bit on the smaller side (Fig. 3.15).

The Hopoate pit was dug to a depth of 1.1 to 1.3 m below the Lapita-age land surface which itself is 60–70 cm below the contemporary surface. Figuring in increased sea levels identified by Bill Dickinson, the bottom of the pit occurs exactly where it

Figure 3.15. *Cyrtosperma* in planting pit surrounded by breadfruit, bananas, and coconut on Ebon Atoll, Marshall Islands. Photo by Marshall Wesler 2011 with approval.

should be to intercept the freshwater lens. The thick stratum of gray crumbly sand is explained by twice-daily tidal inundation as well as degrading organics employed as mulch. This sand incorporates an abundant Lapita ceramic assemblage with several of the specimens being large segments of bowls or jars. An occasional pot might have broken in the process of planting or harvesting, but the sheer quantity requires some other explanation. Lapita ceramics are low-temperature-fired earthenware, somewhat porous in composition and, in Tonga, they are produced from local volcanic tephra-based clays rich in iron. We believe the Lapita people at Hopoate intentionally added ceramics to the planting matrix as part of the mulch (Burley et al. 2018:7–8). Ceramic porosity allows the sherd to absorb and release moisture over time, while their bulk slows the rate for groundwater drainage. They also release iron as a nutrient supplement as the sherds break down. Other than ceramics, the planting matrix incorporates an abundance of faunal bone suggesting food scraps were being added as well.

On completion of the 2014 excavation, we extracted a series of samples from the gray sand at the very bottom of the pit as it was exposed in the north face profile of the trench. I sent part of these to Mark Horrocks, a New Zealand consultant who specializes in the identifications of plants based on pollens, spores, phytoliths, and starch. Mark previously had analysed microfossil samples for me from Fiji with excellent results; I had every confidence the same would be the case for Hopoate. I was not wrong, his report identifies a number of Oceanic cultigens including swamp taro (*Cyrtosperma merkusii*) and taro (*Colocasia esculenta)* as expected, but also banana (*Musa* sp.), candle nut (*Aleurites moluccana*), pandanus (*Pandanus tectorius*), and coconut (*Cocos nucifera*) (Burley et al. 2018). A characteristic feature of planting pits in Micronesia is that they are surrounded by a mixed planting of tree crops, in part for the produce they bear, but in part for shade cover for the pit. Their context at Hopoate seems strikingly the same. Mark also identified *Bruguiera* pollen in most of the samples, this indicative of a mangrove-fringed shoreline, as is the case today.

Unlike Moala's Mound, the Hopoate excavations provided few charcoal samples for radiocarbon dating, and the ones we did recover are from either the fill or later occupation strata. We had taken a 30 x 30 cm column sample collected at 10 cm intervals for later shellfish analysis. This had a coral file for potential U/Th dating in its bottom. If we were to combine this with dates on shell from strategic locations along the column length, we might be able to determine the age of the pit, when it was filled, and whether it was filled gradually or as a single or short-sequenced event. Radiocarbon dates from two of the wood charcoal samples, one from the fill and one from the surrounding occupation, could provide additional insight or serve as a check on the shell dates. All of the dates are coherent and my plan, in hindsight, seems astute (Burley et al. 2018). The U/Th date on the coral file from the bottom provides a 95.4% probability range of

869–858 BC. It is all but identical to the early date for Moala's Mound indicating contemporaneity of events at the two locales. The recovery of Western Lapita ceramics says the same. One shell sample came from the gray sand planting matrix but above the coral file date while the others were at different levels in the fill. As a group, the latter indicates that the pit was infilled between 740 and 440 BC (95.4%); these dates also are indistinguishable, telling us the pit was filled as a single event. The calibrated radiocarbon charcoal date of 800–545 BC (95.4%) from the lowest occupation deposit in the 2 x 2 m excavation unit further indicates pit filling and the residential occupation to be simultaneous as hypothesised. The planting pit had been used for a century, give or take a decade or two.

The planting pit excavation recovered a ceramic assemblage of 47,131 sherds of which 6,158 were decorated Lapita wares (Fig. 3.16). These numbers easily surpass ceramic counts from 2007. The decorated assemblage is a varied lot, including Western Lapita types, but with large numbers having simplified and expanded motifs typical of later Eastern Lapita wares on Tongatapu, and to the north in Ha'apai, Vava'u, Niuatoputapu, and Sāmoa. Hopoate ceramics also are of note for the presence of earlier types of vessel forms including flat bottomed bowls, double-rimmed jars characteristic of Lapita in New Caledonia (Sand 2010) and well made elaborate jars with carinated shoulders, applique bands, and strongly everted rims. The non-ceramic artifact assemblage consists of 1,240 specimens but where only 83 of these potentially can be associated with the gray sand planting matrix. Given the function of the pit, this is not surprising. The types of artifacts and their relative abundance is roughly similar to those recovered at Moala's Mound, dominated by bivalve shell scrapers (n = 333) and *Anadara antiquata* valves where the umbo (hinge elevation) has been removed (n = 363). The significance of the latter is an interesting story to be subsequently told. There is one specimen from Hopoate that does seem appropriate to highlight in the context of a planting pit. It is the valve of a giant clam (*Hippopus hippopus*) where, after what must have been a

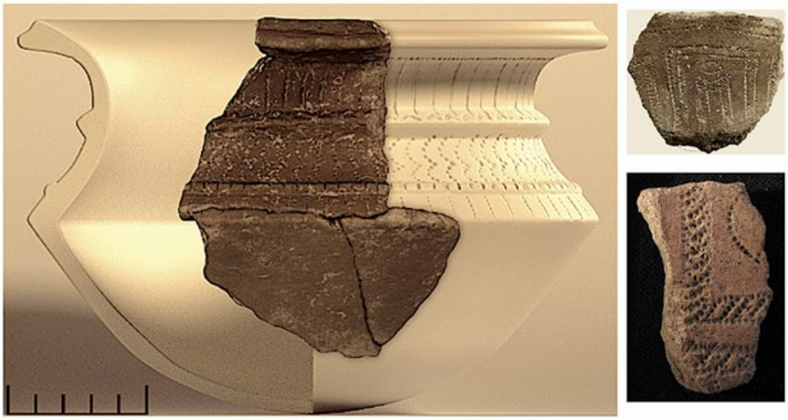

Figure 3.16. Complex Lapita ceramics from Hopoate. A reconstructed Lapita pot including complex vessel form but with simplified motifs characteristic of later Eastern Lapita wares. Scale is in 5 cm increments. Upper right is a face motif with lower right illustrating an expanded zone marker. Both are characteristic of the Western Lapita stylistic aspect found in Fiji, New Caledonia, and Vanuatu but absent elsewhere in Western Polynesia.

considerable effort, the ventral margin was substantially cut back (Fig. 3.17). This is a hand scoop, a tool no doubt employed in the excavation of the hole or in its filling.

We completed the 2014 field project by undertaking survey and a systematic auger test program across much of the peninsula attempting to record shell midden distribution and depths. Combined with strategically positioned 1 x 1 m test excavations, this did locate potential areas where future work might be productive. Survey of the mangrove fringe slightly north of the Hopoate site resulted in a notable and unexpected discovery. Earlier appearing Lapita sherds are being brought to the surface here by the energetic burrowing of mud crabs. Our attempts at exploratory excavation, what one of the students branded "mud flat archaeology" met with abject failure. Digging in mangrove sludge has challenges that are not easily overcome. Yet the presence of archaeological materials in the mangrove is informative. A Lapita stilt house residence on the mangrove edge adjacent to and in association with an aroid planting pit clearly is suggested.

Figure 3.17. Opposite sides of a hand scoop made from the hinge segment of a giant clam (*Hippopus hippopus*) recovered from excavations of the Hopoate planting pit.

Nukuleka Ceramics and the Tan Paste Assemblage

The ceramic assemblages from Moala's Mound and Hopoate incorporate a partial suite of decorative and design features comparable to Lapita sites in western and central island Melanesia as I have emphasised (see Sand 2015). The labyrinth pattern, interlocking triangles, headdress elements, and Lapita face design, among others, easily identify that relationship. Densely applied expanded zone markers are used in some cases to outline a frieze for a centralized motif. Vessel forms such as flat-bottomed dishes or bowls as well as double-rimmed jars occur in conjunction. The relative degree to which ceramic vessels are decorated is high as also is the case in Western Lapita sites. In the gray sand planting matrix at Hopoate, 24.8% of the total sherd assemblage is decorated, and that rises to 49.9% if we include only rims. In all of these, the difference between Nukuleka ceramics and those from all other Lapita sites in Tonga and Sāmoa are categorical and demonstrably self-evident. The transition to later Eastern Lapita ceramic wares brought with it a reduced number of motif categories, a design system focused on simplified rectilinear and curvilinear motifs, motifs that are expanded and open, and motifs that are being applied with coarser dentate tools (Burley et al. 2002). Some of the complex vessel forms also were lost. This simplified decorative system persisted in Tonga for the following century and a half.

Of all aspects of early Lapita ceramics at Nukuleka, by far the most idiosyncratic is the collection of tan paste sherds from Moala's Mound with a few additional pieces recovered at Hopoate (Fig. 3.18). These sharply contrast in colour with the deep red-brown wares that are manufactured from iron-rich tephra-based clays characteristic of Tonga. As earlier described, Jens Poulsen (1987) was quick to recognize this in his 1960s work at Moala's Mound as was I in the limited excavation project there in 1999. Having a different coloured paste does not make a ceramic vessel foreign, but an absence of these sherds in all other Tongan sites draws serious suspicion. The key to this puzzle was Bill Dickinson. For many of us in Pacific archaeology, Bill seems larger than life. A former Professor at Stanford University and the University of Arizona, he had been instrumental in the 1960s development of plate tectonic theory and its integration into the field of sedimentology. He was a field geologist, a synthesizer of grand order, and a scientist of impeccable intellect and genius. He has been awarded all of the appropriate medals, lectureships, and honours to justify that description. He also was a geologist with an interest in archaeology, hence his participation in the Tongan Lapita project from the beginning. Bill had spent a year in western Viti Levu in 1965, identifying and mapping its geological configuration. Visiting an archaeological project at the Sigatoka Sand Dunes, the director asked if he was able to separate imported ceramics from those locally produced. Bill initiated a "petrographic experiment" and a "hobby" in geoarchaeology to keep him busy for the next half-century. The petrographic experiment identified and quantified temper sand constituents from ceramic sherd thin sections. These provide a signature, one that can be compared to other sherds but also assessed against the configuration of local and regional geologies (Dickinson 2006). In 1978 he examined four of Poulsen's tan paste sherds from Moala's Mound but found little, at that time, to differentiate them from other pyroxene-rich Tongan sherds (Dickinson 1987). As earlier reported, this had

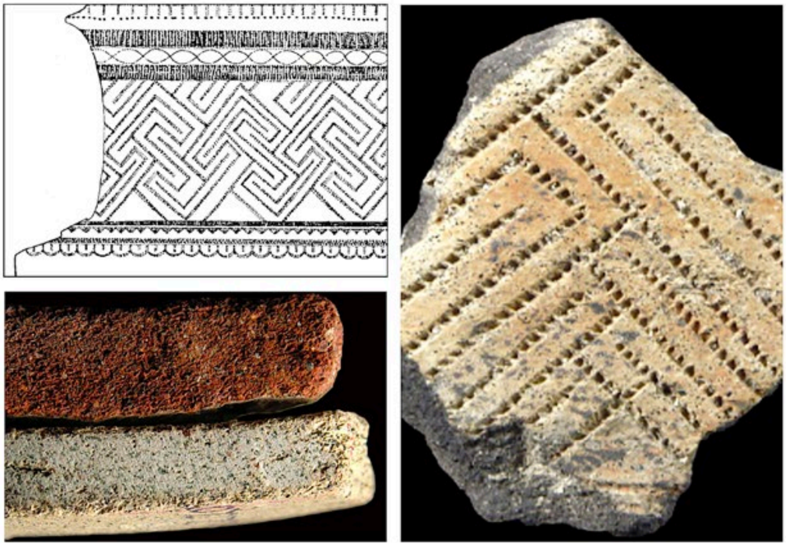

Figure 3.18. Red brown (Tongan) versus tan (exotic) paste Lapita ceramic sherds at Nukuleka. In upper left is the rim/neck/shoulder segment of a Lapita pot from New Caledonia with labyrinth motif. On the right is a tan paste Lapita sherd with labyrinth motif recovered from 2007 excavations at Moala's mound.

been in error (Burley and Dickinson 2001). Not only were these sherds exotic to Tonga, but they had no other match in the Pacific save for a single specimen from a Lapita site on Nendo Island in the Reef/Santa Cruz group. The Nendo sherd also was foreign to the island of Nendo.

The Nukuleka-Nendo temper type is configured by a dominance of quartz and clinopyroxene sand grains, trace amounts of hornblende, and an absence of orthopyroxene. In Tongan tempers, there is no hornblende, but an abundance of orthopyroxene. Also making the tan paste temper type peculiar is the integration of quartz and pyroxene. Quartz normally is derived from felsic volcanic rocks while pyroxene is typical of mafic volcanic rocks. Bill's in-depth knowledge of Pacific geology, and his varied petrographic analyses involving over 2,600 sherds from across Oceania, facilitated a systematic search for the tan paste source. By 2010, we had ruled out Sāmoa, Lau, other areas in Fiji, New

Caledonia, southern and central Vanuatu, the Banks and Duff islands, as well as parts of the main Solomon Island chain (Burley and Dickinson 2010). There are not many places left within the Lapita realm, with most favoured locales then identified as a high dacitic island in northern Vanuatu or the Reef/Santa Cruz group or, perhaps, even further to the west in the Bismarck Archipelago. One of Bill's colleagues once described him as a scholar who would assault a geological problem so intensively that he would beat it to its knees. His search for the source of tan paste tempers in Tonga began to incur this type of onslaught. On 5 August 2011, I received an email from him outlining a new plan of attack. He had been collaborating with geoscience colleagues to employ another of the Uranium series dating methods, U-Pb dating, to acquire geological ages on detrital zircons extracted from sandstones. They had then extended this to archaeological ceramics from the central Solomon Islands with considerable success (Tochilin et al. 2012). If I was willing to sacrifice some of the tan paste sherds for detrital zircon extraction, and if these were successfully dated, we would have a geological age for the island we were trying to identify. The plan seemed brilliant, it would narrow the playing field considerably.

I sent him six of the undecorated tan paste sherds from which 17 zircon grains were extracted and submitted for U-Pb dating. Six of the zircon samples proved problematic but the remainder provided an age range from 8.2 Ma to 13 Ma years ago at 95.4% probability. The dates are clear enough, they identify a mid-Miocene volcanogenic eruptive suite. The dates, though, didn't just narrow the playing field, they appeared to eliminate it altogether. The problem, as Bill put it, is that an eruptive suite of 8 Ma to 13 Ma years in age was implausible in the Bismarck-Solomon-Vanuatu-Fiji-Tonga region given its geodynamic history as recorded by geologists. And he also was quick to say, it is highly unlikely that the geologists got it wrong. Mount Colo on Viti Levu in Fiji is one of the few mid-Miocene geological formations extant within the distributional range for Lapita sites in Remote Oceania. When I first received the zircon dates, my immediate response was—of course! Early archaeological sites with Western aspect Lapita ceramics occur within its shadow at Bourewa and Yanuca. I have always been wary of arguing geological issues with Bill, fearing to reveal my overall ignorance of the subject matter. Accordingly, I took my time in drawing attention to the mid-Miocene age of Mount Colo, a circumstance Bill eventually did say was "tempting." He then reassured me, and pointedly so, that our search was for an exposure of quartz-bearing dacite not the granitic-plutonic magmatism of Mount Colo. That conversation came to an end abruptly.

I would like to be able to say by now that we have found the source of the Nukuleka-Nendo suite or we have made progress in that direction. That is not the case. We have recovered two additional sherds with Nukuleka-Nendo tempers, one from an early Lapita site on the island of Vorovoro off Vanua Levu in northern Fiji (Burley 2012) and the other from mixed deposits at Lapaha, directly across the lagoon from Nukuleka (Dickinson 2014a). Neither contributes much to the search. In a comprehensive report in August of 2014, Bill penned a lengthy and detailed review of the Nukuleka-Nendo temper suite, thoroughly evaluating all potential sources as well as regional geologies (Dickinson 2014b). In the end, he concludes, we are left only with the main Solomon Islands and the Bismarck Archipelago as possibilities. But we are left with these not because there is existing geological or ceramic evidence to suggest either. It is because both are large, geologically complex island groups that geologists have yet to study in their entirety. From wherever the Tongan Lapita colonists may originally have set sail, it is appearing to be a far greater distance than we might ever have anticipated at the outset.

From the Early Lapita Past into the Tongan Present

At the request of Princess Pilolevu Tuita in 2000, I was asked to develop an exhibit for the Tongan National Museum at Haveluloto. It was launched the following year by the Prime Minister, now King, Taufa'ahau Tupou VI. The Museum exhibit presented a storyline on wall-mounted poster boards outlining the first settlement of the Kingdom with Nukuleka figuring prominently. It also had a wide array of artifacts neatly laid out in glassed-in cases illustrative of Tonga's initial Lapita heritage. Over a glass of champagne and imported New Zealand pastries, I was exceedingly pleased to see the reactions of the Tongan guests as they began to recognize their link in material culture to those of their most ancient ancestors. Of particular interest were the numerous sherds of Lapita pottery illustrating different types of dentate stamp designs applied to their surface. Many of those motifs, and the structure of their application, continue to be applied to contemporary Tongan *ngatu* (bark cloth). Indeed, the names for several, *Tokelau Feletoa, Manalua, Amoamokofe,* and *Potuamanuka*, persist into the present. There was no question of cultural continuity with Lapita, it was on display for all to witness.

Sometimes in archaeology there are inadvertent discoveries providing insight into the past in ways that are extraordinary. The excavations at Moala's Mound had one of those events emphasizing the link from early antiquity into the present. The dominant artifact type being recovered in 2007 were valves of *Anadara antiquata* (Ark shell) where the umbo was removed (Fig. 3.19). The umbo is the most prominent or highest part of the valve with the hinge plate on the underside. It is robust, so accidental fracture was not considered an option given the numbers being encountered. Poulsen (1987) had found large numbers of these during his excavations in the 1960s as well, interpreting them as *anadara* net sinkers where umbo removal created a hole for attachment to the net. This type of use had been photographed during the 1952 expedition of Gifford and Shutler (1956) to New Caledonia providing him the analogue. In a published review of ancestral Polynesian fishing gear in early 2007, Richard Shutler and I (Burley and Shutler 2007) agreed, we were unable to conceptualize any other use for the things. An alternative not only came to the fore immediately thereafter, it literally was acted out before our eyes.

Figure 3.19. Excavated *Anadara antiquata* shell valves with umbo removed. Initially thought to be net sinkers, these are a by-product of the Lapita game *taupita.*

Our local crew from Nukuleka in 2007 was an interesting lot. As with all of my Tongan excavation crews, it had been a difficult task to convince them that digging the hole is not the objective, it is finding and recording things in the process. Our crews typically enjoy the work, in part because of the secure wage delivered in cash on Friday afternoons, but also because they are interested in what we are finding, much like the people at the Museum exhibit opening in 2001. At tea times and lunch, the Nukuleka crew played cards or checkers with competitive excitement and associated clamour. As we also observed when ‘Uepi Finau and Tevita Feao became odd men out for the checker board one day, they had another game to keep them enthused. This was *taupita*, described by Tevita as a “war with shell” (Fig. 3.20). It is not any type of shell though, it was *kaloa’a (Anadara antiquata)* picked

Figure 3.20. The Lapita game *taupita* being played by 'Uepi Finau (left) and Tevita Feao during tea break.

off the back-dirt pile of our excavations. In the game *taupita*, you strike the umbo of your shell against the umbo of your opponent's with success measured by the ensuing breakage. Failure to break the shell gives your opponent the opportunity to strike back. A winner is declared when a player's inventory is exhausted. It was a fast-paced contest with both 'Uepi and Tevita seriously engaged. As interesting as the game appears in its playing, far more intriguing is its by-product. This was a heap of fractured shells with many of the *anadara* valves having their umbo broken off cleanly. Sean Connaughton, one of the PhD student field supervisors, was assigned the task of recording the rules and gathering the details. He went far beyond, with experimentation and collection of empirical data. The *taupita* pieces, as he interprets, are all but identical to the archaeological specimens we had been identifying as net weights (Connaughton et al. 2010). *Taupita* is a popular game in Nukuleka. ʻUepi and Tevita had been playing it since they were children, collecting their *anadara* "men" from the beach. There are no restrictions on who might participate, but typically it is played more often by children and teenagers than older adults. We had astonishingly discovered a Lapita-age game for which the evidence was abundantly present. In thinking back on that day, it now seems surreal. In the same locale and in exactly the same manner, ʻUepi and Tevita had been engaging in a game that their Lapita ancestors had played so very long ago. The Lapita past again had leaped into the Tongan present.

The Final Note

I started this chapter with the question, Why Nukuleka? How could this small innocuous village literally be the birthplace of Polynesia, and a village ancestral to all Polynesians. My answer was straight forward, the archaeological record of Nukuleka is that of a founder colony at first landfall. It is earlier, and it is different from all other sites in Tonga, Sāmoa, or elsewhere in Western Polynesia. I have gone on to document the supporting data, providing detail to the volume of work that has been undertaken, and of the discoveries that have come about as a result. At 900 BC when the first canoes came ashore, Nukuleka was no more than a small sandy islet at the entrance into two expansive bays. The sand flats and reef immediately offshore were exceptionally rich in shellfish, fish, and other foods essential for survival. Houses on stilts within the intertidal zone, or perhaps even further out, gave access to this bounty. They also were located to take advantage of cooling breezes, and to avoid mosquitoes and other of the biting insects that would be present on dry land. Giant taro and taro could be grown in a planting pit back from the islet's shore with bananas, coconuts, and pandanus planted around the perimeter. And from here, this original group would be able to grow, and expand outward into a series of hamlets around the bay as to be examined. It was a successful landfall by all accounts.

My work at Nukuleka began over two decades ago. A lot has happened in that span of time. I was saddened by the loss of Richard Shutler Jr., in 2007. He was a pioneer in Oceanic archaeology but also a great colleague and very close friend who I continue to miss. Sadly, there is another of those types of events in the archaeology of Nukuleka that I must also report. Bill Dickinson and I arrived in Tonga in 2015 for a two-week project to, among other things, re-examine the Nukuleka paleo-shoreline as earlier described. His 1999 map had penciled in a scaled-down peninsula based on the contour elevations plotted on a Tongan Government 1:25,000 topographic map sheet. Given the lay of the land on the contemporary peninsula, and my reading of airborne LiDAR imagery provided by the Tongan Ministry of Lands and Survey, this seemed wrong. On Monday, the 20th of July, we spent the day at Nukuleka reconciling the problems. We finally realized that the peninsula, at the time of Lapita settlement, was not a peninsula at all, it was an island surrounded by sand bar ridges and a sandy reef flat at low tide. As Bill was to succinctly phrase it in a final entry into his field book, "all seems settled in mind now (a bit confusing before our visit). But that is what I am down here for." Bill passed away in his sleep that evening.

The ensuing aftermath of Bill's death, as one might expect, can only be described as chaotic, underlain by considerable grief over the loss of a friend. At the wishes of his family, and with the approval of the people in Nukuleka, he was buried in a small cemetery near the beach on the northwestern shore of the village in proximity to Moala's Mound and Hopoate. Appropriately enough, decorated Lapita ceramics are occasionally found eroding from the cemetery surface and across the beach to its front. In Tonga, funerals are serious business and large-scale affairs, requiring traditional protocols to honour and show respect for the

Figure 3.21. William R. Dickinson being laid to rest in Mala'e Sia in the village of Nukuleka, Tongatapu, on Sunday, 2 August 2015. Photo by Pesi Fonua, Matangi Tonga Online News, with approval.

deceased. Our longtime assistant and friend Tenisi Tuinukuafe, his wife Ilima, and Tenisi's parents Sela and 'Atolo, ensured this was going to happen (Fig. 3.21). Led by a brass marching band playing the 18th-century hymn Amazing Grace, the funeral procession slowly proceeded through the village to the grave site. A large group of people were in attendance including Lord Fatafehi Fakafānua, Speaker of the Tongan Legislature, and Lord Tu'ivanuavou Vaea, Parliamentarian and eldest brother of the Queen. Lord Vaea delivered a eulogy to Bill, describing him as a true Tongan warrior for the people of Tonga, and committing the people of Nukuleka to attend to his grave in the years to come. Bill was laid to rest in a vault, wrapped in the finest of Tongan mats. His grave stone is inscribed simply, William R. Dickinson, Geologist and Scholar. There is not much else to say.

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Chapter 4

Expansion on the Tongatapu Lagoon

Tongatapu, with the literal translation of sacred (*tapu*) south (*tonga*), is the largest island in the Tongan Archipelago (Fig. 4.1). East to west it measures approximately 34 km with a spatial area of 260 km^2. From its Lapita beginnings at Nukuleka to the 18th-century arrival of the British explorer James Cook, it was the stage upon which events critical to Tonga's social and political fabric were acted out. By the 14th century it had become the capital for a maritime dynastic state, one ruled at Lapaha by semi-divine paramount chiefs, the Tu'i Tonga. In the first half of the 19th century, it was the centre of a civil war in which the Tui Kanokupolu and current Royal lineage ascended. And the island continues to be central today where 70% of the nation's population is concentrated, and where its capital, Nuku'alofa, incorporates Parliament and government operations.

My first visit to Tongatapu, as I earlier describe, was in May of 1989 when I began to plan a research program in the Kingdom. With W.C. McKern's (1929) volume, *The Archaeology of Tonga* in hand, I wanted to relocate as many of the sites recorded by him as I could. One of these, Mangaia Mound, has been noted. Not only had McKern excavated this "kitchen midden" and recovered decorated Lapita ceramics, but there had been follow-up projects in 1957 and 1959 sponsored by Jack Golson. Mangaia Mound, without doubt, is the easiest Lapita site in Tonga to find. It is located on Taufa'ahau Road, the principal vehicle access into Nuku'alofa, and it has a 7th Day Adventist Church built on

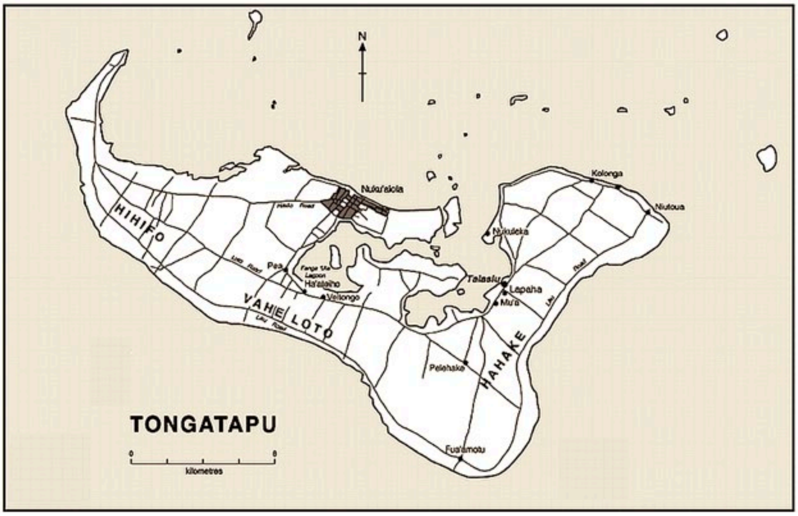

Figure 4.1. Map of Tongatapu, Kingdom of Tonga. Adapted from CAP 00-317, Cart0GIS Services, The Australian National University use by Creative Commons BY-SA License.

top (Fig. 4.2). Notwithstanding my neophyte status in Tongan archaeology, the setting appeared strangely unusual for a shell midden. It is located well over half a kilometre away from the shore of the lagoon where shellfish might have been collected. Since that time, I have field-checked or recorded a variety of other sites with decorated Lapita pottery on the lagoon, either in piecemeal fashion while awaiting transport to Ha'apai or Vava'u, or in systematic survey. The inventory today incorporates no less than 21 Lapita settlements, or at least locales where decorated Lapita ceramics have been recovered. This distribution, as Bill Dickinson (2007:184) once remarked, may represent "one of the densest Lapita populations in the ancient Pacific world." In some areas, survey around the lagoon is all but impossible due to dense residential construction, commercial/industrial development, or various other land uses. There is, therefore, the highest possibility that other Lapita sites are present and yet to be discovered. There also is the probability that still others, possibly many, are fully destroyed.

Figure 4.2. Mangaia Mound excavation 1959, photograph by L. Birks (Davidson 2008:11), with approval.

An expansion of Lapita settlement from Nukuleka along the shores of the Fanga 'Uta lagoon appears to have happened quickly, seemingly within the first two generations after landfall. In this chapter I present a current understanding of what that expansion entails as well as I am able to assemble the evidence. As I describe for Nukuleka, the Tongatapu lagoon was a far different landscape than is the case today. Most of the land on which Nuku'alofa is now built did not exist, while the western and eastern segments of the lagoon were embayments with profuse populations of the bivalves *Anadara antiquata* and *Gafrarium tumidum,* among other species. In my writing of this chapter, I can claim responsibility for only some of the data upon which it is based. Jens Poulsen's 1960s excavations, and the detail with which they are published, are essential supplements. Surveys by Les Groube in the 1960s and by Dirk Spennemann in the mid-1980s also contribute to the larger picture. Les, I have mentioned previously for his Lapitan migration hypothesis; Dirk was another of Jack Golson's PhD students from the Australian National University. More recent excavations at Talasiu on the eastern lagoon have been conducted by Professors Geoffrey Clark of the Australian

National University, Christian Reepmeyer of James Cook University, and Frédérique Valentin of the University of Paris. These provide critical new insight into burial practices and genetic relationships for the Lapita peoples arriving in Tonga. Again, Shane Egan has been ever persistent in his examination of Tongatapu beaches. In the process he too has reported new sites with Lapita ceramics.

The Fanga ʻUta Landscape—900 BC

Tongatapu is dominantly an uplifted coral limestone island sitting on top of a structural base of volcaniclastic sediment. Its core, and its highest elevation at 70 m, is the uplifted Pleistocene Vaini paleo-reef situated on the island's south-central tip near Fua'amotu, but extending along the southern *liku* (windward) coast as a parallel ribbon (see Dickinson and Burley 2007) (Fig. 4.3). This coastline is heavily eroded with steep sea cliffs up to 45 m high being present in some areas. A thin, uplifted, high-energy reef with sandy pocket beaches occurs in various locales, but most of the shore is difficult to access by watercraft and lacks the types of foreshore and lagoon resources required by a colonising community. From the southern coast, the Vaini paleo-reef complex gently tilts downward west–northwest giving way to lower-lying terrain that once formed the base of the Vaini paleo-lagoon. Uplifted patch reefs in that lagoon form a number of abrupt hills today, two being *Sia ko Veiongo* (Mount Zion) and *Holohi ʻUfi* (Popua). Both are well engrained in traditional Tongan history. Overlying the paleo-lagoon are a series of more recently accreted reef formations that are even further down-tilted to structure the low-lying northern coast and lagoon. The coral limestone of Tongatapu has been blanketed at different times by volcanic tephras, dropped as air fall from explosive eruptions along the Tofua volcanic arc. The most recent occurred on January 15, 2022 where upwards of 2–4 cm of ash was deposited from the catastrophic

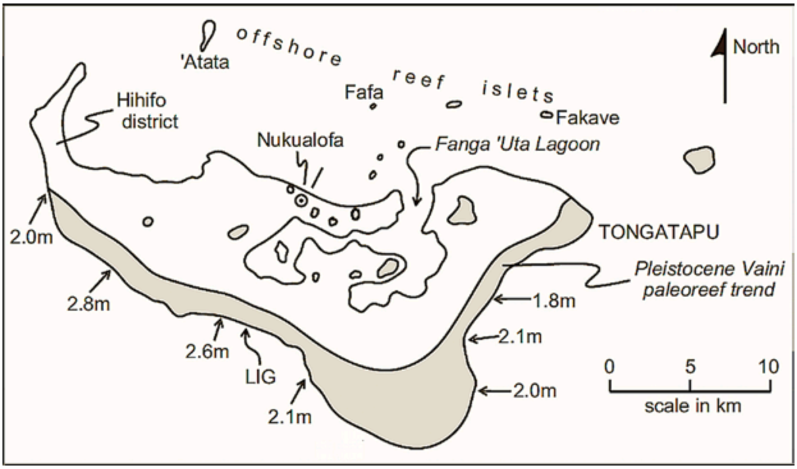

Figure 4.3. Vaini paleo-reef and lagoon system in the Pleistocene. Patch reefs (coloured islands) in the lagoon form prominent hills today. Arrows provide elevations for shoreline notches on the windward coast of Tongatapu.

eruption of the Hunga-Tonga, Hunga-Ha'apai sea mount. Accumulated tephra buildup in some areas of Tongatapu is up to 5.5 m thick. The younger tephra is of critical importance since, as weathering occurs, it forms agriculturally rich soil horizons of friable loam, a soil type referred to as *kelefatu* (Crane 1992).

The enigma of Mangaia's Mound that had me puzzled in 1989 obviously is explained by a period of higher sea levels at the time of first Lapita settlement. When I initiated survey on Tongatapu in 1999, clearly defining the north coast and lagoon-edge paleo-shorelines and their transformations had to be fundamental concerns. Bill Dickinson had been an integral member of our previous studies in Ha'apai, and he already had modelled the mid-Holocene high stand in southwest Pacific sea levels as they applied to Tonga (Dickinson et al. 1994, 1999). He was not the first to identify higher sea levels in the mid-Holocene here (see Taylor 1978; Kirch 1988) nor examine their implications for first Lapita settlement on Tongatapu (Spennemann 1989). His 1999 paleo-shoreline map, nevertheless, provided a critical set of field-checked data for project use. His measurement of wave-cut notch elevations gives an estimate of 2.3 ± 0.4 m above current sea level for the mid-Holocene high-stand optimum in the temporal interval 4800–3600 BC (Dickinson 2007). Based on Lapita site positions along the mid-Holocene beach ridges encircling the lagoon, by 900 BC and arrival of Lapita peoples, sea levels had fallen to 1.2–1.4 m above present levels. Bill also recognised that the tidal amplitude of the Lapita-age low tide was still 1.2 m above the mid-Holocene reef crest. This meant that the reef flats to the front of the paleo-beach ridge continued to be fully submersed. The lagoon landscape consequently was a dual embayment with unrestricted ocean passage to the north. A screen of offshore islets, including those of the Vaini patch reef, were scattered across the entrance, some within the confines of present-day Nuku'alofa. Mangaia Mound is located on the south beach of one of these.

The effect of higher sea levels with salt water flow into Fanga 'Uta embayments supported a substantially different ecology than presently is the case. Most clearly illustrating this is a research project by Joanna Ellison in 1987 at the Folaha mangrove swamp, a locale centrally located on the lagoon (Fig. 4.4). Joanna at that time was a Masters student in Geography at my own university, Simon Fraser, with Richard Shutler Jr., being a thesis advisor. Through sediment coring in the swamp, and analysis of mangrove pollens, she sought insight into the lagoon's sea level record and its impact. The stratigraphy of her cores brilliantly illustrates ecological and sedimentary change across the mid-Holocene high stand into the present (Ellison 1989). Prior to the high-stand, the Folaha swamp was a mangrove thicket, identified by a peat stratum of 1 m or so in thickness. This ended with the onset of rising sea levels in the mid-Holocene. The mangrove receded if not disappeared altogether as lagoon sediments of sand and silt were laid down. As sea levels began to fall once again, mangrove thickets became re-established, again forming an upper layer of peat in core stratigraphy. The mangrove fringe at Hopoate, as identified in *Bruguiera* pollen from the planting pit, seemingly developed early in this latter process.

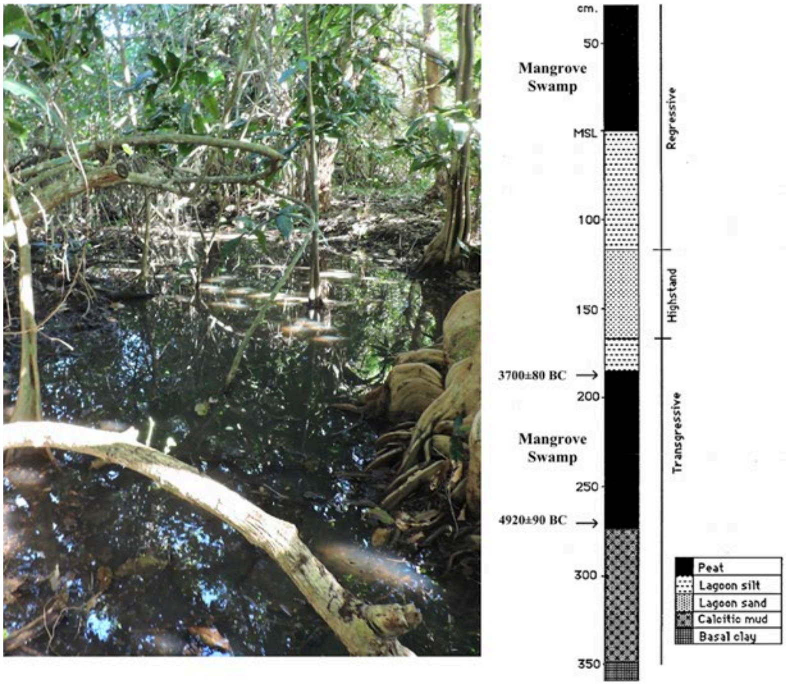

Figure 4.4. Mangrove, Folaha Peninsula 2016. The sediment core on right illustrates significant ecological change on Fanga 'Uta lagoon. An early mangrove environment changed to a foreshore of sand and silt sediments and then, as sea levels fell ca. 2,000 years ago, back to mangrove swamp. The sediment core diagram is adapted from Ellison (1988:62) with approval.

Open embayments with seawater exchange, shallow water, and a silty sand bottom provided ideal habitat for the proliferation of shellfish beds. Two bivalves in particular, *Anadara antiquata* and *Gafrarium tumidum* became dominant relative to their exploitation by Lapita peoples. At Moala's Mound and Hopoate, they account for over half of the shellfish analysed in Lapita levels, while at Ha'ateiho, a Lapita site later to be examined, they are 88%. Poulsen (1987:226) similarly reports that they account "for over 50% (by weight) of all shellfish processed from column samples at each of five sites." There is variation though. *Gafrarium* (*to'o*) are far more abundant in sites on the inner western lagoon while *Anadara* (*kaloa'a*) are more profuse in the Nukuleka sites. This pattern reflects varied habitats and species tolerances. *Anadara* thrive on intertidal reef flats with sandy substrates, but they are poorly suited to sheltered areas where freshwater outflow creates a brackish environment. *Gafrarium* prefer protected inner lagoon habitats and are tolerant of brackish water. *Gafrarium tumidum,* in fact, is one of only two species of shellfish that occur with any abundance in the lagoon today (Wells and Jenkens 1988).

Jens Poulsen additionally associated the contrasting distribution between *Anadara* and *Gafrarium* to temporal change in lagoon ecology. As post mid-Holocene sea levels fell, the channel flowing into the western embayment through what is now Nuku'alofa was closed off (Fig. 4.5). The impacts were significant, resulting in a substantially lowered tidal range, lessened tidal flush, decline in salinity, a transition from an open bay to a sheltered lagoon, and in the re-establishment of mangrove fringe. When exactly the Nuku'alofa landform was fully in place has yet to be precisely dated. That *Anadara* is a component of the midden at Mangaia Mound and other sites on the inner western lagoon during the period of Lapita expansion indicates post 700 BC when decorated Lapita wares were no longer produced (Burley et al. 2015). Others suggest it is even later at 550 BC (Spennemann 1987). What is clear is that the two embayments were impacted differentially, with much slower transition in the eastern lagoon. Here the channel running between Nukunukumotu Island and Nukuleka remained and continues to remain open for sea water transfer and tidal flow. Thus, at the late Lapita site of Talasiu opposite the entrance to this channel, Geoff Clark's (Clark et al. 2015) excavations found *Anadara* in relative abundance to at least 500 BC and probably later. At Talasiu, and the site of Ha'ateiho on the western lagoon, a third species of shellfish then began to dominate with the Lapita to Polynesian Plainware phase transition at 700 BC. This is the leaf oyster, *Dendrostrea cf. folium*, a species with widespread distribution through the Indo-Pacific commonly found in mangrove areas.

Beyond shellfish and mangrove incursion, it is difficult to define when other impacts on lagoon ecologies came into place.

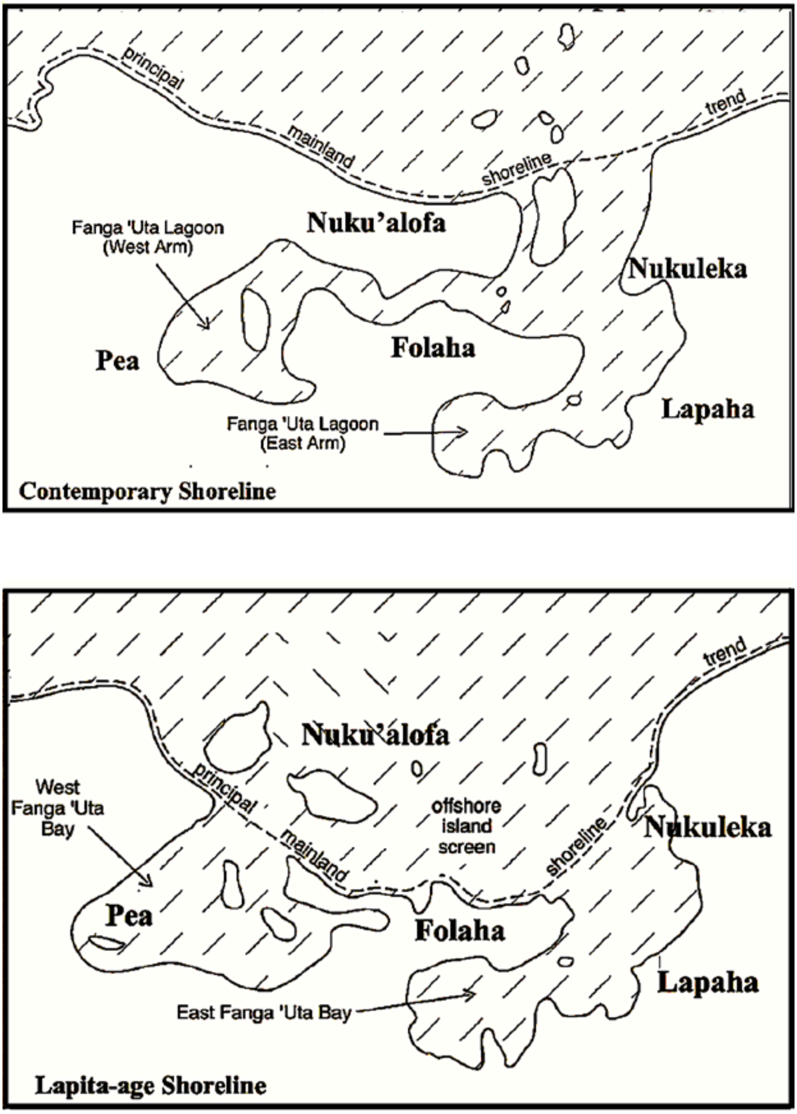

Figure 4.5. Contemporary versus Lapita-age shorelines Fanga'Uta Lagoon. The western lagoon would have been an embayment with seawater flowing through an open channel that no longer exists. The paleo-shoreline configuration is modified from Dickinson (2007) based on his 1999 mapping project.

Corals are all but absent in the lagoon at present resulting from several factors, the principal one being a soft muddy substrate. "Large beds" of dead *Acropora* and *Porites* corals attest to their former presence nevertheless (Wells and Jenkens 1988:297). The contemporary fishery in the lagoon is similarly influenced by freshwater runoff, siltation, depletion of oxygen, and algal growth. Toxic leachate and pollution from the former Patangata dump, a pyramid-sized, grass-covered hill on the reef edge at the entrance to the lagoon, amplifies the dilemma. Remarkably, a high diversity of species (n = 103) continues to be present but where mullet (*Mugil cephalus*) is now dominant in most areas (Hokafonu and Latu 2018). A more open environment during the mid-Holocene would support a broader diversity of inshore fishes, especially including Lethrinids (emporers/breams), Scarids (parrotfish), Serranids (grouper), and Acanthurids (surgeonfish/unicorn fish) as is found in most Lapita sites throughout Tonga, including Hopoate (Cannon et al. 2018). The abundance of turtle bone at Moala's Mound and Hopoate, and the possibilities for turtle nesting beaches on the offshore islands, if not embayment beaches, adds yet another potential fare to the Lapita larder. Thus, in a cumulative sense, it is safe to say that the first Lapita colonists not only encountered a new landscape, but one where exploitable coastal resources were varied, abundant, and predictable. Widespread expansion around the lagoon, as opposed to other areas of Tongatapu, is easy to understand as the Nukuleka population began to grow in size.

Spatial and Temporal Considerations of the Expansion

When archaeologists position sites on a map with dots, as I have done for Fanga 'Uta lagoon, we create or give the allusion of a populated landscape without qualification (Fig. 4.6). Not all sites are equal though; they vary either in their character or in

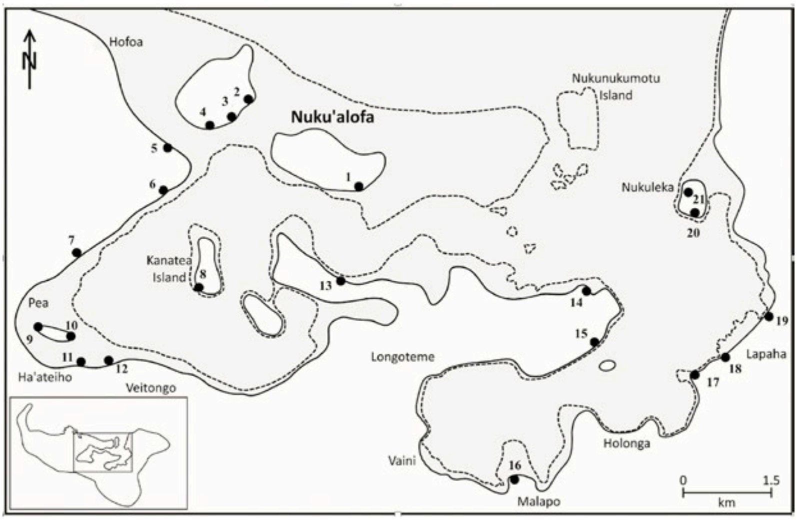

Figure 4.6. Map of Lapita site locations on Fanga 'Uta Lagoon. The Lapita-age landscape is illustrated in white with contemporary shoreline dotted in. Site names in text are referenced to the numbers.

