Islands in an Empire: The Tongan Maritime Chiefdom in Evolutionary Perspective

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Abstract

Across the Tongan archipelago, many people were drawn into the sphere of influence of the Tongan Maritime Chiefdom. The Tu‘i Tonga dynasty extended its regime to many islands, including Niuatoputapu, reaching ‘Uvea, and perhaps as far as Sāmoa. Together these diverse islands provide important insights into the development of socio-political complexity in late prehistory.

While much archaeological study of Tongan society has examined monumental architecture, less attention has been paid to exploring the human-environment interactions across the range of the Tongan Maritime Chiefdom, from its genesis in Tongatapu early in the second millennium AD. Explanations of Tongan influence or political domination have tended to generalise rather than to explain these diverse relationships with specific cultural and environmental mechanisms.

This research draws on traditional narratives and ethnohistory, together with palaeo-environmental and archaeological data, from across the islands where evidence of the Tongan hegemony is known. Potential explanations of the increasingly hierarchical organisation of polities are developed to provide insights into why and how, in variable island environments, different expressions of societal organisation emerged. It is proposed that human responses to social and environmental variables require different hypotheses to explain socio-political change in the Tongan archipelago and beyond. In the emergence of inequality and the development of hierarchical social organisation, these explanations propose that competitive and cooperative behavioural variation was an adaptive response to these differing social and environmental conditions.

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Glossary

‘eiki: prominent chief

‘esi: sitting or resting platforms of chiefs

fa‘itoka: chiefly burial mound

falefā: literally “house of four” – court advising the Tu‘i Tonga

fatongia: duty or obligation (*fatogia* in ‘Uvean)

ha‘a: group of related chiefly titles

hahake: name for northern district of an island, or its eastern extent if its east-west axis is longest

hau: secular paramount

hihifo: name for southern district of an island, or its western extent if its east-west axis is longest

hou‘eiki: lesser chiefs

‘inasi: ceremonial presentation of first fruits (harvest) or the redistribution of seasonal crops

kāinga: chief’s subjects or group of related families

kolo: fort or village

lalo: leeward side of island

langi: burial mound of members of Tu‘i Tonga lineage – *langi* means “sky”

liku: windward side of island

mala‘e: an open space for ceremonial events and gatherings or meetings

matāpule: ceremonial attendants

mu‘a: name for central district of an island, lying between *hihifo* and *hahake*; also, the central location where ruling chiefs resided, and therefore the centre of government

sia: artificial mound (general term)

sia heu lupe: (pigeon snaring mounds) mounds with a central depression used for chiefly sport of pigeon snaring

toafa: desert

tofi'a: ancestral estate

tu'a: commoners or lower rank person

Tu'i: king or title prefix of lineage

vaotapu: sacred forest

Chapter 1 Introduction

1.1 Thesis introduction

What we thought we knew is often shown to be just a glimpse into the mysteries of the past. Tonga over the last millennium is no exception. Even with the immense body of work of Burley, Clark, Dickinson, Kirch and many others, the more we try to unravel the Tongan past, the more there seems we have yet to identify and understand. Inevitably, while fresh avenues of research have led to new discoveries, and new interpretations, many more questions have arisen in the process. This endeavour seeks to know just a little bit more, by taking up the challenge issued twenty years ago by Aswani and Graves (1998). It examines the emergence, expansion and influence of the Tongan hegemony, over the centuries of the last millennium, across the Tongan archipelago and beyond. In so doing, it seeks explanations of how and why social inequality arose in the form of an increasingly complex and hierarchical political and social organisation, as expressed in the Tongan dynastic regime. While this thesis begins with the same basic theoretical premises as Aswani and Graves, it has incorporated new archaeological and palaeoenvironmental evidence of the last twenty years, and it has also taken a slightly different approach.

If some early researchers have been too ready to accept the general proposition of Tonga as a unified polity, that is perhaps because of a greater focus on the Tu‘i Tonga, on the Tongan hegemony and on its origins in Tongatapu. Guiart (1963, 661) alluded to the concept of "*un empire insulaire*", defining and expressing the extent of Tongan conquest and influence, as this "empire" restructured local polities extending to ‘Uvea and Niuatoputapu. However, there are challenges to the degree to which the Tongan Maritime Chiefdom (as it is more commonly known) effected dominance and control over its empire, and challenges also over the period in which major events occurred, whether they were abrupt, sporadic or gradual. Given the variability of environments and social responses, across the range of influence of the Tongan Maritime Chiefdom, it is argued that a finer-grained analysis is required, with reference to specific times and locations, that we might identify behavioural responses, and evaluate these against empirical observations. The Tongan Maritime Chiefdom (hereinafter the TMC) is not an empirical observation any more than is Tonga, the Kingdom. Consequently, there is a need to view the emergence and endurance of the TMC, or its corollaries, not as an entity but as a series of interactions; not simply interactions between individuals or groups but interactions between people and their environments. Only by examining these interactions can we begin to explain how and why such a powerful and ultimately influential hegemony arose and persisted.

The emergence and expansion of the TMC is often cited as expressing social and political complexity, and a stratified society, as evidenced in the increasingly hierarchical regime outlined in oral traditions and observed archaeologically in monumental architecture (see Figure 1). The environmental and social structure, at the period of emergence of social inequality, is important to the analysis of behaviours, but rather than simply describing societal change, it is proposed that investigating and evaluating the mechanisms of behavioural variability which created the observed complexity has greater explanatory power. While archaeology often seeks to explain human behaviour, in this research project, the focus is on certain aspects of behaviour, exploring the behaviours of competition and cooperation, and in its expression as inequality and hierarchical social organisation. The research seeks to explain the phenomena which gave rise to these behaviours, with reference to ecological and social structure, but moving beyond an environmental determinism response. Competition and cooperation are not alternatives, either in the sense of being alternative choices in behaviour, or in a time-bound sense with periods of one or the other, rather, they are mechanisms by which societal relations are mediated within the context of the socio-ecological environment. To examine these mechanisms, a range of evidence is outlined, including oral traditions, ethnography and ethnohistory, geographical context and palaeoenvironmental data, as well as archaeology.

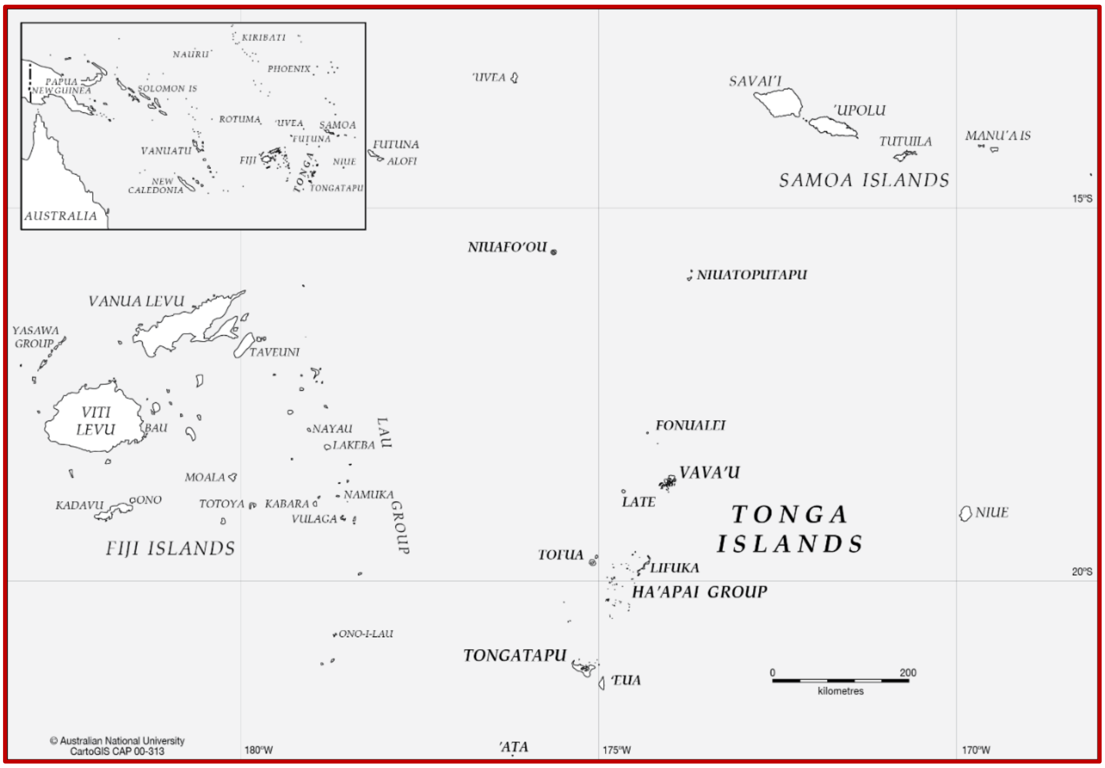
A theoretical framework based in evolutionary theory provides a way of analysing human behaviours, the behaviours that cumulatively resulted in changes to socio-political organisation. In Darwinian evolutionary theory, phenotypic traits can be behaviours as well as artefacts; and competition and cooperation are behaviours which may evolve, arise and disappear, in certain environmental contexts. Expectations derived from theoretical concepts, as employed in evolutionary ecology, provide a means to test hypotheses against observations, and these explanations can then be further tested against different or new data. Alternative theories, or hypotheses, have emphasised demographic and environmental variables, including population growth and carrying capacity, which, while important variables, are founded in processualist ideas of societal-level responses to increasing population density and changing environmental conditions, rather than considering individual behavioural variability. In bringing a different theoretical perspective to the research, incorporating multiple avenues of evidence, it is hoped that new explanations will be generated.