Figure 4.7. Arial view of Fanga 'Uta Lagoon from Holonga, northwest across the Royal Estate of Kauvai and the Folaha Peninsula onward to Nuku'alofa.

the amount of information we have on the type of occupation that might be present. Some, for example, are documented only by the presence of a decorated Lapita sherd or two found on the surface without clear evidence for *in situ* occupation deposits. Three of the plotted dots for Fanga 'Uta lagoon are of that ilk. Others are recorded as having decorated Lapita sherds with occupation deposits including shell midden, but where exploratory tests have not identified the extent, nature, or chronology for the occupation. And still others have rudimentary data from limited test excavations but without the more detailed insight presented previously from the larger scale studies at Moala's Mound and Hopoate. The reality for Fanga 'Uta lagoon, unfortunately, is that there are but four sites with data beyond a rudimentary category—Talasiu (#19) on the eastern lagoon, and Tufumahina (#7), Pea (#9), and Ha'ateiho (#12) on the western side. Mangaia Mound (#3) might have been another in the latter category in so far as the 1959 project excavated over 70 m^2 of archaeological deposit (Golson 1961:173). Regrettably the project report was not completed, and the majority of site collections were destroyed in the 2003 fire at the Australian National University archaeological warehouse.

Having cleared my conscience in characterising the data we are working with, the bits and pieces that remain provide some insight into the nature of Lapita settlement on Fanga 'Uta Lagoon between 900 and 700 BC (Fig. 4.7). In simply looking at the map of site locations as presented, one of the most obvious inferences is that sites fall into eastern and western groups, with very few documented Lapita settlements centrally located. To underscore this, the three sites in central locations at the Nuku'alofa Bypass (#1), Kanatea Island (#8), and Nukuhetulu (#13) are the three noted previously, where only single decorated sherds demarcate their identification. A differential intensity in fieldwork may seem the logical answer, with the central lagoon shore not having equitable survey coverage. Poulsen's and Golson's work on the western lagoon combined with my own and Geoff Clark's studies on the eastern side have certainly skewed the result. Yet in 1999 and

2001, we did carry out intermittent surveys in this central area, walking the breaks in slope at the 4–5 m contour interval and examining erosional exposures on Kanatea and Nuku islands, parts of the Folaha Peninsula, on the Royal Estate of Kauvai, and in high potential areas from Longoteme to Lapaha. There was some success, largely at Kauvai (#14, #15), but shoreline vegetation in some locales, and the nature of the terrain made it a difficult task. What we did learn in the process is that the archaeological record for ceramic period sites is substantially less intense on the central lagoon than it is on the western one or at Nukuleka. For example, from the western embayment entrance at Hofoa through eastern Ha'ateiho there is almost a continuous distribution of ceramics and archaeological deposits along the Lapita-age paleo-shoreline; in places, it is substantially concentrated. It was this distribution leading Les Groube (1971:291) in the 1960s to opine that pottery is "so common along the lagoonal fringe as to be considered by Tongans as part of the soil itself." As he further notes it "is impossible in these areas today to dig a ditch or earth oven, fill in a hole or build a house platform without uncovering pot sherds." Field exposures at Folaha or Kauvai may not have been optimal, but it would have been difficult if not impossible to miss this type of ceramic period occupation if it were present.

The western expansion took place not long after first landfall, as I earlier suggest. This is based on a coral file abrader U/Th date at the site of Ha'ateiho (#12), placing its origins with 95.4% probability in the temporal interval 859–839 BC (Burley et al. 2015). This interval is supported further by radiocarbon dates, where the calibrated age ranges are less precise but fully consistent (Burley et al. 2001). The expansion, then, was underway by no later than the second or third generation after first colonisation with, in this case, 25 years defined as a generation. Whether the Ha'ateiho site was the first settlement on the eastern embayment is impossible to ascertain. One would be naive to not anticipate an immediate exploration of the full lagoon system and its resources upon first landfall, with other areas of the island similarly explored. And we would be just as naive to not expect the exploitation of these resources as needed by early Nukuleka colonists. Without residential occupation these types of activities are all but invisible, leaving little in the way of an archaeological signature. Other than Ha'ateiho, only two other sites in the western lagoon have radiocarbon dates, Pea (#9) and Tufumahina (#7), and these are considerably later in age.

The Ha'ateiho U/Th date is significant for reasons beyond its documentation of initial expansion. Neither Ha'ateiho nor other Lapita sites on Tongatapu have the earlier suite of Western Lapita ceramic motifs. Production of this pottery style must have ended shortly after landfall at Nukuleka and before settlement expansion on the lagoon. Occurring within a 50-year period or less, this type of loss is sudden, given what archaeologists anticipate for normal processes of stylistic transition. Why this might have occurred is a difficult question to answer, one where empirical data seems unlikely to be found. We assume with a degree of certainty that the initial colonising group was small, perhaps less than a hundred individuals. We expect, therefore, that the number of potters capable of producing the complex motifs to be few. If these potters were to pass on quickly, then knowledge transmission to more junior potters might have been deficient. In *The Lapita Peoples,* Patrick Kirch (1997) emphasises that the complexity and nature of Lapita designs are contextualized within social and ritual protocols as I note previously. Scarlet Chiu (2005) suggests they represent subtle expressions of group identity. Without the potters to retain that knowledge, or juxtaposed groups necessitating symbols of identity, a rationale for the production of these motifs might well be lost. Whether either case is correct or not, the end result was a rapid simplification in ceramic decorative design, the hallmark of the Eastern Lapita ceramic series as it has been defined (Green 1979).

Several of the Lapita sites in the western embayment occur on or near the crest of the mid-Holocene beach ridge but some are in quite low-lying terrain. Of particular note are Poulsen's sites in Pea, designated by him as To 1 (#9) and To 3 (#10). Both are shell middens, and both are positioned to the front of, and well below, the paleo-shoreline crest. To 1, what I refer to as Pea more broadly, occurs within a primary school complex where shell is scattered on the surface, but where subsurface pits clearly illustrate the underlying midden. My first visit to this site in 1995 followed torrential rain, with flooding in areas bordering the lagoon. Looking across the schoolyard from the half-submerged road, I quickly realised that it was the accumulation of archaeological deposits creating the elevated land upon which the school complex was built. In 1999, To 1 and the nearby site of To 3 were plotted by Bill Dickinson on the opposite shores of a small sand cay at the head of the western embayment. I now believe this may have been in error. Poulsen's (1987:16) description of the stratigraphy at To 1 identifies the subsoil as being a "range of clay" with its upper "Formation A" intermixed with coral sand, pumice, coral bits, pottery, shell, and faunal remains. A sample of this was analysed in 1966 by Australian National University geologist K.A.W. Crook. His report succinctly identifies "Formation A" as having formed in "a shallow protected salt-water environment," one characteristically found in a "tidal lagoon" (Crook 1987:268). Residential structures at To 1 could only have been on stilts within the intertidal zone, in much the same fashion as Nukuleka. The site of To 3, located 600 m to the east, is much smaller and it is heavily disturbed by modern houses. Only limited excavation was undertaken here in 1964, but Poulsen describes the lowest shell midden stratum as being superimposed on coral sand. This also is comparable to the sandy ridge at Nukuleka upon which Moala's Mound occurs.

Now incorporated within the midst of Nuku'alofa, the cluster of sites (#2, #3, and #4) on the eastern shore of the paleo-island are intriguing. Built over, bulldozed, dug up, and with all the other land modifications so common in urban expansion, it is difficult to convince Tongans today that an island did exist, let alone explain its importance almost three millennia ago. I often compare it to Pangaimotu, the small sand cay lying off the Nuku'alofa waterfront where white sand beaches and Big Mama's Yacht Club provide a common retreat from Sunday prohibitions

Fig 4.8. Pangaimotu island shoreline facing west. Pangaimotu provides an analogue for the Lapita-age paleo-island on which Unga Road (#2), Mangaia Mound (#3), and Police Training Ground (#4) Lapita sites are located.

(Fig. 4.8). The Pangaimotu reef, designated in 1979 as a reserve, is expansive and richly endowed in marine life, much like expectations for the former reef beneath the Nuku'alofa suburbs. We carried out auger tests, surface collections, and test excavations at the Police Training Ground (#4) and Unga Road (#2) sites on the paleo-island shore in 2001 and 2003 (Fig. 4.9). Both have decorated Lapita ceramics and both seem well-situated for shellfish exploitation in the bay. Both are also frustratingly disturbed with only limited intact midden and numerous intrusions, not the least being a deeply buried powerline in one of our units. Yet the data that remain are intriguing. Rather than separate settlements as I illustrate, they may represent segments of a midden ridge formerly stretching a kilometre or so along the coastal fringe. Archaeological deposits at the Police Training Ground extend to the northeast into adjacent properties of the Fire Station, across the St. Andrews high school campus and, we assume, onward to Mangaia Mound (#3), an approximate distance of 500 m. Less

Figure 4.9. Tenisi Tuinukuafe excavates on St. Andrews High School campus 2001. The area is an extension of the Police Training Ground Site.

evidence exists for a 400 m continuation of the midden-ridge to Unga Road, but most of the area intervening is now impossible to examine, being levelled or otherwise modified for road construction, service lines, commercial and industrial operations, paved parking lots, residential housing, and the like. The massive extent of the Police Training Ground site was acknowledged by Groube (1971:291) during his surveys on Tongatapu in the late 1960s. It was, in his terms, "the largest pottery bearing site seen by the author in Tonga" being "uncovered by bulldozers clearing the land for the new police barracks." The fate of archaeological heritage in urban contexts, and our ability to read that past from what is left behind, is at times a precarious one.

Other sites on the western embayment have limited data save for that adjacent to the Royal residence of Tufumahina (#7). Tufumahina is very late in the Lapita temporal sequence on Tongatapu, with only a small assemblage of decorated sherds in the lowest levels of a Polynesian Plainware phase hamlet (Poulsen 1987:38). The single accepted radiocarbon date for the site of 509–363 BC (68.2%) is much later than the initial occupation. Tufumahina occurs on the crest of the mid-Holocene beach ridge, not within the intertidal range as at Pea. By the time this site was occupied, the period of stilt house construction on the lagoon was over. The same argument can be made for most other sites positioned above the paleo-shore. One of the sites on the beach ridge crest, ʻUluaki (#11), is prominent for its location and preservation beneath the grassed over turf of the Nuku'alofa Golf Course (Fig. 4.10). The name means first hole, with Lapita sherds recovered from a bush garden bordering the eastern fairway as it drops to the lower green on the mangrove back beach. That the site extends westward across the golf course and ridge is brilliantly illustrated in the sixth hole bunker. Golfers unlucky enough to hit this sand trap, may find themselves blasting shell midden and pot sherds along with their ball over the elevated rim.

On the eastern embayment, only the sites of Kauvai 1 (#14) and Tinopai (#16) occur at lower elevations along the coast. Limited tests at Kauvai 1 recovered a small assemblage of decorated ceramics but without *in situ* context to give the site better definition. The Tinopai site was discovered by Shane Egan in 2015. Ceramics here, including decorated pieces, are dispersed across a limited back beach at the base of the mid-Holocene rise. Intact occupation was not apparent, but a possible stilt house occupation could account for the distribution. It is difficult to say much else about the eastern embayment settlement pattern. As to the west, sites are well positioned for the intensive harvesting of *Anadara* and *Gafrarium,* and these bivalves are abundantly evident in associated shell deposits. Decorated Lapita wares from these sites are too few to place within a stylistic chronology while Talasiu (#19), as to be examined, is the only one having radiocarbon dates. Like Tufumahina, it is late in the Lapita sequence with several dates placing it in the 750–700 BC range (Clark et al.

Figure 4.10. ʻUluaki Lapita site on the Tongatapu golf course at Ha'ateiho. The site occurs on the elevated mid-Holocene shoreline above the lower terrace and mangrove fringe of the lagoon. Test excavations and surface collections were made within the area of the dashed line. Google Earth photo 2014.

2015:517). In this late Lapita era or shortly before, settlement expansion began to extend beyond the lagoon. Shane Egan, in fact, has collected occasional sherds with dentate stamp or applique in nine locales along the paleo-shoreline of the western leeward coast. In one case, at Puke, plowing has exposed *in situ* Lapita materials with limited shell in tephra-based agricultural soils inland of the beach.

Tongan potters abandoned decorative application on ceramic wares no later than 700 BC, other than in the occasional notching of vessel rims or shoulders. This loss marks a transition to the Polynesian Plainware ceramic phase. Like the sudden departure of complex Western motifs a century and a half earlier, it is difficult to explain this shift. It, nevertheless, precedes an even greater enigma in the Tongan past, a complete abandonment of the ceramic industry by 400 BC (Burley et al. 2018). During the Polynesian Plainware phase, population expansion is widespread throughout Tongatapu, then occurring on the windward coast, interior, and the smaller offshore islands, including Pangaimotu. This came in tandem with substantive population growth, the development of dryland agriculture and a pervasive shift in subsistence economy (Connaughton 2015). This is a story of considerable magnitude, one to be told in Chapter 7.

Ha'ateiho on the Western Lagoon

The Ha'ateiho Lapita site occurs on the estate of Tu'i Ha'ateiho, a high chief of the *Fale Fisi* (House of Fiji) and a critical individual within the traditional Tongan polity. When first encountered by Jens Poulsen (1987:31–32), the site was marked by ceramics and shell on the surface of a garden, to which he gave the designation To 5. It was situated on gently sloping ground 150 m from the mangrove-lined lagoon shore with the steep incline of the mid-Holocene beach ridge to its rear. Several late prehistoric features were in the immediate vicinity, including a large rectangular chiefly burial mound and a conical freshwater bathing well, the latter also being the prerogative of chiefs. Both features proved instrumental in our eventual relocation of the site (Fig. 4.11). Poulsen's excavation of "test holes" suggested a midden extent of ~1,000 m^2 with "morphological similarity" to Pea (To 1); accordingly, he carried out more formal excavations here through July of 1964. These included a 1 x 11 m unit (Trench 1) perpendicular to the lagoon shore and a 1 x 2 m unit (Trench 2) to the east; an additional segment was added to the latter to complete exposure of a burial. The stratigraphy in both trenches was consistent in having an upper 40 to 50 cm layer

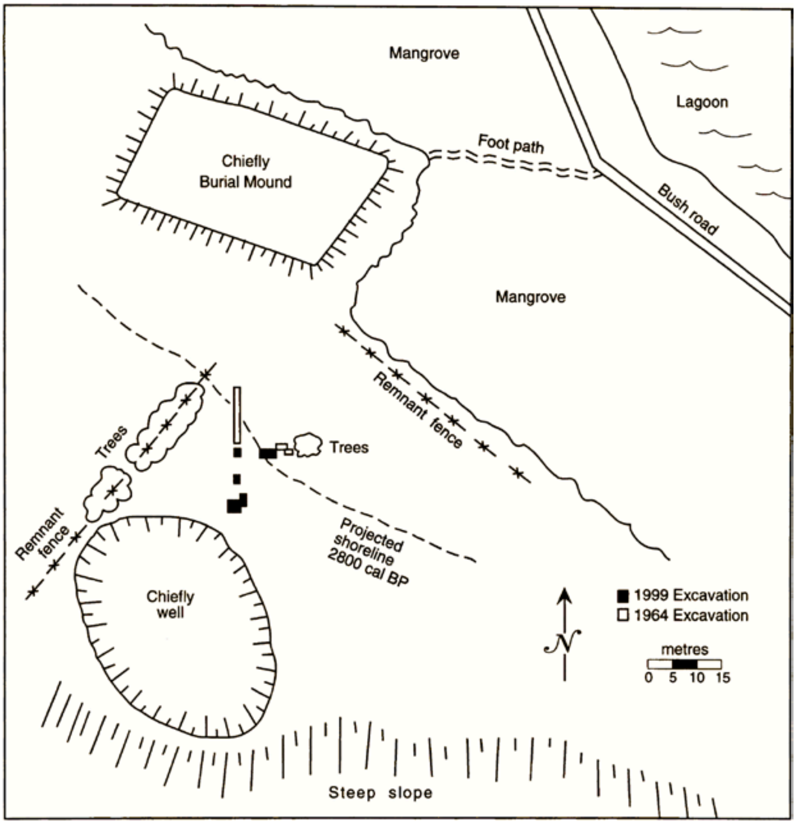

Figure 4.11. Ha'ateiho (To 5) site features and excavation locations as mapped in 1999. The chiefly well and burial mounds are characteristic features of the later era dynastic state.

of "sticky" brown clay, much of it thought to have been slope wash from above. Beneath this was the shell midden, incorporating in some areas 40 to 60 cm of highly compacted whole shell with few inclusions, including sediments. With exception of the southern half of the longer trench, the midden sat directly on "coral rock," a truly unique situation relative to other sites dug by Poulsen or, for that matter, any that I have excavated or am aware of in Tonga.

My purpose in visiting Canberra in 1998, as described in Chapter 3, was to examine Lapita ceramic collections from Tonga, including those from Ha'ateiho.[8] Poulsen's assemblage of decorated pottery from Ha'ateiho included only 321 sherds, a limited number relative to Moala's Mound, but a number in line with our recovery of Lapita wares in Ha'apai. The Ha'ateiho assemblage is distinctive though, with several of the sherds having a substantially larger size where vessel form type is easily distinguished. Also notable for Ha'ateiho was Poulsen's recovery of faunal remains, especially including 144 specimens of an extinct large-bodied iguana as well as 73 bird bones (Poulsen 1987:Table 107). A re-examination of the Ha'ateiho site was high on my priority list in planning the Lapita research program on Fanga 'Uta Lagoon. When I stopped over in Tonga in 1998 to visit Nukuleka, my intention was to also locate Ha'ateiho. Archaeology in the mid 1960s did not have the basic technologies we take for granted today, a most important one being GPS for accurately positioning site excavations. Poulsen did not even have the standard 1:25,000 topographic map sheets to plot a location or provide appropriate coordinates, these maps not being issued until 1974. For Ha'ateiho, nevertheless, we had good fortune in being able to locate Iteni Helu, Poulsen's field supervisor and "righthand man." With his instruction, it was a straightforward task to find the chiefly burial mound and conical water well. These features became the critical reference points for repositioning Poulsen's 1964 excavation area.

The Ha'ateiho project was the last to be undertaken in the 1999 field season on Tongatapu, carried out between 19 July and 11 August (Burley et al. 2001). The goals were specific in wanting to acquire a controlled faunal record using small-meshed sieves, in wanting to enhance Poulsen's assemblage of ceramics and nonceramic artifacts, and in seeking a better context and *raison d'être* for site occupation (Fig. 4.12). The project began with a series of dispersed auger tests, the results matching Poulsen's

8 We were unable to locate the Pea (To 1) collection and approximately 50 decorated pieces were missing from the Ha'ateiho (To 5) assemblage. The latter ultimately were located at the University of Auckland in 2010, meaning they survived the 2003 ANU fire.

Figure 4.12. Excavations at Ha'ateiho 1999. Andrew Barton at screens with Holofau Tongala in excavation unit. White shell on back dirt pile was removed from 1964 excavation unit of Jens Poulsen.

description of site stratigraphy and approximate area. One intersected a 70 cm thick shell deposit with decorated pottery, this prompting excavation of a nearby test pit. Archaeologists rarely find a needle in a haystack, this pit did just that. It was completely located within Poulsen's 1964 backfilled excavation, this being recognized only after 45 cm of loose clean shell, with nothing else mixed in, had been excavated. Fortune again was on our side, we could reestablish Poulsen's excavations and plan the ensuing project accordingly.

Excavations at Ha'ateiho in 1999 were adjacent to but inland of Poulsen's trenches. Not surprisingly they provide the same stratigraphic record as reported in 1964. In one unit off the south end of Poulsen's longer trench, the densely packed *Gafrarium* and *Anadara* midden was slightly thinner with a thickness ranging from 20 to 30 cm. This was positioned on and mixed into the upper surface of a yellow coral sand beach. Excavation units 4 m to the east, however, have a compacted shell layer ranging from 35 to 70 cm in thickness. This stratum sits directly on the limestone reef flat, again as Poulsen reports. The density of shell, the limited amount of sediment, and the underlying reef rock are revealing here. The shell stratum accumulation must have taken place as a short-term event where substantial volumes of *Gafrarium* and *Anadara* were being processed *en masse*, and where the shell was then piled at the beach/reef interface. This occurred early in the Lapita occupation at Ha'ateiho, with a U/Th date of 859–839 BC and a radiocarbon date of 895–805 BC (68.3%). Both dates are taken from samples firmly embedded in the midden.

Auger testing extended inland of Poulsen's excavations, stretching upslope toward the northeastern rim of the chiefly well. A small block excavation in this upper area indicates the presence of an elevated sandy back beach. Without the dense compact shell layer, the stratigraphy is far more complicated here. A number of intrusive pits, post holes and other features create stratigraphic disturbance and some degree of confusion. Decorated Lapita ceramics in the bottom-most levels were found associated with substantial faunal remains, a diversity of shell ornaments, and various other artifacts. These suggest a small-scale residential occupation during initial site use. A single radiocarbon date of 833–782 BC (68.3%) from the Lapita stratum overlaps with dates from the compact beachfront midden. Unlike the lower midden, Lapita materials are overlain in the upper area by Polynesian Plainware phase deposits. Four radiocarbon dates for the Plainware stratum broadly place it between 795–430 BC (68.3%). The Polynesian Plainware archaeological strata are then covered by 40 cm of clay/

loam mix without archaeological material. This sediment was deposited much later, probably resulting from the excavation of the chiefly well.

The 1999 project recovered almost 12,000 ceramic sherds from Ha'ateiho, with over 75% linked to the Polynesian Plainware phase of the upper excavation block. The quantity of decorated Lapita ceramics in a relative sense is low, numbering only 297 specimens, but similar to the assemblage size recovered by Poulsen (Burley et al. 2001). We had anticipated larger ceramic fragments based on my impressions of the Ha'ateiho ceramics in Canberra. This was an unrealized expectation, with less than half of 1% of the sherds being over 4 cm across. There are a few exceptions where larger pieces clearly define vessel form type. One is a quite large, attractively decorated bowl that had been firmly embedded and preserved within shell deposits of the lower Lapita midden (Fig. 4.13). Poulsen's excavations were exclusively in this stratum and, no doubt, his larger pieces were sealed and protected in similar fashion.

The number of non-ceramic artifacts in 1999 likewise was limited, including 137 specimens with 64 from the Lapita occupation. Assemblage composition is diverse, having a range of personal adornment items but with other types reflective of industrial or subsistence-related tasks. Shell bracelet/circlet fragments, shell rings, shell and bone beads, and a complete conus armband are included in the first group, along with preforms from which some of these artifacts were made. The second group has coral file abraders, pumice stone smoothers, hand stones, stone flakes, stone adzes and fragments, a bird bone awl, bird bone needles, and the dome-like tops of tiger cowries used on traditional Tongan octopus lure rigs (Burley and Shutler 2007). Poulsen (1987) identified 81 of the 108 nonceramic artifacts he recovered as *Anadara* "net weights"; the 1999 project was to add 27 more (Burley et al.2001). Simply defined as *Anadara* valves with umbo removed, I now believe the "net weights" at Ha'ateiho are the by-products of *taupita*, the Lapita shell game described earlier for Nukuleka (Connaughton et al. 2010). Virtually all the

Figure 4.13. Artifacts recovered from Ha'ateiho excavations in 1999. These specimens were embedded in the lower compacted midden protecting them from fragmentation. Upper left is a large fragment of an incised and dentate stamped bowl. Lower left is a complete conus armband. On right is a bird bone needle with eye for threading and a bird bone awl.

nonceramic artifacts at Ha'ateiho occur in various forms at other Lapita sites across Tonga.

There is one artifact from 1999 that dramatically stands out (Fig. 4.14). It is the radial bone from a human forearm where the distal end has been intentionally bevelled and ground to a flattened point. What this tool was used for is unknown, although our best guess in the field was as a needle employed for thatching. It might also have been used as a modeling tool for ceramic manufacture or, for that matter, in any number of other tasks. The University of Paris osteologist, Frédérique Valentin, was an integral part of the excavation and analysis of human remains from the Lapita cemetery at Teouma on Efate Island in Vanuatu.

Figure 4.14. A modified human radius for use as a thatching or ceramic modelling tool. The upper end of this specimen has been cut and ground to provide a bevelled working edge.

When viewing the Ha'ateiho tool for the first time at the Tongan Museum, her facial expressions were conspicuous, changing from slightly stunned, to pensive, to knowingly satisfied. Skeletal elements in the burials at Teouma had been frequently removed and rearranged; in one much-publicised case, this involved the reburial of a skull enclosed within two elaborately decorated Lapita pots as earlier described. Skeletal elements for many of the Teouma burials were also missing, this thought to be an intentional act (Valentin et al. 2010). Upper torso bones including radii are foremost among these. The Ha'ateiho radius tool adds another twist to our interpretations of Lapita treatment of the dead, this being the use of ancestral bone for artifact manufacture. A tip fragment from an identical tool had been excavated in 1997 at the Vaipuna site on 'Uiha Island, Ha'apai. The size of that fragment precluded its identification as human bone, this only becoming apparent in comparison to the complete Ha'ateiho specimen.

The excavations at Ha'ateiho, to an extent, duplicate what Poulsen (1987) documented in 1964 but add new insight into the site occupation. Ha'ateiho represents a small hamlet located at the head of the western bay. In this, it was one of several communities eventually stretching west and north along the coast. A screen of offshore islands gave some degree of protection from major storm events, while passage through the island screen provided access to deeper ocean waters to the north. The site occurs to the front of the mid-Holocene high-stand beach ridge, but where a coral sand beach had accumulated and interfaced with the exposed coral reef. The volume of *Anadara* and *Gafrarium* piled on the edge of the reef and beach by Ha'ateiho residents speaks to densely populated shellfish beds in the immediate vicinity. These, I suspect, identify the logistical motivation for site location. Our investigations on the upper back beach identified the residential area, as reflected in the diversity of artifact types and faunal remains. It also is reflected in the disproportionate numbers of Polynesian rat (*Ratus exulans*) bones occurring in upper site deposits. A total of 1,219 specimens come from the upper block Lapita strata with another 899 from the Plainware occupation. By comparison, only 217 specimens were present in the beachfront midden.

Faunal remains from the site are far more than shellfish and rat, these illustrating a broader fishing/foraging strategy. The assemblage is dominantly fish, including the standard range of nearshore reef species, but there is some evidence for offshore capture, including shark. Turtle is present, but not abundant, as are fruit bats. My initial interests in Ha'ateiho fauna was piqued by Poulsen's (1987:Tables 105–107) recovery of large numbers of iguana and birds relative to fish. This had to be a sampling error as a result of the sieve-size he employed, but it otherwise anticipated larger collections of both iguana and bird. The 1999 excavations did not disappoint with 55 specimens of the extinct, large bodied iguana, *Brachylophus gibbonsi* (Pregill and Steadman 2004), as well as 799 bird bones with 27 species now identified. Within the bird assemblage are two species of extinct pigeon and two others of extinct megapodes that had become flightless (Steadman 1999). Megapodes are referred to as incubator birds, given their propensity to bury their eggs in mounded nests as incubation chambers. Both of the megapodes are larger than the *malau* (*Megapodius pritchardi)* of Niuafo'o, the only surviving species in Tonga. Also present in the Ha'ateiho fauna are 91 chicken bones, with 56 of these coming from the Lapita occupation. Domesticated chicken seems a herald of horticultural activities, quite probably swidden-type gardens on the slopes to the back of the site.

Beyond what the archaeological record of the Ha'ateiho site can tell us of the Lapita expansion on Tongatapu, it documents an equally significant story on the changing ecology of the Fanga 'Uta embayment. Ha'ateiho, as I describe, faced an open sand beach and reef when Lapita peoples first arrived. Sea level decline over the next three or so centuries changed that dramatically to a silted in mudflat with mangrove thicket fringe, a situation probably leading to the settlement's abandonment. This transition is documented in mangrove coring on the Folaha Peninsula by Joanna Ellison, and it is apparent in other archaeological sites such as Talasiu to be examined. We do not have the ability to directly date when and how quickly this occurred, but Lapita and Polynesian Plainware shellfish assemblages provide insightful proxies. These samples come from a 50 x 50 cm column in the upper excavation block at Ha'ateiho, a column specifically located to ensure stratigraphic integrity. The Lapita period shellfish assemblage appropriately reflects the open beach/reef ecosystem with 88% of specimens in the assemblage either *Gafrarium* (51%) or *Anadara* (37%). Notably *Dendrostea cf. folium*, the leaf oyster commonly found in mangrove habitat, represents only 3% of the total. In the Polynesian Plainware phase there is striking variation. The percentage of *Anadara* (15%) and *Gafrarium* (29%) is reduced by half, while *Dendrostea* has increased to 29%. Dirk Spennemann (1987) argues that human predation, at least in part, led to *Gafrarium/Anadara* depletion in the lagoon. On the other hand, substantial increase in *Dendrostea* suggests an environment where mangrove incursion is rapidly taking place. Associated with this is a notable change in the relative amount of *turbo* (*'elili*). *Turbo* are gastropods occurring today on the southern windward coast or on the reefs off of Nuku'alofa. In the Lapita period at Ha'ateiho they represent but 1% of the shellfish sample with an increase to 9% in the Plainware phase. Ha'ateiho residents, it appears, began to expand their foraging range beyond the lagoon.

Talasiu on the Eastern Lagoon

In Gifford's (1923:210) compilation of Tongan place names in the early 1920s, Talasiu is translated as "to speak of seeking sharks." It is a tract of land on the far northeastern side of Lapaha, stretching from the lagoon shore to Taufa'ahau Road, the principal highway from Nuku'alofa to Nukuleka (Fig. 4.15). The archaeological site may have been identified by Thomas McKern (1929) as early as the Bayard Dominick Expedition of 1920/1921, but it was not recorded in any detail until 1957 when Jack Golson (1961) carried out test excavations of a 10 x 5 ft trench here (Fig. 4.16). This excavation revealed a 2.5 ft (75 cm) thick shellfish midden with abundant pottery, incorporating a small number of decorated Lapita sherds in the mix. By no later than the early 1980s, the eastern side of the shell midden was cut through by a road, extending from the highway to the shore, creating an erosional face along the midden edge. From various visits to the site in the mid-1980s, Dirk Spennemann (1986:38) collected an assemblage of Plainware ceramics (n = 251), a single decorated sherd and a small number of other specimens including "some

Figure 4.15. The Talasiu site view to southeast from lagoon. The site is located to the rear of the vehicle where the road cut and slight rise are visible. Photo by Geoff Clark, with permission.

human bones" from the road cut and site surface. I first visited the site in 1990 and on numerous occasions subsequently. It is an easy pullover off the highway when travelling to the eastern end of the island, where a quick inspection of the erosional slope might find eroding ceramics or other materials. Despite those visits, or better put because of them, I never thought much about the possibilities for further excavations here. The site appeared to be one of many largely Polynesian Plainware middens along the lagoon shore, notwithstanding the few decorated sherds, and its potential to reflect on first settlement seemed negligible. I could not have been more mistaken.

Geoff Clark was in Tonga in 2008 conducting his third field season of work documenting tombs and other features related to the 13th- to 19th-century Tongan capital at Lapaha (Clark et al. 2008). He incidentally observed human bone eroding from the Talasiu road cut and, aware that it was to be graded in short or-

Figure 4.16. The 1957 excavation of Talasiu by Jack Golson illustrating a substantial midden deposit. Photo by Wal Ambrose, courtesy of the Anthropology Photographic Archive, Department of Anthropology, University of Auckland.

der, initiated a recovery project. With Frédérique Valentin, they excavated a 1.5 x 1.5 m unit into the slope to expose the human remains and sample the surrounding midden deposit (Valentin and Clark 2013). What they found was both fascinating and unique. Incorporated within the unit was a circular feature of 30 to 40 cm in diameter within which was a concentration of burned and unburned human bone (Fig. 4.17). A series of post holes surrounds the feature suggesting it was enclosed by a small structure or fence, possibly a burial house, but definitely a protective grave marker. The skeletal remains were not articulated but positioned as isolated elements and fragments within a concen-

Figure 4.17. Circular feature at Talasiu site within which burned skeletal elements (right) of four individuals were recovered by Geoffrey Clark and Frédérique Valentin. Images by G. Clark with permission.

trated grouping. This compilation of bones indicates secondary burial while the absence of a fire in which they might have been burned speaks to transport from some other locale. Refitting of bone fragments and their analysis identified the incomplete presence of four individuals, a child between three and ten years old, and three adults, including a male of middle to older age (Valentin and Clark 2013:5). With subsequent excavations at Talasiu, 45 individuals from 19 burial contexts have now been recovered (Fig. 4.18) (Valentin et al. 2020). Seventeen radiocarbon dates on charcoal, shell artifacts thought to be in association, and one on human bone are consistent. The Talasiu burial took place between 750 and 700 BC making it the earliest cemetery yet to be documented in Polynesia!

Secondary burial of skeletal remains in Tonga is commonplace today. The Tongatapu landscape alone has over 10,000 burial mounds (Freeland et al. 2015), in numerous cases with houses or even churches built on top, as Mangaia Mound appropriately illustrates. Human remains frequently become exposed and, if traditionally dealt with, are cleaned, oiled, wrapped in white *ngatu* (bark cloth), and respectfully reburied in an appropriate locale. Many Tongans believe in spirit possession (*fa'ahikehe*), where debilitating ailments can occur when graves are disturbed or where the remains of a close relative are intruded upon by roots or other

Figure 4.18. Additional burials in shell midden at Talasiu. These represent the earliest cemetery in Polynesia. DNA extracted from Talasiu skeletal remains has been closely matched with Lapita burials from Vanuatu. Photo by G. Clark with permission.

problems in the grave. The remedy often times is exhumation, again with the careful cleaning of bones, and their reburial in *ngatu*. The Talasiu interment is atypical though. Initial preparation of the bodies appears to be partial cremation as indicated by bone charring and burn patterns consistent with soft tissue presence. The interment also incorporates four individuals with but a fraction of each scooped up and reburied, an act seemingly undertaken as a secondary funerary rite. It is hard to compare the Talasiu burials to a Lapita burial pattern *per se*. There are not many Lapita sites with burials, and interment protocols across these are varied (Valentin 2010). The best described is Teouma in Vanuatu, where elaborate ritual practices were carried out involving some degree of excarnation (removal of flesh), re-excavation of graves with the removal of upper body skeletal elements and repositioning of skulls (see Valentin et al. 2020). The Talasiu burial is broadly similar in its multiphase ritual treatment, in decomposition of flesh before interment, and in the lack of concern for having complete individuals in final placement.

I have highlighted the recent development of next generation sequencing and other protocols for analysis of aDNA in Chapter 2. When applied to skeletal remains from Teouma and other archaeological sites in Vanuatu, the results have been truly informative for Oceanic archaeology, some might say startling so (Bedford et al. 2018). The early Lapita peoples at Teouma are directly descendant from Austronesian speaking peoples in island southeast Asia with virtually no genetic admixture from Papuan peoples in New Guinea, the Bismarck Archipelago, or the Western Solomon Islands (Lipson et al. 2018; Posth et al. 2018). Additional migration into Vanuatu by groups with a dominant Papuan ancestry was soon to follow, beginning no later than 550 BC. The earlier Lapita populace was either replaced outright (Lipson et al. 2018) or through incremental integration (Posth et al. 2018). But equally important in our case, aDNA for this study was extracted from two of the Talasiu individuals as well. The results are near identical to the early Lapita remains from Teouma. The Talasiu burials are two to three centuries removed in time from Teouma and the original colonists at Nukuleka, but the Talasiu/Teouma relationship is critical for its reflection on the processes and origins of first peoples into Polynesia. These origins lay in Island Southeast Asia, ultimately tied to the Austronesian language family dispersal as the linguists have been telling us since the 1930s. In Near Oceania, there was little interaction with indigenous Papuan speakers and, ultimately, groups extended their colonisation efforts into Remote Oceania, reaching Tonga by 900 BC. Referred to now as the "First Remote Oceanians" (Lipson et al. 2018), not only do they have genetic affiliation with southeast Asians, but strong affinities to Polynesian peoples today. Thus, the physical appearance of Tongans, what biologists refer to as phenotype, may have been substantially ingrained in these first Lapita ancestors. Cranio-facial features of early Lapita skeletal materials from Teouma and Talasiu independently associate early Lapita settlement with the Polynesian phenotype (Valentin et al. 2016).

Additional investigations at Talasiu were carried out by Geoff Clark, Christian Reepmeyer, and Australian National University students in 2011. One objective, as described in subsequent publication (Clark et al. 2015), was to gain a detailed understanding of the midden through excavation and intensive analysis of materials and sediments from a 50 x 50 cm unit. The site spatial extent is estimated to be 450 m^2, meaning the sample size (0.06%), on first appearance, is infinitesimally small. That would be true if the fieldwork sought representative collections of ceramics, other artifacts, or cultural features. This was not the case, the intention being to quantify shell midden content, and through the extraction and analysis of macro and micro botanical remains, to identify associated plant taxa. Any shellfish sample from a midden, regardless of size, must assume general homogeneity across the site for sample representativeness to hold true. I have made that assumption on numerous occasions in Tonga where species identifications and quantification similarly are drawn from 50 x 50 cm columns. The results, as at Talasiu, are informed by and tested against the context of other excavations on site. I have never had reason to question the outcome nor the veracity of subsequent inference.

The Australian National University team rigorously excavated the 50 x 50 cm unit, using 5 cm levels and natural strata for provenience control. All of the removed sediment was measured by volume and then processed using bucket flotation. After skimming off the light (floating) fraction, heavy residues were water sieved with 3 mm mesh for recovery of ceramics, lithics, bone, shell, and organics. Stratigraphy within the unit had two shellfish layers, the lower mixed within a "red yellow clay" below which was "red-brown clay devoid of cultural material" (Clark et al. 2015:515). The red-brown clay is andesitic tephra, the volcanic soil situated back from the original beach. All of the Lapita and Polynesian Plainware sites on top of the mid-Holocene beach ridge around the lagoon are similarly situated. The ceramic assemblage is small (n = 467) but incorporates six sherds with dentate stamp decoration. Intensive processing of removed sediments resulted in a relative abundance of small bone fauna, including 2,476 specimens. The vast majority (93%) are fish with Polynesian rat (5%) a distant second. Extinct birds and iguana, faunal markers for early Lapita sites, are absent, and turtle bone is exceedingly rare.

Shellfish recovery and analyses were comprehensive, including the collection and weighing of all fragments above 3 mm in size with identification of various types where possible. This resulted in a total of 91,000 shells or shell fragments weighing 67.8 kg within which 44 taxa occur. Extrapolation from the sample to the site as a whole provides an estimate of ca "8.3 million shellfish" having a cumulative weight of "61 metric tons" (Clark et al. 2015:518). The distribution of shellfish types at Talasiu in some respects is similar to that of the Polynesian Plainware occupation at Ha'ateiho, with 73.6% being *Dendostrea*, *Gafrarium,* or *Anadara*. That being said, the leaf oyster, *Dendrostrea*, is substantially dominant at 61.5% of the total assemblage. Why this is the case is unclear, especially when Talasiu is close to the present lagoon entrance and, when occupied, would have retained greater tidal flush with higher salinity levels in comparison to Ha'ateiho.

Of all data gathered from the 50 x 50 cm unit, the micro-botanical analysis of starch grains is the most informative, at least for me. This study was carried out by Ella Ussher (2015), as one component of her PhD dissertation on *Agricultural Development in Tongan Prehistory* at the Australian National University. It was a Herculean effort, where first she had to compile a comprehensive comparative collection for macrobotanical and microbotanical remains for economically important and supplementary plant taxa in Tonga. Only then could she work on Talasiu and other samples. For Talasiu, this eventually led her to identify starch grains for three species of yam (*Amorphophallus paeoniifolius, Dioscorea alata, Dioscorea bulbifera*) common taro (*Colocasia esculenta*), giant swamp taro (*Cyrtosperma merkusii*), banana (*Musa* sp.), Tahitian chestnut (*Inocarpus fagifer*), and golden apple (*Spondias dulcis*). For introduced plant species associated with the Lapita era in Tonga, these can be combined with the microfossil identifications at Hopoate, and additional documentation of Lapita plant taxa from palynological work in Vava'u, as later examined (Fall 2005). Cumulatively, and consequentially, one can conclude that the economic framework of ancestral Polynesia, as defined by Patrick Kirch and Roger Green (2001), is fully present in Tonga no later than the late Lapita to Polynesian Plainware phase transition; I suspect this was the case much earlier, if not characteristic of the suite of introduced cultigens brought by Lapita peoples at first landfall. At the same time, isotope analysis of human remains at the site indicate inshore and coastal marine foods continued to be central to the Talasiu diet (Herrscher et al. 2018).

The settlement of Talasiu would have been one of several small hamlets along the eastern inlet of Fanga ʻUta Lagoon. The decision to settle here likely was based on its proximity to shellfish beds, access to the near shore fishery and an adjacent freshwater outflow. The hamlet co-occurred with the final drawdown of mid-Holocene sea levels which heavily impacted all settlements on the lagoon. As typical as Talasiu might have been to the people who lived here between 750 and 700 BC, its importance to current understanding of the Lapita period in Tonga is secure. In part, this has been through the fortuitous discovery and recovery of partially cremated human remains from secondary burial context. In part, it has been facilitated by substantive advances in DNA sequencing technologies through which the Talasiu burials can be genetically linked to Lapita peoples in Vanuatu, and by extension with an unfettered ancestry in southeast Asia. But equally in part, it has been the excavation of a very small hole within which a diverse range of cultivated plants are now identified. Contrary to my initial impression of the shell midden on the eastern edge of Lapaha, Talasiu does indeed have a story to contribute to first Lapita settlement. The work of Geoff Clark, Frédéric Valentin, Christian Reepmeyer, Ella Ussher, and others has been instrumental in its telling.

Implications for the Present

Lapita canoes entering Fanga'Uta lagoon at 900 BC encountered a coastal landscape with an untouched fishery, densely populated shellfish beds of *Anadara*, *Gafrarium* and other species, numerous terrestrial birds, and an abundance of other resources to support their immediate needs. They chose to first settle on a small islet on the leeward side of Tongatapu at the eastern entrance to a large double embayment, perhaps for reasons related to maritime access or, perhaps, for intangible reasons that today are impossible to understand. The settlement at Nukuleka was successful, and the population expanded into a series of hamlets along the shores of both eastern and western embayments as well as to the north into the islands of Ha'apai, Vava'u, and beyond. As expansion occurred, dramatic changes were taking place on the Fanga' Uta coastline, ones with substantial implications. Sea levels began to fall, eventually by as much as 1.2–1.4 m. The diminished tidal flow facilitated shoreline siltation and mangrove growth, and otherwise altered the foreshore ecology, including shellfish distribution; this resulted, in some cases, in abandoned settlement. The open water passage in the western bay became infilled by 550 BC, creating the peninsula on which the city of Nuku'alofa is now built. I have tried to document what we know of the details and consequences of first Lapita expansion on the lagoon as best as the archaeological data allow. It would be straightforward, then, to end the narrative without further comment. Yet the Lapita story has additional implications where the past, and its study, speaks to immediate concerns of the present.

In the mid-1980s when I was considering a shift in research focus to Oceania, I was told by an Australian colleague that "Tonga was done" and I would be better off putting efforts into some other island group where archaeologists had yet to tread. It is true that archaeological research on Fanga 'Uta Lagoon had been on-going since 1920 when William McKern first put a test unit in Mangaia Mound, and that intermittent projects by other archaeologists, not the least being Jens Poulsen in the 1960s, had provided insight into the early Tongan past. All the same I ignored that advice. After 30 years of research in Tonga, I can now conclude with certainty that Tongan archaeology is a very long way from being done. This is especially the case on Fanga 'Uta lagoon where, in a metaphorical sense, the birth of Polynesia is historically inscribed along its shore. The opportunities to document that event, sadly, are diminished and continuing to diminish at an accelerated pace, as the archaeological record is destroyed through urban expansion of Nuku'alofa, modern industrial development, and other types of conflicting land use. On the western lagoon, and with possible[9] exceptions of Tufumahina on the Royal Estate, 'Uluaki on the golf course, and Pea within the school yard, the dots I have positioned on the Lapita distribution map are destroyed, or heavily disturbed. Even Ha'ateiho, a site substantially isolated in 1999, is now incorporated within a residential neighborhood (Fig. 4.19). The sites at Nukuleka and the eastern lagoon admittedly have fared better, but without guarantees for future preservation. Tonga does have heritage legislation, the *Preservation of Archaeological Interest Act 1969*, with revisions of 1998 and 2016. Beyond the requirement of research permits for archaeologists though, I am not aware of cases where it has been implemented with consequence. And the legislation title notwithstanding, expert review by legal scholar Mere Pulea

9 I use the word possible because updated assessment of these sites needs to be carried out.

Figure 4.19. The Ha'ateiho site (To 5) in 2020. The site is now incorporated within the residential area in centre of Google Earth photo.

in 1992 suggests there is little in the Act to implement. The government has failed to develop regulations or process, and the Act, in Pulea's (1992:69) assessment, lacks provisions for the "recognition, preservation or protection of archaeological sites as such." Her report emphasises Tonga's rich archaeological landscape, with a strong recommendation for redrafting of the existing Act or development of new legislation. This, then, would guarantee "the protection of the nation's heritage for present and future generations." It is a noble recommendation yet to be undertaken.

The Lapita story on Fanga 'Uta lagoon documents a colonizing population that ultimately had to adapt to the challenge of falling sea levels and anthropogenic impacts on landscape. I have used this story on various occasions to speak to contemporary environmental issues in the southwest Pacific as they relate to global warming and increased sea levels. Tonga's rate of sea level rise since 1993 is estimated to be more than 6 mm per annum, double that on a worldwide scale (Australian Government 2011:4). If Bill Dickinson's map of Fanga 'Uta lagoon is correct, and a monotonic linear rate for sea level is projected, the Lapita-age shoreline with attendant implications will be fully restored no later than AD 2190. For those who are not archaeologists, 170 years in the future may seem far too distant for impending concern. When measured in terms of human generations, with generation length defined as 25 years, the effective number is seven. If you count the generations with which you interact in a lifetime, 175 years is not that far off in reality! To amplify that concern, the complications and consequences for shoreline residents will long precede the 1.2 m sea level rise. These issues are well projected in climate models for the Pacific, with consideration of change in seasonal cycles, air and sea surface temperature increases, proliferation of extreme climate events, and ocean acidification to name but a few. As the Lapita narrative ably demonstrates, there will be cascading ecological effects with potential for dramatic, if not catastrophic, change in reasonably short periods of time. The Tongan government requires an effective plan for action, and that plan must seriously assess the future viability for much of Nuku'alofa. Nuku'alofa as a landform did not exist when Lapita colonists first arrived, and without remediation, this might well be the case long before AD 2190.

I do not want to overplay the "doom and gloom" scenario, as students often characterise my environment-focused lectures. Yet there is still another aspect of Lapita-age sea level fall with considerable implications for future events that is not often considered. Bill Dickinson (2009:7) has called this the "crossover date." I already note that, with Dickinson's model for Fanga 'Uta Lagoon, there was a substantially delayed transformation of the Lapita-age foreshore with tidal amplitude mediating sea level fall. Lapita-age low tides continued to extend to the edge of the mid-Holocene beach ridge until sea level dropped below the level of the mid-Holocene reef crest. The date when that happened is the crossover date, the point at which the full impact of sea level change suddenly took place. With sea levels rising as currently projected, the crossover date will work in reverse. It is the point where contemporary low tides rise above the mid-Holocene reef crest. When that occurs, there will be substantial impact on existing reef, lagoon, and foreshore configurations. Fair-weather high tides will extend further inland with constant and ever-increasing wave attack on existent shorelines. Reef scouring will remove siltation, facilitating altered ecologies without mangrove thicket, as documented by Joanna Ellison for the mid-Holocene high stand. And without tidal intensity mediated by reef crest impact, the destructive capacity of extreme high tides and extreme weather events becomes substantively heightened. Dickinson (2009) has modelled crossover dates for northern Oceanic atolls, all of which fall within the current century. The crossover date for Tonga has yet to be determined, but it is a date that climate change planners for Fanga 'Uta Lagoon are ill-advised to ignore.

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Chapter 5

The Bounties of Ha'apai

My original intent for archaeological studies in Tonga was far removed from Lapita ceramics or Tonga's role in "The Birth of Polynesia," as described in earlier chapters. I wanted to record monumental architecture and other features as they might reflect upon and provide insight into the political intensification of the Tongan Maritime chiefdom. Beyond its historical importance *per se*, this objective relates to broader considerations of socio-political complexity and the processes by which chiefdoms emerge and evolve. Fieldwork in 1989, as I also describe, was to follow the footsteps of Thomas McKern (1929) who recorded a rich and diverse array of sites in his archaeological surveys across the Kingdom. This led me eventually to the islands of northern Ha'apai, a literal string of closely spaced raised coral formations interspersed with sand cays, the lot intricately laced together by fringing and offshore reefs (Fig. 5.1). Ha'apai, I decided, would be the focus of my research for the next three years.

I will provide the geological and geographic context for Lapita expansion into the Ha'apai group in due course. My first impression of Ha'apai was truly positive. Except for the volcanic islands of Tofua and Kao, the islands are small and flat, with few exceptions exceeding a maximum elevation of 15 m above sea level. In some cases, they are so flat that the larger burial mounds are visible on topographic maps as contoured features. Ha'apai is a place where white sand beaches transition into expansive reef flats or lagoons, and where blue-green waters are as clear as any I have seen. In 1989 it seemed the epitome of Old Polynesia where

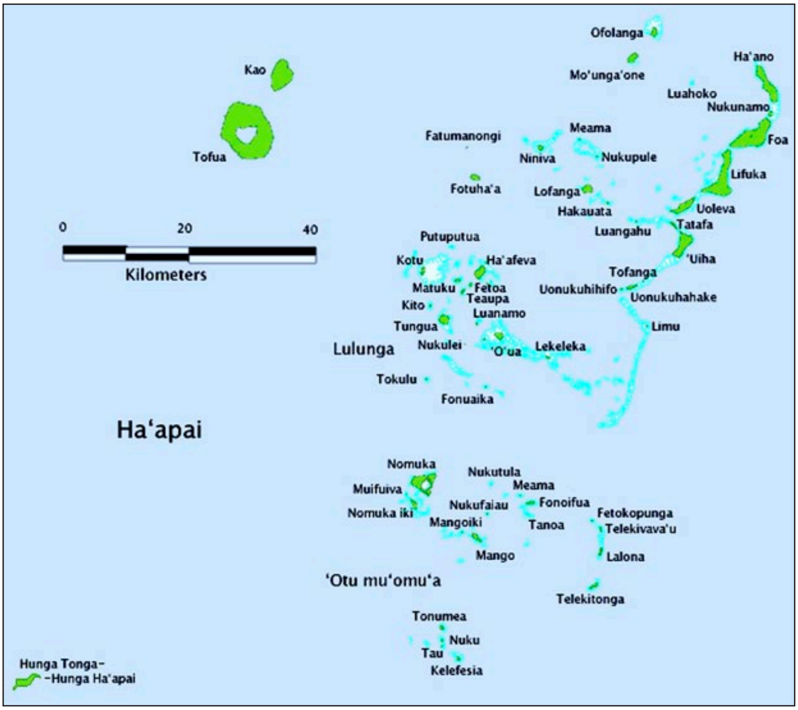

Figure 5.1. Ha'apai Island group, Kingdom of Tonga, Creative Commons Attribution-Share Alike 2.5 Generic License, Wikipedia Source.

western amenities were few, tourists even fewer, and where traditional Tongan culture structured day-to-day existence (Fig. 5.2). Boats in Ha'apai are indispensable, motor vehicles not so much. Boats not only centre the local fishery, they are the connection to neighbouring islands and the outside world. I spent the equivalent of 10 months in northern Ha'apai between 1990 and 1992, documenting sites and traditional history of the dynastic Tongan chiefdom (Burley 1994, 1998). I also began to find "kitchen middens," to use the term employed by McKern. Eroding shell, black organic sediments, burned coral rock, earthenware pottery, and assorted other artifacts reflect the people of deep antiquity, people long predating the chiefly overlords I had come to study. It was hard to ignore these sites, my research priorities notwithstanding. The solution to this enigma was Richard Shutler Jr.,

Figure 5.2. The sense of old Polynesia. Men practicing a *lakalaka* for an inter-island competition, Pukotala, Ha'ano Island, Ha'apai 1991.

a close friend and the archaeologist I had succeeded at Simon Fraser University. Anything to do with pottery, he could provide the veteran oversight. Richard, after all, had been in the trenches with E.W. Gifford in 1952 when they excavated at the original site of Lapita in New Caledonia.

The Ha'apai islands are many (n = 51), widely dispersed and with only 17 of these currently occupied. All of the villages are coastal, most configured by a linear cluster of houses with almost as many churches facing the leeward shore. With fishing, the reef and one's garden providing the majority of day-to-day fare on most islands, it is easy to picture the nature of life as it might have been throughout antiquity. Archaeological work began in earnest in 1990, centred on the islands of Ha'ano, Nukunamo, Foa, Lifuka, Uoleva, Tatafa, and 'Uiha in the northeastern part of the group. Survey eventually was extended to 14 islands in total, additionally including Ha'afeva, Tungua, and Matuku in the central region and

Nomuka, Mango, Tonumeia, and Telekivava'u in the south. Not all of these islands have Lapita period sites, at least as far as we could find them in the time frame we had to look. Ha'apai, nevertheless, has abundant evidence for early peoples. Four Lapita settlements with *in situ* occupation remains were documented by 1992 with anticipation of similar sites on a number of other islands (Shutler et al. 1994). A dedicated program of Lapita research in Ha'apai grew out of this initial foray, one with secure funding, additional survey, and excavation or additional testing at five sites between 1995 and 1997. This also was a large endeavour involving another seven and a half months of cumulative field work. Combined data from the various projects beginning in 1990 provide detailed insight into first peoples of Ha'apai, their way of life, and the impact they had on the islands they came to settle upon.

Small Islands, Complex Geologies, Bountiful Ecologies

In the high school focused text, *The Environment of Tonga*, Wendy Crane (1992) provides an instructive read, where the details of Tongan geography and traditional narrative are engagingly offered and adeptly illustrated. It is a volume I frequently turn to when needing quick but informed inquiry into the idiosyncrasies of Tongan landscape and all things on it. In her introduction to Ha'apai, and to account for the diminutive size and widely scattered nature of the islands, she begins with a mythological account of Maui, the Polynesian demi-god and trickster (Crane 1992:89). Ha'apai, it is said, was once a single island, not many. It was large, big enough in fact to have its own gods. Maui became angry with the Ha'apai gods and its people for reasons unstated. He became so enraged that he climbed to the high ground of 'Eua, the island near Tongatapu, and began throwing stones. Ha'apai was smashed into numerous small pieces, creating the islands and the group as they are present today.

A scientific explanation for Ha'apai, as penned by geologists, is far more involved. As with all islands in Tonga, those in Ha'apai lay immediately west of the Tonga Trench. This trench is the second deepest sea bed on earth, dropping to a depth of 10.8 km below the surface. It is a convergence zone, where the Pacific lithospheric plate subducts westward deep into the earth's mantle beneath the Indo-Australian plate. Plate subduction generates magmatism, giving rise to the Tofua volcanic arc. This arc is the chain of Tongan volcanoes running parallel to the trench, and extending over 800 km from ʻAta in the far south to Tafahi in the north. In between the arc and the trench is the forearc belt, a 140 to 150 km wide plateau. Uplift of the belt has been caused by a variety of geological events beginning in the late Miocene of five to six million years ago (Dickinson et al. 1999:683–685). As sea levels shallowed, coral reefs proliferated providing a limestone crest along the Tongan platform as it is now defined. When further uplift occurred and pushed segments to the surface, Tonga's raised coral limestone islands and complex reef systems began to emerge. Continuous shoaling and banking of eroded coral sand provides the sand cays and ever-changing beaches throughout the archipelago.

The geological narrative may seem straight forward enough; the reality is not. There are numerous events and complicating processes that have conditioned and nuanced Tongan geomorphology (Dickinson and Burley 2007). One of the critical ones has been geological faulting, where transverse structural rifts have occurred along the length of the forearc platform (Taylor and Bloom 1977) (Fig. 5.3). These fractures appear at intervals of between 30 and 100 km, and they create independent geological blocks subject to different degrees of tilt, uplift, or subsidence. They have been likened, quite appropriately, to a series of piano keys (Dickinson et al. 1999:684). Each block has a different history with consequences for any understanding of local geology and, by extension, archaeology. This became obvious to us in Ha'apai surveys in the 1990s. Our initial work in northern Ha'apai was focused on islands of the Hahake structural block.

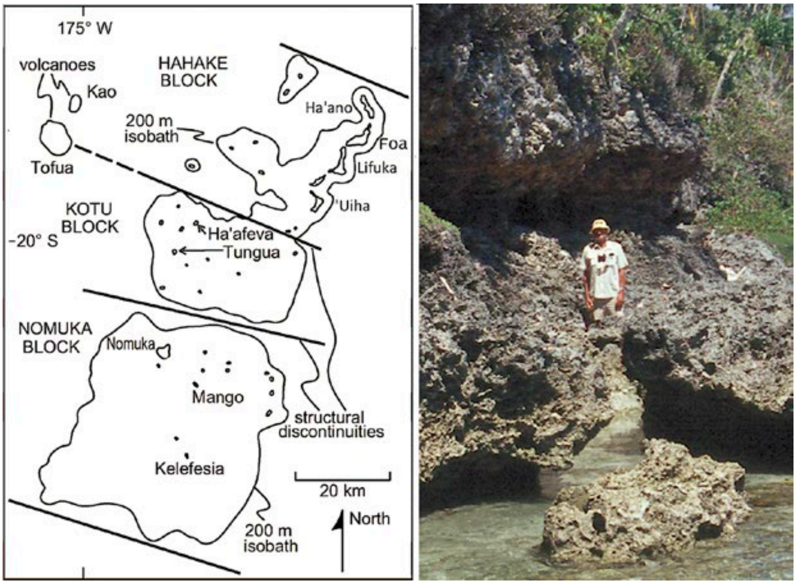

Figure 5.3. Structural blocks across the Tongan forearc platform in Ha'apai caused by transverse geological faults. William Dickinson serves as a scale for a mid-Holocene wave cut notch on the south end of Foa Island 1992.

Lapita and more recent Polynesian Plainware sites are found here on raised elevations, locales inland of the current beach, some substantially so. This was not the case when we moved to the central islands of Tungua and Ha'afeva. Both of these islands are situated on the Kotu structural block, where the same types of sites are found at, or slightly below, contemporary sea level. Like a piano key, the Kotu block was depressed, in this case at an estimated rate of 0.5 mm/year (Dickinson and Burley 2007:249). But the situation is even more complicated when trying to model Lapita-age paleo-shorelines. One needs to factor in mid-Holocene sea level fall and its capacity to enhance or mediate uplift or subsidence on individual islands. Our geologist, Bill Dickinson, earned his keep and our praise in sorting through the many different details.

I have described the coral limestone islands of Ha'apai as small. It is difficult to convey just how small they really are. Half of the islands we surveyed had a landmass of less than 2 km^2; Matuku, at 0.3 km^2, seems no more than a postage stamp with a contemporary village. Except for Nomuka, the larger islands cluster in the north, with Foa and Lifuka having respective areas of 13.3 km^2 and 11.4 km^2 and maximum lengths in the range of 7 km. Even with this size, arriving by airplane on Lifuka is akin to setting down on an aircraft carrier without a hook, where the air strip runs shore to shore across the island's width. The size of islands in Ha'apai means all but the most isolated are anthropogenic landscapes, where present or former agricultural field systems lie below an unvarying canopy of coconut palm. Only a few have wetlands, and a freshwater source beyond the Ghyben Herzberg lens is absent.

Despite these islands being widely scattered over a south to north distance of 100 km or more, Ha'apai has been an integrated and integral political unit at different times in the Tongan past. It was the early seat of power for the present line of monarchs with Pangai, on Lifuka, made the first capital of the post-civil war Kingdom from 1845 to 1851. The integration of Ha'apai is in large measure brought about by the southeast trade winds and the corresponding ease with which people move between islands. As a travel corridor for a northern expansion of Lapita peoples from Fanga 'Uta Lagoon, the islands are analogous to a series of stepping stones, one where travel distances between steps are short and where relations are easily maintained.

The island of Tofua, and its adjacent companion Kao, are manifestations of the Tofua volcanic arc in Ha'apai. They are stratovolcanoes, visible on the horizon from virtually all islands in the group (Fig. 5.4). Kao is the youngest of the two, rising abruptly from the ocean at an angle of over 35°. With its peak being 1,030 m above sea level, it forms the highest elevation in all of Tonga. Kao is dormant, but a series of small volcanic craters on its summit attest to a former period of activity. Tofua, unlike Kao, is sharply truncated, having lost much its cone and former bulk through caldera collapse. The island remains massive though, being 8 km in diameter and steeply rising to the caldera

Figure 5.4. Volcanic islands of Tofua and Kao on horizon looking west from the beach on 'Uiha Island.

rim at 515 m elevation. Within the caldera is a large freshwater lake where, positioned on the northern shore is Lofia, an active vent from which lava, gasses, and steam clouds frequently spew (Fig. 5.5) (Caulfield et al. 2012). Neither of the volcanos has a surrounding coral reef, boat access is difficult, and human presence has been limited as a result. At the same time, Tofua and other of the volcanos along the arc have been critical for Tongan settlement. Explosive eruptions of these volcanoes laid down the thick veneer of tephra now covering the coral limestone islands, as so recently witnessed by the ashfall descending from the Hunga-Tonga, Hunga-Ha'apai eruption in 2022. And weathering of this tephra, as I describe for Tongatapu, provides the rich agricultural soils found throughout much of the archipelago. The volcanoes additionally are a source for andesitic basalt, a tool stone from which adzes, hand stone pounders, and other artifacts were

Figure 5.5. Volcanic caldera on Tofua with freshwater lake and the active vent Lofia from which a steam cloud is rising. Photo by Tom Dye, with permission.

manufactured. Artifact geochemistry unambiguously illustrates that the first Lapita colonists were quick to discover and employ the tool stone source on Tofua, with regular visits to collect this material thereafter.

I title this chapter the "Bounties of Ha'apai." I have done this not because of the agricultural potential on these islands, nor for other aspects of the terrestrial landscape that might have lured settlers northward from Tongatapu. Rather the bounties occur in the expansive and profuse formation of Ha'apai's coral reefs, and the diverse marine biota these reefs support. Tonga is estimated to have 1,500 km^2 area of reef, with the Ha'apai group incorporating the dominant share. Marine ecologist L.P. Zann (1994:55) describes the Ha'apai reefs as "amongst the largest in the South Pacific." All of the coral limestone islands of Ha'apai have a fringing reef of some form, where the attached reef flat extends outward from the beach, and where the outer crest provides a protective shield to the breaking surf. Lagoons with channel access through the reef edge occur typically on the leeward side of these islands. Also present throughout Ha'apai is a complex labyrinth of offshore barrier and patch reefs, some with their own lagoons and developing sand cays. As an integrated ecology, these reefs support upwards of 230 species of fish, 140 species of shell fish, and a wide range of other potential foods, not the least including several types of octopus, spiny lobster, sea urchin, and sea cucumber. Lapita faunal and artifact assemblages in Ha'apai distinctly reflect the significance of the reef to the earliest subsistence economy. That these reefs continue to play a role central to the Ha'apai subsistence economy after 2,800 years of exploitation is an obvious testimony to their incredible productivity and resilience.

Anatomy of a Research Program in the 1990s

Other than William McKern's (1929) archaeological forays with the Bayard Dominick Expedition in 1920/1921, interest and insight into Tonga's archaeological past was slow to develop, not beginning until the 1950s/1960s with excavations of Jack Golson, Jens Poulsen, and Les Groube on Tongatapu. Quickly thereafter, a flurry of archaeological work took place, at least it is a flurry in a comparative sense to the broader perspective of Oceanic archaeology. Strangely though, the islands of Ha'apai were all but ignored, albeit limited exceptions did occur. The social anthropologist Adrienne Kaeppler (1973), for example, collected 151 mostly "water worn" and nondescript ceramic sherds during her ethnographic project on Tungua in 1967. And hiring a "small boat" on Tongatapu in 1968, Les Groube and C.D. Key ventured off to "other islands," carrying out an initial reconnaissance of Ha'apai and Vava'u (Groube 1971:292–293). Documentation of this survey is thin, beyond Groube's eventual statement that "pottery was extraordinarily sparse, although present on almost all the islands investigated." Only a single site in Ha'apai was comparable to ceramic period sites Groube had experienced on Fanga 'Uta Lagoon, it occurring on the "outskirts of Hihifo" on Lifuka island. This is Tongoleleka, as later named by Tom Dye (1988a). To Groube (1971:303), the sparsity of ceramics implied a long period of settlement delay on Tongatapu before people moved to the north. The process of Tongan colonisation, in this scenario, was "several hundred years" in length and it occurred only after pottery was declining in importance. When Jens Poulsen revised and published his PhD dissertation in 1987, he continued to promote this interpretation. Lapita peoples, he (1987:140) infers, "did not take up permanent residence to the north of the Tongatapu group until the late ceramic period, though they may have exploited the local resources prior to this." Both Groube and Poulsen turn out to be wrong.

In 1984 Tom Dye implemented a five-month archaeological research program on the ceramic period settlement of the Ha'apai group, this being his focus for a PhD dissertation at Yale University in the Eastern United States (Dye 1988a). Tom had considerable archaeological experience, importantly including eight months in 1978 as field assistant to Patrick Kirch (1980, 1988) in Vava'u and on the northern outlier of Niuatoputapu. That project excavated at a number of ceramic period sites on Niuatoputapu, including Lolokoka, a site with decorated Lapita ceramics. He subsequently went on to carryout independent survey on the northern volcanic islands of Tafahi and Niuafo'ou (Dye 1980, 1988b). Tom Dye, in short, was very well-prepared to tackle Ha'apai. His plan was straightforward enough, he would first survey islands throughout the group and then, dependent on what was found, he would selectively conduct excavations. His survey was widespread, thorough and ultimately successful. It incorporated 11 islands[10] where beaches were walked, agricultural fields were examined, pits within villages (including outhouse holes) were inspected, and where landowners were asked ques-

10 Ha,afeva, 'O'ua, Tungua, Kotu, Tofua, Lifuka, Foa, 'Uiha, Uoleva, Nomuka, and Mango, with Uoleva and Mango visited for one day only.

tions about ceramic finds (Dye 1988a:65). All but three of the islands he visited had a surface veneer of ceramics or *in situ* ceramic sites. Dentate stamped decorated sherds were collected from the surface of four islands, Lifuka, 'Uiha, Tungua, and Ha'afeva. This, then, led him to excavate Lapita sites at Fakatefenga on Tungua and Tongoleleka on Lifuka. The decorated ceramics from both are all but identical to those reported by Poulsen (1987) for Tongatapu or Kirch (1988) for Lolokoka. The idea of a northward colonisation of Tonga in the declining years of ceramic production clearly was proven flawed. If Lapita peoples had settled Tongatapu first, then their extension into Ha'apai and north as far as Niuatoputapu must have taken place not long after. These excavations further illustrated the substantial impact wrought by Lapita settlement on small island faunas, particularly as it relates to terrestrial birds, iguana, and sea turtles (Dye and Steadman 1990; Pregill and Dye 1989).

My first experience in finding ceramics with dentate stamp application in Ha'apai occurred on Wednesday, 24 October 1990. I was in the village of Faleloa near the north end of Foa Island to interview Hiliau, an elderly *matapule* (talking chief) who, I was told, held much knowledge of traditional history for the island. We undertook a survey in the village following that meeting, documenting sites Hiliau had described, as well as seeking out others of interest. One of the latter was located on the north village slope, where construction of a house had exposed a 35 to 40 cm thick deposit of shell midden (Fig. 5.6). This was recorded nonchalantly in my field book as having "a considerable amount of pottery, including decorated pieces and rim sherds." A limited test excavation of the Faleloa site was supervised by Richard Shutler Jr., in 1991 along with other tests at the Polynesian Plainware site of Holopeka on the adjacent island of Lifuka (Fig. 5.7). Larger scale excavations occurred at both in 1992, these being key projects for a 12-student archaeological field school I had brought from Simon Fraser University. In hindsight, these projects were critical for all of the future excavations I was to undertake in Tonga. They kindled my interest in the early colonisation

Figure 5.6. The village of Faleloa looking north, 1997. The Faleloa Lapita site is marked by the blue house on the right side of the road as it rises upslope. Midden deposits and scattered ceramics occur around the foundations and in the rear yard.

of Ha'apai, one pulling me into the "allure of Lapita ceramics" as my colleagues are given to call it. But equally important, these excavations provided a learning experience, where we could gain insight into site stratigraphy, the nature of the fauna and artifacts therein, and the types of features being encountered. The effectiveness of our data recovery and recording methods also could be assessed.

It was a good day in March of 1995 when I received notification that the Social Sciences and Humanities Research Council of Canada had approved a three-year project for additional fieldwork in Ha'apai, this time with exclusive focus on Lapita colonisation. The proposed research design lays out a series of questions I would try to resolve, ranging from the chronology of first Lapita settlement, to subsistence economy and its impact, to the nature of early society. Fieldwork was to include survey for

Figure 5.7. Excavations at Faleloa in 1991. The original site was positioned on a coral sand back beach that, today, is elevated and 200 m from the shoreline. Richard Shutler Jr., is standing at the sieves on far right.

additional *in situ* Lapita settlements, with special consideration of 'Uiha and Ha'afeva islands where Tom Dye had found decorated Lapita sherds. The bulk of the project, though, was to focus on strategic excavations, where recovery methods were to be comparable, and where data appropriate to the questions being asked might be acquired. If, for example, the Lapita fishery was to be understood in full, finding (or not finding) smaller species of reef fish would be dependent on the use of fine-meshed sieves (3.2 and 1.6 mm), or a sampling design to accommodate their size (Cannon et al. 2018). A set of common standards for excavation, documentation, sampling, radiocarbon dating, and the like consequently was defined, not only for projects in Ha'apai but for all later studies in Tonga. Beyond consistency in field strat-

Figure 5.8. Simultaneous block area excavation at Vaipuna site, 'Uiha Island 1997.

egies, the acquisition of comparable-sized samples from each of our sites was pre-eminent. A minimum excavated area of 10 m^2 was established as a target and, where appropriate, this would be dug as a block area excavation. Excavating in a block allows for the peeling back of site deposits concurrently, exposing feature boundaries and stratigraphic breaks more clearly (Fig. 5.8).

Some of the questions, and aspects of the recovered data, made it apparent that additional expertise would be required for specialized field studies and/or analyses. Richard Shutler Jr., again would provide insight on the Lapita ceramic assemblage and Bill Dickinson was to continue with his work on Lapita-age paleo-shorelines. Added to the team were Erle Nelson (Simon Fraser University), a pioneer in AMS radiocarbon dating, David Steadman (Florida Museum of Natural History), one of the few zooarchaeologists able to identify extinct Oceanic bird fauna, and

Aubrey and Debbi Cannon (McMaster University), individuals with the expertise and an interest in analyzing the many thousands of fish bones expected to be present. John Flenley (Massey University), a palynologist, likewise agreed to extract sediment cores and provide vegetation histories where appropriate wetlands might be found.

The three field seasons of work in Ha'apai are best described as frenetic, at times challenging, but overall a success. The base of operations was Pangai, on Lifuka, where Siaosi and Nipa Vi and various members of their clan offered accommodations, a logistical network of relations throughout the islands, and adopted us into their family. When needed, they also assigned their daughter Vasa to serve as our interpreter and facilitator. Day to day field transport was iffy, for the most part alternating between a small outrigger canoe with 20 hp motor and a 1960s van that rarely started without a push (Fig. 5.9). Our fieldwork in 1995 began to employ a new tool in the archaeology of Ha'apai, one enhancing data collection substantially. This was a hand-twisted 10.2 cm diameter bucket auger with maximum extension of up to 2 m depth (Fig. 5.10). Systematic auger tests at spaced intervals across a site provide accurate information on depth of deposits, the nature of subsurface stratigraphy, and a reasonable measure of site size. Sieving of the removed sediments led to the recovery of ceramic sherds, the number of which, when divided by depth of deposit and multiplied by 100, provides density indices for plotting. All of these data became essential for planning, not only for decisions on where to excavate, but in estimating how long it would take to complete the excavation. The auger similarly provided a tool for expediently testing potential sites in survey work. Buried Lapita occupations for the Vaipuna site on 'Uiha Island and the Mele Havea site on Ha'afeva Island were found through auger tests. Auger testing equally was important for negative results, quickly indicating we had been digging in the wrong place and should be moving on.

Archaeological survey did locate the Lapita settlements on 'Uiha and Ha'afeva islands, as I note. Many more Polynesian Plainware

Figure 5.9. Launching outrigger canoe near the Pangai wharf, Lifuka Island 1995. Richard Shutler Jr. (sitting), Rob Shortland, and John Wolf.

Figure 5.10. Systematic field methods with use of bucket auger and nested sieves of 3.2 and 6.4 mm mesh. Photo on left is 1995 auger testing at Tongoleleka (Lifuka) by Mosese Tuifolau and Robert Shortland. Tualau Lautaimi is at the sieve, Vaipuna ('Uiha) 1995.

sites similarly were recorded. Our efforts on the larger southern island of Nomuka were far less effective, where vagaries of transport on a fishing boat in 1996 allowed but a three-day period for work. There was little difficulty finding areas with ceramics on the surface, as Tom Dye had found in 1984, but auger tests in all cases failed to locate a buried occupation. The Lapita story for Nomuka, and I truly believe such a story exists, must await some future endeavour. Between 1995 and 1997, primary excavations were undertaken at the Tongoleleka, Pukotala, Vaipuna and Mele Havea Lapita sites. We also returned to Faleloa to excavate comparable samples. The results of these excavations are prodigious; the ceramic assemblage alone numbers in excess of 100,000 sherds with 3,100 plus pieces incorporating Lapita decoration.

Additional to survey and excavation, Bill Dickinson walked the beaches throughout Ha'apai, fine-tuning our understanding of relative sea levels on different island blocks. John Flenley completed sediment coring and palynological studies at Finemui Swamp on Ha'afeva Island and Lotofoa Swamp on Foa Island, both reasonably close to the Lapita settlements of Mele Havea and Faleloa respectively. Erle Nelson oversaw the AMS radiocarbon dating program and collected plant samples from Lifuka to establish base-line data for any future analysis of stable isotopes in bone. David Steadman undertook modern bird surveys in northern and central Ha'apai against which archaeological bird remains could be compared. The Cannons participated in excavations, water washing 3.2 and 1.6 mm fine-sieved matrix samples to measure small faunal loss. And Andrew Barton, the archaeological laboratory manager at Simon Fraser University, put great effort into the acquisition and preparation of comparative collections of Ha'apai fish and shellfish faunas in 1995. He also was the logistical magician throughout, often an under-appreciated role, but one indispensable to most everything that we did. On completion of it all in 1997, when for the final time we had packed our gear and artifacts on the inter-island ferry, MV *'Olovaha,* I felt a true sense of accomplishment. The task ahead was to analyse these data, provide interpretive substance, and address the questions as originally penned.

Colonisation and Chronology in Ha'apai

Time and chronology are foundation issues on which the discipline of archaeology is built. Realistically answering questions about the past is all but impossible where temporal relationships of sites, artifacts, or other aspects of the archaeological record are unknown. I suggest in Chapter 3 that the 1949 invention of radiocarbon dating is the single greatest advancement in the history of archaeology. With the ability to date virtually anything of an organic nature, chronologies on a global scale were quick to be rewritten. There is a reason the Swedish Academy of Sciences awarded the Nobel Prize in Chemistry to Willard Libby in 1960. I also describe in Chapter 3 the various growing pains that radiocarbon dating in archaeology has had. This led Jens Poulsen in the 1960s to mistakenly extend the manufacture of decorated Lapita wares at Moala's Mound into the 4th century AD. Jens is not the only archaeologist in Tonga prior to 1990 to have problems with dates. Patrick Kirch (1988:139–141) acquired radiocarbon dates on tridacna shell from the Lolokoka site on Niuatoputapu, estimating first Lapita settlement of this northern outlier to occur between 1400 and 1200 BC. In light of what we now know for colonisation on Fanga 'Uta Lagoon, this misses the mark by 300–500 years. In 1990, Matthew Spriggs (1990:14) published a general review of Lapita radiocarbon dates, listing 17 dates for sites in Tonga. He immediately rejected five of these for various reasons. Even then, trying to make sense of the remainder was confounded by standard errors in excess of 100 years. One (ANU-436), in fact, has a whopping precision, or better put imprecision, of ±415 years. The true date for this sample after calibration had a 68.2% chance of falling between 829 BC and AD 140. The implications of this are obvious. Tongan Lapita chronology was in dire need of an upgrade.

The questions of when Ha'apai was first colonised, the speed with which colonisation took place, and the duration of the Lapita phase in this island group became essential concerns beginning with 1992 field work (Shutler et al. 1994; Burley et al. 1995). Radiocarbon dates needed to be consistent in dating stratigraphic context and related associations, and they required a greater precision than previously was the case. I made three decisions with respect to the dating protocols to be applied. First, we would exclusively date wood charcoal, excluding shell or bone as viable materials. Shell dates in particular require marine reservoir correction, a significant problem in the early 1990s, but with complexities in Tonga continuing to be recognized (Petchey and Clark 2011). The complications for dating bone had yet to be worked out, leading Matthew Spriggs (1990:6) to leave bone dates out of his review altogether. Second, charcoal samples had to come from unquestioned stratigraphic context. Samples without secure associations or those recovered from features without definitive stratigraphic origins had to be avoided. Third, all radiocarbon dates would be measured using accelerator mass spectrometry (AMS). AMS radiocarbon dating directly measures ^{14}C within a sample providing lower measurements of uncertainty compared to traditional counting methods. AMS dating is also capable of measuring very small samples, enhancing our ability to date a wider range of contexts.

My three decisions defined the protocols; our radiocarbon specialist, Erle Nelson, was asked to make the next steps happen, a task he accomplished with longstanding expertise. All necessary pre-treatments were undertaken in his Simon Fraser University lab before samples were sent to Lawrence Livermore National Laboratory in California for measurement. When the dates were sent back, he corrected them for isotopic fractionation, reduced each for southern hemispheric correction, and converted the radiocarbon years into calendrical years using a high precision decadal calibration curve. Collectively to 1997, 31 AMS radiocarbon dates were processed from the five Lapita site excavations as well as the Polynesian Plainware settlement at Holopeka. These include samples from secure Lapita contexts, secure Polynesian Plainware contexts, and samples from transitional contexts intermediate to the two.

The largest majority of the charcoal samples was submitted in 1997, with dates returned early in 1998. I well recall my disappointment and perplexity when Erle passed me the list. Rather than calibrated ages in the 1000 BC range, as I was expecting for initial Lapita settlement, the dates were more recent. They were so recent, in fact, that only a minimal temporal difference existed between Lapita and later Plainware strata. Roger Green, the University of Auckland archaeologist who had written the seminal paper on Lapita in 1979, was visiting Richard Shutler and me at the time we received the dates. His reaction to the list was more measured, and definitely more positive. He was quick to point out that the dates were consistent, they were compelling, and they appeared to present a coherent chronicle with important implications. We went on to incorporate descriptive materials for the dates and their interpretation in an article published in *Archaeology in Oceania* in 1999 (Burley et al. 1999). A beginning for the Lapita chronology of Ha'apai was conservatively placed in the 900 to 850 BC range, with the upper boundary for Polynesian Plainware in the interval 750 to 700 BC. As also stated in that article, however, the Lapita phase in Ha'apai, could easily "have been no more than a single century in duration, dating to the interval 2800–2700 cal BP" [850–750 BC] (Burley et al. 1999:63). At this stage we were beginning to speak in generations, not centuries.

With the Ha'apai chronology as it existed in 1999, and with Roger Green's blessing, I was fairly certain it was a done deal, at least a done deal within realistic boundaries of radiocarbon dating. David Steadman attempted an even more refined chronology for the Tongoleleka site in 2002 based on 20 additional AMS bone dates for extinct iguana, extinct megapodes, and domestic chickens (Steadman et al. 2002). The dates seem to prove his point, the extinction event for terrestrial birds and iguana is almost instantaneous after first settlement, but the site chronology changed little. The implementation of "chronometric hygiene" protocols for acceptance of radiocarbon dates has been a concern in Oceanic archaeology since the 1990s (Anderson and Spriggs

1993). Chronometric hygiene is an interesting combination of words, but it simply means we exclude radiocarbon dates from consideration unless a set of standards for the date are met. This was taken to an absolute level in 2011 in an influential paper in the *Proceedings of the National Academy of Sciences (USA)* by Janet Wilmshurst and others. Reanalyzing 1,434 radiocarbon dates for East Polynesia, the paper illustrates a dramatically late settlement chronology when analysis employs "reliable short-lived samples" only (Wilmshurst et al. 2011). The implication here is that charcoal dates have in-built age if originating from the heartwood of long-lived tree species, leaving associated chronologies suspect if not erroneous. A second paper not long after emphatically decreed that radiocarbon dates on unidentified wood charcoals were "a complete waste of resources" serving to "retard progress" in chronological construction (Rieth et al. 2011:2740). The Ha'apai radiocarbon record had been built almost entirely on unidentified wood charcoals and, regardless of consistency and coherence, it summarily could be dismissed. Even worse, almost the entire chronology for early settlement in Tonga, including radiocarbon dates from excavations on Tongatapu and Vava'u, could be called into question for similar reasons. The Ha'apai chronology was not a done deal at all.

At the same time the Wilmshurst article was gaining traction, I had begun my collaboration with Marshall Weisler and Jian-xin Zhao on the U/Th dating of Nukuleka coral files as described in Chapter 3. The Nukuleka dates established first settlement in Tonga at 900 BC, and this offered a degree of credibility to the more recent nature of the Ha'apai radiocarbon record. Yet the problems of unidentified wood charcoal still needed to be addressed in definitive fashion. For Lapita strata at Tongoleleka, Vaipuna, and Faleloa, four U/Th dates on coral abraders were acquired, the results being consistent with the existing radiocarbon record. I also re-examined archived remnants of previously dated charcoals and, where identifications might be possible, the samples were sent to Gail Murakami, a paleobotanist in Hawaii. Ten of the Ha'apai dates, according to Gail, had been based on short-lived material, most being coconut shell fragments. As a final phase of reanalysis, I convinced Kevin Edinborough, a colleague at University College London, to integrate the mix of U/Th dates, short-lived sample dates, unidentified wood charcoal dates and five extinct iguana bone dates[11] into a Bayesian statistical analysis (Fig. 5.11) (Burley et al. 2015). The Bayesian model provides a probabilistic framework for chronology, and it identifies anomalous outlier dates if present (Bronk Ramsay 2009). The results and their precision went far beyond expectations (Fig. 5.12). The maximum dates for beginning and end of the Lapita period in Ha'apai are 822 BC and 776 BC, respectively. When the analysis is rerun with only U/Th and short-lived wood charcoal dates, the differences turn out to be a matter of but three to five years (Burley et al. 2015:8). Statistical outputs in the Bayesian software also provide a probabilistic estimate for the interval span of Lapita occupation in Ha'apai. This is 32 to 49 years, a temporal period incorporating two generations of people at the most!

For the non-archaeologist, I will have provided far more detail than seems necessary for Ha'apai chronology. To acquire temporal precision in archaeology at the generation level without dendrochronology or calendrics is rare, and justifiably requires explanation. I suggest, in fact, that we may have reached the limits of the archaeological clock with currently available tools. The Bayesian date of 822 BC for initial colonisation of Ha'apai is 70 to 80 years after first landfall in southern Tonga. This delay in northward movement intrinsically is coherent given the scale and documentation for Lapita expansion on Fanga 'Uta Lagoon, as described in Chapter 4. The restricted temporal duration for the Lapita phase in Ha'apai is not so logically predicted. I find it difficult to envision the entire collection of decorated Lapita ceramics from Ha'apai as a product of but two generations

11 The iguana dates are taken from the Steadman et al. 2002 study. Iguana has an exclusively herbivorous diet reflected in $^{13}C/^{12}C$ stable isotope ratios. The chicken and megapode isotopic ratios suggest a mixed terrestrial/marine diet requiring correction. These dates, as a consequence, were not included.

Site Name	^{14}C Date	Material	Cal BP	Model BP	Agree
Tongoleleka	2730±40	iguana	2843-2755	2765-2750	98
Tongoleleka	2720±60	char	2844-2750	2766-2745	109
Tongoleleka	2700±40	iguana	2840-2744	2765-2745	128
Tongoleleka	2690±50	char	2842-2738	2765-2740	136
Vaipuna	2690±50	char	2842-2738	2765-2740	136
Tongoleleka	2680±50	iguana	2841-2725	2764-2738	145
Tongoleleka	2660±40	iguana	2777-2724	2761-2736	141
Tongoleleka	2630±40	iguana	2766-2543	2753-2728	160
Pukotala	2640±60	SL char	2784-2514	2756-2730	183
Mele Havea	2640±50	SL char	2782-2540	2756-2730	174
Pukotala	2630±60	SL char	2775-2507	2755-2727	178
Mele Havea	2620±50	char	2761-2519	2752-2726	171
Vaipuna	2620±50	char	2761-2519	2752-2726	171
Faleloa	2600±50	char	2752-2505	2748-2725	153
Vaipuna		coral	2768-2758	2765-2756	94
Faleloa	2560±60	SL char	2741-2493	2745-2723	96
Faleloa	2560±60	SL char	2742-2491	2747-2723	96
Tongoleleka		coral	2748-2733	2747-2733	100
Tongoleleka	2560±50	char	2739-2495	2744-2723	96
Tongoleleka		coral	2730-2720	2731-2723	98
Faleloa		coral	2734-2720	2734-2724	102

Lapita Start	2772-2759
Lapita End	2728-2716
Span (years)	32-49

Figure 5.11. Bayesian overlap model of Lapita radiocarbon dates in Ha'apai published in 2015 (Burley et al. 2015). Agree is the fit of the modelled date to the Bayesian model. Above 60 is an appropriate fit (Bronk Ramsay 2009). Model is in years before present (BP), present being 1950.

of potters. It is equally difficult to explain, even speculatively, why potters of the second generation abandoned decorative application altogether. This abandonment is not predefined by a simplification or degradation process and it seems abrupt, occurring simultaneously across the excavated sites. The limited duration for Lapita ceramics may be hard to rationalise but at the same time it offers considerable opportunity for archaeo-

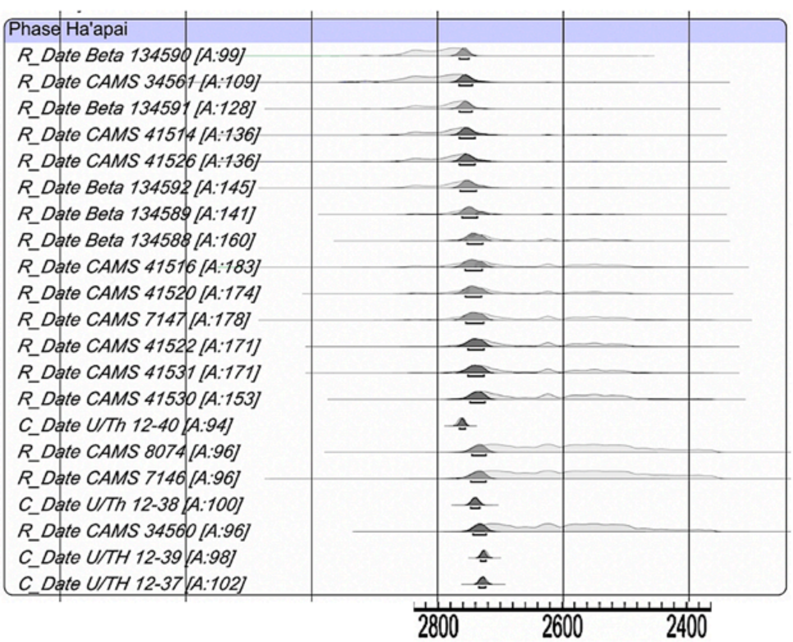

Figure 5.12. Calibrated ranges and modeled dates (darkened) for the Bayesian model of Lapita chronology in Ha'apai. The dates are organized in the same order as Fig. 5.11.

logical insight. Decorated Lapita wares are a horizon marker, an easily recognized artifact that, when found in Ha'apai, date associated remains and events to a 32-to-49-year window. The implications of this are obvious for interpretations of environmental impacts, change in nonceramic aspects of material culture, and all other areas where interpretations of Lapita lifeways are being offered.

Lapita Settlements in Northern Ha'apai

Northern Ha'apai, as I describe at the chapter outset, is a succession of seven small, closely spaced islands enclosed by fringing and offshore barrier reefs (Fig. 5.13).[12] Multiple villages occur on each of the major islands, by far the largest being Pangai, on Lifuka. One can hardly consider Pangai a bustling êntrepot, but with nearby airport, ferry berth, government services, bank, high schools, general store, petrol depot, and other amenities, it is a virtual metropolis for this part of Tonga. The landscape today is not the one encountered by Lapita explorers as they sailed into the island group almost 3,000 years ago. The positions of Lapita sites on the four main islands occur on inland beach ridges 200 to 400 m back from the present shore, and 1.5 to 2 m above it. Paleo sea level notches on the coral limestone islands indicate the Hahake geological block is in balance, having neither emergence nor subsidence over the past 5,000 years (Dickinson and Burley 2007:249–250). Higher sea levels of 1.2–1.4 m following the mid-Holocene high stand account for the inland site locations, with island sizes correspondingly reduced. The small sand cays, Nukunamo and Tatafa, did not exist and Uoleva was considerably smaller. One additional paleo-islet would have existed though. The north end of Foa Island was separated from the mainland by a tombolo, a sand spit now underlying the lower village flat of Faleloa (Dickinson et al. 1999:693).

The excavations at the four Lapita sites in northern Ha'apai were highly productive in our recovery of Lapita ceramics, non-ceramic artifacts, and associated faunal remains. With the data at hand, it is difficult to conclusively identify one site as a founder colony. Virtually all of the radiocarbon dates overlap in temporal distribution with the earliest dates at each of the sites being no more than 15 years apart in the Bayesian model (Burley et al. 2015). That said, Tongoleleka on Lifuka would be my best guess for the earliest land fall. The site today occurs 260 m inland from the shore on a sandy ridge identified by Dye

12 Here, I use northern Ha'apai in the restricted sense of islands in northeastern Ha'apai. To the west there are two small inhabited islands, Mounga'one and Lofanga, as well as a small number of uninhabited islands. None of these have been surveyed, though Mounga'one has a high potential for Lapita occupation.

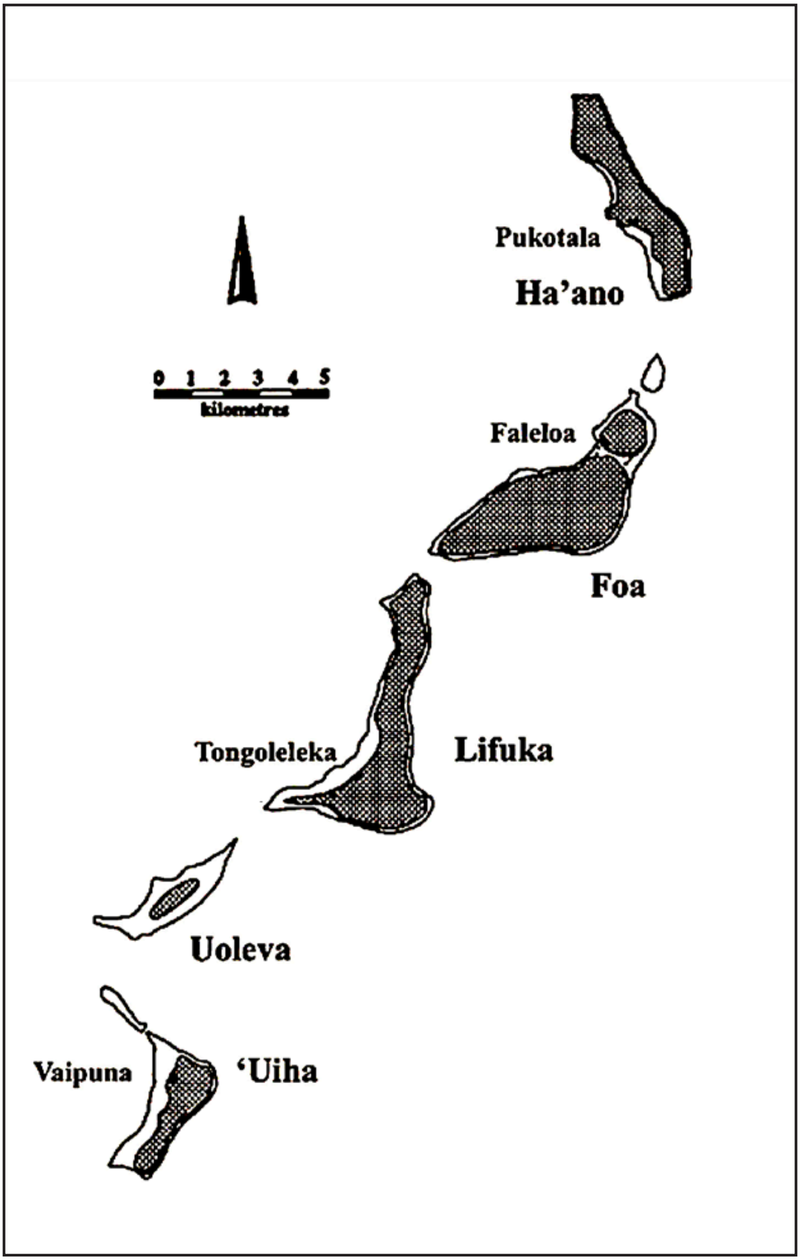

Figure 5.13. Northern Ha'apai Islands Lapita-age shorelines 800 BC (stippled). Approximate location and name of Lapita sites are indicated by smaller font.

(1988a:123) as a dune crest of 20 m or so width. To the ocean side, the settlement faces a reef flat and lagoon with open water access through a reef break. The inland side of the dune gradually slopes downward into a swale of approximately 150 m width (Fig. 5.14). This appears to have been a wetland where taro cultivation could have taken place. Tongoleleka is the only Lapita site in northern Ha'apai with this type of feature in direct association. The decorated ceramic assemblage from Tongoleleka is the most abundant, the site has by far the greatest density of ceramics by area excavated, and it incorporates the greatest diversity in Lapita decorative motifs. And also supporting Tongoleleka as a founder colony is "the first meal," as referred to in 1997 when being excavated (Fig. 5.15). This is a pit feature, possibly a shallow *umu* (earth oven), occurring in the very bottom of our excavations within a matrix of highly swirled beach sand. Recovered in direct association was a notable abundance of fauna representing a literal buffet of sea turtle, extinct megapode, and extinct iguana. It takes little imagination to envision this event as one of the earliest feasts in Ha'apai, if not the earliest.