Figure 1: Langi at Mu'a (Lapaha), Tongatapu
Photograph: University of Auckland: Anthropology Photographic Archive. Garth Rogers (1965). Corner stone in langi, Mu‘a.

1.2 Aims of research

It is all too easy, as Aswani and Graves (1998) concede, to see island landscapes as ideal “laboratories” for examining various societies, and then to arrive at a conclusion that a constrained environment, with population increase and the requisite intensification of production, inevitably led to conflict and increasingly hierarchical structures within societies. Alternative approaches have relied on expectations of how the development of complexity might be expressed. Kirch’s (1988, 260) oft-repeated words, “[the Niuatoputapu] archaeological landscape is indeed consistent with the historical sequence derived from ethnohistorical traditions” and “this is precisely the kind of settlement landscape that would be predicted in the case of conquest and political domination”, invite challenge. Rather than arriving at the conclusion that there is some anticipated landscape as an outcome of Tongan imposition or influence (or conquest and political domination), it is suggested that greater explanatory potential is achieved by developing (based on empirical evidence) testable hypotheses which incorporate the variables of environmental structure as well as social organisation. The important issue is that there is no expected pattern of landscape (in any form) but rather, there are different factors influencing individual behaviours (expressed at group level) in different locational contexts.

This present work builds on that of Aswani and Graves (1998), by taking the same theoretical concepts, but providing new links to these concepts, by exploring various behavioural strategies, and using the empirical record (or evidential record), to develop testable hypotheses or potential explanations. It examines individual behaviours expressed in key places where the TMC influence developed, across the Tongan archipelago, to ‘Uvea and Niuatoputapu (see Map 1). In studying this behavioural variation, new light is shed on how the Tongan hierarchy developed and how and why it was variably expressed in different times and places.



Map 1: Western Polynesia and the Tongan archipelago
Showing ‘Uvea and Sāmoan islands to the north.
Map source: Map reproduced with the permission of CartoGIS Services, ANU College of Asia and the Pacific, The Australian National University.

1.3 Research questions

Aswani and Graves (1998) looked broadly at how individual behavioural strategies of competition and cooperation, in an increasingly circumscribed and unpredictable environment, resulted in social stratification and political integration, expansionism and wide-ranging exchange relationships. Given the new archaeological and palaeoenvironmental evidence of the last two decades, it is proposed to re-evaluate this fairly broad hypothesis on the Tongan maritime expansion. Two major issues, and some more specific questions, are proposed. The key research questions are set out below.

What evolutionary mechanisms explain the emergence and endurance of the Tongan socio-political hegemony?

- What explanations can be proposed for the emergence of inequality and the associated development of hierarchical socio-political organisation?
- What mechanisms operated to maintain these increasing levels of social stratification?

How did the Tu‘i Tonga hegemonic regime develop across the range of the TMC?

- How did differing socio-ecological environments contribute to variable behaviours?
- What evolutionary explanations can be considered for these diverse relationships?

1.4 Structure of chapters

This initial chapter has begun by introducing the research, its aims and key questions. Chapter 2 introduces the theoretical framework. It provides a brief history of theoretical approaches to the development of chiefdoms and stratified societies, inequality and social complexity, and explains the theoretical framework adopted for this work, outlining evolutionary theory and its application in evolutionary ecology models. Chapter 3 gives an overview of the history of the TMC, drawing on a range of literature, including ethnohistorical accounts, ethnography and anthropology. It also provides an analysis of the incorporation of history and oral traditions into archaeological endeavour. An important element of the work is environmental structure, so Chapter 4 provides a general overview of geography and geology, followed by a review of regional and local palaeo-climatic evidence. The history of archaeological work pertaining to the TMC, on Tongatapu and also in other locations across the Tongan archipelago, is outlined in Chapter 5 and serves to introduce the body of the thesis, which incorporates new archaeological evidence, as well as environmental data and traditions, into the analysis.

The main body of the work is in Chapter 6, which takes concepts and models from evolutionary ecology to develop methods, as outlined in Chapter 2, and evaluates the TMC in a series of case studies. Tongatapu forms the starting point, followed by Ha‘apai as a close but distinctive theatre of social and political interaction. While Vava‘u is not included in the analysis, due to data and thesis constraints, there is a brief review of Vava‘u contained in Appendix D. The Niuatoputapu and ‘Uvea case studies provide contrasting environments and social contexts and thence different examples of relationships with the Tongan dynastic regime. Each case study starts with a narrative briefly summarising the environmental context, the oral traditions and other historical accounts, as well as the archaeological research. The data which informs the case studies is presented in tables contained in Appendix C. Using this empirical data as a basis, hypotheses are developed which might explain these observations. These are evaluated using models from evolutionary ecology to test the hypotheses by comparing their empirical expectations against the available evidence or observations, to determine, where possible, their viability, i.e., does the evidence support or refute the hypothesis. Additional data requirements are proposed that might assist this evaluation or lead to new or revised hypotheses. Chapter 7 includes a discussion of the findings and draws some comparisons with other approaches and explanations. Some limitations of the research are identified, and some avenues for further research are proposed. The chapter ends with the overall conclusions.

Chapter 2 Theoretical foundation

2.1 Introduction

A diverse range of theoretical approaches has been proposed as a means of considering the Tongan chiefdom, and in seeking explanations for the emergence of an increasingly hierarchical social and political organisation. This diversity has added greatly to the breadth of analysis and interpretation. The approach in this present work differs in some respects from several previous analyses of the TMC, as it rests on a theoretical perspective derived from evolutionary theory, and uses principles and models based in evolutionary ecology.

2.2 Chiefdoms and complex societies

A preliminary introduction gives some historical perspective to concepts of chiefdoms and complex and stratified societies. Traditional approaches to the evolution of complex societies have included typologies using the unilinear, essentialist-type categories of band, tribe, chiefdom, state (Service 1962). Tonga is often cited as an example of a chiefdom bordering on a state (Goldman 1970, Kirch 1984, Sahlins 1958), as manifest by hierarchical organisation based on chiefly rank (see Bott 1981, 1982) and investment in large-scale monumental architecture with some level of centralised and specialised administration, as found in higher-ranked states (Redmond and Spencer 2012, Spencer 2003). It is often considered as a complex or "classical chiefdom", seemingly situating Tongan society in an intermediate cultural evolutionary category (Junker 2015, 376). Tonga, by mid-millennium could thus be described as a maritime-based complex chiefdom verging on a state – a maritime empire.