The other sites in northern Ha'apai share a number of traits with Tongoleleka, giving insight into the general configuration of the early Lapita colony. Each is optimally positioned for reef foraging and fishing, with associated faunas indicating high degrees of success. Again, the northern Ha'apai sites can be categorized as kitchen middens, including an abundant and diverse assemblage of shellfish mixed with cultural materials, burned rock, and features. Shellfish collection at individual sites reflects local availability as fully expected. Compared to Tongatapu, there is a marked increase in the volume of gastropods while the bivalve, *Anadara antiquata,* is near absent. The dominant gastropod is the turban snail (*Turbo* sp.)*,* accounting for 15% to 30% of individual Lapita assemblages. The most abundant bivalves are the beach clam (*Atactodea striata*), Philippine horse mussel (*Modiolus philippinarum*), and venus clam (*Gafrarium tumidum*). In relative comparison of site assemblages, there appears to be a north/south distinction. Faleloa and Pukotala have greater frequencies

Figure 5.14. Excavations at Tongoleleka 1997 view to east. The inland topography towards the house drops down to a lower elevation in which a freshwater swale would have been present. Melika Siakumi is working at the sieves.

of turban and mussel while Tongoleleka and Vaipuna are dominated by the clams. Small variations exist between Lapita and Polynesian Plainware phase assemblages at individual sites, but consistency between temporal periods is the norm. The effects of sea level fall on the reefs of northern Ha'apai after Lapita settlement appears far more limited than was the case on Fanga 'Uta Lagoon.

Excavation strategies at the four sites varied. Both Tongoleleka and Vaipuna had block area excavations, as our 1995–1997 field plans called for. The majority of excavation at Faleloa was undertaken in 1992 and, beyond dispersed tests, this involved use of a trench. The site at Pukotala had been dug into at some point in the ancient past for burial mound fill, leaving a very large depression in its aftermath. The south slope of this depression cut across

Figure 5.15. The "First Meal." A concentration of turtle, megapode, and iguana bone in a beach sand feature at the bottom of the Tongoleleka excavation 1997.

site stratigraphy at an angle, removing much of the upper deposit. Our excavation focused on the side slope, in part because it was the easiest way to access the Lapita occupation, but also with a concern that these deposits might be destroyed through erosion. The cultural stratigraphy at all of the sites was uniform, with later aceramic and Polynesian Plainware midden overlaying a Lapita stratum of gray and mottled coral sand. Lapita settlements originally were located in back beach settings above the shore, not on the tephra-based soils blanketing the island landscapes. Large postholes extending from the Lapita stratum into the clean yellow coral sand below are absent, as is any potential evidence for stilt house construction. Widespread auger tests define peripheries for the Lapita occupation with settlement sizes ranging between 400 m^2 and 1,750 m^2. Vaipuna on 'Uiha Island is the smallest with Pukotala on Ha'ano Island the largest. The size of individual sites is characteristic of a small hamlet, each hypothesized as having two to three houses occupied by individual families.

Lapita-age vertebrate faunas are dominated by fish. From the 1997 excavations alone, close to 100,000 fish bones were recovered with tens of thousands more from 1992 and 1995 projects. Identifying the types of fish represented in these assemblages is a slow and laborious task requiring considerable expertise. Aubrey and Debbi Cannon with occasional students sporadically carried out the analysis over a two-decade timespan (Cannon et al. 2018). Comparable to other fish analyses in Oceanic archaeology, identifications are grouped into 20 different taxa at the family level or higher. Four taxa account for approximately 80% of the fish, these including Acanthuridae (surgeonfish), Scaridae (parrotfish), Serranidae (grouper), and Lethrinidae (emperor). All of these are reef fish with very little evidence for any type of offshore fishery. The Cannon's analysis sought patterns in the data, especially in their comparison of the major taxa between Lapita and Polynesian Plainware phases. What they found is overall consistency and stability in the Ha'apai fisheries, as present within individual sites and across time. There is no indication that Lapita peoples or those associated with the Polynesian Plainware phase had any degree of impact on reef fish populations as is claimed for the Lapita fishery elsewhere (Butler 1988). Then again, should we expect settlements of two to three families over a period of 50 years or less to have such an effect?

Vertebrate faunas other than fish are similarly abundant and incredibly informative on other aspects of the subsistence economy and their impact. Sea turtle was a valued component of Lapita diet, as Tom Dye and David Steadman (1990) previously make the case. Our faunal assemblages include upwards of 1,800 turtle bones from Lapita strata in northern Ha'apai. By comparison, this represents 73% of all turtle remains excavated from all occupation levels at these sites. Turtle bone found within an auger test was almost as reliable an indicator of buried Lapita deposits as decorated ceramics. We have not been able to identify individual species, but both Hawksbill (*Eretmochelys imbricate*) and Green (*Chelonia mydas*) turtles continued to be hunted throughout Ha'apai into the 2000s (Havea and MacKay 2009).

Lapita colonisers also sought *Brachylophus gibbonsi,* a larger species of extinct iguana and the one already mentioned as part of the first meal at Tongoleleka. The concentrated distribution of this species in all Lapita strata, with little to no presence in later occupations, indicates rapid extinction (Steadman et al. 2002). David Pregill, the herpetologist who defined the species, estimates it to be 1.9 times larger than the still extant Fijian iguana, *Brachylophus fasciatus* (Pregill and Steadman 2004:18). From snout to tip of tail, the Fijian iguana measures up to 80 cm in length, leaving the Tongan species as much as 1.5 m long (Fig. 5.16). The size of the islands in Ha'apai, and the inability of this species to defend itself against predation, made *Brachylophus gibbonsi* an easy lunch with a fate all but sealed upon arrival of the first Lapita canoe.

The carnage of Ha'apai was not restricted to turtles and iguana. Bird populations were equally targeted, resulting in even greater devastation and additional extinctions. On Lifuka, for example, David Steadman's (1998) survey for terrestrial birds in the mid-1990s documents 10 existent species; from excavations at Tongoleleka, 24 species were identified in the Lapita assemblage, with others probably present. Not all of these species went extinct, but a minimum loss of 58% of terrestrial birds on the island since Lapita colonisation is startling. Steadman (2006) carried out the identifications of Ha'apai bird bone and integrated much of these data as a component of his volume, *Extinction and Biogeography of Tropical Pacific Birds*. Overall the Ha'apai list has 32 species of terrestrial birds, 13 marine species, and six species of shore birds.[13] To add to the larder, domestic chicken (*Gallus gallus*) similarly is abundant.

For northern Ha'apai, there are six species of extinct birds that are taxonomically described. One of these, an extinct pigeon, has been christened *Tongoenas burleyi* by David Steadman and Oona Takano (2020) (Fig. 5.17). The eponym was

13 These numbers are based on identifications in the faunal catalogue, not the 2006 list provided in the Steadman volume.

Figure 5.16. The Fijian banded iguana *Brachylophus fasciatus.* The extinct Tongan iguana *Brachylophus gibbonsi* is estimated to be 1.9 times larger than this species. Photo by Tim Vickers, public domain, via Wikimedia Commons.

completely unexpected, but who can complain about having a bird named after them. *Tongoenas burleyi* is the largest of Tonga's pigeons, being over half a metre long not including tail, and capable of swallowing fruit the size of tennis balls. Four of the other extinct species were also food prey for Lapita colonists, including two pigeons (*Didunculous placopedetes*, *Caloenas canacorum*) and two flightless megapodes (*Megapodius alimentum*, *Megapodius molistructor*). The sixth extinct species is a parrot (*Eclectus efectus*), no doubt taken for its feathers. Brightly coloured feathers of the Fijian *kula* (collared lory, *Phigys solitarius*) were a critical item of trade from Fiji into Tonga and Sāmoa in the 18th century (Kaeppler 1978a). *Kula* populations were restricted to Fiji in the historic period, but *kula* bone is notably present in Lapita faunas of Ha'apai. Beyond food and decoration, sizeable diversity exists in other types of birds from northern Ha'apai Lapita sites. These range from the smallish Polynesian starling, *Aplonis tabuensis*, to the substantially larger osprey, *Pandion haliaetus*.

Figure 5.17. *Tongoenas burleyi* occurs in Lapita archaeological sites across Ha'apai. This is the largest species of extinct pigeon in Tonga, one capable of swallowing fruit the size of a tennis ball. Illustration by Danielle Byerly, courtesy of the Florida Museum of Natural History.

The Lapita settlements of northern Ha'apai are homogenous in configuration and strategically deployed. They are hamlets of two to three families, logistically positioned on back beach shorelines from which reef foraging and fishing were easily carried out. Each of the sites represents the sole Lapita occupation on its respective island, leaving the impression of an organized northward expansion, if not a well-planned territorial imperative. Excavated faunal assemblages illustrate a high degree of success in the colonising efforts. They also reflect the devastating impacts humans can inflict on pristine island ecosystems. In Tonga, David Steadman (1998) calls this a "blitzkrieg event." Lapita colonisers, as we know from Hopoate, were also horticulturalists, with a wide range of crops available for planting. Dryland swidden gardens were the norm by the time of Lapita settlement in Ha'apai, and they are anticipated for each of the sites. The wetland at Tongoleleka additionally is well suited for swamp taro growth, while an abundance of chickens fits the horticultural model appropriately.

Central Ha'apai and the Mele Havea Site

Central Ha'apai is composed of 16 islands, five with present day villages. I have characterized the northern Ha'apai islands as small, those in the central group are substantially smaller (Fig. 5.18). The largest is Ha'afeva, with a land base of 180 ha (1.8 km^2). By comparison, it is virtually the same size as the Simon Fraser University campus (170 ha) on which I teach. The central islands are serviced by an interisland ferry on its weekly run from Tongatapu to Vava'u and back. Unlike the case in Pangai to the north, there is no deep-water lagoon or jetty here. Rather, the ferry positions itself beyond the offshore reef at Ha'afeva, dispatching passengers and cargo onto a flotilla of smaller boats lying in wait. The organized chaos of this undertaking is an adventure one never forgets. Neither the size nor isolation of these islands diminishes their importance in traditional Tongan history. The island of Tungua was the seat of the Tamahā, the sacred child, a female positioned at the very top of Tongan social order (Burley 2005). The highest male chiefs in Tonga, including the Tu'i Tonga, annually visited Tungua to present tribute in recognition. Even today, mats woven in Tungua continue to be highly valued and sought after for the island's former association.

Figure 5.18. A segment of the central Ha'apai islands. Ha'afeva is 2.1 km on its longest axis. Google Earth photo, 2011 image. On right is inter-island ferry M.V. Loto Ha'angana off-loading passengers and cargo on to smaller boats outside of the reef on Ha'afeva island, 1995.

Tom Dye's surveys in April 1984 in central Ha'apai included Ha'afeva, Tungua, Kotu, and 'O'ua. These islands are on the Kotu structural block, a geological feature that is submerging. If we are correct in the projected subsidence rate relative to sea level decline (Dickinson and Burley 2007), sea level today is 10 to 20 cm higher than the case at 850 BC. This was coincidentally documented by Dye (1988a) in his discovery and excavations at the Fakatafenga Lapita site on Tungua, where excavation in all of his units reached the water table. Fakatefenga is also bordered on its inland side by a wetland, much the same as Tongoleleka, save for its continued presence as a swamp. The success of finding *in situ* deposits at Fakatafenga went unmatched in Dye's examination of the three remaining islands, due in part, I assume, to the submerging paleo-shoreline. The circumstance of Kotu is particularly surprising, and somewhat puzzling. Kotu is an island situated within one of the largest and richest reef complexes in Tonga with a lagoon along its southeastern shore. In contrast to the other islands where surface ceramics were abundant, only a single "eroded" undecorated pot sherd was present on Kotu, despite several days of archaeological survey on a landmass that is 0.4 km^2 in size. A century of archaeological work in Tonga tells us that evidence for ceramic period occupation, if it actually exists, is near impossible to erase. Kotu stands as an anomaly to expectations for Lapita/Plainware settlement in Ha'apai when bio-productivity of reef/maritime resources is considered.

I visited Ha'afeva and Tungua on a few occasions during my early research tenure in northern Ha'apai, most coming about through invited excursions on the Catholic Mission boat Folau moe 'Eiki. With National Geographic sponsorship, I also spent a week on Tungua in 1995, recording the archaeological landscape of the Tamahā, and producing a map of her tomb, Langi Mahola (Burley 2005). During that venture, it had been a simple task to relocate the Fakatefenga site as well as observe the veneer of ceramic sherds Tom Dye reports for the island surface. Following our all too brief investigation of Nomuka in 1996, Bill and Jackie Dickinson, David Steadman, and I made our way to Ha'afeva for an additional week of survey. We spent some time revisiting Tungua, and examining Teaupa and Matuku islands, but most effort was given to Ha'afeva. Dye picked up three decorated Lapita sherds here and, though small and indistinct, they signified an earlier Lapita presence. The Ha'afeva landscape is relatively flat with a maximum elevation of 12 m above sea level. Freshwater ponds and associated swamps occur in a few locales, providing a rare resource for island residents. There is a single village on Ha'afeva, Kolongatata, this facing the reef outside of which the ferry passengers are dispatched. Our survey of Ha'afeva was judgmental and fortuitous, walking field roads, expeditiously examining garden exposures, and visiting sites reported to us by the town officer and other residents. We also had the bucket auger to test locations where potential for buried remains seemed a possibility. Yet, if we were to find an early Lapita site, the most likely locale was going to be within Kolongatata. This village stretches across an expansive back-beach sand flat for a distance of over 1 km along the length of the leeward coast (Fig. 5.19).

By the time we began our intrusion into village back yards, we were at least recognizable to Kolongatata residents, though

Figure 5.19. Kolongatata village flat to the front of the Mele Havea Lapita site with minimal elevation above sea level. Photo is taken from approximate location of site. Mele Havea is pushing the wheelbarrow.

whether they understood what we were doing on Ha'afeva is a completely different matter. The survey located a number of areas where both shellfish and ceramic sherds occurred on the surface, but where auger tests failed to find buried deposits. There was one significant exception, this being a concentration of minute earthenware fragments in the drip-line from the roof of a small house some 90 m inland from the beach. The auger test here encountered midden debris, ceramics, and faunal remains at a depth of 50 cm extending downward for another 60 cm. Mele Havea, the elderly woman living in the house, gave us permission to continue the auger tests, that exercise minimally defining the midden as 30 x 30 m in size. None of the pottery from the auger tests had decoration, but the faunal bone provocatively included sea turtle. Needing insight beyond a series of 10.2 cm diameter holes, a 1 x 1 m test unit was then located to the front of Mele Havea's house. As the unit was being taken down, a series of stratigraphic layers was encountered, with the bottom-most cultural stratum including decorated Lapita ceramics. All round excitement ruled

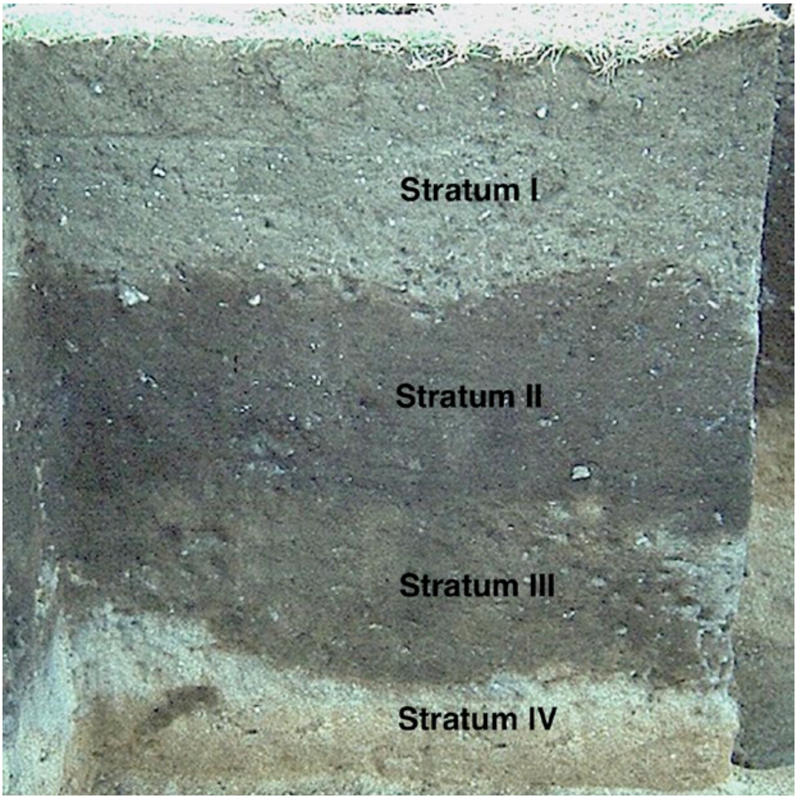

Figure 5.20. Mele Havea layer cake stratigraphy. Stratum IV is underlying beach sand, Stratum III is a sandy turbation zone associated with the Lapita occupation, Stratum II is a midden mix of loam, organics, and shell associated with the Polynesian Plainware phase, and Stratum I is aceramic in age.

the moment, but it was to last for only a moment. Our discovery of Lapita pottery occurred at 5 PM on Monday, July 22 with our ferry departure to Pangai but a few hours thereafter. Additional exploration of the Mele Havea site would have to wait.

In the following field season, 1997, the Mele Havea excavations were the last to be carried out in Ha'apai. Hiring a field crew from Kolongatata, we were able to complete an additional block excavation of 10 m^2 over a period of 11 days. This exposed what can only be described as a textbook-like, layer cake stratigraphy with occasional pit or posthole disturbances (Fig. 5.20).

The upper 35 cm is strikingly set apart from the stratum below by its light grayish-brown colour, and high degree of compaction with limited shell. This represents the accumulation of sediments after the end of ceramic production, a time period roughly covering the past 2,400 years. Beneath the aceramic horizon is 40 to 50 cm of midden deposit characterized by dark brown loam with organic content and shell. It associates with the Polynesian Plainware phase, defined by an undecorated assemblage of ceramic wares as are scattered across the Ha'afeva landscape. Finally, the underlying Lapita occupation is contained within a 30 cm thick stratum of lighter coloured yellowish-brown mixed sand. At the time people first arrived, this was the back-beach with an elevation of 1.3 m above sea level. We submitted eight radiocarbon dates to provide an absolute chronology through the site occupations. Only two of the dates relate to the Lapita stratum *per se* but the results are all but identical, with only a 20-year variation in measurement (Burley et al. 1999). When these dates are integrated into the Bayesian statistical model for the Lapita period in Ha'apai (Burley et al. 2015), first settlement is identified as 806 BC with dentate stamp and other types of decorated pottery abandoned by 766 BC. The 30 cm of mixed sand in the site bottom, and the archaeological materials contained within, represent a 40-year temporal interval. It is, once again, the product of two generations of site residents.

Excavations at the Mele Havea site revealed few surprises. There had been a house built here sometime during the Polynesian Plainware occupation (766–400 BC), and construction activities include a few large postholes dug into the lower Lapita layer. The discovery and exposure of a fully articulated human foot in the upper part of the midden did create a degree of excitement, at least for the crew. Where the remainder of the body may have been continues to be a mystery. The Lapita artifact assemblage from Mele Havea is not overly thrilling, nor did we find unique specimens. The ceramics from the lowest stratum includes a total of 5,168 sherds of which 493 (9.5%) are decorated (Fig. 5.21). A few are interesting for earlier appearing decorative

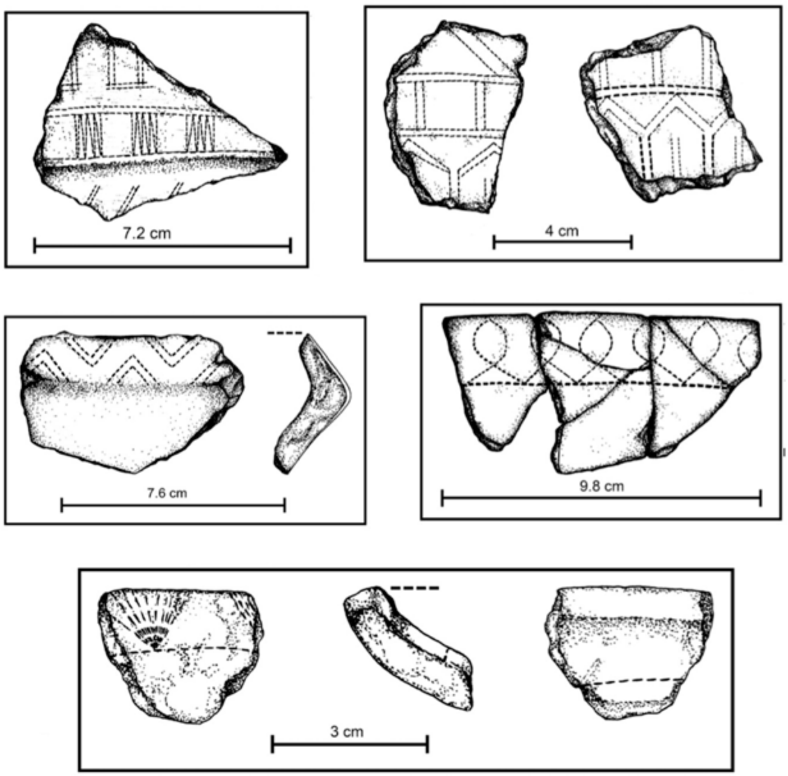

Figure 5.21. Mele Havea Lapita ceramic design motifs. Upper two sherds have earlier appearing decorative motifs but the majority of the motifs are of late Eastern Lapita style.

motifs, but the vast majority have open geometric/curvilinear designs typical of later Eastern Lapita wares (Burley et al. 2002). Less than 90 non-ceramic artifacts are present in the Lapita stratum, and most are expediently produced tools such as shell scrapers or coral abraders, or they are by-products or preforms related to artifact manufacture.

The Mele Havea Lapita excavations nevertheless stand out in the recovery of a well preserved, abundant, and informative faunal assemblage. Lapita shellfish illustrate diversity and wide spectrum foraging with 14 bivalve and 23 gastropod taxa. Beach clams (*Atactodea striata*) and mussels (*Modiolus philippinarum*) dominate the bivalves, as is the case in northern Ha'apai. The Lapita fish assemblage is large with 19 families present, but where parrot fish (Scaridae) account for 33% of the total (Cannon et al. 2018). Fruit bat (*Pteropus* sp.), the extinct iguana (*Brachylophus gibbonsi*), and Polynesian rat (*Rattus exulans*) occur to varying degrees. The presence of sea turtles in the lower levels of the auger tests had not been accidental. From the 11 m^2 area excavation, we recovered the most abundant sea turtle assemblage found at any Lapita site in Tonga. The substantial impact of Lapita peoples on the turtle population for central Ha'apai was clearly apparent. In comparison to the 1,257 bones found in the Lapita stratum, only 125 specimens are from Polynesian Plainware deposits, notwithstanding the latter's substantially longer period of occupation.

If you ask David Steadman in his role as Curator of Ornithology at the Florida Museum of Natural History, he will tell you that it is the Mele Havea bird fauna that makes the excavation truly spectacular. He has been able to identify 772 specimens to class, genus, or species, with 498 of these coming from the Lapita period. The diversity of Lapita-age birds is considerable incorporating 21 taxa for land birds, nine for sea birds, and three others for shore birds. Eight of the land birds are extinct, with Mele Havea specimens contributing to the taxonomic description for four of these. Included in this group are *Megapodius alimentum*, *Megapodius molistructor*, *Caloenas canacorum,* and *Tongoenas burleyi.* The four other extinct species have yet to be given taxonomic description, the number of specimens being too few. One, a rail (*Gallirallus* undescribed sp. F.), could represent a species endemic to Ha'afeva (Franklin and Steadman 2008:1886). The genus *Gallirallus* seems predisposed to the colonisation of smaller islands where they lose their ability for flight (Beauchamp 1989). The abundance of terrestrial bird taxa occurring in the Mele Havea assemblage is anomalous given the miniaturized size of the island, and its relative distance from a larger island source. Janet Franklin and David Steadman (2008), in fact, suggest it flies in the face of the long-held equilibrium theory in island biogeography. In this, area effect (size/isolation) is central to prediction of species richness and diversity (MacArthur and Wilson 1967). The number of bird species on Ha'afeva in the Lapita period, or Ha'apai more generally, are all but impossible to project using this theory.

Palynology at Lotofoa and Finemui Swamps

In the mid-1990s when I was planning additional fieldwork in Ha'apai, the debate over Lapita as "strandloopers" continued to persist. Few if any of my colleagues believed Lapita colonisation was exclusively driven by a search for new and unfettered coastal resources, nor did we consider Lapita economy to be devoid of agricultural capacity, as I am sometimes accused. This debate relates to scale. Were the Lapita people arriving in Tonga as a Neolithic society with agricultural production and land clearance central to their ethos? Or alternatively, was Lapita agriculture a limited impact, low-level-food production system with reef foraging and fishing critical to subsistence? The excavations in Ha'apai, and Pouslen's (1987) and Spennemann's (1989) even earlier work on Tongatapu, had me squarely in the latter camp. The idea was to try and test this through paleo-environmental reconstruction for pre- and post-Lapita periods. The late John Flenley, a Geography Professor at Massey University in New Zealand, would be central to these efforts. John's specialization was palynology, an expertise gaining him international recognition for his documentation of a dramatic human-induced transition in the later vegetation history of Easter Island. Indeed, in his book *Easter Island, Earth Island* with Paul Bahn (Bahn and Flenley 1992), the island is convincingly portrayed as a metaphor for ecological collapse on a global scale. When I approached him in 1993 about a project in Ha'apai, I was actually surprised by his positive response.

John selected two wetlands from which to gather paleo-environmental data as background for the on-going archaeological studies (Flenley et al. 1999). These were Lotofoa Swamp on Foa island and Finemui Swamp on Ha'afeva island (Fig. 5.22). Both locales occur in relative proximity to early Lapita settlements. The Lotofoa swamp is 2 km southwest of the Faleloa site while the Finemui wetland is 800 m north of Mele Havea. Neither is close enough to register small disturbances in the landscape of a Lapita hamlet, but they would identify larger patterns related to forest clearance and anthropogenic disturbance as had been the case on Easter Island. With students in tow, John made his way to Tonga in August 1996 to acquire sediment cores for the analyses. He was successful, extracting multiple cores for each of the swamps using a hand twisted 4.5 cm diameter sampler. Cores were carefully packaged and transported to his laboratory in Palmerston North where single cores from Lotofoa and Finemui were selected. Radiocarbon dates on organics from near the base of each core provided respective date ranges of 5624–5491 BC and 4786–4365 BC. These cores not only spanned the entirety of human occupation in Tonga, but they could also provide a vegetation history for the islands extending back to the mid-Holocene era.

Palynology is a time-consuming endeavour requiring experience and in-depth knowledge. Each of the 3+ m long cores were sampled at 10 cm intervals, sample slides were prepared for microscopic analysis, and pollen grains and spores were identified with a target count of at least 200 grains per sample (Flenley et al. 1999). The counts were then normalized as a percentage of the sample for different vegetation categories and sample percentages were plotted by depth in standard pollen diagrams. The relative distributions of pollen types across time (depths) defined zones for each core where subtle or not so subtle changes had taken place. Additional radiocarbon dates were also acquired for several of the zone boundaries giving a calendrical chronology for the results. The cores additionally incorporate a stratigraphic sequence where basal clays are overlain by organic muds and peats with occasional strata of volcanic origin intervening. Both swamps, as John interprets, formed as "lagoons within atolls" that are now surrounded by coral reef limestone (Flenley et al. 1999:2).

Figure 5.22. Finemui wetland and freshwater pond from which sediment cores for palynological analysis were extracted in 1996 by John Flenley.

For the questions I had set relative to human impacts of Lapita settlement, the Lotofoa core is frustratingly problematic. The upper zone of the core, Zone 5, incorporates a more or less modern vegetation regime as we might expect. Charcoal concentrations within this zone indicate burning, where a mangrove (*Excoecaria*) forest was replaced at the beginnings of the zone by sedges and grasses. A radiocarbon date at the the bottom of the zone yielded an age of 1054–899 BC, with a second date 20 cm below, supporting its reliability. This means that the entire pollen sequence for human presence on the island occurs in Zone 5, a zone extending from the surface to a depth of 37 cm only. With sampling at 10 cm intervals, and a high probability of mixing, secure interpretation of change in the pre-Lapita to post-Lapita period is all but impossible. The Lotofoa core does provides insight into two areas of note. First, eight of the nine samples in Zone 4 (37–127 cm) have coconut pollen (*Cocos nucifera*), in some cases coconut accounting for upwards of 10% of tree pollens. With the lower boundary for Zone 4 dating between 4578–4344 BC, coconut is definitively

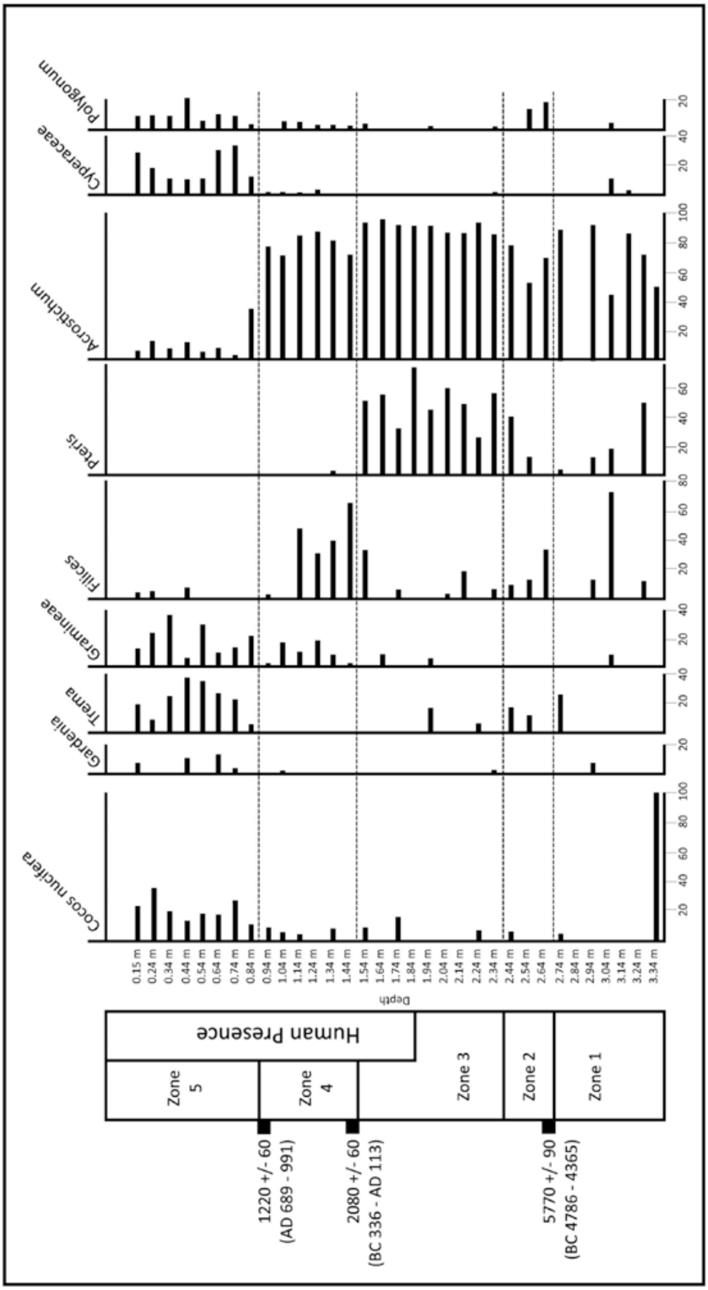

Figure 5.23. Select pollen distributions from the Flenley et al. (1999) report defining Zones 3, 4, and 5 for the Finemui core, Ha'afeva Island, Ha'apai. The Zone 4/5 boundary marks the transition to expansive agriculture with open field systems.

present long before the arrival of Lapita peoples in Tonga. Second, intervening between Zone 3 and Zone 4 is a 50 cm thick stratum of volcanic ash without pollen. This was a substantial volcanic event, quite possibly marking the eruption of Tofua during which caldera collapse took place. The radiocarbon date for the Zone 3/4 boundary indicates this happened by no later than the mid-5th millennium BC.

The Finemui core similarly is divided into five zones (Fig. 5.23). Radiocarbon dates on this core suggest human presence first occurs within Zone 3, with the upper boundary of this zone dating well into the Aceramic period between 336 BC and AD 113. The Zone 3 pollen profile is consistent throughout with nothing to indicate anthropogenic impacts or anything more than a gradual transition from Zone 2. It is not until Zone 4 where vegetation patterns begin to illustrate incipient disturbances with grass pollens consistently present, and where varying amounts of pandanus, coconut, and iron wood pollens imply intentional plantings in the vicinity of the swamp. The transition in Zone 5 (90 cm), on the other hand, is substantial. The swamp opened up, grasses, sedges, and weeds took over, and coconut dominates tree pollens. Sweet potato (*Ipomoea*) also occurs in the upper part of Zone 5. The beginnings of this transition at the Zone 4/5 boundary are dated to AD 689–991. Volcanologists (Caulfield et al. 2011) have linked the onset of this transition to another eruption of Tofua, as indicated by a stratum of fine volcanic sand (lapilli) in the core. Whether this caused or contributed to major ecological change is debatable. Neither volcanic sand nor ash is apparent in the archaeological stratigraphy of the Mele Havea site, nor does traditional history describe a devastating event of this nature. The Finemui Zone 5 pollen record, on the other hand, is as easily explained by an expansion of agricultural field systems resulting from population growth on a very small land base.

My original objectives, and the stimuli for the 1996 palynological project, relate to first Lapita settlement, the scale of agricultural production, and the impact this might have had on island ecology. The coring projects at Lotofoa and Finemui swamps, and subsequent analyses of the data, are substantial efforts by John Flenley and his Massey University team. The Finemui core suggests little to no change or anthropogenic effects on the Ha'afeva Island interior for the first millennium of occupation at the Mele Havea site. And even after subtle changes began to appear, it was not until sometime between the 8th and 10th centuries AD that the contemporary pattern of open field systems is evident in the palynological record. The interpretation of low-level agricultural production as I suggest in earlier chapters for Hopoate, and other Lapita sites on the lagoon on Tongatapu, seems to stand true. The compression of Zone 5 sediments within the upper 37 cm of the Lotofoa core is regrettable, in that it excludes additional insight into the chronology of human induced environmental change. That this did occur on a substantive level is readily apparent in the pollen record of Zone 5 as it exists, and in the Foa Island landscape as manifest today.

Ha'apai in Retrospect

It has been almost 25 years since I sat on the jetty in Pangai waiting for the interisland ferry MV 'Olovaha while contemplating the results of our assorted field projects in Ha'apai. The task ahead, as I earlier state, was to give these data interpretive substance. I must admit it has been a far longer haul than anticipated, intervening publications notwithstanding. I have always believed that the test of any archaeological project, and its value, is the degree to which new knowledge is created, and whether that knowledge contributes to a greater understanding of the past, either in the sense of history, or through better understanding of the processes underlying that history. Different segments of this chapter provide highlights of these accomplishments, and I leave it to the reader to assess as they may.

Of the discoveries and conclusions presented for Ha'apai, the most important for me is the radiocarbon chronology, and the sustained effort to get that right. This chronology provides the essential framework to which everything else relates. We have been fortunate in this for the acquisition of high precision U/Th dates on coral artifacts. These provide a reliability check for the radiocarbon record, but they tighten it substantially when dates are input into Bayesian statistical analysis. The expansion of Lapita peoples from Tongatapu into Ha'apai began by 822 BC and, no later than 776 BC, it ended abruptly with the disappearance of decorated ceramics (Burley et al. 2015). This provides a 46-year maximum duration for the six Lapita colonising hamlets and their associated assemblages of decorated ceramics.

If there is a second, extraordinary outcome of the Ha'apai excavations, it is the exceptional quality of the faunal record and the insight this provides. The Lapita subsistence economy in Ha'apai was heavily dependent on the exploitation of a wide range of available resources, particularly those foraged or fished from the reef. Colonists brought with them a horticultural complex, including tree crops, but it is hard to frame their endeavours within the notion of Neolithic agriculturalists where land clearing and crop production are central concerns. John Flenley's pollen data from Finemui swamp illustrates this. The impact of the Lapita colonists on a pristine ecology was instantaneous nonetheless, marked by repetitive extinctions or extirpations of terrestrial bird species, the extinction of an indigenous iguana, as well as notable depletions in sea turtle stocks. They create, as David Steadman suggests, a blitzkrieg type event that is contained within the 46-year window of Lapita occupation, or perhaps even less.

Beyond faunal remains, I have spoken little about the artifact assemblages recovered from the five Lapita site excavations in chapter discussions. The number of ceramic fragments from each is large, with a cumulative total approaching 100,000. Of these, over 3,100 have some type of Lapita decorative application including dentate stamp, incision, shell edge impression, applique modelling, or notching (Burley et al. 2002). When decorative motifs can be defined, typically they are of the open curvilinear/geometric design system described by Green (1979) as Eastern Lapita. Occasionally more complex designs occur, as was illustrated earlier for the Mele Havea site. Decorated vessel forms include a range of bowls, jars having out-turned rims, and jars with collared rims, many having carinated (sharp-angled) shoulders. In all of this, there is notable consistency between sites, as we might expect given the limited time depth for Lapita in Ha'apai and the anticipated interactions between Ha'apai potters. One exception is a ceramic piece excavated from the Faleloa site in 1992 (Fig. 5.24). It is a 30 cm diameter collar-like form with inverted rims occurring on both the top and bottom. Being hollow, we assumed it was a pot stand in which some type of vessel was placed. Recently, Patrick Kirch and Scarlet Chiu (2022:298) identify a hollow "ring" from excavations at the Talelpakamalai site as a Lapita ceramic drum. Though of a different form than the Faleloa specimen, it provides an alternative possibility.

A collective of 577 non-ceramic artifacts exists for Lapita-age deposits in Ha'apai, with the majority offering few insights into day-to-day activities or Lapita culture *per se*. Shell valuables, including bracelets, circlets, rings, beads, long units, and a few other items, account for a third (n = 183) of the excavated non-ceramic assemblage. These typically are given prominence in archaeological interpretation as status markers or as items for trade. In Ha'apai, or for that matter in Lapita sites throughout Tonga, there is little evidence to support either beyond assumption. The number of preforms and amount of shell debitage also attest to local production of these artifacts. There is some evidence to infer long-distance interaction or possibly even trade, however. Volcanic glass flakes occur in the Lapita assemblages of the Pukotala site (n = 2) on Ha'ano Island and Faleloa site (n = 1) on Foa Island in northern Ha'apai (Burley et al. 2011:2629). As I review in the coming chapter, the source for this material is to the far north on Niuatoputapu.

Figure 5.24. Ceramic collar from the Faleloa site, Foa Island. This specimen may have served as a pot stand or alternatively as a ceramic drum.

At the outset of the project in 1995, I had high hope for finding fish hooks and other forms of fishing gear, given the abundance of fish bone present in our excavations at Faleloa. That optimism was far from met. In Lapita and Polynesian Plainware deposits combined, there are single fish hooks from each of Mele Havea, Vaipuna, Tongoleleka, and Pukotala sites, and a single fish hook preform from Faleloa (Fig. 5.25) (Burley and Shutler 2007). All but one is manufactured of pearl shell and as a group, they are small, clearly being designed for the in-shore fishery. The point of a shell trolling lure (*Trochus* sp.) also was recovered in 1995 from Lapita deposits at the Vaipuna site (Fig. 5.26). This is part of a two-piece composite form, all but identical to those collected in the 18th century by James Cook (Kaeppler 1978b). The origin for the two-piece trolling lure rig is argued to be East Polynesia, the lure being a later innovation making its way back to the west (Kirch and Green 2001:140). Clearly this is not the case. Finally, and while there is no arti-fact *per se* to prove the point, there is indirect evidence for the use of fish poisons (*'aukava*) as continues to occur in Ha'apai

Figure 5.25. Shell fishhooks recovered from Ha'apai Lapita sites—a Vaipuna site, 'Uiha, b Tongoleleka, Lifuka, c Pukotala site, Ha'ano. Scale: c has a maximum length of 2 cm.

today (Vaea and Straatmans 1954). That evidence is the many thousands of bones from aquarium-sized fish collected from our 1.6 mm sieved samples.

As a final note for consideration of Lapita archaeology in Ha'apai, I must return to the configuration of its settlement landscape. The six Lapita sites are small, they are strategically positioned on the leeward reef, and they are homogeneous in their composition. They were hamlets, where a population of no more than two to three families had come to reside. The bounties of Ha'apai were ample, and they well-supported settlement as abundantly represented in the archaeological record. These bounties, we might assume, were the attraction, the underlying incentive for expansion as predicted in Les Groube's "Strand Looper" model discussed in Chapter 2. Yet the nature and distribution of these sites gives room for thought. The Ha'apai settlements are dispersed, with individual sites on individual islands simultaneously

Figure 5.26. Two-piece composite trolling lures. Upper specimen is manufactured from the base of a trochus shell. It was recovered from a Lapita context at Vaipuna, 'Uiha. Lower specimen is a 19th-century example from Ha'apai. It has a turtle shell point mounted on a pearl shell shank.

settled by very small groups. These hamlets were not just isolated from the homeland on Fanga 'Uta Lagoon, but for day-to-day interactions with each other. Why was it not a centralized aggregation for first settlement, where the course of social engagement, and the dynamics of community cooperation would serve to negate the isolation of a Lapita founder colony? Island size, geography, nor resource availability were inhibiting factors. This pattern of small hamlets dispersed throughout Ha'apai suggests a territorial presence that is planned for maximum dispersal. It in fact seems a predefined strategy where territorial claims are critically embedded. It is a pattern, as I note in previous discussion, harkening back to Robert Ardrey's (1966) concept of the "territorial imperative." This same pattern characterises the Lapita settlements of Vava'u, as I examine in the chapter to follow.

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Chapter 6

Vava'u and the Northern Frontier

As much as Ha'apai is geographically different from Tongatapu, Vava'u is spectacularly unlike neither (Fig. 6.1). For many of the "yachties," backpackers, and others who have discovered these islands, they are as close to a tropical paradise as one can begin to imagine. Calm sheltered harbours, blue-green lagoons, white sandy beaches, numerous offshore islets, steeply rising slopes covered in rich verdant foliage, and breath-taking scenery with humpback whales breaching offshore are but a few of the images that come to mind. I spent two weeks in Vava'u on my first trip to Tonga in 1989. As with Tongatapu and Ha'apai, I was there to search out sites recorded by William McKern in the 1920s. I was also there to gain a sense of the place for further archaeological consideration. Based out of Neiafu, the group's principal town, my time in Vava'u was informative, and I made lasting contacts and valued friends. That trip, however, highlighted logistical and other difficulties of working in these islands. Even finding archaeological sites already recorded was often problematic. I made the decision to initiate research in Ha'apai in 1990, but Vava'u was not forgotten. I returned often over the next decade, more for a sojourn than work, but always with interest in the archaeological landscape.

My Lapita-related research between 1998 and 2001 had shifted from Ha'apai to Tongatapu. Previously known sites were relocated, additional survey was undertaken, Bill Dickinson mapped the lagoon paleo-shoreline and, as I outline in Chapter 4, excavations were conducted at Ha'ateiho. It was during this latter proj-

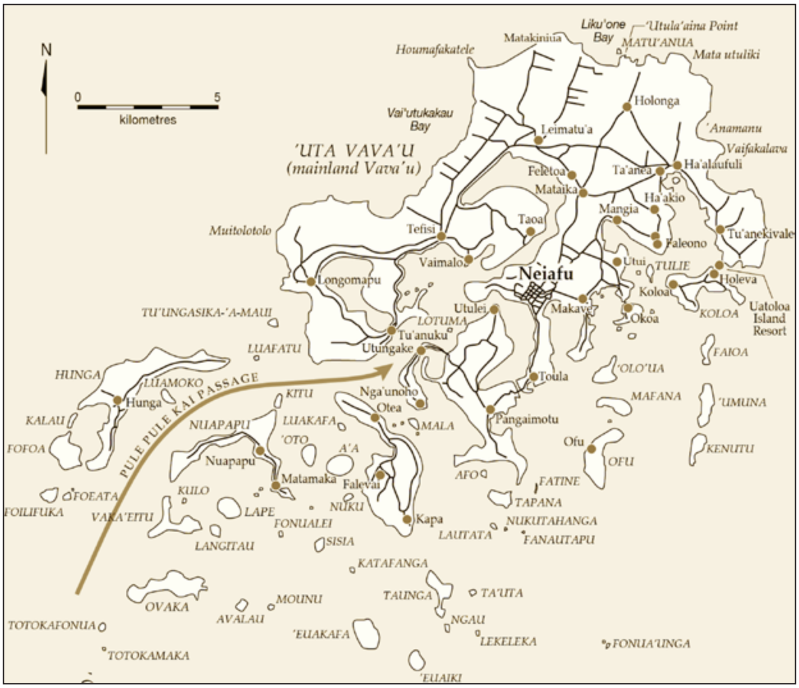

Figure 6.1. Principal islands of Vava'u. Adapted from CAP 00-315, CartoGIS Services, Australian National University, under Creative Commons BY-SA License.

ect that I received an invitation to tea by Her Royal Highness, Princess Sālote Mafile'o Pilolevu. After the formalities and small talk of such an event, the Princess described her efforts in establishing a museum as a gift to her father, HRM Tupou IV. The Museum was being housed in a building at the Tongan National Centre at Haveluloto. My summons had not been a social occasion, the Princess was requesting a permanent archaeological exhibit with a focus on the first Tongans. There was no hesitation, it is hard to refuse a princess. The Prime Minister (now HRM Tupou VI) officially opened the exhibit in July of 2001 with an invited audience of diplomats and high-ranking officials (Fig. 6.2). The display took up a wing of the small Museum building, incorporating eight wall-mounted interpretive panels with Ton-

Figure 6.2. Opening of the Lapita exhibit at the Tongan National Centre Museum, July 2001. HRM Taufa'ahau Tupou VI (then Prime Minister) is speaking with the author about the displays. Photo by Pesi Fonua, Matangi Tonga online news, with permission.

gan text translations. Ten museum cases of archaeological materials were presented in support. We had accumulated considerable collections from Tongatapu and Ha'apai for the display, and the storyline seemed secure. Missing in all of this, and demonstrably so, were the islands of Vava'u. It was time to turn our archaeological focus northward.

I submitted a Social Sciences and Humanities Research Council of Canada proposal to study the Lapita settlement of Vava'u in October 2002. Beyond McKern, the only sustained archaeological survey of these islands had been done in 1969 by Janet Davidson, then of the Auckland Institute and Museum. She (1971:37) reports surface ceramics in "most of the areas searched" but could identify few deposits with remains *in situ*, and only one where a decorated Lapita sherd had been found. Vava'u, literally, was a blank slate in terms of ceramic period prehistory. To accentuate that metaphor, the several forays I had made into Vava'u in the 1990s had results little different from Davidson's. Yet, and with a small amount of trepidation, I was confident that the sites were there; they just needed to be found. I received notification that the Vava'u proposal had been funded in March 2003. Archaeological survey was to start immediately with follow-up excavations and survey planned for 2004 and 2005. Adding in other commitments, not the least being host for the 2005 Lapita conference in Tonga, I had set a hectic schedule. Yet the archaeological field programs were in Vava'u, it was truly hard not to smile.