Service (1975) described the Polynesian classical chiefdom as pyramidal ranked hereditary lineages with sacred rank and spiritual power resulting in social differentiation, which in turn organised economic affairs, as chiefs controlled both production and distribution, and thereby increased the political power of the chiefdom (Service 1975, 149-152). Chiefs maintained a political power base through strategies of resource accumulation and distribution, through ideological means (rituals and myths) and through military coercion (Junker 2015). Chiefdoms might also be considered as being based in ideological processes where the stability of a chiefdom depended on a balance of interests, power monopoly and ideology, with economic and political power closely related, and ideological values and symbols reinforcing and maintaining this socio-political structure (Earle 1987).

Given the degree of variability across Polynesian chiefdoms, differing competitive and aggrandising behaviours, and variable ecological contexts, these differences might better be considered by exploring origins. Carneiro (1970) proposed that the seeds for political development and integration, i.e. state development, included environmental circumscription, resource concentration and social circumscription, leading to conflict – warfare and land acquisition. In a different approach, Goldman (1955) considered that Polynesian societies differed in how status rivalry effected cultural change, as expressed in various scales of conflict for position and power – status rivalry led to economic control which led to societal change. This scale was divided by Goldman into three broad (progressive) phases of traditional, open and stratified societies, with stratified being the culmination of the cultural development process. Using this categorisation, Goldman identified ‘Uvea as traditional verging on open, while Tonga was stratified. Sahlins (1957) proposed different forms of social systems with different modes of production and distribution, resulting from adaptation to differing ecological conditions and resource distribution. Stratification depended on several interrelated functional criteria: economic, socio-political and ceremonial (Sahlins 1958, 3). Based on a categorisation using four stratification levels, Sahlins (1958, 22-29) suggested that for Tonga, three status levels could be identified, while ‘Uvea was more appropriately categorised with two status levels (Sahlins 1958, 64-68).

These approaches to stratification and state development identified contributing factors but focussed predominantly on the arrived state, its transformation or its progression. They did not directly address the ultimate causes of change, or why variables contributed to competitive and aggrandising behaviours, the emergence of inequalities or the persistence of chiefly hierarchies; nor did they adequately consider human behavioural variability. In many of the above explanations of types of complexity, such as chiefdom or state, the stage is defined by certain characteristics, so that the stage becomes the subject of explanation, rather than archaeological and behavioural variation. Narratives are thus built about reconstructed stages of cultural change. However, the types (of chiefdoms and so on) are not appropriately the subject of explanation, as they are empirical generalisations, and not always qualitatively accurate (Leonard and Jones 1987). It is the distribution of cultural traits that requires explanation, not the units (labels) themselves. A theory for the classification of archaeological data (expressions of cultural phenomena) is needed to provide a link to empirical patterns, which can then be matched to theoretical expectations.

2.3 Cultural evolution

The idea of cultural evolution through stages (band-tribe-chiefdom-state) has considered societies (cultures or groups) as a unit of change, evolving or progressing (Dunnell 1988). While cultural evolution, arising from Darwinian evolutionary thought, shifted the focus from biological to sociocultural systems, the traditional application of cultural evolution to increasing complexity continued to encapsulate this concept of progress (Dunnell 1988). While there have been many attempts to avoid such a "ladder" view of social evolution, many approaches have been more descriptive than explanatory and have been limited in the way they explore causal mechanisms. As a result, the "evolution" has neither reflected real group organisations, nor explained the rise of complexity and increasingly hierarchical organisation (Currie et al. 2010, Ladefoged 1995).

"Cultural evolution" is a confusing term, having been employed in different ways over time. While it is a useful general way of describing cultural change, it is not simply the application of biological evolutionary theory to cultural mechanisms (Dunnell 1988). The cultural evolution of the nineteenth century employed an essentialist metaphysic where societal transformation proceeded through stages, e.g. Thomsen's Three Age System or Morgan's (1877) savagery, barbarism, civilisation. In the twentieth century rejuvenation of cultural evolution, specific parameters or traits were used to measure cultural development, while still employing categories, such as simple to complex societies. While these are potentially useful ways to describe broad patterns within cultural change and to differentiate groups or societies, they are primarily descriptive tools, and do not in and of themselves locate cause, other than in invention and intention. Since it is seeking explanations of archaeological and behavioural variation, rather than societal transformation per se, that is relevant to this research, the application of cultural evolution needs to transcend the stages approach and the Spencerian theory of evolution as progressive – the ladder-view of evolution. Thus, a return to the tenets of Darwinian evolution is necessary.

2.4 Evolutionary theory

In proposing to use evolutionary principles as a theoretical framework, it is necessary to outline how and why evolution is relevant to the archaeological record. Since the basis of biological evolution is genetic inheritance, the problem is how to extend Darwinian evolutionary theory from biology to culture, and to behaviour, in particular (Barton and Clark 1997, Lycett 2015). Darwinian evolution has the theoretical assumptions of variation, transmission and selection (Mesoudi 2016). Applying Darwinian evolutionary theory assumes that the process of natural selection has two steps: the generation of variation, and then selection operates on variation such that more advantageous variants reproduce at a greater rate; the process of differential reproduction means either the less advantageous variant is replaced, or it persists only at lower frequencies (Ladefoged 1995). An important distinction here is that the generation of variation is decoupled from the differential persistence of variants (Mesoudi 2008).

While evolutionary processes operate at individual level, the effects are seen at population level as the persistence of variation through time. New behavioural variation arises and is subject to evolutionary processes of selection, but it is the differential persistence that is important, not just the creation of variation (Barton and Clark 1997). Evolutionary processes do not operate on material culture but on the behaviours that produced it, and the archaeological record is what remains of those behaviours (Barton and Clark 1997). Thus, archaeologists must link remains in the archaeological record with the behaviours that produced that record (Bird and O'Connell 2006). The concept of fitness is a cornerstone of evolutionary theory; in biology, the concept is differential reproductive success, whereas for behaviour, replicative success is a more appropriate measure of fitness (Barton and Clark 1997, Leonard and Jones 1987). Fitness then is defined and measured in terms of successful information transmission, rather than reproduction. Decoupling fitness from biological reproduction and redefining it in terms of information transmission better aligns with evolutionary processes, and better explains behaviour (Barton and Clark 1997), particularly in light of the extended evolutionary synthesis (Laland et al. 2015).

The concept of cultural inheritance includes a range of social learning mechanisms or processes, from simple and indirect, to complex and direct, and includes learning influenced by observation and interactions (Lycett 2015). Humans also use social learning and imitation to culturally transmit information in order to "adjust" behaviour (Borgerhoff Mulder and Schacht 2012). These so-called social learning processes are the means by which traditions or lineages of heritable continuity are formed in the archaeological record (Lycett 2015).

2.5 Dual inheritance theory

Dual inheritance theory has been developed over recent decades as a means of explaining the dual processes of genetic and cultural evolution. Cultural variation, in a conceptual parallel to phenotypic (genetic) variation, can be acquired via cultural transmission processes. Cultural transmission mechanisms depend on an evolved cognitive capacity occurring at some point in the evolutionary past. The inheritance of acquired variation is a central tenet of Darwinian evolutionary theory, and since culture is transmitted, it can, it is proposed, be studied using evolutionary concepts. Cultural evolution can occur via mechanisms, including guided variation, and processes of biased transmission (Clark and Barton 1997, Richerson and Boyd 1992), but a significant feature of cultural evolution is the rate of adaptations, which, while varying according to the mechanism of transmission, are much faster than biological evolution mechanisms (Clark and Barton 1997). Guided variation allows populations to adapt quickly to environmental changes, especially when the goals of learning-rules are closely correlated with genetic fitness (Richerson and Boyd 1992). Biased transmission is similar to guided variation, but people evaluate alternative behaviours, select and adopt one which may then spread (Richerson and Boyd 1992). Bias processes include results bias (copying based on the results of others' behaviours), content bias (copying based on some memorable feature of a behaviour), and context biases which relate not to any intrinsic value of the behaviour but appear as conformist bias (copying what most people do) or prestige bias (copying prestigious others (Shennan 2008). While the focus is on individual decision-making, cultural changes are tracked via changes in distributions of cultural attributes in populations.