The Vava'u study was successful, as is described in the sections to follow. Our initial survey did find sites with decorated Lapita ceramics, and four were excavated in the ensuing years. A number of Polynesian Plainware sites similarly were recorded. The recovered data provide a chronology for first settlement, and we have gained an overall understanding of life at first landfall. We also discovered that the circumstance of Lapita people in Vava'u was different from that further to the south. Vava'u does not have the richly endowed reefs of Ha'apai, and the lagoon and inshore fishery is more limited as well. For all its beauty, Vava'u seems to have been a landscape with relative shortfalls. The Lapita population was small, and settlements were restricted in their location. The limited nature of the population continued through the Polynesian Plainware phase. Janet Davidson's survey results had indeed been an accurate reflection.

My confidence in finding early sites in Vava'u was based on the knowledge that Lapita exploration and migration had continued even further to the north. In the late 1970s, Patrick Kirch (1988) excavated the site of Lolokoka on Niuatoputapu island where, among other materials, he recovered an assemblage of dentate-stamped decorated ceramics. Lapita peoples on Niuatoputapu had discovered a source of volcanic glass, a poor grade of obsidian valued for stone tool manufacture. This material was then traded or given to Lapita settlements in the south, where it has been recovered in Lapita sites of Ha'apai and Tongatapu. And

300 km beyond Niuatoputapu is Sāmoa, where another Lapita settlement had been documented at Mulifanua on 'Upolu. Mulifanua ceramics are all but identical to those excavated in Ha'apai (Petchey 1995). In both cases, and like Vava'u, the population of these islands seems ephemeral in their initial phase of settlement. Lapita migration into Niuatoputapu and Sāmoa, and implications for the emergence of ancestral Polynesia, are additionally examined as another aspect of the northern frontier.

Geographic Intricacies of Vava'u

The Vava'u group consists of 71 islands, positioned 100 km northeast of Ha'apai. The islands predominantly are raised coral limestone formations of quite variable size with smaller sand cays scattered to the south. The volcanoes, Fonualei and Toku, are positioned along the Tofua volcanic arc to the north while Late occurs to the east. 'Uta Vava'u is the foremost island in the group with a land area of 89 km^2. It also is the second largest landform in the Kingdom. As Vava'u uplifted and emerged from the ocean 2.5 million years ago, 'Uta Vava'u tilted southward with northern elevations now raised to heights of 200 m or more. Its landscape, as a result, is unique. The northern coastline is scalloped, with in-cut bays backed abruptly by cliff or steeply sloped inclines. The upper plateau undulates as it grades southward toward an irregular coast and closely positioned islands (Fig. 6.3). The south coast configuration is extraordinary, with geologist Peter Roy (1990:27) describing it as "ria-like" in appearance (Fig. 6.4). Ria refers to the submergence and drowning of valley systems as they open to the sea. Constrained shorelines and fjord-like inlets of 'Uta Vava'u fit that portrayal well. The remaining islands of Vava'u are collectively grouped as Vava'u Tahi. Some, such as Pangaimotu, Kapa, and Hunga are quite large. The majority, though, are strewn outward, with ever diminishing size as they stretch toward Ha'apai.

Figure 6.3. View to southeast from Mount Talau, 'Uta Vava'u. 'Utelei village (Pangaimotu) is in the foreground with Neiafu inner lagoon, 'Uta Vava'u, Mafana and Ofu islands in the distance.

Figure 6.4. 'Uta Vava'u, "ria-like" inlet with upper northern plateau in background.

The coral limestone islands have a karst topography, where limestone dissolution has altered both surface and underground core (Dickinson and Burley 2007:238–239). Solution caves along the coast are common, some of quite significant scale. Swimming into the domed inner chamber of Swallow's Cave on Kapa Island, or diving through the constricted underwater passage of Mariner's Cave on Nuapapu Island are among the more exciting tourist attractions in Vava'u today (Fig. 6.5). Occasional sinkholes and depressions similarly characterize the karstic landscape. The largest is Ano Lake on the western side of 'Uta Vava'u. This is a 2 x 1.5 km land-locked, brackish-water cistern formed from a doline (funnel-shaped depression) with subsurface drainage. Other landscape features include linear ridges, isolated hills, and variously eroded benches. Vava'u soils are heavily weathered andesitic tephras, as is the case elsewhere in Tonga. Most are *kelefatu* soils, friable loams or clay-loams with reasonable agricultural potential (Crane 1992:108). Parent materials originate from at least two episodes of volcanic eruption along the Tofua volcanic arc (Orbell et al. 1985). A brilliantly red tephra accumulation over limestone can be up to 10 m thick (Fig. 6.6).

The uniqueness of Vava'u geography relative to Tongatapu and Ha'apai is enhanced by its position on the edge of the equatorial climate zone. Temperatures are warmer, and rainfall is considerably greater than is the case to the south (Thompson 1986). Greater ecological variation is a consequence, especially as it relates to vegetation diversity within the tropical lowland rainforest (Fall 2010). The natural flora of Vava'u would have been lush and the understory thick on first landfall. Our survey on the southern uninhabited island of Fua'motu in 2003 found it impenetrably so. The reef systems of these islands are complex, ranging in distribution, exposure, drop off, sediment accumulation, wave energy, and productivity (Holthus 1996). As a general observation, reef development is most extensive to the east and south of the group. This includes barrier platforms between Ovaka and 'Euakafa islands with others south of Pangaimotu and the eastern island screen of 'Umuna and Kenutu. The scattering of islands

Figure 6.5. Swallows Cave, Kapa Island.

even further to the south have more limited fringing and patch reef presence.

The population of Vava'u today is centred largely on 'Uta Vava'u where, other than the town of Neiafu, 17 villages are dispersed across the island. Eighteen additional villages occur on 13 other islands in Vava'u Tahi. Only Koloa, Pangaimotu, 'Utungake, Kapa, and Nuapapu have more than one. Major road systems now occur throughout 'Uta Vava'u providing ease of access to virtually all parts of the interior and coast. Via causeways, these extend to Pangaimotu, 'Utungake, and Koloa islands. Boat travel to most other islands is facilitated by their proximity. Southeast trade winds predominate between May and September with wind patterns from the northeast through the remainder of the year. The predictability and seasonality of winds locates Vava'u as an intermediate stop on a travel corridor linking Tongatapu to Sāmoa. Travel along this corridor has been commonplace throughout the Tongan past.

Figure 6.6. Andesitic tephra exposure, Ene'io Beach, 'Uta Vava'u

Survey 2003

I earlier describe Vava'u as a blank slate for ceramic period prehistory prior to 2003. William McKern (1929) failed to find "kitchen middens" during the Bayard Dominick expedition of 1920 to 1921. Les Groube (1971:293) fared no better in 1968, stating that it took him "several days before a single highly eroded sherd was recovered." And while Janet Davidson (1971) was able to report 17 ceramic period sites, few had *in situ* archaeological deposits, and none had been given test excavation. I, too, had visited Vava'u on several occasions in the early to mid-1990s with no more than the occasional degraded ceramic sherd found on the surface. In 1998 my efforts became more focused when I was asked to carry out an archaeological survey of Taunga and 'Euakafa islands. These constitute the chiefly estate of 'Akau'ola, then Minister of Fisheries, who was planning an ecotourism development (Burley 1998). Archaeological remains of the later

Tongan chiefdom are abundant; an earlier ceramic period occupation was represented in total by two undecorated sherds on Taunga. I decided to return to Vava'u in 1999 for another two-week project, planning to relocate the more promising pottery scatters reported by Janet Davidson. With limited exception, the outcome remained the same, despite survey efforts expanding into the larger islands of Pangaimotu, Nuapapu, Ovaka, and Hunga. As discouraging as these ventures might seem, they did provide insight for the planning of our archaeological mission between 2003 and 2005.

Of the insights gained through experience in Vava'u, certainly the most important relates to sea level and paleo-shoreline relations at the time of initial Lapita presence. A standout feature throughout Vava'u, and one easily observed across most coral limestone islands of Vava'u Tahi, is the absence of emergent paleo-shoreline notches. Rather, there is but a single solution notch that has been cut, and continues to be cut, by tidal action into shoreline cliff faces (Fig. 6.7). Since sea levels were as much as 2.5 m higher in the mid-Holocene, the absence of a higher solution notch appears anomalous. This can be accounted for only by subsidence of the Vava'u structural block at a rate equivalent to sea level fall (Taylor 1978). That rate is estimated to be 0.5 mm per year with caution that sea level decline and subsidence may not always have been in tandem (Dickinson et al. 1999:695). For archaeological survey of Vava'u, the critical point is that coastal topography and shorelines first encountered by Lapita canoes are effectively the same as exist today. Our eventual discovery of Lapita-age settlements on island back beach features in immediate proximity to the coast provides substantive validation.

The 2003 survey had a single objective without an overly elaborate research design. The minimum goal was to identify three ceramic period sites for excavation in subsequent years of the project. Our focus was on initial Lapita settlement, but a Polynesian Plainware site also was sought. These would provide insights into regional adaption and allow for comparison

Figure 6.7. Single paleo sea level solution notch, Kapa Island.

to Ha'apai and Tongatapu. Seven weeks of field time (1 May to 23 June) was scheduled with expectation that 'Uta Vava'u and other of the larger islands could be systematically surveyed as well as many smaller ones. Survey was guided by two observations to be implemented with understanding of the 3,000-year-old paleo-shoreline. First, Lapita peoples were maritime focused, meaning settlements needed reasonable access from the water for landing and beaching canoes. Second, site data from Tongatapu and Ha'apai emphasises the importance of a foraging reef, where shellfish, fish, and other resources could be exploited. Beyond these considerations, and equally important for project success, I employed two individuals I had known and worked with since my first trip to Tonga in 1989, Peau Halahingano and Tenisi Tuinukuafe. Peau is from Pangaimotu, well known in Vava'u and well-skilled in organizing logistics; Tenisi has an eye for finding ceramics far better developed than my own (Fig. 6.8). 'Aukau'ola had been appointed Governor of Vava'u, all but guaranteeing a

Figure 6.8. Tenisi Tuinukuafe (left) and Peau Halahingano waiting for boat transport 2003.

free range of the islands with his support. There were no impediments, but we still had to find the sites.

My archaeological career has spanned 50 years with some type of field project in virtually all. The 2003 survey project in Vava'u, without qualification, has been my most enjoyable. Our home base was Neiafu, with accommodation at Fungamisi overlooking the harbour and Mermaid Bar (Fig. 6.9). The Mermaid, a self-proclaimed yacht club, was no more than a tin roofed platform over the water, anchored to a narrow fringe of reclaimed shore. It became our pickup point for boats into the islands, and a venue where critical connections were easily made. Peau had a workable van, and an unending number of boatmen willing to ferry us about. The most difficult decision for any given day was the selection of an island to survey as we were about to set off. For islands somewhat further afield, and to expedite travel time, temporary accommodations were easily acquired. And if the sea

Figure 6.9. The Mermaid, with 2003–2004 Fungamisi field accommodation on upper story of house on the centre right. The Mermaid sadly caught fire and was razed on May 10, 2011.

was rough, our attention turned to the systematic study of 'Uta Vava'u. In all of this, it was a straightforward process to target accessible bays and shorelines across a seascape of islands where much of the shore is cliff or steeply sloped. The bucket auger, as the case for Ha'apai and Tongatapu, was an invaluable tool, providing subsurface exposure where none appeared present.

The survey was extensive, including 23 islands in Vava'u Tahi, 'Uta Vava'u, and a substantially exciting day trip to the volcanic island of Late. Suffice it to say that Late is not the easiest island to get on to or off from. Island reefs played a large part in our decisions for initial survey coverage, particularly the expansive reef system extending in the east from Koloa southward. This integrated two island chains with Okoa, Olo'ua, Mafana, and Ofu to the west, and Kaloa, Faioa, 'Umuna, and Kenutu defining the eastern outer coast. Kapa has relatively limited reef but, being an island with expected *in situ* ceramic deposits, and a locale where Janet Davidson had found a decorated sherd, it was prioritized for survey and testing. Success for the 2003 survey was almost immediate. Decorated Lapita ceramics were recovered from five sites, *in situ* Polynesian Plainware sites were recorded in 12 locales, and scatters of undecorated pottery were found in 20 other cases (Fig. 6.10) (Burley 2007a). Test excavations were undertaken at eight sites to assess the depth and integrity of their archaeological remains. Bill Dickinson also joined us in 2003 to refine our understanding of Vava'u geology (Dickinson and Burley 2007:252–253).

The context in which ceramic period sites occur in Vava'u is sharply defined by the areas in which survey efforts failed. Quite notable in this was 'Uta Vava'u, an island accounting for 65% of the Vava'u land base, and most of the contemporary population. Survey here included considerable effort to examine the outer and inner harbour areas of Neiafu, all areas with accessible beaches by road or from the water, and all the contemporary villages with proximity to the coast. Intensive pedestrian survey, examination of excavated pits and ploughed or planted gardens, and use of auger testing was the norm. In some cases, we returned to highly ranked locales to be sure something had not been missed. The results were bleak. These included two, spatially restricted, Polynesian Plainware sites, with isolated finds of ceramic sherds in three other locations. Similar results occurred on the larger islands of Hunga and Nuapapu to the west, where only single undecorated sherds were recovered on each. This, admittedly, was a slight improvement over the 1999 survey when nothing was found. Most surprising in 2003 was our failure to locate a ceramic period site on Ovaka. Ovaka occurs on the northwest end of an extensive reef system and has shoreline accessibility on the east and south coasts. The island, accordingly, was rated high relative to research design considerations. Successive surveys on Ovaka in 1999, 2003, and again in 2005, in fact, failed to find even a single degraded pottery sherd. The results are not just unexpected but baffling as to why this island had been shunned. Not surprising is the absence of ceramic period sites on several of

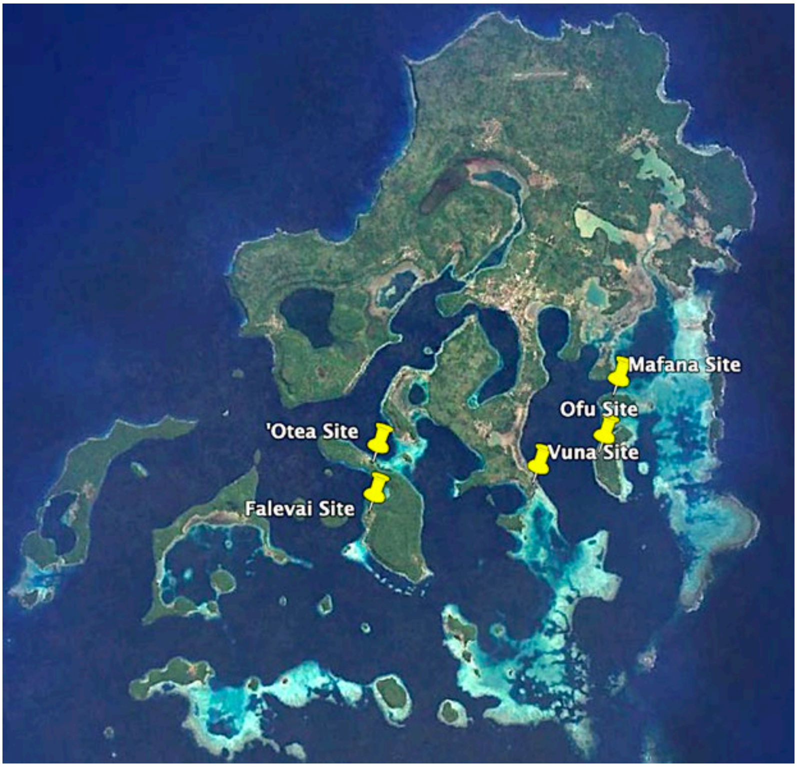

Figure 6.10. Lapita site locations recorded during 2003 survey of Vava'u. Google Earth image.

the smaller isolated islands to the south, despite the presence of fringing reefs.

Survey success, alternatively, was high on the eastern chains of islands, on Pangaimotu and on Kapa. Decorated Lapita ceramics occurred on Mafana and Ofu, on the south end of Pangaimotu, and at 'Otea and Falevai villages on Kapa. Ten of the Polynesian Plainware occupations with deposits *in situ* are located in this vicinity as well. Areas with survey success, in juxtaposition to survey failure, are informative. Vava'u had been settled early, but with settlement focused, if not exclusively so, on the islands south and southeast of 'Uta Vava'u. Survey results additionally are revealing for the location of individual sites. Lapita settlements did occur in the general proximity of foraging reefs, but not necessarily in optimal locales. Each, instead, is adjacent to a wetland feature where, it is assumed, taro could be planted without concern for rainfall patterns (Fig. 6.11). Palynologist Pat Fall (2010) conclusively documents Lapita-age taro pollen from the Avai'o'vuna swamp adjacent to the Vuna Lapita site on Pangaimotu. The Lapita settlement of Vava'u had been strategic but where the strategy emphasized a concern for food production in gardens with more limited dependence on natural resource exploitation.

Polynesian Plainware phase sites in Vava'u occur either as a continuity of Lapita settlement at Ofu, Otea, or Falevai, or they continued to be concentrated on islands to the southeast. The limited number of sites and their distribution again is instructive. The founding Lapita population in Vava'u did not grow appreciably in size in the subsequent Polynesian Plainware phase. Site distribution further indicates a constricted rather than expanded settlement landscape. Both situations are in marked contrast to simultaneous events occurring on Tongatapu and the islands of Ha'apai, where population and settlement growth were substantial. It is conceivable that deeply buried sites have been missed or that numerous scatters of surface ceramics have gone unrecorded in inland areas, especially on 'Uta Vava'u. That will remain for someone else to address. For the present, I can only conclude that the archaeological record of Vava'u is as different from Ha'apai and Tongatapu as is the physical geography of this island group.

The Lapita Settlements of Vava'u

Our survey had been successful in its discovery of four new Lapita sites and the verification of *in situ* Lapita deposits at the 'Otea site, on Kapa Island. Each of the five shares the common presence of a wetland or swale but with individual variations in their

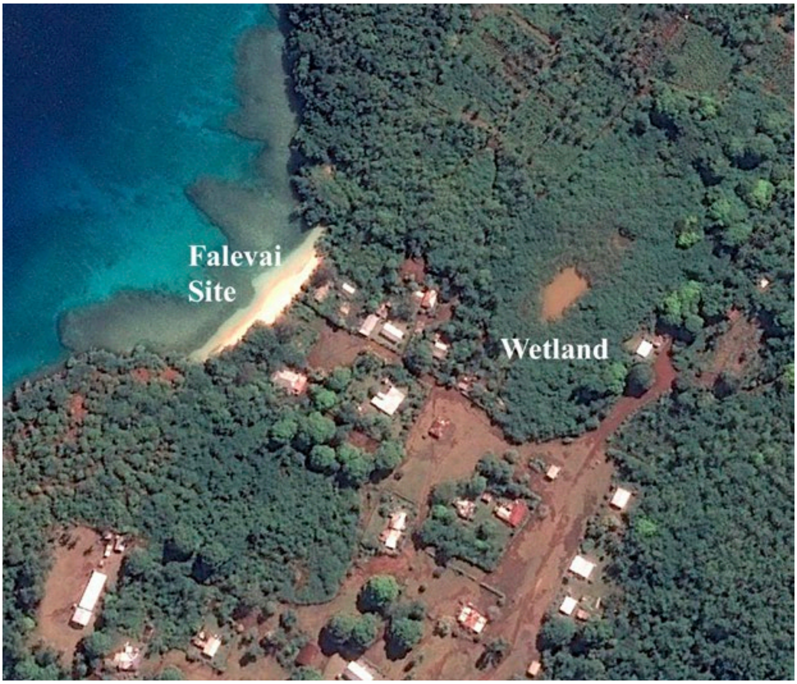

Figure 6.11. Falevai Lapita and Polynesian Plainware Site with adjacent wetland, Kapa Island, Google Earth image.

nature and context. We carried out test excavations at each in 2003 to give preliminary insight into stratigraphy, disturbances, cultural materials, and fauna. Auger probes were used to assess site size and the depth of deposits. These data were critical to the formulation of research designs and excavation strategies as they would be implemented in the following years. The first excavation was undertaken at the Vuna site on Pangaimotu in 2004. This was carried out in tandem with another Simon Fraser University field school involving 19 students and assistants. Subsequent projects were undertaken at Ofu, 'Otea, and Falevai the following year (Fig. 6.12, Fig. 6.13). Our initial testing at the fifth site on Mafana island indicated a small occupation on a back-beach ridge with complex stratigraphy and evidence for disturbance. Further study here seemed futile.

Figure 6.12. Area excavations and sieves at Ofu Lapita site 2005. View to west and leeward beach.

Excavated sites varied in their occupation sequences, with implications for culture historical interpretation and comparisons. The Vuna site, for example, was abandoned during or at the end of the Lapita phase, leaving it without overlying Polynesian Plainware deposits. The site, though, had a much later occupation in the 13th or 14th century AD, and then near the end of the 17th century AD. In the latter case, traditional history records it as the compound of the Tu'i Vava'u, Vuna, the namesake for both location and the site.[14] The Falevai site on Kapa Island has a quite different timeline where the Lapita occupation is ephemeral with fewer than 50 decorated sherds, and very late in the Lapita phase (Connaughton 2007). There is, however, a substantial Polynesian Plainware phase deposit, one significant for

14 The area name is Avai'o'vuna, literally translated as water of Vuna. This may be in reference to a large conical chiefly bathing well at the site or the adjacent freshwater swamp referred to in text as Avai'o'Vuna.

Figure 6.13. Profile of ʻOtea Lapita site excavations 2005 with Sean Connaughton serving as scale. Large pits in bottom are indicative of specialized activities. The Lapita stratum is isolated to the bottom 40 cm of deposit with much of the upper matrices being slope wash.

insights into Lapita demise and the post-Lapita transition. Sean Connaughton (2014) centred his PhD dissertation on this site with focus on the emergence and development of ancestral Polynesian society in Tonga. The ʻOtea site has a full Lapita through Polynesian Plainware sequence, but where large and complex pit excavations in the bottom suggest specialized activities. The site also is buried deeply by 80 to 90 cm of slope-washed sediments flowing from the southeast. Only Ofu has the typical context found in sites throughout Ha'apai and on the Tongatapu lagoon in its uninterrupted continuity from first Lapita settlement into a contemporary village.

Five radiocarbon and a single U/Th date on a coral file initially were acquired for Lapita occupations at Ofu, Vuna, ʻOtea, and Falevai (Burley and Connaughton 2007). These were integrated into a Bayesian model in 2014 to provide a more statistically precise chronological estimate for first settlement in the group (Burley et al. 2015). This was estimated to fall between 855 and 730 BC at 68.2% probability with a caution that the number of dates was few. Three other U/Th measurements on coral files from 'Otea and Vuna subsequently were acquired. Their integration into the model shifted the range to between 901 and 806 BC[15] (Burley et al. 2021). In both cases, there is overlap with first occupation in Ha'apai, this occurring between 822 and 766 BC as earlier given. There is little doubt that the first people into Vava'u are part of a single, intentional, migration stream emanating from Tongatapu early in the 9th century BC. And like the case in Ha'apai, there is no temporal distinction between initial Lapita sites at Ofu, Vuna, and 'Otea. These hamlets were individually and intentionally positioned on separate islands in a way that would lay claim to Vava'u.

Excavations closely followed protocols established for Ha'apai and Tongatapu. Among these was use of a block area strategy, use of nested sieves with 6.4 mm and 3.2 mm mesh, and for the most part, use of small hand tools for excavation. Site size estimates varied from Ofu and Vuna at 1,500 m^2 to a more constrained occupation of 600 m^2 at Falevai. The 'Otea site on Kapa proved the most difficult to excavate extending with features to 3.0 m below surface. Ofu, with its Lapita occupation being no more than 1 m in depth, was the most straight forward. The 2004 and 2005 projects recovered a large volume of material, including an integrated ceramic assemblage in the range of 65,000 specimens; over 2,000 of these sherds are decorated Lapita wares. Also recovered were 600 or so non-ceramic artifacts as well as faunal assemblages, including an abundance of fish and bird species. As collections and gear were being shipped from Neiafu to Tongatapu in 2005, I again felt a sense of accomplishment. We had cracked Vava'u, and we had attained an

15 Here I incorporated an earlier date on unidentified wood charcoal from Ofu that, in the initial analysis, was identified as an outlier and omitted. This accounts for the earlier date range.

archaeological data set for Lapita expansion throughout the archipelago.

The decorated Lapita ceramic assemblages from Ofu, Vuna, and 'Otea are similar in form and in decorative application and motifs (Fig. 6.14). They also are identical to Lapita ceramics from Ha'apai and later Lapita sites on the Tongatapu lagoon. Dentate stamping is the dominant decorative technique on over 70% of the sherds but where incision, shell impression, appliqué modelling, and notching also are common. The use of slips as a surface finish is particularly notable, more for the use of a bright red clay tephra wash, than its relative abundance. The majority of the decorated sherds are small fragments where it is possible to identify decoration but say little else. Where motifs or motif variants can be recognized, they are simplified, open-spaced, curvilinear, or rectilinear forms. At Vuna, a site without an ensuing Polynesian Plainware phase, decorated sherds account for a little over 3% of the assemblage. This is typical for late Eastern Lapita ceramic assemblages.

Non-ceramic artifacts from Lapita occupations at each site are few in comparison to ceramic collections. Many of these are expedient functional tools such as shell scrapers, coral files, or the like. Many others are shell debitage, this including cut shell or waste debris from the manufacture of shell valuables. All sites incorporate a full range of the latter, including beads, rings, bracelets, Lapita plates, and pendants. Here they are indistinguishable from Lapita settlements across Oceania. There are a couple of artifact types that stand out and are worthy of note (Fig. 6.15). At the 'Otea site I already have described the presence of complex pits dug deeply into the former sand beach on which the site was established. Also recovered from near the bottom of this site is an assemblage of over 20 coral abraders. Several had been grooved across their surface, indicating a repetitive and specialized task. What that task might have been can only be speculated upon, but the density of the coral suggests shell or wood as the material being worked. The second artifact of note is easily identified. It is a triton shell (*Charonia tritonis*)

Figure 6.14. Dentate stamp ceramic motifs recovered from 'Otea site, Kapa Island.

Figure 6.15. Lapita shell trumpet and abrader. Left is a *kele'a* from Lapita levels at the Vuna Site, Pangaimotu Island. Right is a grooved abrader from the 'Otea site, Kapa Island.

trumpet recovered well within the Lapita stratum at the Vuna site on Pangaimotu Island. With a mouth hole cut into the neck of the apex for blowing, this is a *kele'a*, a horn well-capable of sending signals, an alarm for danger, or as a trumpet blown in war. It also could be used as a musical instrument (Moyle 1987). The Vuna specimen importantly adds this iconic Polynesian artifact to the list of items transported across Tonga on Lapita colonising canoes.

The Lapita sites in Vava'u are tied into the social and economic life of a thinly populated archipelago through inter-island voyaging. X-ray fluorescence geochemistry of volcanic glass fragments from each of the sites illustrates this clearly, their source being Niuatoputapu to the far north (Burley et al. 2011). Niuatoputapu volcanic glass would have been a highly valued commodity, providing a razor-sharp edge for cutting tools. The Vava'u specimens generally are small with a few probably employed as insets into a knife or some other type of cutting tool. Andesitic basalts from the volcanic islands of Tonga also have been analyzed through XRF and other types of geochemistry (Clark et al. 2014). These, unfortunately, are island arc volcanoes with little detectable variation from source to source in Tonga, at least given the approaches currently being employed. That said, Late andesitic basalts may be identified by a light gray-green colour as found in collections from Vava'u, and as observed in beach cobbles during our 2003 excursion to the volcano.

The Paucity of Inshore Fisheries and the Reef

With exception of Ovaka island, the differential distribution of Lapita sites in Vava'u seems related to reefs and reef productivity. The subsistence economy for Lapita peoples on Fanga'Uta Lagoon on Tongatapu, and throughout Ha'apai, was an integrated system of reef foraging, reef/lagoon focused inshore fisheries, and low-level horticulture. The absence or limited scale of reefs in some parts of Vava'u, thus, rendered these areas incompatible with customary practices for Lapita food production. Peter Roy (1997:170) seemed to provide a degree of insight into this, asserting that "low nutrient levels" and "other water quality factors" have led to low biogenic productivity in the western islands compared to those in the east. In an earlier discussion of survey results, and without benefit of completed faunal analyses, I (2007a:93–94) was confident that Lapita sites in Vava'u would continue to illustrate the centrality of foraging and the fishery within Lapita subsistence practices. I note also, however, that the presence of swales or wetlands adjacent to these sites emphasises the elevated importance of aroid cultivation for colonising groups.

Nadia Densmore, a Master's student at McMaster University, agreed to analyze fish fauna from Vava'u as a basis for her thesis (Densmore 2010). Nadia's analysis provides insight into the Lapita fishery in these islands, and a set of data for direct comparison to Ha'apai. Fifteen fish families were identified in the collections, with five being dominant. These include Acanthuridae (surgeonfish), Scaridae (parrotfish), Serranidae (grouper, wrasse), Lethrinidae (emperor), and Diodontidae (porcupine fish) (Fig. 6.16). There is no single pattern for Vava'u with relative distributions varied between sites. The two most abundant fish assemblages are from Vuna and Ofu. At Vuna, emperor fish, grouper, and parrot fish have almost equal representation accounting for 71% of the assemblage. At Ofu, porcupine fish (37%) and groupers (23.5%) are dominant. The abundance of porcupine fish at Ofu is replicated to some extent at Falevai (26.5%) and Otea (19%). The relative frequency of this family is unexpected and seems atypical. In archaeological fish faunas of Ha'apai, they constitute 2.7% or less of identified bone in Lapita assemblages (Cannon et al. 2018). Porcupine fish are small to medium sized with massive spines. When threatened, they inflate into a large spiny ball. Some species are poisonous and, most often today, are taken as a fishery bycatch rather than a targeted species. The Tongan porcupine fish, *sokisoki*, is nevertheless eaten when caught.

A far more important takeaway from the fish data in Vava'u, as emphasized in Densmore's thesis, is its overall scarcity when compared to Ha'apai and elsewhere. When converted to densities of identified bone per 100 L of excavated matrix, the Ofu and Vuna assemblages average 1.2 and 5.2 specimens, respectively (Densmore 2010:36). At Tongoleleka in Ha'apai, the comparable number of specimens per 100 L is 86. The difference cannot

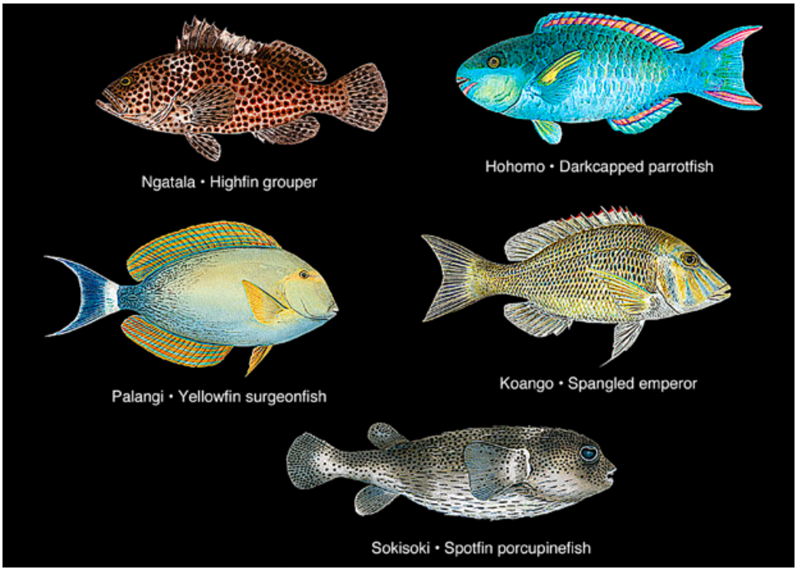

Figure 6.16. Five most common fish taxa in Vava'u faunal assemblages. Extracted from the poster Common Reef Food Fish of Tonga, Secretariat of Pacific Community Marine Resources Division. Illustrations by Les Hata. http://www.spc.int/fame/en/fame-digital-library. Scales are variable.

be a sampling problem. Excavation and screening methods are the same, differential preservation of bone is not apparent, and scarcity occurs across all sites in Vava'u. To Nadia, the Vava'u fishery appeared "casual" and not a "foundation of the subsistence economy" in either the Lapita or Polynesian Plainware phases (Densmore 2010:65). I am not sure it was as much "casual" as perhaps limited in its productivity for large-bodied fish. The relative abundance of smaller porcupine fish may have been an alternative.

The Secretariat of the Pacific Regional Environment Programme (SPREP) funded a rapid biodiversity assessment of the Vava'u group in 2014 (Atherton et al. 2015). The assessment incorporates a range of field studies from plants to coral reefs with 18 authors contributing to the final report. Two of the projects focus specifically on the Vava'u fishery, one broadly examining coral reef fish (Stone 2015) and the other targeting species with commercial, subsistence, or recreational value (Imirizaldu 2015). The fishery studies involved coordinated dives over a period of 15 days with survey of 27 locales associated with 18 islands. Survey sites are scattered with few in the immediate proximity to Lapita or Polynesian Plainware settlements making their results difficult to use. The results, though, are intriguing with possible relevance to the circumstances of Lapita fish faunas in Vava'u. Most notable in both is the documentation of an imbalance in the trophic structure of fish populations across the island group. Acanthuridae (surgeon fish) and Scaridae (parrotfish) are dominant with Serranidae (groupers), Lethrinidae (emporers), and Lutjanidae (snappers) substantially underrepresented (Imirizaldu 2015:145). The former two are herbivores; the latter three are large-bodied carnivore/piscivore predators. The predator/prey relationship is an important one in that it regulates prey species abundance, their distributions, and overall community structure. This imbalance, thus, has resulted in a substantial loss of regional biomass and species diversity. This is amplified further where sizes for some species were found to be smaller than the minimum maturity length. Imirizaldu (2015:145) consequently describes the Vava'u fishery as having "a very narrow variety of small-sized and lower commercial valued species."

Both the Stone and Imirizaldu studies identify over-fishing of predator species as an inherent cause for trophic disparities. It is difficult to argue that fishing would not have considerable impacts over the longer term. Yet, and this is the intriguing part, the data for overfishing are far from conclusive. Vaka'eitu in west central Vava'u, for example, is identified in the study as having a healthy reef with high coral coverage and limited fishing activities. Survey here found almost no fish other than herbivores, a situation Imirizaldu (2015:166) finds "difficult to explain." Coincidentally, the 2003 archaeological survey of Vaka'eitu failed to find even a single ceramic sherd on the island. In contrast, the island of 'Umuna on the eastern island screen has one of the densest populations of piscivore predatory species with these also having a higher average size. A Polynesian Plainware phase site occurs on 'Umuna, and the island faces both Mafana and Ofu to the west. The problems of the Vava'u fishery with its trophic imbalance and lowered biomass may have been present when the first Lapita colonists arrived, as anticipated in fish faunal data from the archaeological record.

Shellfish for each of the Vava'u sites were collected from 50 x 50 cm column samples with provenience maintained by 10 cm levels. Once identifications were complete, the samples were quantified by cultural component. This provides relative insight into what species were being exploited at individual sites at different periods in site history. At the broader scale of trying to compare shellfish productivity between sites or compare trends or patterns to sites in Ha'apai and Tongatapu, the issues become more complicated. The scale of our samples, where they come from on any given site, and how representative those samples are relative to the site as a whole are challenging problems. For Vava'u, though, my overall impression is that shellfish abundance was diminished overall, in some cases substantially so. With one exception in a post ceramic period context at 'Otea, shell is scattered throughout archaeological matrices without concentrated density. The SPREP biodiversity assessment incorporated a study of macro marine invertebrates in which 96 species of mollusca were identified (Bauman 2015). The report does illustrate variable habitats and ecosystems throughout the group with different potentials for invertebrate productivity. This also is apparent in the relative distributions of shellfish taxa recovered from excavated sites.

Of the shellfish columns analyzed, Ofu is the only site where bivalves are more abundant than gastropods, and this is consistent from initial Lapita occupation through to the Aceramic period. *Atactodea striata* and *Anadara antiquata* account for 80% of the Lapita bivalve assemblage at Ofu. Optimal habitats for both are sandy/muddy bottoms on the foreshore and reef. Lapita shellfish species at Vuna, on the other hand, are dominantly gastropods with *Turbo* sp. accounting for 61% of the total shell assemblage. *Turbo* are found on rocky and exposed surfaces in shallow waters of the reef flat. The reef extending off the front of the Vuna site and then southward is of this nature (Fig. 6.17). The 'Otea Lapita assemblage is completely dominated by gastropods (81%) with *Turbo* again being the principal taxa. Giant clams, including *Tridacna derasa* and *Tridacna maxima,* occur in small numbers in all Lapita assemblages with *Tridacna squamosa* also present in the Polynesian Plainware occupation at 'Otea.

Other Faunas on the Lapita Menu in Vava'u

Beyond fish and shellfish, site excavations recovered a range of other fauna reflecting further on Lapita subsistence and its impacts. The assemblages are varied in size with the most abundant again coming from Ofu and Vuna. Turtle, in general, is less profuse than is the case in Ha'apai, but it was exploited, and it occurs in all excavated sites. The more limited number of specimens may suggest a smaller turtle population at first landfall where consequential impacts occurred quickly. This is distinctly illustrated at 'Otea and Ofu with 165 and 105 identified turtle bones present in respective Lapita occupations; those numbers dramatically drop to seven and four specimens in the successive Plainware period. The Polynesian rat, *Rattus exulans,* came northward with settlement expansion. The largest rat assemblage was recovered from Vuna. Fruit bat is present in moderate quantities at Ofu and Vuna but absent on the Kapa Island sites at 'Otea and Falevai. The extinct iguana, *Brachylophus gibbonsi,* occurs in the Lapita levels of Ofu, Vuna, and 'Otea in very small numbers. Its fate, as described for Ha'apai, would be sealed by the arrival of first colonists. And notable again for Lapita and Polynesian Plainware subsistence economies, there are no pigs or dogs in either of the phases. Both domesticates are a later introduction.

The Vava'u faunal assemblages discussed to this point can be appropriately characterized as scanty. There is one component, however, that significantly stands above the rest. This is the num-

Figure 6.17. People foraging on the reef at Vuna, Pangaimotu Island, 2004.

ber and relative volume of bird specimens. At Vuna and Ofu, birds represent well over 50% of the excavated bone, exclusive of fish. The Vava'u birds were sent to paleo-zoologist Trevor Worthy in 2017 for analysis at Flinders University in Adelaide. Trevor is often referred to as "Mr. Moa" for his comprehensive study of New Zealand moa species and their extinction (Worthy and Holdaway 2002). His acknowledged expertise extends well beyond moas. When the bones were shipped to Adelaide, I was hoping to get back a straightforward catalogue with as many identifications as confidently could be made. The catalogue, with 741 successful identifications, arrived in 2018. It was accompanied by a superbly detailed report, including systematic palaeontological descriptions for the identified assemblage. The basics of that report are now published in the *Zoological Journal of the Linnean Society* (Worthy and Burley 2020).

Worthy was able to identify 22 bird taxa for Vava'u, most to species level. This consists of 15 terrestrial species, five seabird species, and two shorebirds. Most abundant within the terrestrial taxa are rails, pigeons, megapodes, and chickens. A small group of passerines (songbirds) when identified will enhance species diversity. The chicken, *Gallus gallus,* was present at all sites in all time periods providing a reliable component to diet. Eight of the terrestrial bird species are now globally extinct. This includes two megapodes, three pigeons, two rails, and a parrot. The parrot, *Eclectus effectus,* may have survived into relatively recent times, as possibly illustrated in a sketch from the Alejandro Malaspina visit to Vava'u in 1793 (Steadman 2006a). It also has been found in excavated faunal assemblages from Ha'apai and Eua (Steadman 2006b).

The Vava'u bird fauna is a significant record, allowing us to identify, name, and describe two new extinct species (Worthy and Burley 2020). The first is a large flightless rail, *Hypotaenidia vavauensis*. We believe this species is endemic to the group, as is reflected in the name. The Vava'u rail has leg bones that are larger and stouter than any other of the *Hypotaenidia* species currently documented. Skeletal elements for *Hypotaenidia vavauensis* were concentrated at the Vuna site where a minimum number of individuals is nine. The second newly identified extinction is a pigeon, among the largest of the *Ducula* genus now documented in the Pacific. We named it *Ducula shutleri* (Shutler's fruit pigeon) in honour of Richard Shutler Jr., and his contributions to our studies in Tonga throughout the 1990s. At least 11 of these pigeons were recovered from Ofu with others present at Vuna and Falevai. This species similarly is identified in bird assemblages from Ha'apai and Tongatapu, though previously unnamed. The skeletal morphology of *Ducula shutleri* indicates it was a capable flier, despite an estimated body mass over 1 kg.

The Agricultural Basis of Lapita Subsistence in Vava'u

The Vava'u faunal record helps to explain the limited population size for Lapita and Polynesian Plainware phase peoples. Without consistent reef foraging and inshore fisheries, agriculture must have been central to the colonisation effort. That each of the Lapita sites is positioned close to some type of wetland or swale appears significant in this respect. In Ha'apai, only two sites, Tongoleleka and Mele Havea, are in proximity to such features. For Vava'u, the Vuna and Falevai sites are close to ponded wetlands while the remaining three are adjacent to intermittent swampy lowlands/swales. All facilitate or provide a well-watered planting matrix for aroid production, regardless of rainfall regularity. In the case of Vuna, Ofu, and 'Otea, the underlying strata of coral sand at these sites might also have supported planting pits of the type described for Hopoate on Tongatapu.

Patricia Fall, a palynologist at Arizona State University in Tempe, received National Geographic funding in 1997 to carry out research on the vegetation history of Vava'u. She selected two sites from which to extract sediment cores, Ngofe Marsh near Ano Lake on 'Uta Vava'u and Avai'o'vuna swamp on the southern end of Pangaimotu island. The latter is located 700 m distant from the Vuna site (Fig. 6.18). Her analysis of the Avai'o'vuna core has proven particularly important for documenting chronological transition in plant communities on Pangaimotu. More important from an archaeological context, she also provides insight on plant introductions by initial Lapita colonists (Fall 2010). Core stratigraphy for Avai'o'vuna is marked by terrestrial clays in the bottom, marine clays superseding, and then peat/organic clays in the upper 90 cm. The latter are characteristic of the sedge wetland environment present today. A single radiocarbon date acquired on the marine clay/peat transition falls within the calibrated interval of 824–545 BC (68.3%) with a median probability of 683 BC.[16] This date spans the age for Lapita settlement at Vuna, and it is a critical horizon marker for vegetation change in the core.

16 The uncalibrated radiocarbon date on organic peat is 2620 ± 80 BP (Beta 114012) (Fall 2005:454). The recalibration here is done using the Calib 7.2 calibration program (Stuiver et al. 2020) and the southern hemisphere calibration curve, SHCal13 (Hogg et al. 2013).

Figure 6.18. Vuna site, Pangaimotu Island and the Avai'o'vuna Swamp from which a sediment core was extracted by Patricia Fall (2005) and analyzed for pollen.

Lapita presence appears distinguished in two ways. First, a count of microscopic charcoal particles was made to provide a successional history. The assumption here is that counts would increase sharply with human presence through land clearing and other activities. This was dramatically documented with estimated numbers ranging from "200,000 to 1,000,000 particles per cm^3" above 0.96 m while charcoal is "absent from sediments deposited below" (Fall 2005:454). Second, Fall (2010) identified a series of plants that are either introduced during the Lapita temporal interval or where pollen counts notably increase. Most important of the former is taro, *Colocasia esculenta.* This is a "canoe plant" (after Whistler 2009), brought to Tonga by Lapita colonists as an agricultural staple as earlier described for Hopoate. Also appearing at this time is ti, *Cordyline fruticosa*, another introduction used as food, a medicinal, and an ornamental

(Whistler 1991:111). Pollen increases for canarium (*Canarium harveyi*), a nut bearing tree and iron wood (*Casuarina equisetifolia*) during the Lapita period suggest intentional plantings (Fall 2010:262–263). Both are indigenous to Tonga but are important trees within a Polynesian context. Coconut (*Cocos nucifera*) and pandanus (*Pandanus tectorius*) are similarly present in the Lapita temporal interval, with both central to Tongan economy. None of these transitions begins to occur at Nofe Marsh, her second research site, until the end of the Polynesian Plainware phase at 400 BC (Fall 2010:262).

The pollen coring and analyses at Avai'o'vuna Swamp were unknown to me until Fall published her work in 2005. That is unfortunate. These data would have influenced archaeological survey coverage in 2003 as well as excavation and sampling designs at Vuna. That said, our recovery and documentation of bird fauna has become a critical component of the post-Lapita story for vegetation ecology in Vava'u (Fall et al. 2007). For tree and understory species in the lowland rain forests, birds are critically important for seed dispersal. The number of bird extinctions and extirpations in Vava'u, as well others throughout Tonga, considerably impacted the dispersal system. For several of the "large seeded trees," the loss of pigeons would have been particularly disastrous, drastically reducing their ability to propagate successfully (Fall et al. 2007:405). Anthropogenic impacts on bird populations in the Lapita settlement of Tonga clearly had ripples through island ecology.