2.6 Evolutionary ecology

This brief preliminary examination of theoretical frameworks has focussed on evolutionary theory. The term "theory" is applied somewhat loosely herein. Archaeology needs theory to guide interpretation of the empirical record, and methods (conceptual tools or models) with which to do this; models help develop research questions and work out what data is needed to answer questions (Codding and Bird 2015, Winterhalder 2002, 206). Models are heuristic devices, used in problem solving, rather than designs for reconstructing the past (see Winterhalder 2002). Programmes within the evolutionary ecology stable provide such models within a framework of evolutionary theory (Codding and Bird 2015).

There are several terms used to describe similar programmes, all of which are founded in evolutionary theory. Evolutionary ecology (hereinafter EE) can be defined as the study of evolution and adaptive design in ecological context (Winterhalder and Smith 1992, 3). When applied to the study of human behaviour, this field of endeavour is often termed "behavioural ecology" or "human behavioural ecology". The study of EE emerged as a distinct field of research in the 1960s with works by Brown (1964) and MacArthur and Pianka (1966). For a useful general history of its development, see Winterhalder and Smith (1992, 2000). The term

EE is employed for this research because, although human behaviour is the subject of analysis, the models and concepts are derived from EE.

Evolutionary ecology is evolutionary in the Darwinian sense, and ecological in the sense that it deals with interactions between organisms and the environment (Winterhalder and Smith 1992). Drawing on evolutionary theory, it works on the premise that reproductive strategies and decision-making capacities are shaped by natural selection (Bird and O'Connell 2006) and behavioural diversity arises from individuals' strategic decisions, from variability in ecological context (opportunities and constraints) and from the cultural transmission of information (Bird and O'Connell 2006, Borgerhoff Mulder and Schacht 2012). Thus, EE is an explanatory framework for studying the adaptive function of behaviour in particular socio-ecological contexts, and looks at why certain behaviours emerged and persisted, and how a particular behaviour enhanced individual fitness (Bird and O'Connell 2006, Borgerhoff Mulder and Schacht 2012, Broughton and O'Connell 1999, Codding and Bird 2015, Winterhalder and Smith 1992).

In EE, simple models are developed, often based on optimisation or game theory (Winterhalder and Smith 1992). These models are used to analyse human behaviour to explain variability by linking simple theoretical predictions about individual decisions to dynamic and complex social and environmental contexts (Codding and Bird 2015). Thus, models are a useful way to define a problem, organise ways to think about the problem, understand the data, test this understanding and then make further predictions (Winterhalder and Smith 1992).

In EE, the focus of explanation is on phenotypic variation to understand complex behaviours and systems (Winterhalder and Smith 1992). The EE approach to phenotypic variation is that organisms have the ability to make adaptive changes to phenotype because selection has designed it so. This ability for phenotypes to adapt responsively and differentially to variable environmental conditions is known as phenotypic plasticity (Boone and Smith 1998, Codding and Bird 2015). An adaptive phenotypic variation is an interaction with a variable environment and includes (though not exclusively) behavioural change (Boone and Smith 1998, Codding and Bird 2015, Shennan 2008). It is not the behavioural variation itself that is shaped by natural selection, but rather, the precursor of this response, being the organism's capacity to respond adaptively (Boone and Smith 1998, Codding and Bird 2015, Shennan 2008). Adaptation is not the same as optimal phenotypes; it is not that there will be some ideal behaviour, rather, natural selection produces the best solution within the constraints of social and physical environments, and different trade-offs people make relative to different goals (Codding and Bird 2015). EE analyses phenotypic variation by using the idea of adaptive strategies, meaning fitness-enhancing behavioural responses to different environmental states (Boone and Smith 1998), whereby an individual actor has the capacity to select from an array of strategies, to assess payoffs, and to determine the best alternative for the particular circumstances (Smith and Winterhalder 1992).

The phenotypic gambit (Grafen 1984) is a research strategy, with the premise that selection allows adaptive phenotypes (Bird and O'Connell 2006, Codding and Bird 2015, Smith and Winterhalder 1992), but how these phenotypes are linked to inheritance does not need to be accounted for. Thus, EE is not concerned with specifying the mode of inheritance, as it is only a tool to generate testable hypotheses about fitness-related trade-offs that individuals may face in particular socio-ecological contexts (Bird and O'Connell 2006).

In sum, EE tries to explain patterns in human cultural behaviour rather than explaining them away as a function of culture (Bird and O'Connell 2006). The challenge is in how to incorporate mechanisms that underly adaptive behaviour to account for past behaviours, and the fitness implications of those behaviours (Bird and O'Connell 2006, Borgerhoff Mulder and Schacht 2012). EE seeks to assess fitness-related costs and benefits of potential strategies, drawing hypotheses about which pattern was likely adopted under specified constraints, and why it was adopted (Bird and O'Connell 2006). To do this requires methods derived from theory, i.e., conceptual models.

2.7 Models in evolutionary ecology

For archaeology, EE models provide a good basis for generating hypotheses to account for patterns in the record, but they require specified conditions, a range of options, currencies, and constraints affecting payoffs (Shennan 2008). In order to measure fitness, models use simple proximate currencies, assuming that these are highly correlated with fitness, i.e., they are proxy variables for fitness or proximate currencies to measure fitness (Codding and Bird 2015, Smith and Winterhalder 1992). In EE, the actors are individuals, which aligns with the presumption that selection operates at individual level (Smith and Winterhalder 1992). Most EE models invoke methodological individualism, which assumes that collective social phenomena are the aggregate of individual behaviours (Ladefoged 1995).

One of the key principles of EE is optimality, which assumes that individuals interact with the environment in ways that maximise reproductive success. Optimality models provide a framework for generating hypotheses – hypotheses which predict an optimal behaviour or strategy, within a particular set of conditions and constraints (Borgerhoff Mulder and Schacht 2012, Broughton and O'Connell 1999). Importantly, hypotheses are not a statement or an empirical generalisation about an observation. The model itself requires actors (decision-makers), a set of strategies, currencies (to measure costs and benefits), and a set of constraints (which affect the payoffs) (Shennan 2002). This does not imply individual consciousness, as individuals have proximate goals rather than an interest in selection (Shennan 2002). It does not matter if individuals make decisions based on fitness considerations (or indeed any considerations), as long as the behavioural results of their decisions have reproductive or replicative fitness consequences. Optimality models neither ignore nor require intentionality; nor does optimal mean best – it means only that selection will favour the best strategy among alternatives in specific contexts (Broughton and O'Connell 1999). The model simply predicts a possible "optimal" behaviour which can be tested empirically (Shennan 2002). If optimising activities depend on what others are doing, then evolutionary game theory may be employed (Bird and O'Connell 2006, Shennan 2008). The difference between the two is that optimality models evaluate hypotheses about individual behaviours under specified conditions, while game theory (evolutionarily stable strategy theory or ESS theory) adds a social dimension, i.e., the behaviour of the individual depends on the behaviour of others (Bird and O'Connell 2006).

The best-known optimality model is optimal foraging. Optimal foraging theory (OFT) models assume optimality in maximising efficiency and include analyses for diet-breadth and central-place foraging (Shennan 2008), but beyond these examples, models can be used for social processes (competition, ritual, warfare), notwithstanding the problem of operationalising the models in terms of archaeological data (Shennan 2008).

Ideal distribution models provide another useful method. The best known of this suite of models is the ideal free distribution (IFD), which has been used, for example, to explore the colonisation of Oceanic islands (Kennett, Anderson, and Winterhalder 2006). The two fundamental assumptions in IFD are: the ideal component, which posits that all individuals have the information necessary to select an optimal habitat, and the free component which provides that all individuals have equal access to the habitat resource (Fretwell and Lucas 1969, 21, Kennett and Winterhalder 2008, 88, McClure, Jochim, and Barton 2006, 204). This ecological model provides a framework that allows multiple variables to be considered – variables of habitat suitability, variables influencing migration (both density-dependent and independent), and variables of food production, as important influences of population movement (Kennett, Anderson, and Winterhalder 2006). IFD models assume that there is variability in habitat suitability and that individuals are free to move between habitats and do so in order to maximise benefits (Codding and Bird 2015). In a simple model, as population density increases, habitat suitability declines, resulting in a redistribution of the population across into the next most suitable habitat. Variants on this model include the "Allee effect", which delays the move to the next habitat when there are positive effects from habitat modification, or from economies of scale (Kennett et al. 2009). The Allee principle (following Allee et al. 1949, cited in McClure, Barton, and Jochim 2009, 255-257) recognises that habitat suitability may increase as a result of population increase, where the population's activities increase the resource value of the environment, i.e. there is a second higher suitability value (McClure, Barton, and Jochim 2009, 255-257).

The ideal despotic distribution (IDD)[1] is useful when differing competitive abilities result in differential access to resources (Kennett and Winterhalder 2008, 88-89, Kennett et al. 2009). If there is interference competition, inferiors are pushed into lower quality habitats, resulting in recalibration of the equilibrium, such that more population appears in lower quality habitats, while those with a greater competitive edge will retain higher quality habitats (Kennett, Anderson, and Winterhalder 2006). In an alternative variant, instead of driving individuals out, despots may bring them into their habitat under conditions of submission (Bell and Winterhalder 2014, Codding and Bird 2015). In yet another Allee-like effect, individuals may be better off staying in higher suitability habitats, even if they must forfeit some of their production to the despot (Bell and Winterhalder 2014, 130-133, Codding and Bird 2015). By changing the variables in the model, the effect on other variables, e.g. climate change, economies of scale in subsistence practices, territoriality, and social inequality and economic exploitation, can be investigated (Kennett, Anderson, and Winterhalder 2006).

Evolutionary game theory (ESS theory) is an alternative when dealing with selection operating in a more complex, reflexive manner than simple optimisation analysis, i.e. it requires a strategic analysis (Smith and Winterhalder 1992, 34). ESS theory combines game theory methods with the explanatory logic of natural selection theory, but instead of

[1] Fretwell and Lucas (1969, 28-30) also developed this idea, as the ideal dominance distribution.

economics of rationality and self-interest, ESS uses evolutionary stability and fitness (Smith and Winterhalder 1992). ESS models are useful when there are conflicts of interest or when frequency dependence effects apply to the characteristics being examined – in these cases the optimum is a competitive (evolutionary stable) one, rather than the simple (average fitness-maximising) one (Smith and Winterhalder 1992). Thus, optimisation underlies ESS analyses but in a strategic rather than parametric context (Smith and Winterhalder 1992). In ESS theory the relative payoffs of strategies depend on what others are doing; the fittest strategy does not relate only to the alternative strategies available, but also to what other individuals are doing with their strategy selections (Smith and Winterhalder 1992). So, in strategic contexts (frequency-dependent), each strategy's payoff is calculated in light of all the strategies that could be played against it – which strategy is unbeatable over evolutionary time, rather than just which strategy has the highest average payoff (Smith and Winterhalder 1992). The Prisoner's Dilemma (PD), and Hawk-Dove (H-D) games are two examples of game theory used to examine ESS (Smith and Winterhalder 1992).

In game theory, social interactions involve conflicts of interest (Smith and Winterhalder 1992, 37). Behaviours that maximise one person's fitness are unlikely to maximise another's, and so, since these fitness interests do not often coincide, individuals face trade-off decisions, as costs and benefits depend on others' actions (Hawkes 1992, 274-276). The simplest games involve two players and two strategies, as seen in the PD and the H-D games. These games are usually presented in a matrix, with strategies of player one (ego) shown in the rows and those of the opposing player two (alter) shown in the columns; the payoffs (cost vs value/benefit) appear in the cells. The Prisoner's Dilemma (PD) game is suited to examining behaviours of cooperation. The problem of whether to cooperate or defect is the prisoner's dilemma – self-interested individuals should always defect. The PD matrix for a symmetrical game is shown below in Figure 2. It is in ego's self-interest to defect (highest payoff for ego is D=4), whatever alter does, but if both were to cooperate, both would be better off (payoff C=3 for ego and alter). These payoffs or choices might also be termed reward (for mutual cooperation), punishment (for mutual defection); when one cooperates and the other defects, the co-operator receives the sucker's payoff, and vice versa, the temptation to defect payoff.

Prisoner's Dilemma		Alter strategy	
		Cooperate	Defect
Ego Strategy	Cooperate	C = 3	A = 1
	Defect	D = 4	B = 2

Figure 2: The Prisoner's Dilemma
The payoff matrix – the two alternative strategies are: cooperate or defect.
Payoff values are shown A-D with highest payoff being D.

This game demonstrates that individuals can benefit from mutual cooperation, but conversely, each can do better by exploiting the cooperative efforts of others – so the best strategy is to defect (Axelrod and Hamilton 1981, 1391). Cooperation does occur within groups, so the theory of reciprocation addresses this (Axelrod and Hamilton 1981, 1390). Self-interested individuals do not have an interest in reciprocity, since the payback is delayed, but reciprocity may develop where groups are small, and interactions are repeated, such that cooperation develops on a tit-for-tat basis (Boone 1992, 308). As the same individuals repeatedly interact (in multiple runs of the game), strategic interactions differ from the one-game version, where the optimal strategy was to defect (Axelrod and Hamilton 1981, 1391). This is called the iterated PD (or tit-for-tat), where the strategy is to cooperate on the first encounter, then to do whatever the other individual did on the last encounter (Axelrod and Hamilton 1981, 1393). Cooperation based on reciprocity can outcompete other strategies and be an ESS if (and only if) there is a high probability of interactions continuing between individuals (Axelrod and Hamilton 1981, 1393). A strategy is evolutionarily stable if a population of individuals using that strategy cannot be invaded by another individual using an alternate strategy (Axelrod and Hamilton 1981, 1392).

In the PD game applied to a resource area and the decision to exclude or allow (admit) others to access the resource, there is a conflict of interest for current users – their choices are to admit and pay costs, or to exclude and also pay costs – so the PD is which of the current users should bear the cost of exclusion (see Hawkes 1992, 277). Self-interest precludes paying the cost of excluding, so on one round of the game there is no collective action. On repeated interactions, there are contingent strategies, i.e. contingent on the previous round where players respond by doing what the other player did. In this way reciprocal altruism (the strategy) arises with delayed rewards for cooperation (Hawkes 1992, 278). However, as above, as group size grows and interactions are no longer between the same individuals, there is the collective action problem, with the possibility for free riders – those who do not pay the costs.

Decisions to defend a resource area and exclude intruders can also be considered in the Hawk-Dove game. Here, the value of the resource compared with costs of excluding others will determine the ESS, i.e., if the value of the resource exceeds the cost of defence, then hawk strategy is the better payoff. The ESS is, in fact, a mixed strategy depending on the relative value of the resource and the costs of defence. The Hawk-Dove game consists of the hawk tactic which is to contest the resource aggressively (compete) and escalate until hawk either wins the contest or is defeated, suffering injury and loss (no resource); the dove tactic is to bluff/display until faced with an aggressive player, and then to acquiesce or yield. If hawk plays against dove, hawk will always win. If hawk plays hawk, while one may win and gain in fitness benefits, costs are incurred in the fight (loss and injury). If dove plays dove, neither pays a cost and they share the fitness benefit. A symmetric H-D game can be presented in a simple matrix (Figure 3), with player one (ego) shown in rows, and the opponent in columns; payoffs are calculated as value of resource (or fitness gain) (V) and cost of injury (C).