Onward to Niuatoputapu

The volcanic islands of Niuatoputapu and Tafahi are 300 km north of Vava'u, and about the same distance south of Sāmoa (Fig. 6.19). These are island arc volcanoes, representing the northern end of the Tofua volcanic arc. Niuatoputapu is the older of the two, where the volcanic centre (145 msl) is fully eroded,

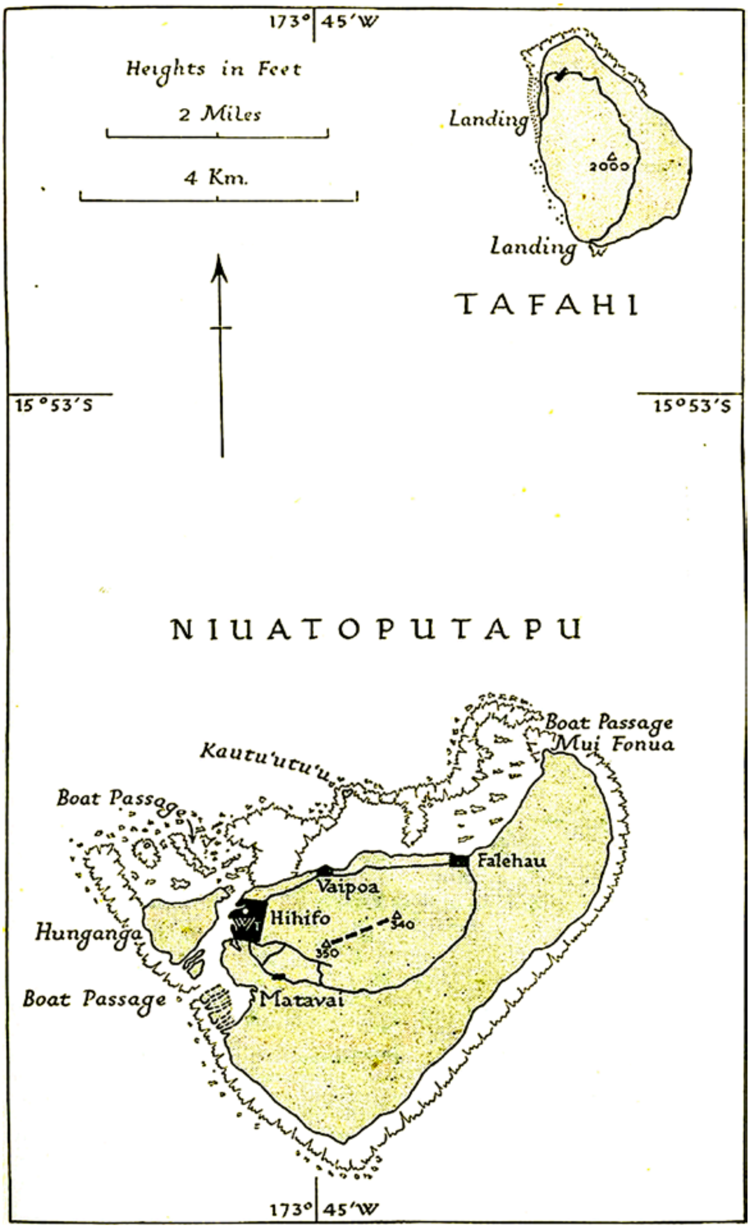

Figure 6.19. Niuatoputapu and Tafahi Map 1932. Public Domain, Courtesy of the University of Texas Libraries, The University of Texas at Austin. The Lapita-age paleo-shoreline and central ridge are encircled by the plotted road.

and where recognizable vents no longer exist. The island has an area of 18 km^2, much of it accumulated marine sediments and raised coral limestone. At the time of northward Lapita exploration, Niuatoputapu was considerably smaller, limited to an area of 4.9 km^2 formed by its central ridge and a lower sloped terrace (Kirch 1988:241). Three villages, Hihifo, Vaipoa, and Falehau, are positioned today along the northwestern leeward shore facing an expansive reef and lagoon. Tafahi is 7 km to the north. It is a much younger composite stratovolcano with slopes rising steeply to 625 m elevation at its peak, Piu ʻo Tafahi. The island is surrounded by a thin but largely unbroken ribbon of fringing reef making access difficult. A small village, Kolokakala, is located on the northern end. Tafahi is now dormant, its last eruption estimated as more than 8,000 years ago (Beier et al. 2017:1090).

Archaeological investigations on Niuatoputapu were first undertaken between 1969 and 1971 by University of Auckland PhD student Garth Rogers.[17] Rogers (1974:312–314) discovered surface ceramics in several areas around the central ridge and carried out test excavations at three of these. He also recognized that ceramic sites and other finds of pottery were restricted exclusively to a "belt" that "encircles the mountain." These had been situated on a "former beach line" defining the island's coast at first settlement. At one site, Lolokoka on the eastern outskirts of Vaipoa village, a small number of dentate stamped and incised sherds were excavated (Fig. 6.20). This led him to hypothesize that time depth for settlement on Niuatoputapu was early, and commensurate with Tongatapu. A seven-month long program of survey and excavations subsequently was carried out in 1976 by Patrick Kirch (1988), then of the B.P. Bishop Museum, Honolulu. Kirch, with his assistant Tom Dye, had many interests ranging from an ethnoarchaeological study of fishing (Kirch and Dye 1979), to monumental architecture, to a full culture history

17 Rogers was on Niuatoputapu from July 1969 to December 1971 carrying out an anthropological study of Tongan social organization. The archaeological study is an "ancillary" investigation (Rogers 1974:308)

Figure 6.20. Lolokoka Lapita site on the eastern outskirts of Vaipoa village, Niuatoputapu. A volcanic glass source occurs within the vicinity. Google Earth image.

for island settlement, particularly its earliest Lapita phase. For the latter, the presence and exclusivity of a ceramic bearing zone on coastal beach sands was reconfirmed. Controlled excavations and tests at several ceramic period sites were undertaken with decorated Lapita wares again located at Lolokoka only. Finally, at the end of the Niuatoputapu program, Tom Dye carried out survey and test excavations on Tafahi. Undecorated ceramic sherds were found concentrated on the island's southern end on the "small flats that break the island's rocky slopes" (Dye 1988:283). Test excavation at one of these, Fatuloa, recovered 847 plainware sherds.

Given the size of Niuatoputapu relative to the amount of time spent on its archaeological landscape, this island must be the most intensively studied piece of real estate in all of Tonga. At Lolokoka, Kirch's excavations incorporated a random sample testing program, scattered 1 x 2 m units, and larger block area excavations. The cumulative excavation is 51.5 m^2 within an estimated site area of 1,500 m^2. The excavations recovered a ceramic assemblage of 31,495 sherds, 8,778 flakes/cores of volcanic glass, a small assortment of other artifacts, as well as fauna (Kirch 1988:93). The site had shallow stratigraphy with cultural materials, for the most part, restricted to the upper 40 to 50 cm of deposit overlying beach sand. Cultural deposits were heavily disturbed by post-abandonment garden activities. Organically enriched by charcoal and other byproducts of human occupation, the archaeological matrix had become a recognized agricultural soil (*fasifasi'ifeo*) ideally suited for the planting of yams. Lapita cultural materials were thoroughly intermingled with materials from the Polynesian Plainware phase and subsequent occupations through a continuous process of pedoturbation (mixing). Ever the optimist I guess, Kirch (1988:90) describe this situation as not ideal but "not analytically intractable." But then again, one must deal with the hand of cards you are dealt.

Four radiocarbon dates were acquired for Lolokoka, of which two were ascribed to initial Lapita settlement (Kirch 1988:140). The Lapita dates are based on "culturally modified tridacna" giving an estimated age for first landfall between 1400 and 1200 BC. This range is far too early considering our current understanding of Lapita chronology across the Pacific. The Lapita decorated ceramic assemblage from Lolokoka is small, incorporating 122 sherds. Some vessel forms have carinated shoulders, 88 sherds have dentate stamp/incised applications, and 16 are identified with appliqué/modeling. Complex vessel forms or design elements of the Western Lapita aspect found in Fiji or at Nukuleka are absent. The decorative motifs are simplified and open. In all of this, the Lolokoka assemblage is identical to later Lapita wares from Tongatapu, Ha'apai, and Vava'u. The ceramic assemblage suggests a Lapita colonisation of Niuatoputapu beginning no earlier than 830 BC, but more likely closer to 800 BC. It would have been an extension of the northern migration through Ha'apai into Vava'u. Niuatoputapu volcanic glass occurs in securely dated Lapita-age assemblages of this time period in Vava'u, Ha'apai and Tongatapu (Fig. 6.21) (Burley et al. 2011), as I note in earlier chapters. This illustrates continued interaction with the

Figure 6.21. Niuatoputapu volcanic glass recovered from various Lapita sites in Vava'u, Ha'apai and on Tongatapu.

homeland and, coincidentally, provides additional support for an 830–800 BC colonisation event.

The most remarkable aspect of the Lolokoka assemblage, and other ceramic period sites on Niuatoputapu, is the volcanic glass assemblage. By comparison, the number of pieces from Lolokoka alone surpasses the cumulative total of lithic flakes, cores, and artifacts from all other Lapita and Polynesian Plainware phase assemblages of Tongatapu, Ha'apai, and Vava'u. Other than "occasional flakes with secondary retouch," formal tools of this material are absent (Kirch 1988:215). Based on the reported analysis, and my own examination of a part of this collection in 2009, the assemblage incorporates a volume of shatter fragments and cores, cortex flakes, flakes with hinge or step fractures lacking a bulb of percussion, and more limited numbers of flakes with striking platforms. The assemblage is in large part characteristic of lithic debitage from a hard hammer bipolar reduction process employing some type of anvil. It also indicates that small nodules of volcanic glass were being worked on site at Lolokoka.

A second New Zealand anthropologist, Wendy Pond, was on Niuatoputapu in tandem with Garth Rogers in 1971. Among other things (Pond 1995), she carried out a place names survey on Tafahi (Fig. 6.22). At a locale named Tefito i maka, she collected a small number of volcanic glass fragments that were embedded within a volcanic extrusion.[18] These were given to Rogers who had X-ray fluorescence trace element analysis carried out on both the Tafahi pieces and his own Niuatoputapu samples. The results proved indistinguishable, leading to the conclusion that Tafahi, as a geological source, must have been the location from which the Niuatoputapu archaeological material is derived (Ward 1974:345). Thereafter, Tafahi became entrenched in the archaeological literature as the origin locale for this type of volcanic glass whenever found in Tonga (Smith et al. 1977). Even after a more viable source for this material was recorded on Niuatoputau (Kirch 1988:215), primacy has been given to Tafahi. Tafahi seems an unlikely source. Its limited record of ceramic period occupation, difficulties of island access, its steeply sloped and forested terrain, and the sheer volume and nature of the materials on Niuatoputapu raise substantive questions. The source, as described by Tom Dye (1988:287), seems more likely to be an outcrop of "tuff" behind Vaipoa village where "glassy nodules" can be collected. Being a very short distance from Lolokoka, one might also query whether this source was influential in the location of the initial colonising hamlet.

A total of 568 faunal bones was recovered from the excavations of Lolokoka in 1976. Because the site is so shallow and heavily disturbed from pedoturbation, temporal assemblages are mixed. Faunal data, thus, were presented as an integrated collection for comparison to other Niuatoputapu sites (Kirch 1988:220). Site matrices were also screened using quarter-inch mesh, a sieve size through which smaller bone passes. The recovery of but a single

18 Email correspondence 10 July 2016. Wendy states that the pieces were "tiny" and the source was not a "workable lode." Her local guides were unaware of any other obsidian source on Tafahi.

Figure 6.22. View of Tafahi from Niuatoputapu 1969. Photo by Garth Rogers, Source University of Auckland Anthropology, Wikimedia.org, Creative Commons Attribution-Share Alike 4.0 International License.

rat bone at Lolokoka seems a reflection of small bone loss in the sieves. Any attempts to use the Lolokoka faunal data to infer a Lapita subsistence pattern for Niuatoputapu or compare faunal data to other Lapita sites in Tonga is challenged. Yet, with these problems identified, there are a few interesting aspects or occurrences worthy of note. Sea turtle (n = 71), for example, accounts for 54% of identified bone other than fish at Lolokoka. It is certain that, like elsewhere, turtle was a critical resource for initial colonists. Second, of the identified fish (n = 107), parrot fish (Scaridae) (39%) and porcupine fish (Diodontidae) (35%) are dominant. As implied by Kirch (1988:223), the latter appears extraordinary, as highlighted by their rarity in catch records for the ethnoarchaeological fish study. The pattern found in Vava'u fish assemblages at Vuna, 'Otea, and Falevai seems replicated. Finally, the presence of all Polynesian domesticates, including chicken (n = 12), pig (n = 2), and dog (n = 4) requires comment. The latter two can only be viewed with a high degree of suspicion for association with the

Lapita phase. Pigs and dogs are absent from all other Lapita faunal assemblages in Tonga, and the mixed nature of the Lolokoka assemblage provides considerable room for skepticism.

The foundation laid by the Lolokoka Lapita settlement on Niuatoputapu was a strong one. On a quite small remnant of an ancient volcano, the colonising hamlet not only was able to survive, but it expanded substantially in the Polynesian Plainware phase. This is evident in the continuous "belt" of midden ridge extending around its shore, in the eight other Plainware sites identified and tested by Garth Rogers and Pat Kirch, and in the extension of settlement to the more difficult landscape of Tafahi. The continued presence of Niuatoputapu volcanic glass in Polynesian Plainware and Aceramic periods in Vava'u, Ha'apai, and Tongatapu attests further to a continued relationship of this community with its homeland (Burley et al. 2011:2629). I can only anticipate that the reefs and fisheries of Niuatoputapu at 800 BC were plentiful, and that a successful colonisation integrated agricultural production. Test excavations at Lolokoka may have exposed a feature with implications in this latter respect. This is a steeply sloped pit dug deep into the underlying coraline sand (Kirch 1988:97). Excavation did not explore the feature fully, but its size and configuration led to its interpretation as a freshwater well (*vaitupu*). The profile and context of this pit is all but identical to the early 9th century BC aroid planting pit encountered at the Hopoate site on Tongatapu in 2014 (Burley et al. 2018). The volcanic soils inland of the Lapita-age beach on Niuatoputapu also are fertile and highly productive. Today this area is a critical agricultural zone for Niuatoputapu covered in "yam-aroid cultivation" that is interspersed within a range of tree crops (Kirch 1988:23).

The Confusion of Sāmoa

To tell a Sāmoan that their ancestors came from Tonga is a life-threatening act. Sāmoa has its own origin stories and a very long history of interaction and conflict with Tonga (Burley and Addison 2018). It also has an early archaeological past that is best described as unclear and, at times, hotly contested. I consequently debated whether to incorporate Sāmoa into a discussion of first peoples into Polynesia. Yet Sāmoa is at the end of the natural travel corridor running northward from Tongatapu and is only 300 km distant from Niuatoputapu. Tongan and Sāmoan languages derive from a common linguistic substage, Proto-Polynesian. Sāmoa does have a single site, Mulifanua, with decorated Lapita ceramics. Tonga and Sāmoa long have been considered the core for an ancestral Polynesian homeland. And most linguists seem to concur that the settlement of East Polynesia derives from Sāmoa ca. AD 900–1000. It would be impossible to ignore all of this in a narrative on the birth of Polynesia.

Sāmoa is positioned on the edge of the Pacific Plate, separated from Tonga by the Tongan Trench (Fig. 6.23). The eight inhabited islands are exclusively volcanic, having formed through hotspot volcanism. Hotspots are plumes of hot mantle rock that upwell through cracks in the plate to the surface. Hotspots are thought to be stationary so, as the tectonic plate moves, the hotspot produces lines of islands, atolls, and sea mounts. The Sāmoan islands run east to west with the hotspot on the eastern end. The western larger islands of 'Upolu (1,125 km^2) and Savai'i (1,694 km^2) are geologically older as a consequence.[19] Sāmoan geography literally has been sculpted by its volcanic history. Coalescing lava flows, extinct cones, collapsed steam tunnels, and other features provide variable landscapes of constricted coastal plains through upland plateaus that are often cut by steeply sided valleys. These islands vary significantly in their tectonic and geomorphic histories presenting numerous limitations for early settlement.

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19 The conceptual framework for a hotspot seems confused by Savai'i, with major eruptive events between 1905 and 1911. Dickinson and Green (1998:253) suggest this may be the result of a rupture in the Pacific plate as it flexed in passing the northern end of the Tongan Trench subduction zone.

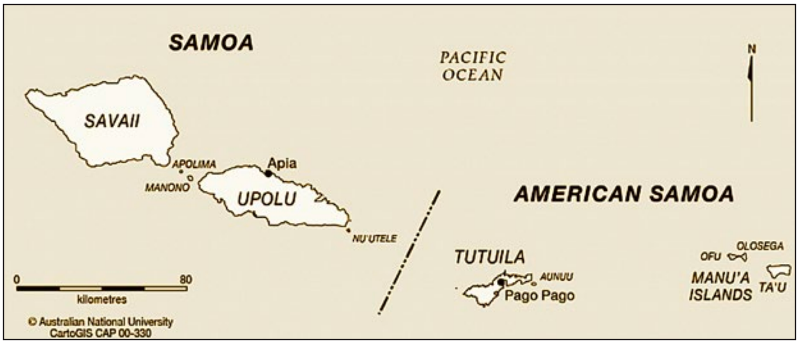

Figure 6.23. Map of Sāmoa with political divisions. CartoGIS Services CAP 00-330, The Australian National University use by Creative Commons BY-SA License.

Sāmoa today is politically divided, with the smaller eastern islands forming American Sāmoa, and the larger western islands being the independent state of Sāmoa. Much of the early archaeological focus was centered on the western islands, particularly ʻUpolu. Most notable of these projects is a widespread survey, mapping and excavation program initiated by Roger Green and Janet Davidson between 1964 and 1967 (Green and Davidson 1969, 1974). Despite the intensity of this work, the many different participants, and the amount of field time involved, earlier ceramic period sites were negligible. As Green (1974a:245) reports, surface pottery was absent and the limited number of sites with excavated ceramics *in situ* were dominated by small plainware bowls dating after 100 BC. Green saw continuities in Sāmoan plainwares with earlier ceramics from Tonga and Fiji, but the data proved remarkably thin. In 1973 Green's assertions of continuity seemed all but guaranteed. Dentate stamped Lapita ceramic sherds were found by a shell collector in dredge tailings extracted from the harbour at the Mulifanua ferry berth on the western end of ʻUpolu (Fig. 6.24) (Green 1974b). The Mulifanua collection today is sizeable, including 5,000 sherds with approximately 5% of these decorated (Dickinson and Green 1998). Subsequent surveys and excavations throughout Sāmoa have proliferated over the past four and a half decades, particularly in

Figure 6.24. Mulifanua site with dredged channel and lagoon. Dredge tailing piles incorporating decorated and undecorated ceramics are located to the lower side of the ferry berth dock. Google Earth photo, 2013.

American Sāmoa where the US National Historic Preservation Act is being implemented. A substantial inventory of ceramic period sites is now acquired (Martinnson-Wallin 2007; Addison et al. 2008) but additional sites with decorated Lapita wares remain elusive.

The engineer in charge of the Mulifanua dredging operation in 1973, T.W. Haskall, took interest in the archaeological discovery and kept watch on the fill being removed, and where it was coming from. This information provides a degree of insight into site context (Jennings 1974). The pottery originates from a 30 to 40 m wide band about 115 m offshore and extending 110 m parallel to the shore. The lagoon floor here is 1.5 m deep while the archaeological remains were capped by a 0.75 m thick stratum of calcareous beach rock (Dickinson and Green 1998:242–243). Bathymetry of the area suggests the site had been situated on the back beach of a lagoon opposite a deep-water passage facing Manono, Apolima, and Savai'i islands. The discovery of submerged archaeological deposits 2.25 m below sea level begged explanation, with possibilities ranging from rapid localized subsidence (Jennings 1974) to the site having been a stilt-house village over the water (Leach and Green 1989). Dickinson and Green (1998:239) subsequently proposed that coastal subsidence in the western islands was a widespread event, resulting from a "downflexure of the lithosphere from volcano loading" centered on Savai'i. They also suggest that the problems of Lapita site discovery in Sāmoa is a consequence, where appropriate shorelines and coastal flats are now submerged.

The Mulifanua dentate stamp and incised ceramic motifs are of the open, simplified, geometric/curvilinear type characteristic of Eastern Lapita sites throughout Tonga (Fig. 6.25). Particularly notable is the common use of single or double crescent dentate stamp (Petchey 1995), the dominant design element employed in the Eastern Lapita style. Vessel forms similarly are identical to those from Tonga, including jars and bowls, some with carinated shoulders, others with collared rims, and a few with remnant slips. Other artifacts picked from the tailing piles are rare, limited to a grooved abrading stone, a possible lithic flake, and two stone adzes. One of the adzes is reported as being andesitic basalt typical of island arc volcanics in Tonga (Leach and Green 1989:321). Attempts to date Mulifanua have involved a radiocarbon date on the beach rock crust, two radiocarbon dates on shell embedded in the crust, and a fourth radiocarbon date on collagen extracted from a turtle bone recovered from the dredge pile. The latter (NZA-5800) had a calibrated age range of 888–772 BC (Petchey 2001:65), providing an interval appropriate to the ceramic motifs. Based on ceramics, and similar to Lolokoka, the earliest age for the site can be estimated in the 830–800 BC range.

The Mulifanua site is most easily explained as an extension of the Lapita colonising path northward through Ha'apai, Vava'u, and Niuatoputapu. With Ha'apai and Vava'u radiocarbon dates overlapping in their age ranges, the colonisation of the north seems likely to be simultaneous or a close-in-time event emanat-

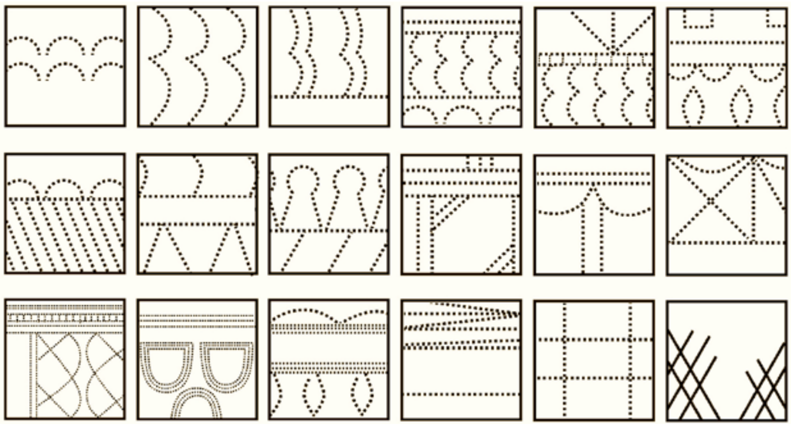

Figure 6.25. Eastern Lapita decorative motifs at Mulifanua as inferred from Petchey (1995).

ing from Tongatapu, not a sequential series of events with progressively younger colonisation episodes. At the same time, the ephemeral nature of Lapita settlement in Vava'u, the single site at Lolokoka on Niuatoputapu, and the possibilities for but a single site in Sāmoa could represent an ever-diminishing population involved in the colonisation effort. In 2003 I participated in a conference focused on archaeological demography on Mo'orea in the Society Islands. Among other issues, I attempted to estimate population size in Tonga at the end of the Lapita phase. Using site numbers, distributions, sizes, and a few assumptions that threw caution to the wind, I calculated 600 to 700 individuals in total (Burley 2007b:190). If that number is even remotely correct, demographic exhaustion is not a possibility, but the strongest of probabilities. This is underscored by the 900 km distance separating a Lapita population nucleus on Fanga 'Uta Lagoon on Tongatapu and the Mulifanua site on 'Upolu, Sāmoa.

In the decade and a half following the discovery of Mulifanua, archaeologists working in Sāmoa not only failed to find additional sites with decorated Lapita pottery, but any evidence for an earlier ceramic record relating to the Polynesian Plainware phase. There was, in the opinion of Sāmoan archaeologists David Addison and Alex Morrison (2008:359), 600 to 800 years missing in the sequence. There had been a working assumption that, like Tonga, Sāmoa once had a viable, if not sizeable, Lapita population, and this carried onward through Plainware into ancestral Polynesian society. The absence of Lapita and earlier Plainware sites could be explained by a coastline that no longer exists in the eastern islands, by lava flows over the north coast of Savai'i, and by various other geological processes deeply burying or otherwise concealing site deposits (Kirch 1993).

The 1980s discovery and excavation of Plainware sites in American Sāmoa at 'Aoa on Tutuila Island (Clark and Michlovic 1996) and To'aga on Ofu Island (Kirch and Hunt 1993) seemingly filled the chronological void. To'aga was particularly notable for its non-ceramic assemblage, one Kirch and Green (2001) made central to the fleshing out of ancestral Polynesian society with archaeological data. Yet ceramic assemblages for both sites are problematic in illustrating a relationship to Mulifanua. The 'Aoa collection is limited in size (n = 878), sherds are exceedingly small and heavily degraded, and it is all but impossible to record vessel forms or other attributes beyond thickness (Clark and Michlovic 1996). The ceramic assemblage at To'aga similarly is limited in size with 2,334 sherds, many being small. To'aga vessels are exclusively thick and thin open round-based bowls (Fig. 6.26) (Hunt and Erklins 1993:123). If one assumes direct continuity from Mulifanua, a rapid and inexplicable loss in ceramic diversity must have occurred in the immediate post-Lapita era. But even more difficult to understand, radiocarbon dates for both sites suggested an occupation dating to 1000 BC (Addison et al. 2008:100). If correct, these sites would be contemporaneous with or predate the Mulifanua settlement. Something strange was afoot in Sāmoa, leading Clark (1993:326) to offer the possibility that Mulifanua may not have been occupied by Lapita people at all, with decorated ceramics explained as imported trade ware.

The 'Aoa and To'aga excavations notwithstanding, few new sites were found in Sāmoa through the early 2000s to either cor-

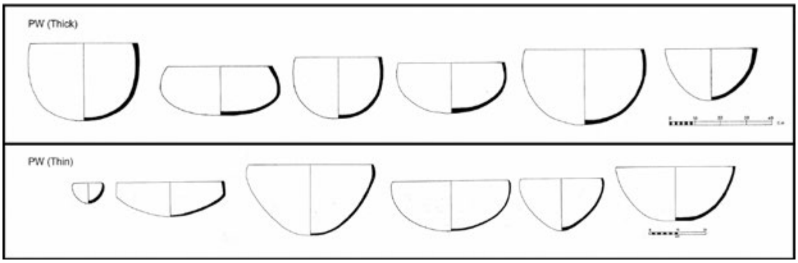

Figure 6.26. Samoan Plainware thin and thick bowl forms from Connaughton (2014:113), with permission.

roborate the Lapita/Plainware transition or fill in the presumed Sāmoan chronology. Sāmoan Plainware ceramics were by then recognized as distinct from Polynesian Plainware. Vessel forms are restricted to bowls, there is limited use of slips, and clear carination of shoulders is absent. Many of the assemblages are crudely manufactured thick wares, leading some to facetiously label them "crud-wares." Tim Rieth, Alex Morrison, and David Addison (2008) applied chronometric hygiene protocols to 47 Sāmoan radiocarbon dates accumulated up to 2006 with all having calibrated age ranges older than 50 BC (also Rieth and Hunt 2008). The exercise was shocking, only 22 of the dates met the minimum requirement for acceptance! The recalibrated results of acceptable dates indicated that the settlement of Sāmoa, other than at Mulifanua, did not occur until after 550 BC. Widespread occupation across the islands, in fact, fell only in the temporal interval 350–50 BC. To some, the absence of evidence had become evidence for absence, suggesting a post-Lapita abandonment of Sāmoa. Sāmoa, it was described, fell "beyond the sustainable limits of Lapita expansion" with Lapita people leaving "after a short time (perhaps within a generation)" (Addison and Morrison 2008:369).

There have been two recent studies where the abandonment model for Sāmoa is challenged. Both focus on the island of Ofu in American Sāmoa. One presents new data for three additional Plainware sites, including radiocarbon and U/Th dates (Clark et al. 2016). The other provides new radiocarbon dates on shell and bone for the To'aga site (Petchey and Kirch 2019). Bayesian analyses of dates for both projects illustrate an 8th century BC Plainware settlement of Ofu in line with Polynesian Plainware chronology in Tonga. The chronological gap for a Lapita/Plainware transition in Sāmoa seems resolved. Yet questions and confusion continue to remain given the substantive and abrupt differences between Eastern Lapita ceramics at Mulifanua and those of Sāmoan Plainware on Ofu and elsewhere in Sāmoa. The situation is amplified further by equally distinctive differences with equivalent aged Polynesian Plainware ceramics in Tonga, including those of Niuatoputapu. The how and why of Sāmoan Plainware origins, and the relationship of this complex to Late Lapita settlement at Mulifanua, remain to be determined.

A Final Word

As I began the survey in Vava'u in 2003, I had a preconceived model for a staged settlement of northern Tonga by Lapita peoples, one where a colonising group progressively moved from Ha'apai to Vava'u and then onward. I also believed that the colonising effort and its aftermath would be little different from Tongatapu and Ha'apai. Colonising Lapita sites might be few, but where a substantial population expansion would take place in the Polynesian Plainware phase. The results of the Vava'u survey, and then excavations at Ofu, Vuna, 'Otea, and Falevai began framing a different narrative. Radiocarbon and U/Th dates from Lapita settlements in Vava'u overlapped with Ha'apai and each other. The move to Vava'u from Tongatapu was not staged but simultaneous and coeval with Ha'apai. In consideration of decorated Lapita ceramics from Lolokoka on Niuatoputapu and Mulifanua in Sāmoa, the migration appears to continue onward. Lapita sites in Vava'u are logistically spaced on different islands as the case in Ha'apai. But population expansion in Vava'u through the Polynesian Plainware phase was significantly restricted. The reality of diminished reefs and the fishery are documented in our survey and excavations The islands of Vava'u were in large measure incompatible with a Lapita subsistence economy focused on reef foraging, inshore fishing, and low-level agricultural production. I had viewed Vava'u as a paradise at the outset of this project. I now realize this was through the eyes of a *pa'alangi* (European), not from the perspective of a colonising group needing to put food on the table. The three-year study has been illuminating.

The northern migration took place approximately 70 to 90 years after first landfall at Nukuleka on Tongatapu. Lacking evidence to suggest additional movement of Lapita peoples into Tonga, the population nucleus on Fanga'Uta Lagoon at that time would have been small, perhaps no more than a few hundred individuals. The migration northward was not motivated by population pressure or competition for land in that Tongatapu was an island with considerable room for expansion. The dispersal out of Tongatapu has the hallmarks of a "territorial imperative" as I suggest in Chapter 5. It was organized and it was intentional. It also was effective in consideration of Tonga's political boundaries as they exist today. Moving beyond Ha'apai into the northern frontier with small groups of colonists would have been challenged by demographic exhaustion. Distance from a homeland centred on Tongatapu also would have been limiting. The 900 km from Tongatapu to Sāmoa formed a natural sailing corridor, but one where interisland voyaging clearly had risks. The site at Mulifanua may have reached the limits of sustainable expansion, as David Addison and Alex Morrison suggest. Whether Lapita settlement in Sāmoa was abandoned, or the connections to a Tongan homeland were severed by distance, provide alternative possibilities. The early and rapid change in Sāmoan Plainware ceramic diversity at To'aga may be a consequence of the latter. Widespread distribution of Niuatoputapu volcanic glass in Lapita and Plainware sites throughout Tonga, on the other hand, speaks clearly to the maintenance of relations and interisland voyaging by a far northern outlier.

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Chapter 7

Ancestral Polynesia and the Polynesian Plainware Phase

My quest to document Polynesia's first people has been a rewarding venture to say the least. It is a chronicle that I have tried to convey through earlier accounts of places, peoples, events, and discoveries throughout Tonga as they have taken place over the past three decades. Beyond the first Lapita arrivals as archived in their decorated ceramics, there is still another story to tell. It is one we have encountered time and again in our survey and excavations, and it is one where a substantial data set now exists for its telling. This narrative relates to the Polynesian Plainware phase, the period immediately following Lapita. It is distinguished in the archaeological record by a ceramic industry where decorated vessels no longer occur. It is during the Polynesian Plainware phase where the diminutive Lapita population expands, and where well-established communities develop. It is a time where the subsistence economy begins to shift to dryland agricultural practices. It is a time where Tonga begins to emerge as Tongan. Polynesian Plainware phase archaeological sites are ubiquitous throughout Tongatapu and Ha'apai. And even in the more limiting geography of Vava'u, there is expansion in the settlement landscape.

It is rare to excavate a Lapita site in Tonga without first digging through substantial deposits of Polynesian Plainware ceramics with attendant occupation debris. In this, there is unequivocal proof of continuity from Lapita peoples into the Polynesian Plainware phase. It is a continuity extending to virtually all other aspects of material culture recovered by the archaeologist. This has been emphasized emphatically by Anita Smith (2002), not just for Tonga, but West Polynesia as a whole. The archaeological transition beyond decorated ceramics, then, seems inconsequential, and hardly worthy of the significance so often ascribed by Pacific archaeologists. Yet the implications of this transition can be defined more broadly, and with transcendental importance. Lapita, if nothing else, has always been viewed as a community of culture, as it was defined early on by Jack Golson (1961). Ceramics not only demarcate the migration trail eastward, but impute a sense of cultural homogeneity, variations notwithstanding. Whether in Tonga, Vanuatu, or the Bismarck Archipelago, Lapita is still Lapita! The transition from Lapita to something else in Oceania breaks this connection; the community has become dissolved. Later archaeological phases across the region usher in variations in material culture, adaptations, innovations, and external interactions. They inject the diversity of peoples so apparent today. The Polynesian Plainware phase is one of these regional variants, Polynesian added to the name with explicit intent. In the words of Patrick Kirch (1997:68), "in Western Polynesia the 'end' of Lapita is the 'beginning' of Polynesian culture." It is the onset of ancestral Polynesian society in an ancestral Polynesian homeland (Kirch and Green 2001). This premise, its interpretations, its archaeological manifestations in Tonga, and questions now being raised, provide the basis for this Chapter.

The End of Lapita Ceramics

The Lapita peoples are recognized almost exclusively today by their decorated ceramics as they occur in archaeological contexts. The impressed application of a dentate stamp, the suite of applied motifs, the structure of the design system itself, and the form of the ceramic vessels on which these occur are emblematic of these Austronesian seafarers. The disappearance of decorated Lapita wares is as remarkable as its sudden presence. As an archaeological event it is roughly synchronous across Oceania, occurring in the temporal interval 750–650 BC. Explanations as to why are rarely examined in detail. In the case of an expansive migration such as Lapita, distance and time seem the most pragmatic if not coherent considerations. Inter-regional interactions would decline with distance, exchange and social networks withered, communities became isolated, and stylistic and technological change in ceramics took place. In his analysis of Lapita ceramic motifs in the late 1970s, Roger Green (1979a:42) proposed a "distance decay" in the Lapita design system, this occurring on a west to east trend. This involved a simplification of the decorative tradition, where ornate and elaborate patterns in the west diminish in complexity further to the east. University of Otago archaeologist Glenn Summerhayes (2000), working on sites in the Bismarck Archipelago, recognized and has shown the same simplification process. These parallels, he believes, relate to time, rather than space. Whether time or distance, or both, the processes of simplification implicitly anticipate an outcome, the inevitable end of decorated Lapita wares.

As I identify in Chapter 2, there is good reason to believe ceramics are part of the ritual and social fabric of Lapita society. Not all pots were decorated, and many that are hypothetically had a specialized use. In his volume, *The Lapita Peoples*, Patrick Kirch (1997:132–144) spends considerable time examining what these roles might be. Are these vessels ancestor pots, where face motifs embody people, living or dead? Do the motifs represent lineage affiliation, as characteristic of Austronesian house societies? Or is the application of a dentate stamp allegorical in its representation of a Lapita tattoo? From an archaeological perspective, it is hard to conceptualize the role of ceramics beyond immediate function. Yet the use of elaborately decorated pots in funerary practices at Teouma, or their ritual interment at Site 13 (Lapita) in New Caledonia testify otherwise. Ethnographic studies for the Paiwan peoples of Taiwan, as Kirch (1997:143) also illustrates, provide further precedent for ritualized ceramic use in the Austronesian realm. The demise of Lapita decorated wares, at least in some measure, may further reflect on difficult to recognize changes taking place in Lapita culture *per se*. Identifying what these might have been is a challenge.

The Lapita/post Lapita transition in Tonga was not only sudden but coeval across the archipelago. Bayesian analysis of radiocarbon dates provides a timeline as to when this occurred within a 68.2% probability margin (Burley et al. 2015). The disappearance of decorated wares occurs first in Ha'apai between 778 and 766 BC. This, as I state in Chapter 5, was no more than a few generations following initial Lapita settlement of these islands. The end of decorated ceramics on Tongatapu and in Vava'u are all but identical, respectively taking place in the intervals 750 to 733 BC and 759 to 730 BC. The sharpness of the Lapita/post Lapita break seemed evident in our site excavations, as we dug downward through Plainware strata into earlier Lapita levels. And contrary to expectations for further decay or dissipation of Lapita motifs, transitional change is hard to document. Katie LeBlanc (2016) examines this in more detail in her PhD dissertation at Simon Fraser University. While she is able to find a slight decrease in the diversity of design elements over time, an overall temporal and spatial homogeneity in design application is characteristic of Tongan Lapita wares as a whole. Thus, and with the exception of Western Lapita ceramics at the founder colony of Nukuleka, it is all but impossible to define early and later Lapita variants in Tonga.

Why Tongan Lapita potters stopped decorating their vessels continues to be a mystery to me. The abruptness and extent of this event contributes to the puzzle. It is almost as if the Lapita people called an archipelago-wide conference in the mid-8th century BC, debated the merits of dentate stamped pots, and decided to immediately cease production. As elsewhere across Oceania, the transition brought with it the abandonment of at least a few of the vessel forms to which decoration had been applied. These largely include shallow bowls and jars with sharply out-turned rims and carinated shoulders, and flat-bottomed bowls having out-turned sides without shoulders. These may have been presentation vessels with social significance, but neither is particularly abundant in our excavated sites. The dominant change in Lapita ceramics, as I note above, occurs early at Nukuleka, and prior to northward expansion. This involved the almost immediate loss of decorative motifs, design elements, and some complex vessel forms characteristic of the Western Lapita aspect. That change is dramatic, and it is one Katie LeBlanc and I speculatively attribute to the scarcity and demise of Master potters who arrived on the founding canoes (Burley and LeBlanc 2015). If only a few had made the journey, and they passed on soon after arrival, then the expertise, knowledge, and cultural rationale for the complex designs might also have passed on. The continued application of less complex motifs may have been devoid of the social or ritual meaning of earlier Lapita wares occurring to the west. Decoration in this context becomes customary, perhaps aesthetic, and an application that ultimately could be abandoned without consequence.

There is still another puzzle related to the disappearance of decorated Lapita wares in Tonga. The artistic expression as applied to the pottery, its structure of application, and its motifs, were not actually lost. These continued in other media, in so far as they persist on Tongan *ngatu* (tapa), as earlier described (Fig. 7.1) (Burley 2020). Roger Green (1979b) recognized this in the 1970s, noting that many are similarly present in Polynesian tattoo design (Fig. 7.2). He, in fact, was able to identify 52 Lapita motifs as they are replicated today. I had not read Green's publication on this as I began to forge an interest in the Lapita archaeology of Ha'apai. The parallels, though, were enthusiastically pointed out to me in 1992 at a *fono* (community meeting) I had called in the village of Faleloa. The meeting was to explain our presence in the village, and we had brought a selection of decorated Lapita sherds as a show and tell for residents. Almost immediately our audience began slipping out of the meeting hall, returning not long after with their bolts of family *ngatu*. The printed designs were matched closely to our show and tell sherds, creating a high degree of excitement in the process. Some even

Figure 7.1. Painted Lapita rim sherd from Hopoate with dentate stamp *Tokelau Feletoa* design, photo by Shane Egan, with permission. Traditional Tongan *ngatu* patterns on right including *Tokelau Feletoa, Manalua,* a variant of *Fata 'o Tu'i Tonga,* and a variant of *Amoamokofe.*

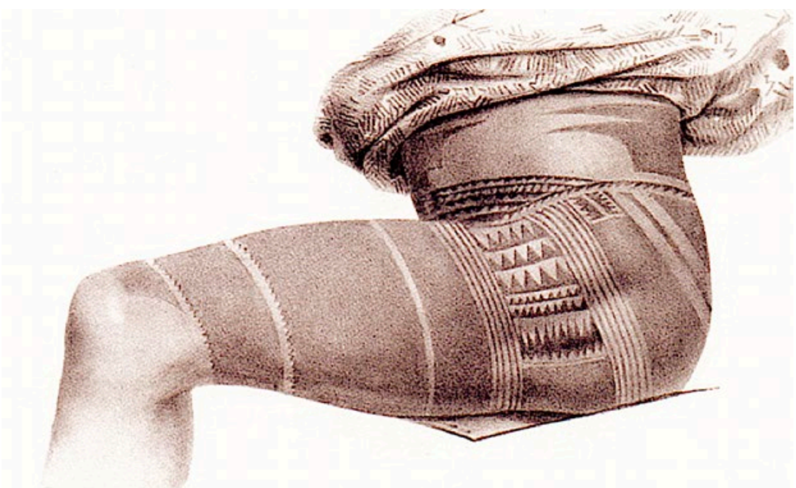

Figure 7.2. Tongan tattoo, 1827 lithograph by Auguste de Saison who accompanied Dumont d'Urville to Tonga on his ship, La Perouse. Public Domain, Dumont d'Urville (1833:Plate 76).

retained names, making it all the more eerie. One, *Tokelau Feletoa*, has proven critical in linking the ancient Lapita past to the Tongan present; the intricate complexities of this design go far beyond possibilities for any coincidental occurrence.

The Polynesian Plainware Phase in Tongan Archaeology

The imprint of the Polynesian Plainware phase on the northern leeward coast of Tongatapu is all but impossible to miss. Undecorated pottery sherds literally are underfoot, extending from Kolonga on the east, to the back beaches of Fanga'Uta Lagoon, and onward to Kanokupolu on the western end of the island (Fig. 7.3). As was described by Les Groube (1971:291) in the 1960s, pottery sherds are so profuse in some locales, residents consider them "part of the soil itself." It is not just along the leeward coast of Tongatapu. Dirk Spennemann (1986), in the mid-1980s, intensively examined a cross-island transect from the village of Ha'ateiho to the windward coast, documenting scatters of pottery across inland fields. My surveys, as well as those of Roger Green, Geoff Clark, and others, similarly have encountered Polynesian Plainware ceramics on Tongatapu in pretty much every locale that we have examined without an overly significant effort. This veneer of ceramics in itself speaks clearly of events in the Polynesian Plainware phase, from a major period of population growth to widespread settlement expansion and dispersal.

With a focus in Lapita archaeology on decorated ceramics, there has been far less emphasis on the description and interpretation of the associated undecorated utilitarian wares. In comparing decorated to undecorated rim sherd frequencies at Lapita sites in Tonga, the undecorated wares account for 75% or more of ceramic vessels. The production of these wares, as best as I can determine, survive largely intact across the Lapita to Plainware transition. Sean Connaughton (2015), another of

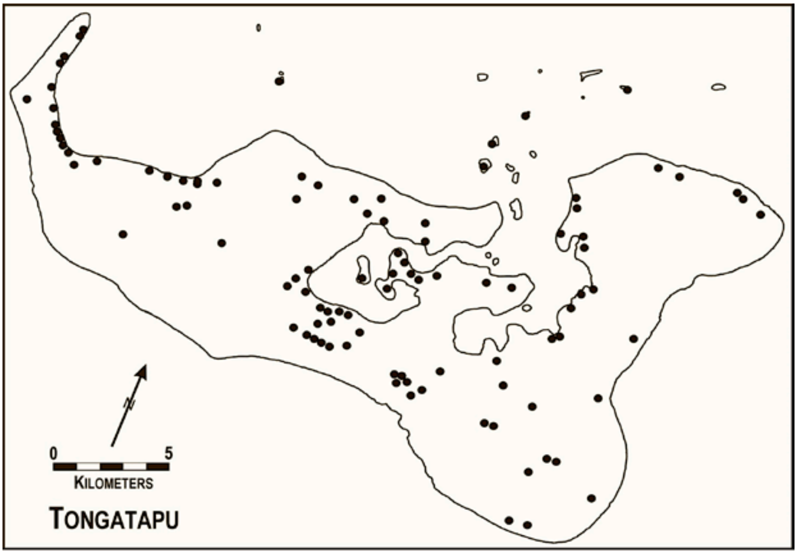

Figure 7.3. Map of recorded Polynesian Plainware site locations, Tongatapu. This map includes site locations from Spennemann (1986) with additions (Burley 2007:192). The dots on the northern coastline are substantially underrepresented, with scattered Plainware finds almost continuous from the western tip of the island to the eastern entrance of Fanga'Uta lagoon.

the PhD students at Simon Fraser University working in Tonga, sought to better understand the transition as revealed in the ceramic record. In this he examined in detail ceramic assemblages from four of our excavated sites. These include Falevai in Vava'u, Holopeka in Ha'apai, Tongoleleka in Ha'apai, and Ha'ateiho on Tongatapu. Holopeka, on the island of Lifuka, is exclusively a Polynesian Plainware phase site intentionally dug in 1991 and 1992 for that reason. The remaining three have both Lapita and Polynesian Plainware occupations. Sean's analyses incorporated over 28,500 sherds where he attempted to decipher the types and quantities of vessels present in both the Lapita and Polynesian Plainware assemblages as well as variation in such attributes as rim, neck, and shoulder forms. This study kept him busy, as one might anticipate, with 28,500 pieces of broken pottery, many of thumbnail size. His dissertation in 2014 went on to verify what we long had expected, though now given support by quantified data. Early Polynesian Plainware ceramics changed little, if at all, from Lapita undecorated utilitarian ware, with a variety of cups, bowls, and jars continuing to be produced. As the phase persisted, a few of the vessel forms were lost, including larger jars with collared rims and vessels with notched or incised lips. More gradual and subtle transformations then took place over the duration of the phase. These are documented in the relative frequencies of different rims forms, rim orientations, as well as in shoulder type with far fewer instances of carination (also Dye 1996). Perhaps most importantly, one vessel form begins to dominate, a large subglobular jar with slightly restricted opening and oftentimes a short, almost vertical neck (Fig. 7.4). Les Groube conducted excavations at the Polynesian Plainware site of Vuki's Mound on the outskirts of Pea in 1966. He, too, recovered cups, bowls, and sub-globular jars, the jars matching closely the vessel form being described. A range of sizes is present, though the majority, as he (1971:199) reports, appear to be "very large pots, capable of holding two or more gallons of liquid." He categorically identified these jars as cooking pots, though the evidence for this is not presented. Cooking is a possibility if not a probability, but the case is far from certain. I have examined tens of thousands of Lapita and Polynesian Plainware phase pottery sherds in Tonga over the past three decades. None, as yet, have presented indisputable evidence for use in cooking. In contrast, I have conducted several excavations at the Sigatoka Sand Dunes site in Viti Levu, Fiji where cooking vessels unequivocally are present. These are identifiable through exterior surface staining from repeated use on an open fire, as well as burned on residues adhering to inner sherd surfaces (Burley and Edinborough 2014). To rule out cooking as a principal function for Lapita and Polynesian Plainware pots in Tonga seems a rather daring claim indeed. I am not alone here, the same observation has been made by Patrick Kirch (1997:120–122). Undecorated Lapita pots, in his view, were employed for storage, serving, and presentation, not in the preparation of food on an open fire.

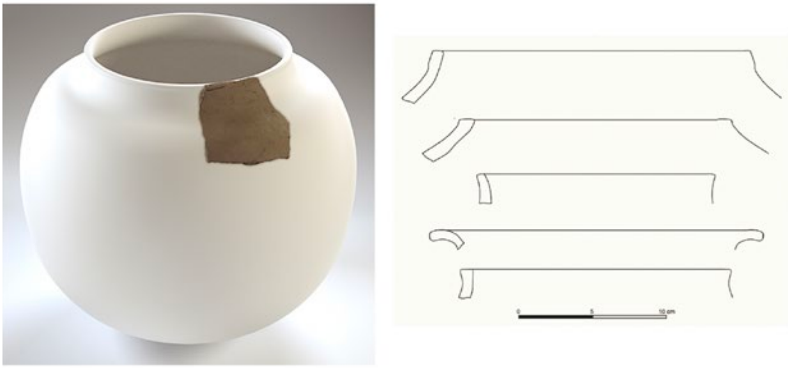

Figure 7.4. Polynesian Plainware jar. Rim/neck variations of the Plainware subglobular jar.

It is certain that ceramics in the Polynesian Plainware phase had a considerable degree of importance. Otherwise, why would there be so much pottery produced throughout the archipelago? Cups and bowls obviously functioned as cups and bowls, the latter coming in a range of sizes. Bowls are employed in food service and storage but the smaller varieties, as well as cups, could expediently (and efficiently) be replaced by *ipu*, containers made from the inner half-shell of a coconut. The probable significance of Polynesian Plainware ceramics, then, seems to lay with the larger jars, this reflected in their dominance at Vuki's Mound, Holopeka, and elsewhere. If not cooking pots, what purpose could these serve? The porosity of the earthenware paste, and the absence of applied slip, makes them unlikely receptacles for water storage, at least for any period of time. Dry storage might be the expectation, but more easily produced basketry accommodates the range of nuts, fruits, and other goods needing to be stockpiled. Patrick Kirch and Roger Green (2001:296) suggest they were used for sago flour, a starch staple of considerable importance across Melanesia. Yet evidence is lacking for sago starch as a component of Tongan or Sāmoan subsistence until introduced in more recent times from Rotuma (McClatchey and Cox 1992).

In the absence of other possibilities, or at least possibilities supported by evidence, I offer a "what if" speculative conjecture. What if the large, short-necked, subglobular jar was central to the fermentation and storage of *ma*? *Ma*, the Tongan word for bread today, is a fermented starchy paste made from breadfruit (*ma mei*), giant taro (*ma kape*), or plantain (*ma hopa*). The fermentation process not only produces a dough for cooking, but one capable of being stored for very long periods of time. This latter quality provides a measure of food security in ancient Polynesia where cyclones, droughts, or other disasters can lead to famine. The production of fermented pastes in Polynesian ethnography is consistent in their description of semi-subterranean fermentation pits lined with banana or breadfruit leaves (Pollock 1989). There is no reason to think, however, that the large earthenware jars, sealed at the opening, could not have served the same purpose, albeit on a smaller scale. The ability to move these jars from place to place, in fact, provides a truly significant advantage. That I have yet to excavate Lapita or Plainware fermentation pits of a size or configuration suited to *ma* production, influences my speculations accordingly.[20]

Polynesian Plainware ceramics incorporate two add-ons as well as the losses and transitions I note. Neither of the two are abundant, neither are ceramic vessels, and neither have straight forward explanations of function. The first are ceramic disks that are reshaped from larger pot sherds. Patrick Kirch and Scarlett Chiu (2022:315) interpret similar specimens from Mussau as gaming pieces for a "disc-pitching game." These, as they suggest, may have been a "precursor to the later Polynesian game of *tupe*." The second addition is a series of knobs, legs, and thickened ceramic pieces with various projections. There is little in the way of uniformity in this collection other than the oddness with which they were formed. In the late 1990s, Roger Green thought some might have been legs for ceramic kava bowls, as made in Fiji today. I sent him two of these to test for kavalactone residue; nei-

20 Kirch (1988:109) does identify a large pit at a Polynesian Plainware site (NT 93) on Niuatoputapu as being used for fermentation while he and Green (2001:160) suggest other possible examples.

ther was successful. Similar specimens have been excavated from the Sigatoka Sand Dunes and other sites in Fiji. The Sigatoka examples invariably are called "pot rests" (Birks 1973:125), though how a pot could rest on these things remains to be determined.

The Polynesian Plainware phase non-ceramic artifact assemblage, to say the least, is meagre in comparison to its ceramic one. Only rarely does the artifact count from excavated sites in Tonga rise above 60, with the majority dominated by shell valuables. As a collective, the assemblage replicates closely that of the Lapita phase as I note at the outset of the chapter. Drilled Lapita plaques made from conus shell body segments, an artifact type presumably strung together as bands worn on the arm or ankle, no longer occur. As well, a comparison of shell disk beads and conus shell bracelet/ringlet segments appears to illustrate an inverse relationship between Lapita and Polynesian Plainware periods. Bracelet fragments dominate in Lapita relative to beads, while beads are more abundant than bracelet pieces in Plainware. For this, there is a qualification. These percentages could as easily reflect a sampling issue rather than newly discovered insight into a change in personal adornment. The consistency of the Lapita to Polynesian Plainware artifact assemblage in terms of shell, lithic, and bone tool kits suggests more than a continuity in occupation. It implies long term stasis in the nature of day to day tasks where adaptation and innovation may have been limited.

Comparison of Lapita and Polynesian Plainware faunal assemblage are in some ways spectacularly varied but in other ways not so much. On the spectacular side, the extinct birds and iguana we have documented for Lapita faunas in Tongatapu, Ha'apai, and Vava'u are no longer present. This emphasises the rapidity with which these extinctions took place, and the devastating consequences of founder colonies on these islands. It was, to use the words of my colleague David Steadman again, a "blitzkrieg event." Very much in a similar way, substantial decreases occur in sea turtle bone in Plainware period sites throughout Tonga. This is most apparent at the Mele Havea site in southern Ha'apai, as described in Chapter 5, but the pattern is conspicuous in all of the excavated site assemblages. In opposite fashion, fish and shellfish faunas across Ha'apai illustrate high degrees of stability as well as productivity (Cannon et al. 2018). There is nothing we can see to suggest resource depletions or changes in the nature of the fishery, fishing methods, or reef foraging practices in these islands. On Tongatapu and in Vava'u, the circumstances are more complicated. Sea level fall on Fanga'Uta Lagoon did affect lagoon sedimentation and ecology, and this resulted in a dramatic change in shellfish availability and exploitation (Spennemann 1987). Vava'u can only be described as same old, same old. Limitations and deficiencies in the fishery and foraging reefs continued to impede subsistence economy and, it would seem, settlement expansion. Finally, it is remarkable to note that unequivocal evidence for pigs or dogs in Polynesian Plainware fauna continues to be absent. This is enigmatic given the presence of pig and dog in both proto-Oceanic and proto-Polynesian lexicons, as well as the ultimate role pigs came to play in the Polynesian feasting complex.

Of the insights we might gain for the Polynesian Plainware phase from archaeological data, site distribution and site size are by far the most revealing. I already have described the density of sites along the north coast of Tongatapu, extending across the island interior. By the end of the Polynesian Plainware phase, Dirk Spennemann (1989) suggests most of Tongatapu was settled, including 'Eua and the smaller offshore islands. This also was the case throughout Ha'apai. On Lifuka, Polynesian Plainware ceramics are associated with a 5 km long midden ridge running parallel to the leeward coast (Burley 1994). Concentrations along this ridge occur in several areas, including Tongoleleka and Holopeka, these representing quite sizeable communities. On 'Uiha, the small Lapita hamlet at Vaipuna expanded in size to over 1 km in length while also spreading shoreward as sea levels fell. Even on Matuku, the 0.3 km^2 island in central Ha'apai, the contemporary village is underlain by a Polynesian Plainware settlement. For Niuatoputapu, the central volcanic ridge was rimmed with well-developed midden deposits in which Plainware ceramics occur throughout (Kirch 1988). Tom Dye (1988) likewise reports an expansion of Polynesian Plainware settlement in Niuatoputapu onto the nearby and somewhat inhospitable volcanic island of Tafahi. The Tongan landscape noticeably was beginning to fill.

In August of 2001 following installation of the Lapita exhibit at the Tongan Museum, the present King, HRM Tupou VI, asked David Steadman and I to go to the far southern outlier of ʻAta (Fig. 7.5). He was serving as Prime Minister at the time, and considering the declaration of ʻAta as a National Park or Ecological Reserve. ʻAta is a remnant volcano isolated from Tongatapu by 140 km of open ocean. Blackbirders (slavers) had raided the island in 1863, with the remainder of the population then resettled on ʻEua. There have been few visitors to ʻAta since, the most notable being a group of castaway school boys washing ashore in the mid 1960s, and New Zealand archaeologist Atholl Anderson in 1977. Anderson (1978) mapped in detail the abandoned village of Kolomaile, and he carried out a limited number of test excavations. From the tests, he recovered three small ceramic sherds enticingly suggesting a degree of antiquity. My objective in 2001 was to sort that out, while Steadman was to record ʻAta's bird population. The naval patrol vessel VOEA Neiafu became the field vehicle, dropping us off and picking us up four days later on its return from the Minerva Reef. I have had many adventures in the course of my career, but ʻAta ranks near the top. It was as if Jules Verne had penned the script, from the spectacularly difficult landing in hard pounding surf, to the grueling trek across a shoreline covered by massive rock fall, to the primeval-like scenery of ʻAta's steeply rising slopes. We learned a lot in a few short days, not the least coming from Steadman's incidental discovery of ceramics on the surface of the upper plateau. With rim sherds of unmistakable Polynesian Plainware subglobular jar form (Burley et al. 2003), and ceramic petrography identifying the sherds as manufactured on ʻAta (Dickinson 2003), the settlement of this island was astonishingly early. The volume of lithic flakes, cores, preforms, and adze segments observed or collected during the project suggests tool stone export as a key motivation (Weisler 2003).

Figure 7.5. Landing beach on ʻAta with Bird Rock in background right. ʻAta was first occupied during the Polynesian Plainware phase sometime before 400 BC.

Every once and a while you get lucky. For me, it was in December of 2003 when I was invited as a participant to a workshop on Pacific Island demography held at the Richard Gump Research Station on Mo'orea, in the Society Islands. If you have never been to Mo'orea, put it on your bucket list. It is one of the more stunning and beautiful high volcanic islands in the heart of tropical Polynesia. I have briefly spoken of this workshop in the previous chapter. The event was small, incorporating an interesting mix of Oceanic archaeologists and demographers. My presentation, and in the subsequent publication (Burley 2007), gave an estimate for the maximum population size relative to carrying capacity limits for human settlement in Tonga. With this as a measure, I went on to examine transitions and checks in population growth through the archaeological past. Anthropologist Alaric Maude (1965) provided the groundwork for this type of analysis in the 1960s, estimating a maximum population of 29,700 individuals for Tonga. This, later, was revised upward by Patrick Kirch (1984) to 40,000. My assessment, like Maude and Kirch, centres in part on the nature of the crops being grown, the amount and productivity of arable land available for cultivation, and how much of that land per person is required in support. Unlike Kirch and Maude, I also accounted for supplemental provisions from the reef and fishery, downscaling these numbers for Vava'u in recognition of resource limitations. Full land capacity in my estimation was reached with a population size of 34,223 individuals (Burley 2007:186). How long it took for a founding population of 100 to attain that size could then be calculated using an exponential population growth rate of 0.008 per annum. A variety of studies support this rate, notably including one on biological anthropological data for Maori population growth in New Zealand (Brewis et al. 1990). In this exercise, a full land capacity in Tonga occurred early, in fact somewhere in the vicinity of 200 BC (Burley 2007:194). That was not expected, at least by me. Tongan settlement reached carrying capacity limit by the end of, or slightly after the Polynesian Plainware phase! The distribution and density of Polynesian Plainware sites throughout Tonga are not there by happenstance, they provide an independent measure of support for widespread population growth throughout the archipelago.

The population growth model is based on agricultural capacity as can be examined in traditional land use practice. This incorporates a high yield, mixed crop, short fallow, dry land farming system with integrated tree crops. To the eyes of Captain Cook in 1773, Tongan gardens were as fertile as any occurring on "the most fertile plains of Europe" (Beaglehole 1969:52). The agricultural system witnessed in 1773 was a far cry from what we project for initial Lapita colonists. At Hopoate and other Lapita sites in Tonga there seems to have been low-level, family-based food production through smaller swidden gardens, planting pits, or, in Ha'apai and Vava'u, the use of wetland swales. For the type of population growth estimated in the Polynesian Plainware phase, some degree of intensification in agricultural capacity must have taken place. The Tongan archaeological record is poorly suited for a firm documentation of when and how this would have occurred. The widespread veneer of pottery recorded in the interior of Tongatapu or on several of the islands in Ha'apai suggests forest clearance was well underway. It is hard to think of a reason why, save for the establishment of field systems as are present in dryland agricultural practice. There is still another possible indicator of agricultural intensification in the Plainware archaeological record, albeit a somewhat indirect one. Plainware occupation sites are characterized by thick deposits of dark organic sediment where shellfish account for only a small percentage of volume. The origin and accumulation of these sediments cannot be explained easily through wind or slope wash transport. Rather, the sediments most likely derive from long term and slow accumulation of garden soil mixed with household organics, the former brought to the village adhering to root crops, mud on people's feet, and in a myriad of other quite subtle ways.

The islands of Vava'u stand in marked contrast to the picture of Polynesian Plainware settlement and population growth that I paint for Tonga more generally (Fig. 7.6). Archaeological survey in 2003, as well as at other times previous and since, provides a reasonably comprehensive coverage for 24 islands, not the least including 'Uta Vava'u, as described in the previous chapter. These projects identified 12 sites in total with *in situ* Plainware occupation as well as 20 ceramic scatters or isolated finds. Most of the latter, as Janet Davidson (1971) concludes, serve only to say that pottery was being used somewhere in the vicinity. Again, the majority of Vava'u sites are clustered on the south-central and southeastern islands, and only a few appear to be more than hamlet-sized settlements. None of the latter occurs on 'Uta Vava'u. The limited nature of the Plainware population in Vava'u seems mystifying with so much land available for agricultural expansion. Most of the Vava'u soils are moderately deficient in nitrogen and to varying degrees other nutrients (Orbell et al. 1985)[21], this

21 The majority of soils in Vava'u are classified as belonging to the Pangaimotu and Longomapu groups. Their nutrient deficiencies in nitrogen, phospates, and potash however, are similar to most soils described for Ha'apai and Tongatapu (Orbell 1983).

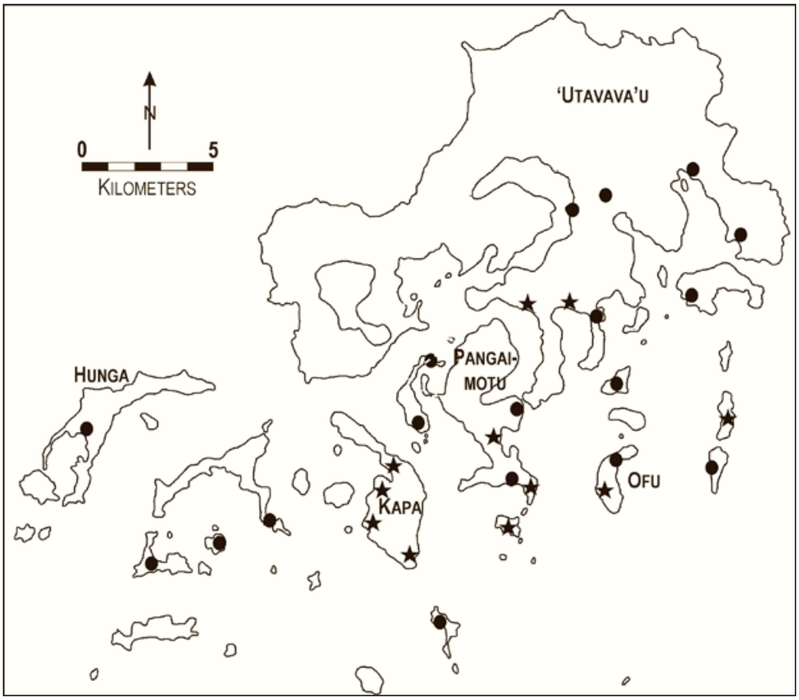

Figure 7.6. Polynesian Plainware site locations in Vava'u. Isolated ceramic finds without archaeological deposits are marked by dots. Sites with *in situ* occupation are delineated by stars.

possibly being a factor. The density and the nature of the rain forest here, combined with steeply sloped terrain or cliff face on several of the islands, might also serve as impediments. Or, as I suggest in previous discussions, when these problems are combined with the limited nature of the fishery and reefs, extensive population growth was critically handicapped.

Polynesian Plainware phase ceramics are notable for their homogeneity across a distance of almost 800 km from 'Ata in the south to Niuatoputapu in the north. This anticipates interisland engagement, an interacting community of potters, and some degree of integrated society. Movement of people and material throughout Tonga at this time is well illustrated in XRF studies of excavated volcanic glass fragments from multiple sites in each of the island groups. Niuatoputapu volcanic glass is found in Polynesian Plainware phase occupations at Ha'ateiho, Kauvai 2, and Talasiu on Tongatapu, Tongoleleka, and Vaipuna in Ha'apai, and at 'Otea and Falevai in Vava'u (Burley et al. 2011). Our analyses also compared the geochemical signature for source samples from Niuatoputapu with samples from four sites reported in Sāmoa. Three of these are temporally associated with the Plainware phase in Sāmoa. A simple bivariate plot of strontium (Sr) versus rubidium (Rb) for the results categorically demonstrates the distinctiveness of Niuatoputapu volcanic glass relative to the Sāmoan material. The geochemical analysis further included volcanic glass from Lapita and Aceramic assemblages in Tonga, with a total of 68 samples from the length of the archipelago. All but one specimen has an origin in Niuatoputapu. The exception is Sāmoan, recovered from the late period 17th-century AD occupation at Vuna in Vava'u. The absence of Sāmoan volcanic glass with any degree of antiquity in Tonga seems telling, as does the absence of Niutoputapu volcanic glass in any of the Sāmoan Plainware sites where volcanic glass occurs (Clark and Wright 1995). These distributions potentially define an unexpected Tonga/Sāmoa boundary, across which limited interaction was taking place.

Sean Connaughton (2014:224–227) carried out additional XRF geochemistry on a sample of 96 andesitic basalt adzes, adze fragments, and adze flakes recovered from Lapita, Polynesian Plainware, and later Aceramic strata at various sites in Tonga. The island arc volcanoes of Tonga are difficult to differentiate relative to geochemical signatures as earlier reported. For the chemical elements of strontium (Sr) and zirconium (Zr), they are easily distinguished from hot spot volcanics as occur in Sāmoa as well as from other sources in Fiji and further to the west. Sean employed a Bruker portable XRF spectrometer, a machine looking for all the world like a ray gun off a Star Trek movie. His results are as intriguing as the spectrometer. The largest group in the Lapita period, as one might expect, are Tongan volcanics, but there are multiple specimens from the Lau Islands of Fiji, an unidentified source, and a possible adze fragment from Sāmoa.[22] Small population or not, Lapita voyaging to Lau, and, presumably throughout Tonga, appear commonplace activities. For Plainware, virtually the entire assemblage is Tongan except for two specimens from Lau (Fig. 7.7). It is as if the period of widespread voyaging came to an end. Polynesian Plainware peoples in Tonga seemed to turn inward. Finally, in the Aceramic assemblage, the pattern is dramatically reversed with Sāmoan source samples almost as prevalent as Tongan ones. This pattern previously had been documented by Geoff Clark (Clark et al. 2014) who, with colleagues, analyzed a large sample of materials from the late chiefly centre of Lapaha, on Tongatapu. Sixty-six percent of the Lapaha stone tool assemblage had been imported, most from Sāmoa but with Fiji well represented. This, in Geoff's view, demarcates the emergence and intensification of a long-distance economic and political exchange system characteristic of the archaic Tongan state.

The end of the Polynesian Plainware phase occurs by 400 BC, as I examine later. It is defined in Tonga by the almost simultaneous disappearance of pottery without evidence for progressive degradation of the industry (Connaughton 2015). The question of how and why is as puzzling as the loss of Lapita decoration. In this case, perhaps more so. As a technology and material culture associated with the rise of sedentism, agriculture, and cultural complexity in human history, the abandonment of ceramics conflicts with evolutionary expectations for cultural development. Ancestral Polynesia is one of the few examples on the globe where this occurs. There have been several attempts at explanation, ranging from functional considerations of pottery use through the social role of ceramics in Plainware society (Le Moine 1987). None are overly robust or causal, in and of themselves, and none incorporate evidence beyond theoretical or speculative

22 Sean's analysis identified three Sāmoan samples. I have reexamined these closely with one determined to be a nonvolcanic material and another with a context wrongly grouped with Lapita. Reepmeyer et al. (2021) have more recently identified a small number of Sāmoan adze flakes/fragments in late Lapita deposits at Talasiu.

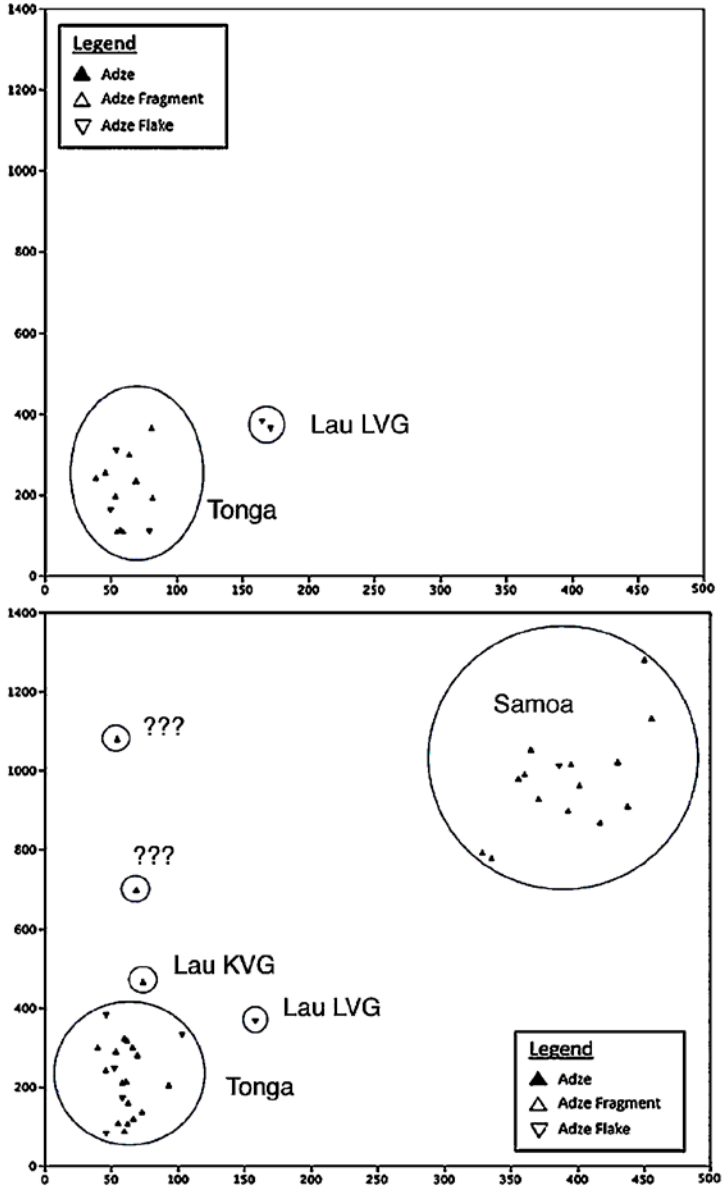

Figure 7.7. Trace element source geochemistry for Tongan andesitic basalt artifacts strontium (vertical axis) versus zirconium (horizontal axis). Polynesian Plainware specimens are in upper plot with Aceramic period artifacts plotted below. Based on Connaughton (2014:224–225) with permission.

premise. We do know that Tongan society and cuisine continued, unchanged by the passing of earthenware pottery. As New Zealand archaeologist Janet Davidson (1977:91) comments, the abandonment of ceramics, and the failure of later Polynesians to "relearn the art," is an intriguing reflection of cultural process requiring much more study. I pass that mystery to a future generation of colleagues.

Ancestral Polynesian Society and the Long Pause

A small nucleus of Lapita colonisers rapidly settled Western Polynesia. Longstanding consensus exists for a hiatus between these first arrivals, and renewed exploration into the archipelagos of Eastern Polynesia. This interval is the "long pause," a period of time in which Polynesians became Polynesian as emphatically stated in the quote by Patrick Kirch at the chapter's outset. Proto-Polynesian, the discrete linguistic sub-stage to which all Polynesian languages belong, diverged from proto-central Pacific, the latter presumably marked in archaeology by the Eastern Lapita phase. Proto-Polynesian is a well-studied language stage, its structure and vocabulary reconstructed through comparative historical linguistics across the spread of Polynesian languages (Fig. 7.8). Described by Kirch and Green (2001:58–59), these lexical reconstructions represent "the point at which this subgroup finally broke apart," a time coincident with the settlement of "parts of central Eastern Polynesia and certain Polynesian outliers." Technological innovation and societal change in Western Polynesia are additionally expected during the long pause. This, then, provided a suite of traits distinguishing Polynesian from its earlier Lapita ancestry (Kirch 2017:192–194). Like proto-Polynesian, these traits form an ancestral template, one ultimately transported into Eastern Polynesia. And also like proto-Polynesian, the composition and characteristics of this template can be revealed through ethnographic comparison across the Polynesian

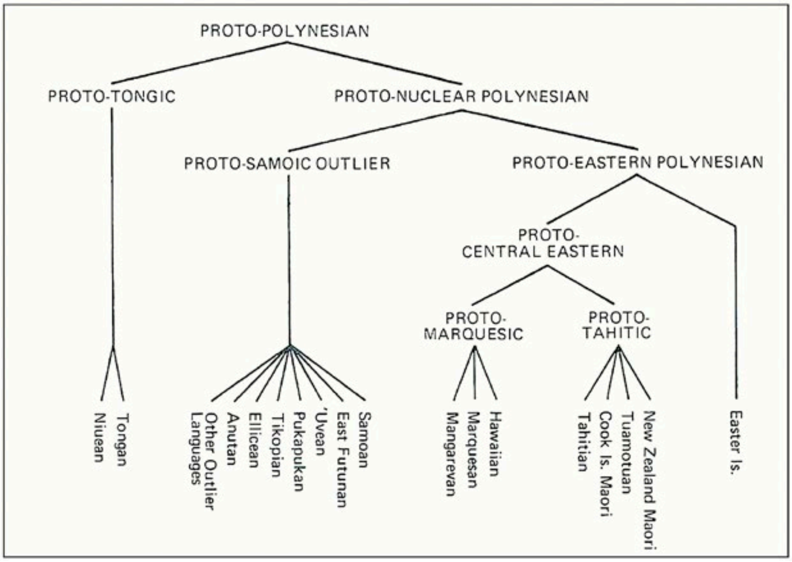

Figure 7.8. Proto-Polynesian linguistic subgroupings and divergences distinguished by linguist Bruce Biggs, as illustrated by Kirch (1984:27), with approval.

triangle. This shared ancestral language and cultural template account for the high degrees of correspondence in Polynesian languages and cultures, historically and today.

Chapter 2 provides a cursory review of Austronesian linguistic reconstruction as pioneered by Otto Dempwolf and built upon by numerous linguists since. I also discuss the Oceanic Lexicon Project under the guidance of historical linguists Malcom Ross, Andrew Pawley, and several others. Proto-Oceanic is the language spoken by the Lapita people as they crossed Remote Oceania to arrive in Fiji. Trying to write a history and ethnography of the Lapita past from pot sherds, stains in the ground, a limited material culture, and a selective sample of food refuse is difficult. The proto-Oceanic dictionary substantively enhances our abilities to do just that. Bruce Biggs, a Maori linguist, and his students at the University of Auckland, similarly initiated a proto-Polynesian lexicon project in the 1960s (Biggs 1979). Given the name POLLEX, the project continues today with over 5,000 word reconstructions. These are integrated within and accessible through an easy-to-use, on-line database (Greenhill and Clark 2011). Reconstructions range widely from details of the material world to broader concepts of cosmology and society.

With extensive knowledge of Polynesian ethnography, and a full appreciation of comparative historical linguistics and proto-Polynesian vocabulary, Patrick Kirch and Roger Green published a landmark paper in the journal *Current Anthropology* in 1987. Here they championed a phylogenetic approach to the Polynesian past. This is a "genetic model"[23] where cultural divergences from an ancestral core and subsequent relationships can be isolated, grouped, and illustrated. The phylogenetic unit is defined in linguistics by proto-Polynesian, but where "physical type" and "systemic cultural patterns" additionally support the notion of an integrated ancestry for the 30+ Polynesian societies as they currently exist. To cite Kirch and Green (1987:168), the definitive goal is to "understand and ultimately explain evolutionary change in Polynesia," and this requires the ancestral culture or society to "be precisely delineated and extensively reconstructed." Ancestral traits (homologies) can then be defined and differentiated from those illustrating later adaptations, innovations, convergences, or resulting from external contact. Data from archaeology, biological anthropology, ethnography, and ethnohistory, combined with that of historical linguistics, provides the fuel for analysis. The 1987 publication focused largely on method and rationale, with "some initial propositions" for evolutionary process. I label this paper landmark, not so much for the approach, but more so for its initiation of a collaboration through which the authors began to flesh out the details of an ancestral Polynesian society. Their initial intention was to integrate these details within "a little essay between covers" (Kirch and Green 2001:xiii). The consequence, in fact, was a 370+ page

23 The term "genetic model" in this sense is taken from Romney (1957) and Vogt (1964), the latter laying out an eight-step methodology adapted by Kirch and Green (1987:163).

volume titled *Hawaiki, Ancestral Polynesia: An Essay in Historical Anthropology.*

For virtually all peoples in eastern Polynesia, *Hawaiki* and its lexical derivatives refer to a distant homeland, the place where ancestral spirits reside. To Kirch and Green (2001:96), this homeland is the Sāmoa-Tonga region, where ancestral Polynesians began their journey eastward, completing a final stage in human exploration and settlement of the globe. The initial focus of the *Hawaiki* volume restates and examines the principles and methods on which their phylogenetic approach is based, incorporating a detailed discussion of Polynesia as a phylogenetic unit. Here they lay out a triangulation method in which "the subdisciplines of historical linguistics, archaeology, comparative ethnology and biological anthropology independently contribute.... to the common objective of historical reconstruction" (Kirch and Green 2001:43). The majority of *Hawaiki* though is an ethnographic-like account with reconstruction and insights into ancestral Polynesian society. Individual chapters focus on the "Ancestral Polynesian World," "Subsistence," "Food Preparation and Cuisine," "Material Culture," "Social and Political Organization," as well as "Gods, Ancestors, Seasons and Rituals." I was thoroughly impressed with this volume on first reading. It was brilliant! The richness of the linguistic data, the insights these provide, and the innovative and interdisciplinary approach to support interpretations or decipher additional details brought ancestral Polynesia alive. All of this was taking place in the long pause, where previously so little had been extracted from the archaeological record beyond rather boring descriptions of plainware pottery.

Yet the framework for analysis, its application, and some of the underlying assumptions raise questions. Much of this relates to the archaeological record, or lack thereof, as well as Kirch and Green's attempts to correlate that record with the origins, development, and breakup of proto-Polynesian. The paucity of appropriate archaeological data is anticipated in a commentary on the 1987 article by Anthropologist/Museum Curator Robert J. Welch. As he observes, in spite of "Kirch and Green's insistence to the contrary, the data from Polynesia's archaeological record are so thin that they appear obliged to draw historical, phylogenetic, and evolutionary conclusions from linguistic markers" (Welch 1987:451). In fact, in 2001 when *Hawaiki* was published, our understanding of the archaeological record in West Polynesia beyond first Lapita settlement and the late prehistoric chiefdom period can only be described as dim. It was so dim in Tonga, that a large part of the middle period sequence had been labelled the "Dark Age" (Davidson 1979). The archaeology for ancestral Polynesia, thus, derives largely from Green and Davidson's (1969, 1974) studies in independent Sāmoa as well as Kirch's excavations on Niuatoputapu (Kirch 1988), on Ofu, American Sāmoa (Kirch and Hunt 1993), and on Futuna and Alofi (Kirch 1981). Roger Green would often call me from Auckland in an effort to plumb additional information or get my insight from Tonga as the volume was being penned. I cannot say I was of much help, and the few bits of information I passed on had little influence. Relative to the latter are reconstructions for the ancestral Polynesian trolling lure, the nature of one-piece fishhook manufacture, and the absence of an early octopus lure rig (Kirch and Green 2001:131–141). Suffice it to say the reconstructions in *Hawaiki* in each of these cases is not at all consistent with the Tongan case (Burley and Shutler 2007).

In fairness to Kirch and Green (2001:83), they acknowledge the limitations of their archaeological database, challenging archaeologists to "turn finer-grained attention to sites in the age range bearing on Ancestral Polynesian culture." Of particular concern for the construction of ancestral Polynesia is temporal control. This is an essential requirement for the definition of a phylogenetic unit based largely on linguistics. Polynesian archaeology, they argue, did have sufficient dates and data to afford that capacity. By 2001, the Eastern Lapita chronology was reasonably well established in Tonga, with an age interval of 900–650 BC, or thereabouts (Burley et al. 2001). To Kirch and Green, the transition to the Polynesian Plainware phase and related developments were most critical. This transition provided the parallel link between linguistic and archaeological evidence, where proto-Polynesian (Plainware) diverged from proto-Central Pacific (Eastern Lapita). The Polynesian Plainware phase and ancestral Polynesian culture, became one and the same. No less than 32 Polynesian Plainware sites in Western Polynesia are listed by Kirch and Green as ancestral Polynesian; almost half of these occurring in Tonga, with the remainder scattered through independent Sāmoa, American Sāmoa, Futuna, and ʻUvea. Cumulatively these sites offered a data set from which "the reconstruction of certain cultural domains within Ancestral Polynesia" could be adduced (Kirch and Green 2001:81–83).

The beginning date for the onset of the Polynesian Plainware phase in the mid-7th century BC in Tonga was based largely on terminal dates for the Eastern Lapita phase. A chronology for the duration and end of the Plainware phase in the *Hawaiki* volume was less robust, incorporating a wide range of dates from the suite of ancestral Polynesian sites. The ceramic period in the ancestral homeland minimally was assigned an 800 to 900-year interval, extending to ca. AD 250 or even later (Kirch and Green 2001:168). This duration was significant for two reasons. First it provided sufficient time depth to meet Andrew Pawley's (1996) estimate for the full development of linguistic innovations associated with and defining proto-Polynesian. Second, and of equal importance, Kirch and Green (2001:79) were convinced that east-central Polynesian settlement, and the breakup of proto-Polynesian, began no later than AD 350. Again, the linguistic and archaeological records were aligned, with exploration of Eastern Polynesia (breakup of proto-Polynesian) occurring within a century or two after the demise of pottery technology (end of Plainware). Ceramics did not make the trip eastward, but they were sufficiently close in time to allow reconstruction of "emic" categories for pottery types as these had been applied to non-ceramic vessels (Kirch and Green 2001:166–173).

If the Polynesian Plainware phase is broadly defined as Ancestral Polynesia in a phylogenetic sense, and the Ancestral Homeland is identified as West Polynesia, then a relative degree of homogeneity for this phase should be expected across the region. Archaeological data indicate otherwise. In Tonga, the Polynesian Plainware phase is consistent throughout the archipelago with a range of cups, bowls, and jars as well as a limited but standardized material culture. Volcanic glass and geochemistry of Tongan and Sāmoan adzes further point to isolation rather than integration within a West Polynesian homeland (Cochrane and Rieth 2016). In Sāmoa, the ceramic industry is impoverished, largely limited to bowls, with many of these being thick and of crude manufacture (Addison et al. 2008). Sāmoa also is divergent in its development of a distinctive adze typology, and in its ancestral Polynesian fishing gear. While more poorly sampled, still other variation occurs in the plainware ceramic assemblages of Futuna (Sand 1990) and ʻUvea (Sand 1998). Kirch and Green recognized and accepted these variations as "historical differentiation" but where a broad cultural base came to "cohere." The divergences, then, were referred to as Ancestral Polynesian "*societies*" (my emphasis), in contrast to the unified proto-Polynesian linguistic model. In justification, they (2001:77) state that any attempt "… to get too close a chronological 'fit' between the different biological, linguistic and cultural fields is probably an unwarranted expectation, and not even a realistic occurrence historically." The theoretical foundation for Ancestral Polynesia, at least the one so comprehensively promoted as a phylogenetic unit, became complicated.

Temporal Considerations for Ancestral Polynesia

As the volume *Hawaiki* was being planned, it would have been difficult to predict future developments in radiocarbon chronologies across Polynesia. These have been revolutionary through improved technologies, in consideration of the materials being dated, in refinement of the radiocarbon calibration curve and other offsets, and in disciplinary reflection on what is an acceptable relative to unacceptable date. To large extent, I address this transformation in Chapter 5 in discussion of Lapita chronology for Ha'apai. Yet for Kirch and Green, and the publication of *Hawaiki*, there had been a foreshadowing of things to come. A considerable volume of East Polynesian radiocarbon dates did exist by the 1990s to infer the breakup of ancestral Polynesia. These, however, are best described as a mixed bag, with many of the dates having questionable integrity, or where stratigraphic/contextual associations are not secure. Mathew Spriggs and Athol Anderson attempted to make sense of this chronological muddle in 1993, ostensibly to resolve existing debate over island specific chronologies with implications for East Polynesian settlement. Applying a strict set of chronometric hygiene requirements to then existing data, a majority of the dates were either rejected or identified as questionable. In the case of Hawaii, for example, 60 of 109 dates could be discarded outright, 28 others were questionable, and only 21 (19%) met an acceptable standard. When stripped of problems, the remaining set of dates were informative to say the least. In the words of Spriggs and Anderson (1993:211), there was "nothing to demonstrate settlement in East Polynesia earlier than AD 300–600" with the probability that it could be as late as 650–900 AD. The long pause was getting longer.

The East Polynesian radiocarbon database grew substantially over the decade and a half following the Spriggs and Anderson review. By 2011, Janet Wilmshurst and colleagues (2011) were able to compile 1,434 radiocarbon dates to conduct a meta-analysis that, in their overall objectives, parallels the earlier study of Spriggs and Anderson. Chronometric hygiene principles again were applied with dates classified into one of three groups relative to integrity. Class 1 dates in this scheme (n = 209) are from short-lived plant species or eggshells without the potential for inbuilt age. Class 2 and 3 dates are based on unidentified charcoals or other less reliable materials. Subsequent analyses provide cumulative and summed probabilities for calibrated age ranges for each class, illustrating considerable skew between groups. The conclusions of this study are informative. The Class 1 data set supports a two-stage sequence of colonisation for East Polynesia, with the earlier phase occurring in the Society Islands between "A.D.~ 1025–1120." After a delay of 70 to 265 years, settlement expansion then moved into the far eastern, northern, and southern archipelagoes (Wilmsherst et al. 2011:1816). The implications are important, ranging from evolutionary considerations of monumental architecture in East Polynesia to time frames for human impacts on island ecosystems. The authors also note that, "linguistic similarity, often used to trace phylogenetic relationships of populations in East Polynesia according to a longstanding model of relatively slow, incremental expansion, now needs to be reconsidered in terms of founder effects and isolation" (Wilmsherst et al. 2011:1818). Not all regional archaeologists are convinced by the meta-analysis (Mulrooney et al. 2011), but it is impossible to deny a far more recent chronology than previously conceived. The long pause has become truly long, potentially extending over a temporal period between 1,800 and 1,900 years.

Earlier I presented the more recent revisions to Lapita chronology in Tonga with identifications of short-lived species radiocarbon dates and high precision U/Th dates on coral file abraders. Integrating these into a Bayesian analysis, temporal intervals could be defined for the Lapita phase on Tongatapu, Ha'apai, and Vava'u. Within that study, Polynesian Plainware dates were dealt with in a separate Bayesian model with similar objectives. The results suggested a much shorter chronology than anticipated, but mitigating factors raised questions for a secure interpretation (Burley et al. 2015). The number of dates was limited and disproportionately distributed for Ha'apai (n = 14) compared to Tongatapu (n = 3) and Vava'u (n = 2). All 19 of the dates fell within the Hallstatt Plateau, this being a flattening in the radiocarbon calibration curve that homogenizes calibration outputs to a roughly 350-year interval. Sampling bias also was anticipated for the Ha'apai Plainware dates, as most had been selected to date the Lapita/Plainware transition. But to be truly honest, I was convinced of a much longer temporal period for the Polynesian Plainware phase given the published estimates for Ancestral Polynesian Society by Kirch and Green, and the sheer abundance and distribution of Plainware sites across the archipelago.

The limited suite of Polynesian Plainware dates and the Bayesian results were perplexing. I made the decision to re-examine the issue in 2017 with additional radiocarbon dates drawn from my inventory of unprocessed samples. Geoff Clark, who had been dating Plainware deposits at Talasiu and two other sites on Tongatapu agreed to collaborate, as also Sean Connaughton. Sean previously had published a comprehensive list of Plainware dates throughout West Polynesia (Connaughton 2015). As for the new dates, these were selected from middle and upper matrices in Plainware occupation strata with priority given charcoal samples from short-lived species. The outcome more than doubled the original suite of dates, now including 44 radiocarbon measurements (Fig. 7.9). The data set incorporated 14 dates from five sites on Tongatapu, 24 dates from six sites in the Ha'apai group, and six dates from two sites in Vava'u (Burley et al. 2018). All dates are from charcoal with 17 of short-lived material, predominantly coconut shell. All but two samples were measured by AMS radiocarbon dating either by myself or Geoff. In archaeology, it is rare to find a radiocarbon record with complete and undeniable coherence. Our results are exactly that, with 44 dates providing a consistent and convincing story. All dates overlap, but 39 of these fall within the Hallstatt plateau calibration curve interval.

The Hallstatt Plateau is a well-known and frustrating phenomenon for radiocarbon calibration, particularly in Europe where almost the entirety of Iron Age archaeological sites falls within its boundaries (Hamilton et al. 2015). It is caused by atmospheric variation in ^{14}C content and changes in the carbon cycle. For the radiocarbon calibration curve, it appears as an undulating and overlapping series of peaks and troughs. Consequently, a "date could fall in the lower trough of a wiggle where there is a decrease in atmospheric ^{14}C while another may fall on a peak where it is increased" (Burley et al. 2018). This can provide the impression of a reversal in the radiocarbon clock, or it can suggest inverse stratigraphy where lower dates are more recent than those above.

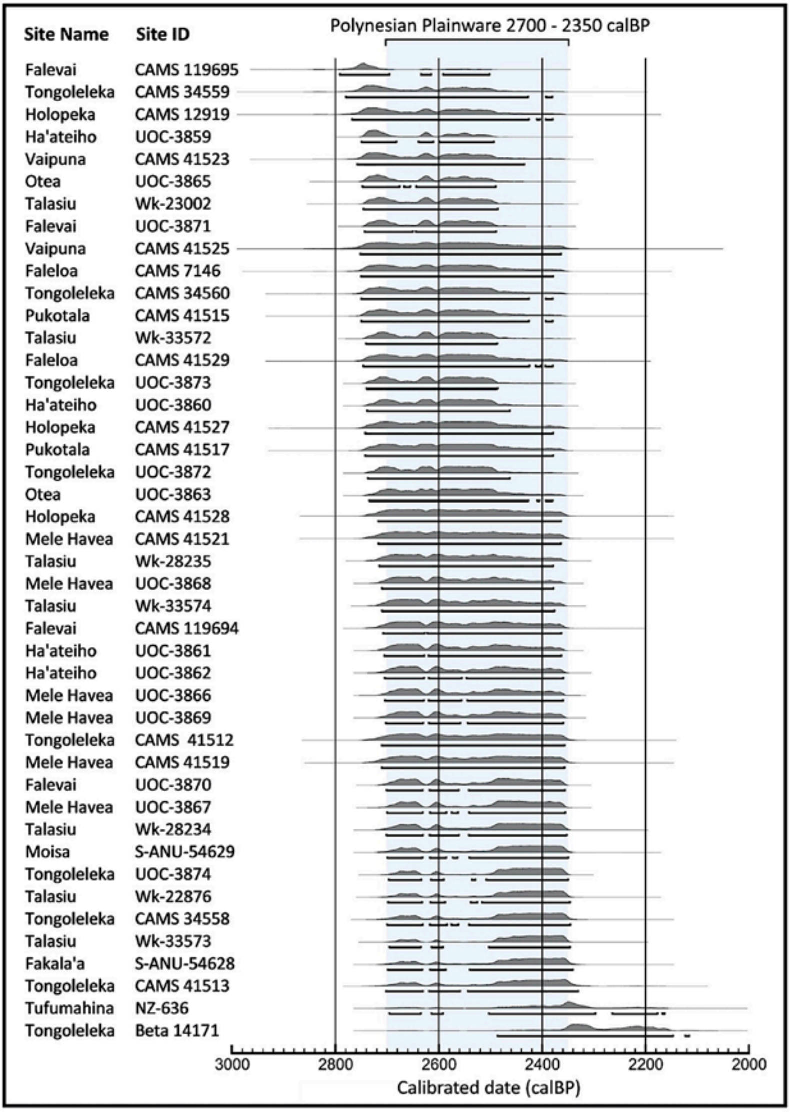

Figure 7.9. Plot of calibrated (95.4% probability) Polynesian Plainware dates in Tonga from Burley et al. (2018). The Polynesian Plainware temporal interval is defined as 750 BC (2700 cal BP) to 400 BC (2350 cal BP).

The latter, in fact, is the case for stratigraphically controlled dates from the sites of Talasiu and Tongoleleka. For the Polynesian Plainware phase in Tonga, there is no easy solution for the Hallstatt Plateau. Radiocarbon dates falling within its range, once calibrated, can date anywhere between 760 and 420 BC. The end of the Polynesian Plainware phase is set at 400 BC in approximate correspondence with the upper plateau boundary.

In the *Hawaiki* volume, ancestral Polynesia across the West Polynesian homeland correlates with a Polynesian Plainware phase dating between 650 BC and AD 250. The existing radiocarbon records for Plainware sites in ʻUvea and Futuna are either limited or difficult to assess. In Sāmoa, there may be a measure of support for the chronological interval with sporadic ceramic production claimed to be as late as AD 450 to 550 (Rieth and Hunt 2008). In the case of Tutuila Island in American Sāmoa, ceramic continuity is projected into an even more recent context (Clark and Michlovic 1996). The case of Tonga, nevertheless, seems significantly problematic. The maximum duration of Plainware here is 300 years at most, dating to the interval 700 to 400 BC. This is difficult if not impossible to reconcile if Tonga is to be integrated into the conceptual framework for an Ancestral Polynesia defined by ceramics.

For both Sāmoa and Tonga, the temporal extent for Ancestral Polynesia relative to first settlement in East Polynesia has even greater implications. If East Polynesia was settled no earlier than AD 1000 as Wilmshurst and colleagues suggest, then the interval between then and the end of the Lapita phase is 1,700 years. This is a protracted period of time for cultural development, with considerable consequences for the delineation of ancestral Polynesia. By ca. 900 AD in Tonga, a complex chiefly system under the Tu'i (Lord of) Tonga had emerged (Burley 1998), laying the foundation for development of a state-like polity (Clark 2016). Supporting this is the intensification of agricultural production through dryland field systems as documented by Captain Cook in the 18th century. Population saturation, internal chiefly conflict, developed maritime technologies with interisland voyaging, exchange, and a range of other implications need to be considered. On the other hand, socio-political complexity and population demography in the Polynesian homeland provide a compelling set of factors to elucidate the rapid colonisation of East Polynesia, as well as for the development of Polynesian chiefdoms across Polynesia.

In the Aftermath of Ancestral Polynesia

Ancestral Polynesia as a concept has issues; its application as a phylogenetic unit, the implications of its temporal framework, and the ambiguity and incongruity of archaeology and comparative historical linguistics are challenging if not irreconcilable. Yet, and to use a time worn idiom, do we throw the baby out with the bathwater? How can we dispute the idea that, somewhere in West Polynesia, there must have been a homeland and point of departure for eastward exploration and colonisation? And how can we ignore the cultural template and ancestral traditions common to Polynesian societies historically and today? Ancestral Polynesia did exist, and the people moving eastward brought with them its structure and common elements, regardless of cultural and socio-political diversity in place within the western archipelagoes. We need to rethink the framework for Ancestral Polynesia through its archaeological context, perhaps uncoupling it from the structure of proto-Polynesian, as defined in comparative historical linguistics. At the same time, can we not appreciate the significance of an ancestral lexicon, one providing insight into a suite of shared cultural traits in West Polynesia prior to East Polynesian settlement? My enthusiasm for those aspects of *Hawaiki, Ancestral Polynesia* continues unabated.