As with PD, the best strategy would appear to be dove (the value of the resource is shared with no injury costs), but a strategy is only an ESS if it cannot be invaded by an alternative strategy. In a hawk-dove contest, hawk will win every encounter (gaining the resource, paying some cost of injury when contesting another hawk). Thus, an all-dove strategy is not an ESS, as it can be invaded by a hawk strategy. In the H-D game, an evolutionary equilibrium occurs when the average payoffs are equal. The ESS is calculated based on a payoff structure of fitness points and cost points. If payoffs are calculated (for example) at 100 for the value of resource (V), and -300 for the cost of contesting (C), and the chances of encounters being won are equal, i.e. 0.5, then the ESS can be a mixed strategy, i.e. play hawk 1/3 of time and dove 2/3 of time. Alternatively, the game can be expressed as the ratio of hawks and doves in a population, e.g. 1:2. An alternative asymmetric version of H-D is Hawk-Dove-Bourgeois (H-D-B). In H-D-B there is an assumption that possession or owning a resource (“resource holding potential”) gives a defensive advantage, so that the Bourgeois strategy suggests if you’re the owner, play hawk, or if you’re an interloper, play dove (Boone 1992, 318-319).

		Opponent strategy	
		Hawk	Dove
Ego Strategy	Hawk	(V – C)/2	V
	Dove	0	V/2

Figure 3: Hawk-Dove game
The payoff matrix in H-D game.
The alternative strategies are hawk and dove.
Payoff shown as V (value of resource) and C (cost of injury)

Another useful model, incorporating territoriality, is the economic defendability (ED) model. The ED model rests on the principle that natural selection favours territorial defence only where the fitness benefits exceed the costs (Mattison et al. 2016, 189). Territorial defence or territoriality implies exclusive use of a territory, and may be adaptive in certain ecological conditions (Cashdan 1983, 47, Codding, Parker, and Jones 2017, DiNapoli and Morrison 2017, 5). Territoriality is not a fixed trait, rather, it is a possible strategy which may be chosen when it has an adaptive advantage, i.e. territoriality is an adaptive response to environmental factors of resource distribution (Dyson-Hudson and Smith 1978, 36). Hypotheses must be derived from the model and then tested with (ideally quantitative) data (Dyson-Hudson and Smith 1978, 37).

For territoriality to occur, resources must be economically defendable, i.e. the benefits of protecting its exclusive use exceed the costs of defence (DiNapoli and Morrison 2017, 5). The costs and benefits of a territorial strategy depend on both spatial and temporal predictability, and resource abundance (density) (DiNapoli and Morrison 2017, 6, Dyson-Hudson and Smith 1978, 24-25, see also Cashdan 1983, 47). Densely distributed and temporally and spatially predictable resources are not only economic to defend, but also attract competitors, as they deliver the highest net gain (value of resource less cost of aggressive competitive actions (Boone 1992, 315). It follows that with increased territoriality there is increased competition (a superabundance of resources would not warrant competition). Conversely, if resources are dispersed and unpredictable and of poor quality, then payoff is low, the cost of defence is high, and so low territoriality is expected, although this may instead see increased cooperation, or mobility (DiNapoli and Morrison 2017, 6). The table (Figure 4 below) adapted from Field (2008, 4 Table 1, adapted from Dyson-Hudson and Smith 1978, 26) shows the likely relationships between resource distribution, economic defendability and competitive and/or cooperative subsistence strategies.

Resource distribution	**Economic defendability**	**Resource utilisation**	**Degree of mobility**	**Behavioural strategies**	
				Resources temporally predictable	Resources temporally unpredictable
Predictable and dense	High	Territoriality	Low	Competitive	Competitive + cooperative
Predictable and scarce	Fairly low	Home ranges	Low-medium	Cooperative	Competitive + cooperative
Unpredictable and dense	Low	Information-sharing	High	Cooperative	Cooperative
Unpredictable and scarce	Low	Dispersion	Very high	Cooperative	Cooperative

Figure 4: Economic defendability and territoriality
The relationship between spatial resource distribution, economic defendability, and behavioural (subsistence) strategies in temporally predictable or unpredictable environments.
Adapted from Field (2008, 4 Table 1), and Dyson-Hudson and Smith (1978, 26).

The economic defendability of resources depends not only on environmental factors of density, patchiness and predictability, but also how defence is facilitated (behavioural factors) (Mattison et al. 2016, 189-190). It is the uneven or clumped resource distribution which allows differential control, and so a resource area can be economically defended by a few individuals (dominants) who may then grant access to others (subordinates) in exchange for labour or other services (Mattison et al. 2016, 190). However, group defence raises the collective action problem, with the propensity for individuals to free-ride, as well as the problem of the unequal distribution of costs and benefits (Mattison et al. 2016, 190). The ED model assesses where territorial behaviour might occur, by using a cost-benefit model (where the costs of exclusive use and resource defence are outweighed by the benefits gained from the resource) to identify links between resource structure and spatial organisation (DiNapoli and Morrison 2017, 5, Dyson-Hudson and Smith 1978, 23). The ED model, as with other models in EE, emphasises generality rather than precision and realism (Mattison et al. 2016, 190).

2.8 Complementary approaches

As Schiffer (1999) (response to Broughton and O'Connell 1999) avers, perhaps no one programme provides a comprehensive theory, if one considers "theory" as incorporating a full and inclusive conceptual framework. Shennan (2008) notes that future developments could include the explanatory role of culture, as conveyed by DIT perspectives in combination with the predictive modelling power of EE, as a means of developing and testing hypotheses on social evolution. Consideration (Fuentes 2016) of how organisms and environments co-evolve or are co-constructed, employing niche construction theory, adds a useful heuristic tool, acknowledging such influences on evolutionary trajectories, but can still be accommodated within evolutionary theory. Laland et al. (2015) propose a new conceptual framework, the extended evolutionary synthesis, which, while still adhering to the principles of Darwinian evolutionary theory, incorporates developmental processes which operate through developmental bias, phenotypic plasticity, inclusive inheritance and niche construction. The extended evolutionary synthesis allows for the integration of constructive development and the reciprocal nature of causation.

An additional approach to social complexity is by asking how economies structured political relations. Traditional approaches to political economy in prehistory focussed on agriculture and trade in prestige goods. Earle and Spriggs (2015) proposed a political economy approach to understanding evolutionary change, in this case, how powerful elites arose. The ways in which different societies developed power structures depended on local conditions within their political economies, and so to find conditions which allowed social stratification and political control, Earle and Spriggs (2015) proposed a simplified version of Marx's analysis by looking at how "bottlenecks" occurred which allowed hierarchies to emerge. Bottlenecks or constriction points allowed emerging leaders to limit access, thus creating ownership of resources, technologies, and knowledge (Earle and Spriggs 2015). Political economy considerations provide an additional means of exploring social complexity, particularly in specific locational contexts, but ultimately still require a causal mechanism to be identified and would seem to disregard much of the competitive and cooperative behavioural variation documented in archaeology and in oral history, and do not outline any models which might help deduce testable predictions.

2.9 Summary

The overview of theoretical perspectives in archaeology, with a particular emphasis on cultural change and social complexity, has focussed predominantly on Darwinian evolutionary theory, and allied approaches whose central principles lie in evolutionary theory, regardless of differences in the way they address evolutionary processes and explanations of variation, and the manner in which human behaviours are linked to the archaeological and empirical record. As Neiman (1997, 268) has noted, behavioural meaning varies according to archaeological fashions; changing paradigms have led to changing language, reflecting different approaches to social complexity. Archaeology is interested in examining social and political organisation, but to do so, must employ theory for linking empirical evidence to explanation, rather than relying on inferences or empirical generalisations to link the record with explanations of complexity (Neiman 1997).