I am not a linguist, I have limited understanding of sound correspondences and lexical innovations, and even less comprehension on how these are given weight and analytically integrated into a study of genetic relatedness. This is especially the case when these data are assembled and analyzed through computational phylogenetics (Gray et al. 2009). Yet, where these studies result in a family tree with questionable interpretations, or in contradiction to soundly-based chronology, I feel the need to raise a hand. After all, linguists like archaeologists make assumptions, and these assumptions can structure interpretation. One of particular relevance to the Birth of Polynesia is the ancestral reconstruction of proto-Central Pacific as I already note. Proto-Central Pacific is the projected ancestor for Fijian, Rotuman, and Polynesian languages. As Kirch (2017:188) asserts, this is “the language spoken by the Eastern Lapita colonists of the Fiji-Tonga-Sāmoa area,” forming as “a dialect chain throughout the region.” In Chapter 2, I note that the archaeological data to support such a narrative is limited if existing at all, nor is there sufficient time depth for this to occur. Katie LeBlanc and I (Burley and LeBlanc 2015) go further, questioning the integration of Fiji, other than Lau, within the Eastern Lapita realm. And the problem of Rotuman, as the third divergence from proto-Central Pacific, remains an enigma in so far as the Rotuman archaeological record, at present, dates only to the 7th century AD or later (Ladefoged et al. 1998). There is little question why linguists refer to proto-Central Pacific as temporally ephemeral and weakly attested by lexical innovation (Pawley 1996).

My trepidation with proto-Central Pacific aside, University of South Pacific linguist Paul Geraghty (1983) proposed a period of common development for languages in Lau, southeastern Vanua Levu, and the antecedents of proto-Polynesian in West Polynesia. Also framed as a dialect chain, he refers to the aggregate as proto-Tokalau Fijian, Tokalau meaning “east wind.” Proto-Polynesian and Tokalau-Fijian subsequently diverged, the latter pulled into a west/central Fijian association through diffusion of lexical innovations. In Geraghty’s (1983:383) view, Tokalau-Fijian “transitioned” to a Fijian subgroup through convergent processes emanating from a “Southeast Viti Levu prestige area.” As complex as this might appear, the archaeological record seems to support this scenario (Burley 2005). Lapita and early Polynesian Plainware sites of Lau, unlike western/central Fiji, are all but identical to contemporaneous sites in Tonga. It is possible, or more likely probable, that Lau had been integrated throughout the Eastern Lapita phase in Tonga in the same manner as Ha'apai, Vava'u, and Niuatoputapu. This close association finds support not just in the ceramic record but through volcanic glass and adze geochemistry. Prevailing wind patterns facilitate interisland voyaging to and communications with Lau. If you are beyond the reef in Ha'apai or Vava'u in a dingy with failed motor, you will find yourself washing ashore in Lau three or four days later. That was the situation for Peau Halahingano, my field assistant in Vava'u, who experienced the journey firsthand.[24] Sometime during the Polynesian Plainware phase in Lau the ceramic record changed, both in technology and form (Burley 2005). These vessels are comparable to Plainware forms of west/central Fiji, with the ceramic record conforming to the Fijian cultural historical sequence thereafter (Best 1984).

There is still another linguistic event of critical importance that is marked in the "pre-Polynesian" period, and with well-defined reflection in the archaeological record. This is the emergence of southern versus northern "dialect clusters" in West Polynesia (Pawley 1996). This linguistic variation developed early, "…from the beginning in the formation of the Polynesian subgroup" (Kirch and Green 2001:59). For Andrew Pawley the variation seems well marked, but minor relative to the shared phonological, lexical and grammatical innovations that ultimately define proto-Polynesian. This variation, nevertheless, pre-structures the proto-Polynesian family tree with first order divergence of proto-Tongic and proto-Nuclear Polynesian subgroups, the latter including all Polynesian languages save for Tongan and Niuean. Kirch and Green (2001:78) suggest the Tongic/Nuclear Polynesian divergence, at least for the beginnings of dialectical variation, occurs as early as

24 Peau is by no means the only person I know in Tonga who inadvertently drifted to Lau. In a FAO United Nations Bulletin, the Lau Group is described as a "net" where "…the majority of vessels drifting away from Tongatapu, Ha'apai, and Vava'u eventually end up" (Gillett 2003).

the middle of the first millennium BC. The confusion of Sāmoan archaeology in the early period, and the Tongan/Sāmoan divide in the Polynesian Plainware phase are undoubtedly a reflection.

I have difficulty conceptualizing proto-Polynesian as a cultural/historical phase cross cutting West Polynesia. I am not sure I truly understand what proto-Polynesian means, beyond a reconstructed language stage that has structure and aspects of a lexicon common to all of Polynesia. The significant scope and duration given this linguistic unit and the absence of archaeological evidence indicating regional integration for this period cultivate obvious questions. Pawley (2020) similarly notes the issue of regional variation in proto-Polynesian, and its automatic equation with an ancestral Polynesian society extending across a West Polynesian homeland. Perhaps all of this will be elucidated or resolved when greater insights are forth coming for the so-called dark ages in the archaeology of Tonga and Sāmoa. Kirch and Green (2001:59) define the end of proto-Polynesian as the point where it finally "broke apart," a time they correlate with settlement of central Eastern Polynesia, and the Polynesian outliers in Melanesia. Yet as they and others illustrate in family tree classifications of Polynesian languages, the breakup predates this by a considerable margin with divergence of proto-Tongic and proto-Nuclear Polynesian. Colonisation of the Polynesian outliers and Eastern Polynesia, thus, is the breakup of the proto-Nuclear Polynesian linguistic substage. The working hypothesis for linguists and archaeologists is that these migrations originate from a homeland in Sāmoa, although one linguist, William Wilson (2012), suggests Eastern Polynesian settlement may have derived from the Polynesian outliers.

The migration of Nuclear Polynesian speakers beyond Western Polynesia is a volume in and of itself. It is a narrative in which the entirety of the Polynesian triangle and 18 Polynesian outlier islands in Melanesia became settled. For Eastern Polynesia, this involved new homelands, isolation, and multiple linguistic divergences as are now schematically defined in the proto-Polynesian family tree. In the sheer magnitude of what came to pass, it is hard to think back to that small number of canoes pulling ashore on the beach at Nukuleka on the island of Tongatapu. That was a historical moment indeed.

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Chapter 8

In the Rear-view Mirror

The geography of Polynesia is roughly configured as a triangle, where a little over 2,900 years ago Austronesian speaking Lapita colonists sailed across its western flank. These are the first individuals to walk on a Polynesian beach, and they form the nucleus from which Polynesia and Polynesians sprang. The archaeological evidence for this landfall points toward Nukuleka, then a small sandy islet at the head of Fanga'Uta lagoon on the island of Tongatapu. From that nascent beginning, we can follow the expansion and imprint of these people and their descendants around the lagoon on Tongatapu, and then northward into Ha'apai, Vava'u, Niuatoputapu, and onward to 'Upolu in Sāmoa. I have further examined post-Lapita archaeology as applied to the conceptual frameworks for ancestral Polynesia, and the shared template of material culture, behaviors, and language carried eastward into the remainder of the Polynesian triangle. As a book, "The Birth of Polynesia" is also about a personal journey of research, one taking over three decades to complete. This has involved numerous field seasons, a multitude of individual projects, and a large number of colleagues, students, and Tongan assistants who committed lengthy periods of time in the field and laboratory. This research, and its results, have been an ever-progressive endeavour since my first steps onto the tarmac at Fuamotu Airport in 1989. I am satisfied, I have done my best.

So, what in the rear-view mirror of this long-term project can I incorporate in a concluding chapter? Three decades of archaeological study have been able to track the specifics of Lapita colonisation and subsequent events northward through Tonga. A summary of the details as presented in various chapters seems repetitive and unneeded. Beyond this, though, there are peripheral areas in Lau, Futuna and ʻUvea with Eastern Lapita ceramics, as I touch upon briefly in preceding chapters. The range for Eastern Lapita expansion originally emanating from Tonga, and the boundaries for early Polynesia, are potentially extended. If a history of Polynesian origins in Polynesia is to be complete, these need to be addressed. Over the past 30 years we also have recovered new data contributing to or altering insights into at least a few of the larger questions for Lapita migration in Oceania. The implications of these for settlement process and its motivations similarly are important to highlight in the context of Lapita writ large. For this I have chosen two. The first focuses upon a Lapita colonisation strategy in which aroid planting pits are central for initial success, not just in Tonga but across the full extent of the Lapita range. The second is identified as the territorial imperative, an innate human factor seeming to drive Lapita settlement in the first place. It is hard to account for the rapid settlement of Tonga and West Polynesia otherwise. And finally, if there is one message to be taken from Lapita sites in Tonga I have encountered, it is the undeniable continuity in traditional Tongan material culture and practice. This continuity provides a link through which aspects of Lapita archaeology can be understood, and it reflects upon Tongan culture and identity in the contemporary world.

On the Periphery of Eastern Lapita Settlement

The Lau group of islands of eastern Fiji is positioned to the west of the Polynesian triangle while to the north, Futuna and ʻUvea extend the triangle's boundary to the west of Sāmoa (Fig. 8.1). Despite voyaging distances between 400 and 600 km from Tonga, Tongan influence in each of these groups is well documented

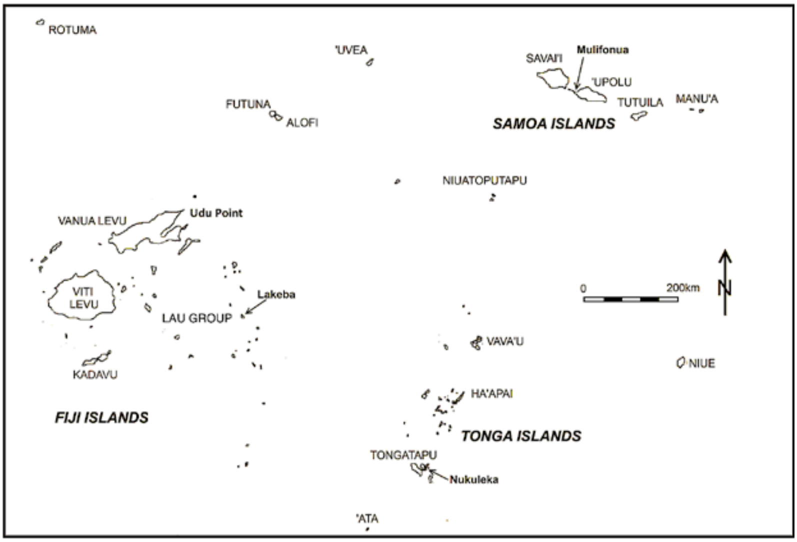

Figure 8.1. Western Polynesian with Fiji and Lau Group to east.

from at least the mid-15th century AD (Burley 1998). The recovery of Eastern Lapita ceramics on these islands illustrates a far deeper association and interaction in antiquity. As I will address, each variously has been suggested as a travel corridor through which early Polynesia came to be settled.

The Lau group incorporates upwards of 60 islands dispersed over an ocean expanse of 114,000 km^2. These islands have a complex geological history with some being high volcanic formations, others of raised coral limestone type, with still others incorporating both volcanic and coral limestone configurations. Like Ha'apai, currently inhabited islands have fringing and/or offshore reefs with productive fisheries and other resources. Archaeological investigations in Lau have been undertaken sporadically since the 1970s, albeit with projects of variable duration and scale. The most comprehensive project, and the most thoroughly reported upon, is that of Simon Best (1984) on Lakeba between 1975 and 1978. With his focus on the full range of Lakeba culture history, he recorded and excavated two sites with Lapita dentate stamp ceramics, both with a Polynesian Plainware overlay. The Lapita excavations are at Qaranipuga, a rock shelter with 4.7 m of well-defined stratified deposits and Wakea, an open beach site estimated to be 15,000 m^2 in area. Over 2,000 dentate stamped Lapita sherds were recovered from the latter. The Lakeba Lapita wares have simplified, open motifs typical of later Lapita style as occurs throughout Tonga, and at Mulifanua in Sāmoa. This association was recognized immediately by Best in a relative sense to Lapita wares from then excavated sites in Fiji. Thus, rather than an "outpost" of Lapita settlement in Fiji, his motif analysis shows Lakeba to have far greater similarities to Tongan sites. To Simon Best (1984:653), Lapita ceramics on Lakeba represent a "break to the west [that] is substantial and real" with the possibility that the Lau group "was finally settled from the east." All other Lapita sites recorded in Lau incorporate ceramics of similar nature.[25]

Beyond homogeneity in Lapita ceramics, there exists other evidence indicative of Tongan/Lau interisland voyaging if not integrated community relations in the Lapita period. At the Qaranipuga rock shelter, Best recovered two pieces of Niuatoputapu volcanic glass from the upper part of the Lapita occupation. Even as a straight-line voyaging distance, this material would have travelled no less than 600 km to arrive at its destination. As I also describe in the previous chapter, portable x-ray florescence analyses of Lapita adzes from several of the Tongan sites incorporate andesitic basalts from the three volcanic groups exclusive to Lau. These include Korobasaga volcanics, Mago volcanics, and Lau volcanics (Connaughton 2014:225). Of the Lapita samples identified to volcanic type, specimens from Lau account for 38% (13 of 34) of the total. This seems extraordinary, suggesting regular interaction between Lau and Tonga during the Lapita colonisation phase. Interaction is not surprising given the southeast trade

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25 This includes dentate stamped sherds from sites on Totoya (Clark et al. 1999), Votua (Clark et al. 2001), Mago (Clark et al. 2001), Ono i Lau (Best 1984), Cikobia i Lau (Nunn and Matararaba 2000), and Nayau (Jones O'Day et al. 2004).

winds, the ease with which interisland voyaging to Lau from Tonga was accomplished historically, and the not infrequent drift voyages that continue today.

The reconstructed narrative from comparative historical linguistics highlights the close relationship between Lau and Tonga. Paul Geraghty's (1983) concept of a proto-Tokalau Fijian linguistic substage in which Lau and pre-Polynesian peoples occur has support in the archaeological record. The divergence of Lau, and its integration into a western/central Fijian sphere of influence similarly is seen in the transition of plainware ceramics on Lakeba (Burley 2005). It also may be apparent in the decline of Lau volcanic sources in Tongan adze geochemistry for the Plainware period in Tonga. The Lau/Tongan relationship brings us to the bigger question of whether Tongan settlement is from Lau, or Lau is part of the post-Nukuleka expansion as previously described. In comparative historical linguistics, the Central Pacific substage of Oceanic hypothetically asserts a dialect chain extending across Fiji into West Polynesia. Even Geraghty takes the central Pacific subgroup for granted with proto-Tokalau Fijian arising as a dialect chain extending southward from eastern Vanua Levu. The immediate origins of the Polynesians in Geraghty's scheme of things lay in Vanua Levu with onward expansion through Lau.

The radiocarbon chronology for Lau is of mixed quality, with the earliest dates on marine shell, bone, and unidentified wood charcoals. Application of chronometric hygiene to these dates leaves little to support Lau as a staging ground for southern Tongan colonisation. On the other hand, Simon Best recovered two Lapita sherds from Wakea comparable to earlier Western types at Nukuleka and Hopoate. Both have complex motifs integrating restricted zone markers. Best (2002:41) describes one as "redder in colour than is standard for the site" while the other "is unique for the site in its yellowish colour." The dichotomy is intriguing, with parallel in the tan versus red paste sherds from Nukuleka. That said, the similarity may be more coincidental than real. Bill Dickinson's petrographic analysis in 1979 identified both as "Indigenous (?) Feldspathic-Lithic Tempers" (Best 1984:A37), albeit

Best (2002:41) challenges that the pyroxene-dominated temper of the red paste sherd clearly identifies it as an "import." The restricted zone markers on these sherds provocatively suggest Lau was explored or settled early, perhaps within the first few decades after landfall in Tonga, if not simultaneously.

As Polynesia's most westerly islands, Futuna and 'Uvea today are an island collectivity administered by France. Futuna and its adjacent island of 'Alofi are 275 km to the northeast of Vanua Levu, and 'Uvea is 230 km beyond. These islands are a volcanic/raised coral limestone mix with surrounding reefs limited in the former but well developed in the latter. Both have excavated Lapita sites; Asipani on Futuna (Sand 1993a) and Utuleve on 'Uvea (Frimigacci and Sand 2016). Dentate-stamped ceramics in both cases are limited in number and have open simplified motifs of the late Eastern Lapita variant. Associated radiocarbon dates after application of chronometric hygiene are again few, with the earliest dates appropriate to a late or very late Lapita context. Given the nature of the ceramics, and their age, it seems reasonable to argue for an extension of northwestern Lapita settlement from somewhere in the Tonga to Sāmoa corridor with southeast trade winds again facilitating exploration and colonisation. The integrity of this voyaging route is evident in the extensive interaction with and socio-political presence of Tongans in 'Uvea during the Tongan Maritime Chiefdom (Sand 1993b).

In the 1988 Niuatoputapu volume, Patrick Kirch carried out a comparative analysis of Lapita motifs from the Lolokoka site with then-documented assemblages from Fiji, Tongatapu, Sāmoa, 'Uvea, and the Reef/Santa Cruz islands. Based on available data, it is not surprising that he identifies a distinctive northern group of Eastern Lapita sites with simplified motifs including Niuatoputapu, Mulifanua, and 'Uvea. He subsequently advances "the hypothesis that their [Lapita ceramics] makers were either in relatively continuous contact or were settled from a common source community" (Kirch 1988:188). Christophe Sand in 2006 goes one step further, proposing a northern colonisation route for Lapita settlement of Sāmoa and, implicitly, Niuatoputapu by extension. He justifies this by "a simple look at a map" pointing to the existence of a straight-line route from Fiji to Sāmoa, passing through Cikobia (Fiji), Futuna, and 'Uvea (Sand 2006:7). Beyond the common suite of later Eastern Lapita ceramic motifs, the route is validated further by "Lapita sherds in Mulifanua, petrographically sourced to the region of Udu point in north-east Fiji" (Sand 2006:7). The idea of a northern route more recently has been raised by Fiona Petchey and Patrick Kirch (2019) in their redating of the Toaga site. They label it a "tenuous" possibility but present it as a potential explanation for the central and early appearing position of Mulifanua in their "new regional sequence" for Lapita and Polynesian Plainware occupation in Western Polynesia.[26]

In earlier chapters, I review the abundant evidence for early Lapita landfall with Western Lapita ceramics on Tongatapu, as well as the well-dated south-to-north movement through Tonga. The northern route, in comparison, is speculative at best, with little to no supporting evidence beyond a look at the map. In this, I note, the Mulifanua/Fiji (Udu) connection is not based on "Lapita sherds" in the same sense as the tan paste assemblage from Nukuleka. Rather, it is a single, undecorated sherd collected off the Mulifanua dredge pile surface (Petchey 1995). It is impossible to link this to the first Lapita colonists at Mulifanua, nor can the sherd be securely associated with Lapita-age settlement, given the possibilities of a Polynesian Plainware occupation at the site as well. To argue further that late Eastern Lapita ceramics in Futuna/'Uvea, or Mulifanua, predate and are ancestral to Tongan settlement needs to ignore the ceramic record altogether. And if that is not enough, the archaeology of north coast Vanua

26 Petchey and Kirch (2019) recalibrate and plot the Mulifanua turtle bone date (NZ 5800) as 1070–810 BC (68% probability). This date, as the authors state, fails to meet contemporary standards for radiocarbon dating of bone. Collected from the surface of a dredge pile, the sample also lacks a guaranteed association with the Lapita occupation. The date fails accepted criteria for chronometric hygiene, and to use its temporal range as a foundation for "a new regional sequence" is misleading, to say the least.

Levu in the vicinity of Udu, the presumed starting point for a northern route, is without a comparable Eastern Lapita ceramic occupation, at least as I could find in two field seasons of survey. Ceramics with complex motifs of Western Lapita style were recovered from excavations at Vorovoro (Burley 2012) and Kavewa (Burley et al. 2019), both on small islands offshore of the Udu Peninusula. Vorovoro and Kavewa Lapita wares, not surprisingly, have a high percentage of the Udu temper type.

The Strategy of Lapita Exploration and Colonisation

I present the context for Lapita archaeology across Oceania in Chapter 2, with highlights of its history, critical projects, individuals, as well as some of the debates. One of the earliest, and most contested of the latter focuses upon the why and how of Lapita migration. What possible motivations might account for the rapid dispersal of Lapita canoes into Remote Oceania, a migration ultimately crossing an expanse of 4,500 km from New Guinea to Tonga? And of equal importance, how are these groups able to survive, if not thrive, in so many different islands and ecological contexts? Working in Tonga in the 1960s, Les Groube was struck by the nature of Lapita sites around Fanga'Uta Lagoon on Tongatapu, where excavations illustrate subsistence practices heavily focused on shellfish and other near shore and reef resources. As he also notes, by the 1st millennium BC there appears to be a shift, where midden accumulation ceases, and agricultural production begins to dominate. Recognizing this in other areas of the then known Lapita world, he likened Lapita potters to Oceanic "strand loopers" who, in their constant search for new resources, expanded their range ahead of colonisation by agriculturalists across Remote Oceania (Groube 1971:312). Groube's proposal was able to package the question of why and how into an integrated resolution.

The strand looper hypothesis was quickly contested as I earlier describe, both as a stimulus for migration and as the basis for subsistence economy. Roger Green (1979:37) was resolute, describing the archaeological evidence for agriculture as "persuasive," and noting the presence of pigs, these providing conclusive markers for horticulture. Excavation of paleo-botanical remains at Talepakemalai and Apalo during the Lapita Homeland Project in the Bismarck Archipelago more or less ended the debate relative to Lapita subsistence and the strand looper explanation. In *The Lapita Peoples*, Patrick Kirch (1997:220) then speaks of transported landscapes, where purposeful transplantation of crops, domesticates, and a range of commensals "initiated a process of modification and transformation of Pacific Island ecologies." As descendants of Neolithic agriculturalists in island southeast Asia, and with addition of agricultural and arboricultural elements existing in New Guinea and Near Oceania, Lapita peoples seemed well equipped for the eastward migration into Remote Oceania and the island ecologies they were to encounter.

The evidence for Lapita agriculture/arboriculture is impossible to dispute. The paleo-botanical remains and other archaeological data are supplemented by a proto-Oceanic vocabulary identifying numerous species of domesticated plants (Kirch and Green 2001). Yet the location and circumstance for many early Lapita settlements make little sense for an expansion of Neolithic agriculturalists and their transplanted economy. Groube was not wrong in his interpretation of sites in Tonga, as Simon Best (1984) suggests, while pig, at least in Fiji and Tonga, is absent during the Lapita phase.[27] In writing a synthesis paper on Tongan archaeology in 1998, I too found it difficult to ignore these

27 Green had identified pig at Poulsen's Lapita sites in Pea and Tufumahina on Tongatapu. However, the number of specimens were few, identifications were less than conclusive, stratigraphic contexts are seriously problematic, and even Poulsen (1987:243–246) expresses a degree of scepticism. Groube and Best dismissed these for substantive and valid reasons. A similar problem of context exists for the association of pig with the Lapita occupation at Lolokoka, Niuatoputapu, as previously described.

circumstances. All of the Lapita sites are coastal middens, and all have a wealth of faunal data indicative of reef foragers and fishers. To me (1998:355), agricultural activities seemed of secondary importance and probably limited to low-energy, swidden-type gardens. Optimisation of settlement location for agricultural production in the early Lapita period is negligible to non-existent. I subsequently became linked to the strand loopers, one "dismissive" of Lapita agricultural endeavours (Davidson and Leach 2001) and, as such, in league with Les Groube and Simon Best.

Lapita site discoveries across Near and Remote Oceania in the aftermath of Groube's publication continued to define this enigmatic pattern of settlement. Lapita residential sites are positioned on the reef, on small offshore sand cays, on sandy back beach settings, and on tombolo and sand spits of different types and forms (Nunn and Heorake 2009). Faunal data continue to emphasize intensive foraging and fishing pursuits as well. Very few of these sites seem suited to a Neolithic agricultural endeavour, at least one with more than limited scale and intensity. My discovery of an early Lapita site on Vorovoro island off the north coast of Vanua Levu in Fiji in 2009 highlights how limiting these contexts can be (Burley 2012). This site occurs on a sandy tombolo between two rock outcrops on an island no more than 0.75 km^2 in size without fresh water and agricultural soil. Higher sea levels at the time of first Lapita settlement reduced island size even more. These extraordinary contexts have led others to also raise questions on the centrality of agricultural production in Lapita subsistence economy (Anderson 2003).

As a founder colony for Tonga, the location of Nukuleka has been foremost in my mind when questioning the central role of agriculture in Lapita subsistence pursuits. The 2014 excavation of an aroid planting pit at Hopoate truly was illuminating in its consequence. It is another of those "of course" type moments where, suddenly, enigmatic settlement locations for Lapita sites across Oceania are given understandable logic. This pit illustrates a brilliant strategy for colonisation, one logistically adapted to most Oceanic islands Lapita peoples might encounter in their eastward migration. Pit cultivation does not require well developed soils for planting, the clearing of lowland tropical forests for gardens, nor does it need detailed knowledge of rainfall patterns to ensure growth. The requisite for success is a sandy and elevated back beach where, with excavation of the pit, a freshwater lens can be tapped. In this it provides reasonable certainty that aroid planting stock can be moved and successfully propagated. Perhaps more important, the ability to plant crops in sandy substrate strategically supports the location of founder colonies adjacent to or within the reef. Here the unfettered reef and foreshore provides an abundance of foods to be foraged or fished. These resources would be essential to the survival and success of a fledgling settlement.

As archaeologists we are often slow to acknowledge technological innovation and complex knowledge systems in cultures of the ancient past. Ascribing aroid planting pit use to the Lapita peoples is one of these. In their efforts to track the development of irrigation within Polynesian agricultural systems, Patrick Kirch and Dana Lepofsky (1993:199) do attribute proto-Oceanic (Lapita) speakers with an intimate knowledge of the "edaphic and hydrologic templates" of swamp taro and taro. Complex systems of water control are inferred to be later, but "naturally swampy areas might have been planted in hydrophilic aroids such as *Colocasia* and *Cyrtosperma*" (Kirch 2017:101). Creating one's own swamp with recognition of the Ghyben-Herzberg fresh water lens, and providing mulch, is not an inconceivable step forward. The earliest secure evidence for planting pit use prior to Hopoate is on Maloelap Atoll in the Marshall Islands. Described by Marshall Weisler (1999), this feature dates to approximately 2,000 years ago and is simultaneous with first settlement. The successful colonisation and longer-term occupation of Micronesian atolls would be difficult if not impossible without this type of agrosystem.

The 2014 excavation at Hopoate identifies an additional innovation associated with aroid planting pits, one enhancing plant growth and agricultural capacity. Lapita gardeners intentionally added pottery fragments into the mulch layer. These are from earthenware pots manufactured from tephra-based clays with a high iron content. They are open-fired at low temperatures and, without addition of slips, can be porous. Porosity make the vessels poor receptacles for water storage as I earlier note, but it lends significant functionality to their inclusion as fragmentary pieces in a planting pit mulch. When sherds are inundated in the freshwater lens, they absorb moisture. As the water lens is lowered when the tide goes out,[28] the sherds become exposed and release the moisture. A similar practice occurs on Micronesian atolls where, without earthenware ceramics, pumice is added to the mulch (Sachet 1955). Both practices are analogous to modern day use of polymer crystals that expand when wet and slowly release water content as planting soil dries. We also believe the Hopoate ceramics, as they degrade, add iron as a nutrient into the gray sand matrix. Lapita peoples, it seems, had a far greater understanding of agricultural practice and principles than previously given credit.

Lapita Migration as a Territorial Imperative?

Aroid planting pit use provides insight into a colonisation strategy for Lapita peoples across Near and Remote Oceania. It does not, however, address the question of motive. What possible factors or aspirations could possibly drive exploration and migration across such a vast expanse of ocean? Why would small groups of Lapita peoples pack their material world and families into sailing canoes to face the vagaries and uncertainties of open ocean voyages? Why did they continue onward to Tonga when

28 On atolls, sand cays, elevated sand spits, tombolo, and back beach sand flats, sea water intrusion into the substrate fluctuates with tidal movement. So too, does the Ghyben-Herzberg lens sitting on top. At Hopoate, the level of the lens at high tide was coincident with the bottom of the pit (Burley et al. 2018:7). The pit would then be dry at low tide.

New Caledonia, Vanuatu or the 360 or so islands of Fiji are all but empty and equally attractive? As Geoffrey Irwin (1992:211–212) puts it, there has been no shortage of possible answers. The list includes adventure, curiosity, the joy of discovery, wanderlust, prestige, shame, the search for prized resources or raw materials for exchange, overpopulation, warfare, and social issues within a descent group. Adventure, curiosity, discovery, and wanderlust are intuitive rationales that dramatize the past. They provide inherent intent, but are difficult to evaluate. At the same time, the remainder, especially including overpopulation, are without evidence or merit relative to our understanding of Lapita peoples today. Motive, as Irwin also states, remains an esoteric issue. Like the loss of decorated Lapita ceramics, or the ceramic industry altogether, its resolution is a challenging task to tackle.

We may not, as yet, be able to ascertain immediate or ultimate reasons for the Lapita migration, but we can give it chronology and we can define its structure across Oceania and within Tonga. Initial Lapita presence defined by dentate stamped ceramics occurs in the Bismarck Archipelago sometime before 1290 BC (Denham et al. 2012). The larger islands already were inhabited by Papuan speakers, with Lapita settlements then focusing on the coastal fringe and smaller offshore islands. How large the colonising group might have been, whether multiple colonising groups are involved, or the extent to which Lapita/Papuan interactions occur, remain unknowns. Matthew Spriggs (1997:104) suggests "It would be wrong to see the new colonists immediately blanketing the Bismarcks and Solomons with dense settlement." Expansion east of the northwest Solomon Islands, thus, seems to have ceased for the next 250 to 300 years. Between 1100 and 1050 BC, Lapita canoes crossed the boundary between Near and Remote Oceania arriving in the Reef/Santa Cruz islands. Quickly thereafter, exploration and colonisation of Vanuatu, New Caledonia and Fiji ensues. This takes place in no more than a radiocarbon moment of "a few generations" (Sheppard et al. 2015). Extension into Tonga is not long after.

Geoffrey Clark and Athol Anderson (2009) provide a reasonable summation of the issues and challenges for Lapita settlement in Remote Oceania in their final chapter of *Colonisation and Culture Change in the Early Prehistory of Fiji*. Of particular note are the incredible voyaging distances from the Bismarck Archipelago to the easternmost Lapita sites in Tonga/Sāmoa. The first leg in this trip is substantial, some 1,800 km or so across Near Oceania to reach the Reef/Santa Cruz Islands. Given the absence of Lapita sites in the main Solomon Islands, this voyage may have leapfrogged around an already inhabited landscape (Sheppard 2011). The volume of Talasea obsidian found in Reef/Santa Cruz Lapita sites not only suggests return voyaging, but a voyage "routinely undertaken" (Clark and Anderson 2009:413). Southward to the islands of Vanuatu and New Caledonia is less demanding with distances between islands not exceeding 250 km. From Vanuatu or New Caledonia to Fiji requires an open ocean crossing of 800 km with estimated distances from Fiji to Tonga of an additional 370 km. A Google Earth pathway distance from New Britain to the Santa Cruz group to Vanuatu, then Fiji and Tonga is in the range of 4,100 km, a seemingly staggering journey. That these voyages took place anticipates well designed and equipped voyaging canoes, a developed degree of navigation skills, and a clear understanding of wind patterns, particularly the northwesterly monsoon winds of the Austral summer (Irwin 2008). To cross these distances also suggests or requires a series of gateway communities serving as stopovers. Beyond providing a sojourn, earlier colonists could be engaged, geographic knowledge of the region passed on, and possibilities for extended exploration further to the south or east examined. For this, as Clark and Anderson (2009:416) conclude, communities in the Reef/Santa Cruz Islands may have been the most crucial, serving as a funnel for the ensuing migration stream. Perhaps telling, a sherd with the exotic temper type found at Nukuleka was recovered from the Nenumbo site on Nendo Island in the Reef/Santa Cruz group (Dickinson 2006). The temper type, however, is foreign to Nendo, its origins from somewhere further to the west.

If we conceptualize gateway communities as stepping stones, Lapita expansion into Remote Oceania was strategized and far more integrated than previously considered. Lapita peoples are not risking their family in a voyaging canoe as they sail blindly into an unknown void. Rather, they are travelling to known communities on previously charted routes to an ever-expanding frontier. Families can be left in these frontier communities, as exploration groups continued to seek new islands and opportunities for settlement. As speculative and tentative as this narrative probably seems, the pattern and process fit well within a framework of migration theory as it is developed within the fields of geography and demography. Migration, according to David Anthony (1990:895), "can be understood as a behavior that is typically performed by defined subgroups (often kin recruited) with specific goals, targeted on known destinations and likely to use familiar routes." Anthony's review of migration is general without reference to Oceania, but his principles delineate a process with insightful relevance to the Lapita case. Critical in this are the transmission of knowledge through return voyaging, the use of "scouts" as an exploratory party, leap frogging around areas where potential obstacles are in place, migration as a "stream" not a wave of advance, and the centrality of kinship underlying the process. Rapid settlement, alternative streams to the south (Vanuatu/New Caledonia) and east (Fiji/Tonga), and the homogeneity of Western Lapita ceramics and motifs in Remote Oceania from the Reef Santa Cruz through Fiji are a consequence.

Bill Dickinson's (2014) interpretation of the Nukuleka tan paste ceramic temper anticipates an origin somewhere in the Bismarck Archipelago or main Solomon Islands as I earlier suggest. That voyage cannot be undertaken without stepping stone islands and communities, the last most likely occurring in Fiji. The return distance and travel time from Tonga to a homeland in Near Oceania creates unfeasible obstacles for any consideration of return voyaging. Whether relations were maintained with stepping stone communities is difficult to assess. The presence of a shell scraper made from freshwater mussel (*Batissa violacea*) at

Nukuleka could be an indicator, given its probable source from either the river systems of Viti Levu or north coast Vanua Levu. The archaeological record for Lapita settlement in Tonga suggests negligible if any in-migration following first landfall. Settlement expansion around the lagoon over the ensuing 70 to 80 years seems to be fueled by population growth within the founder colony.

There can be little doubt that exploration into Ha'apai, Vava'u and further to the north took place during the early phase of settlement on Tongatapu. Knowledge of these islands, their resources, and suitability for habitation in the long term would be instrumental for eventual movement throughout Tonga and, possibly, into the Lau islands of Fiji, Sāmoa, Futuna, and 'Uvea. For the most part, radiocarbon dates for individual Lapita sites in Ha'apai and Vava'u overlap. This, as I have argued, suggests simultaneous dispersal to multiple locales between 820 and 770 BC (Burley et al. 2015). The pattern and nature of settlement in Ha'apai and Vava'u also appears unique. In all cases, sites are small, with expectations for no more than two to three families at individual sites. And equally notable, these occur as exclusive communities on the island being settled. All of this, again, speaks to an intentional colonisation strategy where small groups are maximizing territorial claims. Tonga, as an interrelated aggregate of islands, occurs early.

The speed and extent of Lapita settlement in Remote Oceania, and the nature of the expansion through Tonga and beyond, appears driven. Proximate causes such as conflict, population pressure, or resource stress are impossible to conceive given the empty landscapes of Remote Oceania. Lapita expansion could only be attracted to the frontier edge by pull factors that are difficult to grasp. Agricultural land, new reefs, or other resources hardly require a migration extending over a distance of 4,100 km. Hence, the inherent motivations of adventure, curiosity, discovery, and wanderlust have been suggested. In like sense, and to comprehend the process by which Lapita settlement of Tonga took place, I earlier refer to Robert Ardrey's (1966) notion of the territorial imperative. This is an implicit motive, an instinctive behavior in humans originating in our evolutionary history. Ardrey was foremost a playwright and screen writer[29] who in his later career became focused on human origins and behavior. His publications were revolutionary, controversial at the time, and widely read by the general public. They presage many of the basic tenets accepted today in palaeoanthropology, evolutionary anthropology, and ethology. To Ardrey, the territorial imperative is an instinctive drive common to most animals and humans. We seek to acquire, secure, and fiercely defend territorial space. The territorial imperative is a thesis, one able to explain migration, the rise of nations, warfare, and many other political phenomena. It is "a consequence not of human choice but of evolutionary inheritance" (Ardrey 1966:ix). We are hard-wired by evolution whether we are cognizant of it or not. The compulsive search for new territories across Remote Oceania by the Lapita people, and the nature of settlement northward through Tonga may well be the consequence. In this, it differs little from the Bantu expansion into sub-Saharan Africa ca. 1000 BC, the Thule (Inuit) migration across the Canadian arctic ca. 1000 AD, or the many other migrations associated with the dispersal of the Austronesian language family between the 5th and 4th millennium BC.

From Past to Present and Back Again

The initial settlement of Tonga represents a final frontier, the westernmost extension of the Lapita migration. Without evidence for later immigration of any scale, we assume population continuity from those founding canoes into the present. Polynesians, as Peter Bellwood (1978:48) describes early on "are the

29 In 1966 when *The Territorial Imperative* was first published, Ardrey received an Oscar nomination for the film script of *Kartoum*, starring Charlton Heston and Sir Laurence Olivier.

direct, and as far we know, uninfluenced descendants of these intrepid [Lapita] voyagers." The Polynesian physical type is a projected consequence. Not all archaeologists agree, some having claimed similar continuity in different regions in Melanesia. Stuart Bedford and Mathew Spriggs (2008:113), for example, found nothing in the archaeological record for northern Vanuatu to suggest new arrivals or even external interactions. Thus, in a 2005 postage stamp series for Vanuatu, Lapita peoples were cast in *ni Vanuatu* likeness (Bedford et al. 2011). Recent studies of ancient DNA, their identification of a Papuan intrusion into Vanuatu in the immediate post-Lapita period, and the genetic homogeneity of Lapita skeletal remains from Tonga and Vanuatu strongly suggest otherwise. The Lapita peoples have a cultural and genetic profile seemingly indicative of a homogeneous ethnic group as they began their eastward journey into Remote Oceania.

In different ways over the past three decades, I have witnessed the continuity of Tonga's Lapita past as it continues to persist into the present. Watching people in the village of Faleloa in 1992 match their *ngatu* patterns with Lapita ceramic motifs is one of those. The Tongan past literally is bridged to the Tongan present in a way apparent to all in attendance. Another of these connections took place when 'Uepi Finau and Tevita Feao began striking off the umbo of *anadara* shell valves as they played the game *taupita* at Nukuleka in 2007. In this, they produced a material record not only present in our excavations at the site, but one we previously had been at a loss to explain. Eerily, as I earlier describe, the same game had been played in the same locale by their ancestors almost 3,000 years before. And still another of these occurrences took place on the island of Mango in southern Ha'apai in 2010. After a preliminary survey of the island's coast, I became mesmerized by a young Tongan man in a dugout canoe who was fishing on the reef for octopus. It was my first time to witness the use of a traditional octopus lure with cowrie shell dorsa and a cone-shaped sinker attached to a line without hook. The churning mass of tentacles in the bottom of the canoe marked obvious success. The lure is a brilliant piece of technology,[30] the knowledge of which being passed down and used continuously from the time of first Lapita settlement.

Like the octopus lure, other aspects of Lapita material culture continue unaltered into the historic present. Some are distinct and iconic. The Tongan trolling lures collected during the voyages of James Cook are one of these (Kaeppler 1978). An all but identical example was excavated from a dated Lapita context at the Vaipuna site on 'Uiha in Ha'apai as I earlier describe. Another is the recovery of a triton shell trumpet from the Lapita stratum at the Vuna site on Pangaimotu Island, Vava'u. Nothing is more iconic of Polynesia in general than the image of a warrior blowing a *kele'a* to summon villagers to a meeting or to alert them of threat. Equally striking was Jens Poulsen's 1963 excavation of bone tattoo chisels from Lapita deposits at the site of Pea on Tongatapu. Recent radiocarbon dates and reanalysis of these implements conclusively associate Polynesian tattooing with the arrival of Lapita canoes in Tonga (Clark and Langley 2020). There are, in fact, few items in the Lapita archaeological record that do not appear to persist across the entirety of Tonga's culture historical sequence. This context is well illustrated and supplemented by Kirch and Green (2001:163-200) in their presentation of proto-Oceanic versus proto-Polynesian cognates for different aspects of material culture. It also formed the basis for Anita Smith (2002) to question a succinct transition to ancestral Polynesian society out of an Eastern Lapita base.

The scale and complexity of traditional Tongan society relative to its initial Lapita ancestry clearly are transformed. This began with population growth and agricultural intensification in the late Polynesian Plainware phase as implied by the clearing of inland areas on Tongatapu and in the proliferation of plainware sites throughout Tonga. The nascent beginning of an integrated

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30 The lure simulates the tiger cowrie, a natural prey for octopi. The octopus pounces on the lure, wrapping it between its tentacles. Not wanting to release the prey, the octopus is then pulled to the surface.

chiefdom is in place by 900 AD, with amplified socio-political complexity witnessed in monumental architecture occurring thereafter (Burley 1998). Yet, even in these developments one can find aspects of continuity into the ancient Lapita past. Tongan dryland agriculture, with its pattern of shifting cultivation and slash and burn field preparations, seems an amplified vestige of initial Lapita swidden plots. Social stratification and inherited rank by birth may have been present within the proto-Oceanic (Lapita) vocabulary as interpreted by Andrew Pawley (1982) and others. Proto-Oceanic terms **qa-lapa* and **qa-diki*, respectively refer to chief, and first-born son of a chief.[31] The particle **qa* is significant in its marking of a title or formal name. In an extensive review and analysis of social and political organization for ancestral Polynesia, Kirch and Green (2001:227) describe these recognitions as significant for the "notion that in early Oceanic societies leaders were drawn from the senior branches of a lineage." Peter Bellwood (2006) theorizes this for Lapita and later Polynesian migrations. To Bellwood, these represent a "founder ideology," where founders are revered and mythologized, with substantive benefits accruing to their successors. Ranked society in this sense is by no means on a scale comparable to the socio-political complexities of the Tongan archaic state. Yet it does provide a structural base and principles for elaboration across the range of dynastic Polynesian chiefdoms. This is in marked contrast to Papuan-speaking societies where rank is achieved largely through competitive conventions and manipulation.

I label the final segment of my conclusion "From Past to Present and Back Again." My intention has been to emphasize the significant carry-forward from the Lapita phase into the Tongan ethnographic present. In this, we can be assured, it goes well beyond material culture and the few examples I present. Its expression occurs in traditional art, through cuisine, through food

31 The term **qa-lapa* was lost in the development of proto-Polynesian. The term **qa-diki* transformed to **qariki* and assumed the meaning of chief. In Tongan this, then, changed to ‘eiki.

preparation, in concepts of *mana*, *tapu* and the spirit world, through foundation myths, and in virtually every aspect of culture reconstructed for ancestral Polynesia by Patrick Kirch and Roger Green. Richard Shutler and I published a paper in 2007 on ancestral Polynesian fishing gear as I earlier note. The majority of fishing technologies are made from perishable materials which render them invisible in the archaeological record. The ones that are not, the trolling lure, one-piece shell fishhooks, the octopus rig, and shell net weights originate with initial Lapita colonists. Excavation samples from Lapita deposits processed through fine 1.6 mm mesh also recovered a range of aquarium-sized fish, a tell-tale sign of ethnographically documented fish poison use. There exists no evidence for a change in fishing strategies between Lapita and ancestral Polynesian society or, we anticipate, with traditional fishing practices at present (Vaea and Straatmans 1954). Eastern Lapita peoples are as much ancestral Polynesians as those on the canoes departing for East Polynesia 1,700 or more years later. There may have been innovations in material culture and other aspects of society as implicit in the proto-Polynesian lexicon, but the process is additive not at all transformative (Burley and Shutler 2007:157).

With occasional trepidation, archaeologists long have recognized the importance of ethnographic analogy for gaining insight into past human behaviors. It is, according to philosopher of science and archaeologist Allison Wylie (1985), fundamental to most archaeological interpretation. Analogies in this context use observations from the ethnographic present to explain phenomena in the past where identifiable similarities can be defined. The connection and continuity between traditional Tongan culture and Lapita peoples, I suggest, provide a strong foundation for potential insights into the ancient Lapita past. Here I refer not just to Tongan Lapita peoples but Lapita peoples throughout Remote Oceania if not even further to the west. Analogical inference, or the framing of hypotheses based on such analogies across Remote Oceania, are given strength through biological affinities as well as cultural ties. These create direct historical analogies, where the past and present serve each other (Ascher 1961:324).

Most Tongans today appear uninformed with respect to first settlement throughout the Kingdom. In various ways over the past three decades I have tried to alter this situation through the Museum exhibit in the Tongan National Centre, through popular publications in *Matangitonga* on-line news[32] and through whatever opportunities have been presented. Tongans have an ancient history, one predating the rise of the dynastic state by almost 2,000 years. Indeed, Tonga as a nation, and its political and cultural integration, finds its roots in initial Lapita expansion as illustrated throughout. The Lapita heritage of Tonga is a significant narrative for Tongans, for Polynesians, and for global history. It is a history to be proud of, and it is a history integral to the birth of Polynesia. It also is a history inscribed on a landscape that is quickly being altered, and in threat from climate change. In a 1994 publication in the *Journal of the Polynesian Society* on archaeological surveys being undertaken in Ha'apai, I began with an oration by Chief Tafolo, as recorded in Tongan and English by Edward Winslow Gifford (1924:6). It, more than anything, speaks to the importance of Tonga's archaeological landscape, and why its preservation is critical to Tongan identity and future generations. It is well worth reciting as my ending.

Fakemolemole a houeiki mo ngaohi haa,
He oku mamao mo faingataa ae faanga;
Koe tolutalu nae tuu holo he ngahi halanga
Kuo fuu puli pea alu mo hono toutangata.
Ka ne ongo ene vao fihi mo tevavaa,
Kae fai pe ha vavaku mo sia faala
Kia Touiafutuna, koe uluaki maka
Nae fai mei ai hotau kamataanga.
Kehe koe taltupua ia mo fananga,
Oku utuutu mei ai sii kau faa.

32 https://matangitonga.to/search/site/archaeology

Pardon me, noble chiefs and lineages,
For the searching place is now far and difficult;
The old plantations once scattered on the roads
Have now quite disappeared and gone with them their generation,
But although they now lie in very thick bush,
Search will be made at any rate
For Touiafutuna, the first rock
Where our origin began.
Though these are only traditions and fables,
'Tis here the inquirers get their facts.

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The Birth of Polynesia

An Archaeological Journey Through the Kingdom of Tonga

The Birth of Polynesia recounts the story of first Polynesian settlement in the Kingdom of Tonga and its expansion from a founder colony on Tongatapu north through a myriad of islands to Sāmoa and beyond. This book also is about a 30 year-long archaeological journey and the many different field projects, events and people involved in pursuit of the first Polynesians.

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