In summary, EE is a means of explaining processes. It provides a framework within which to seek explanations of cultural phenomena. The difficulty lies in moving beyond describing observations to explaining variation in the archaeological and behavioural records. This is achieved by looking at various natural and social constraints, assessing different behavioural strategies and why and how these might be selected, relative to the costs and the benefits conferred. By using evolutionary theory, models from EE enable the development of hypotheses which can be tested empirically and explained in evolutionary terms. Behaviours, such as construction of monuments without evidence of residential occupation, or transporting of raw materials despite locally available equivalents, might be examined using models of competition and cooperation, and evaluated in terms of individual fitness-maximising strategies and evolutionarily stability.

Chapter 3 Traditions and history of the Tongan Maritime Chiefdom

3.1 Introduction

This chapter provides a brief overview of the history of the TMC, principally the Tuʻi Tonga dynasty and associated lineages. It does not set out to critique the historicity or value of the selected literature, rather, it serves to introduce the Tongan chiefdom, and sets the scene for the subsequent case studies, where more specific details are provided, together with archaeological and environmental evidence. Hence, it is not a comprehensive review. For further detail relevant to Tongan history the reader is directed to Campbell (2015), Bott (1982), Herda (1988), Rutherford (1977a), and for origins and histories of the Tuʻi Tonga, see Gifford (1924)[2], (1929)[3] and Bott (1982).

Since this research draws heavily on traditional as well as ethnohistorical accounts, a preliminary comment on the use of traditions in archaeological enquiry is required. Previous uses of oral traditions in conjunction with the archaeological record include Kirch and Sahlins (1992) on Hawaiʻi, Ladefoged (1993) on Rotuma, and Kirch and Yen (1982) on Tikopia; see also Allen (2010) on Marquesan ethnohistorical observations of drought. The New Caledonian ORMST team of Frimigacci, Vienne, Sand and others incorporated ethnohistory and ethnology into their work on Wallis and Futuna. Burley (1994a, b, 1995, 1996) in his work in Haʻapai also integrated traditions into investigations of the Tongan chiefdom. Kirch (2018, 278) has noted that for much of archaeology's history, genealogies and oral narratives were the means of establishing chronologies, prior to the advent of radiocarbon dating. Whilst a structuralist paradigm in the subsequent years proposed that traditions beyond living memory were, in effect, timeless, and thus events could not be situated in any proper relative order (Kirch 2018, 280-281), Kirch's work, including that on Niuatoputapu, has shown a correspondence between traditions, genealogical reckoning and archaeological evidence (see Niuatoputapu case study at 6.5) (Kirch 2018, 292-295). As Kirch (2018, 300-301) observes, traditions and archaeology are two different ways of discovering the past and using both enriches this historical knowledge.

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[2] Gifford (1924) acknowledges his sources as the publications of the Wesleyan Methodist and Roman Catholic Churches, as well as local informants, but noting that the latter frequently recited the published versions, rather than knowledge handed down by relatives.

[3] Gifford (1929) provides comprehensive details of Tongan society and the Tuʻi Tonga dynasty, including the most often-used list.

Care is required, however, in adapting genealogies to chronologies, as genealogies are structured by cultural ideals and political processes (Herda 1990, 29, Sand 2008, 75). As Herda (1988, 39) notes, many authors assign dates to Tongan events, but these are based on genealogical reckoning, and are therefore speculative, arrived at by Eurocentric calculations of generation spans, derived from succession lists. Gifford (1924, 1929, 3) used missionaries' accounts and church manuscripts and also relied upon Mariner's account (Martin 1818) and the Tamahā's genealogies. Latukefu (1968, 136) has noted that oral traditions are usually preserved by chiefs and their matāpule, but are nonetheless of great value, if care is exercised to recognise where bias may occur.

Oral traditions are a means of linking people and their past (Kolo 1990, 7) but are not necessarily a precise rendering of past events (Ladefoged 1993, 67). Traditions may include ideological rationalisations (see Cachola-Abad 1993), as well as myths and legends, whose purpose may be validation and explanation of contemporary social and political structures (Burley 1995, 154, 1998, 369, Campbell 1982, 178, Kolo 1990, 2-10). The recounting is also influenced by the method of transmission, since written records have become a new means of conveyance of formerly oral recitation. What appears as a continuous narrative may instead be a product of historians fitting narratives into a structure that creates a concise statement about the Tongan political system (Campbell 1982, 178). This present-day structuring of a logical narrative often focusses on current perceptions of links between events, and the motivation of the key players, in the absence of an understanding of the relevance and meaning of past behaviours. What we now understand of Tongan cultural processes and social structures cannot be presumed to have applied throughout the last millennium. This poses some challenges when incorporating the oral narratives into an investigative framework (see also Burley 1998, 369-370, and Herda 1990, 21-29). Yet this is eminently achievable, as Kirch (2018) has demonstrated, and these "voices on the wind" add an invaluable and more nuanced dimension to our endeavours.

3.2 The Tongan Maritime Chiefdom

3.2.1 Dynastic hierarchy

The traditional view of the Tongan chiefdom is that the Tongan archipelago was controlled by a dual paramountcy of the sacred and the secular, as expressed in the person of the Tu'i Tonga and the *hau* (secular ruler or working king), and that the Tongan polity integrated a vast geographic area, with the central focus being Tongatapu, Ha'apai, and Vava'u, but extending to the Niuas (Niuatoputapu and Niuafoʻou), to ʻUvea and Futuna, as well as Fiji and Sāmoa (Campbell 2015, Herda 1988, 39-40, Kirch 1984, 219, Sand 2008).

The chiefly system incorporated a complex hierarchy, including regional and minor chiefs,

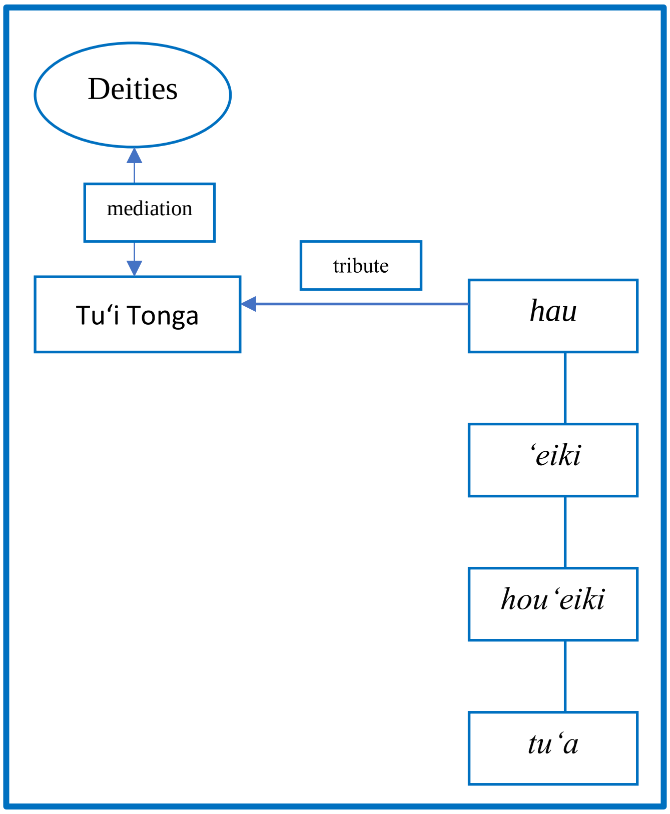


Figure 5: Hierarchy of Tu'i Tonga and chiefs.
Adapted from Kirch 1984:231 Figure75.

attendants and hereditary craftsmen (Burley 1998, 369, citing Bott 1982). The hierarchical structure provided for decisions to be passed down the lines of authority, from the Tuʻi Tonga to the secular ruler (*hau*), to great chiefs (ʻ*eiki*) and lesser chiefs (*houʻeiki*), to the chiefly ceremonial attendants (*matāpule*) and to commoners (*tuʻa*) (Campbell 2015, 57, Kirch 1984, 231, Sahlins 1958, 22-23). The *ha'a* was a set of titles deriving from any of the three lineages (Bott 1981, 27), a loose grouping of related but autonomous chiefs. Figure 5 provides a simple outline of some of these relationships. This description of the Tongan hierarchy describes several "positions" or rungs in the hierarchical ladder that did not all exist contemporaneously, so the description conflates several processes of change that occurred over time within the TMC. Bott (1981, 39) considers that trying to analyse Tongan social structure is better done by looking at it as a set of interacting principles rather than looking for well-defined structures, since the system of rank differs markedly from a system of social class.

3.2.2 The origins and rise of the Tu‘i Tonga dynasty at Heketā and Lapaha

The origins of the Tu‘i Tonga are recorded in the myth of the demi-god ‘Aho‘eitu, born of a mortal mother and a god father (Campbell 2015, 31, Collocott 1924, 169). While Collocott (1924, 170-171) notes a Sāmoan (Manu‘a) origin for the Tu‘i Tonga, other versions suggest ‘Aho‘eitu’s mother came from Niuatoputapu (Rutherford 1977b, 27). Campbell (2015, 33) also notes that some traditions record early memories linking Fijian and Sāmoan peoples to a Tongan migration, and so possibly these various associations reflect a period very little known, or alternatively, they seek to establish connections and justify associations.

Early dynastic lists date the Tu‘i Tonga dynasty back to AD 950,[4] using genealogies such as that recorded by the Tamahā Amelia[5] (Collocott 1924, 167, see also Herda 1988, 33-36, and Herda 1990 for how lists were determined). Gifford (1929, 50) used six sources for his list of 39 names (the most-cited version), including the Tamahā Amelia’s 1844 record, the Baker List (as provided to him by King George Tupou I in 1862), and the Catholic List. Lists vary (see Collocott 1924), both in the number of Tu‘i Tonga names presented, and in their order, and while there is large agreement in some periods, particularly the earliest and later names, some discrepancies appear mid-second millennium AD.[6] The lack of correspondence between lists may indicate that the period was one of volatility, as has been noted for Hawai‘ian traditions by Cachola-Abad (1993). A comparison of the most-cited list (known as the Catholic List with 39 names) and the Baker List (with 48 names) (Rutherford 1977b, 29) is shown in Appendix A. It is not proposed that any one list is the correct list, rather, it serves to illustrate that there is no certainty in the matter, and therefore the use of these lists, including for the purpose of developing chronologies, is tentative, at best. It is noted that the genealogical chronology has become generally accepted (and cited), based on a list of 39 Tu‘i Tonga incumbents, and an approximate founding date of 1000BP (AD 950) for the lineage (see Collocott 1924, 167, and Gifford 1929, 50 as cited above).

Little is known of the early Tu‘i Tonga between ‘Aho‘eitu (1st Tu‘i Tonga) and the 10th Tu‘i Tonga, Momo (Collocott 1924, 171). Momo established the first seat of the Tu‘i Tonga at Heketā in north-eastern Tongatapu (Collocott 1924, 171), where he is recorded as buried (AD

[4] Herda (1990, 24) notes that Collocott was the first to date back to AD 950 using dynastic lists.
[5] Genealogies were oral traditions, often with the purpose of legitimising rights (Herda 1990, 28) but started to be recorded in the 19th century, as in this case with the Tamahā Amelia; genealogies were the domain of the elite, as commoners had no need of them, and thus their use in historiography must be considered in this light.
[6] This is of some importance to this inquiry, since this middle era was the period of expansion and fission, featuring several key figures.

1350)[7] (Campbell 2015). Tuʻitatui, the 11th Tuʻi Tonga, is linked in traditions[8] with the construction of the Trilithon (Haʻamonga-a-Maui) at Heketā (Campbell 2015, 33, 37-38, Collocott 1924, 172, Rutherford 1977b, 33, Sand 2008, 74). This may however be a "reshaping" of the tradition (Sand 2008, 75), seeking to create a link to Tuʻitatui, since Tuʻitatui is also linked with the beginning of harbour works and the reclamations at Lapaha on the Fanga ʻUta lagoon, not far distant from Heketā (see Map 4). It was not until the following generation, the 12th Tuʻi Tonga, Talatama, that the chiefly residence was moved from Heketā to Lapaha (AD 1400) (Campbell 2015, 34, Collocott 1924, 174, Gifford 1924, 30, 46-47, 1929, 53). The move to Lapaha has been associated with the importance of long-distance voyaging by this period, although this is perhaps an assumption about location and its advantages for voyaging (Campbell 2015, 38, Gifford 1924, 30). Gifford (1929, 71) records that the Tuʻi Tonga, as early as Momo (10th Tuʻi Tonga), often travelled and stayed in other islands, as far away as Sāmoa. This is suggestive of continuing interactions and the importance of voyaging and inter-archipelagic relationships in the development of the Tongan hegemonic system.

3.2.3 Establishment, expansion and fission

Up until the mid-fifteenth century (by genealogical reckoning), it appears that the Tuʻi Tonga was the sole dynastic lineage. During and after this time, a series of events changed political arrangements. Oral traditions, including those of other islands such as ʻUvea and Sāmoa, indicate some degree of influence, or even control, by Tongan chiefs over other islands (Barnes and Hunt 2005, Burrows 1937, Rutherford 1977b, 34). Talakaifaiki (15th Tuʻi Tonga) is recorded as having ruled Sāmoa, but subsequently having been driven out (Campbell 2015, 41, Collocott 1924, 175, Gifford 1929, 54, Rutherford 1977b, 34), after which Sāmoans vowed that Tongans would never again invade Sāmoa, although relationships were evidently maintained.[9] Following Talakaifaiki (15th Tuʻi Tonga), traditions record a series of assassinations, with a rapid turnover of Tuʻi Tonga, which seems to indicate instability and political unrest (Campbell 2015, 44, Gifford 1929, 54).

[7] Bracketed dates are approximate dates, based on associated radiocarbon dates.

[8] Legends record people from ʻUvea, Futuna, Rotuma, Sāmoa assisting in the Trilithon's construction, and indeed state that the stone came from ʻUvea, although the blocks are actually coral limestone, likely from the nearby reef.

[9] Herda (1988, 46) notes subsequent Tuʻi Tonga married high-ranking Sāmoan women. In addition, a few generations later, Tuʻi Tonga were again living in Sāmoa, possibly in retreat.

Later in this (mid-millennium) period, the allegedly harsh Takalaua, the 23rd Tuʻi Tonga, was assassinated (Bott 1982, 95, Gifford 1924, 61-62, 1929, 54-55, Herda 1988, 48, Kirch 1984, 224-225, and see Burrows 1937, 27 for an 'Uvean version). What followed, radically changed the power structure and relations across the Tongan archipelago. Upon the murder of Takalaua, his eldest son, Kauʻulufonua, went in pursuit of the perpetrators, which adventure took him far and wide, including to ʻUvea, Futuna, Fiji and Sāmoa[10] (Collocott 1924, 176, Gifford 1929, 55-56, Kirch 1984, 224-225). While the alleged purpose was revenge for his father's murder, beyond these literal meanings, this may be interpreted as referring to acts of aggression, usually expressed as the conquest of adjacent, formerly independent chiefdoms, or simply as Tongan expansionism (Burley 1995, 159, Herda 1988, 95, Kirch 1984, 225). An alternative version of this event is that it was a re-asserting of control by the centralised Tongan power. Whether an assertion or re-assertion, this was the "event" that is known as the major period of Tongan conquest and domination of islands, within and beyond the Tongan archipelago. The conquest event is dated to about AD 1450 or 1470, as calculated using genealogical records. Gifford (1929, 56, 83) provides a date of AD 1470 for the institution of the Tuʻi Haʻatakalaua lineage, and the date of AD 1450 (1929, 54) for the reign of the 23rd Tuʻi Tonga. However, these dates should not be relied upon, but used cautiously (Sand 2008, 81-82).

In tandem with this expansion, a new political regime was established, with reforms in the exercise of dynastic authority. Kauʻulufonua, having succeeded as Tuʻi Tonga, instituted a new secular role, with the title Tuʻi Haʻatakalaua, in effect a "working king", a position more generally termed *hau* (Campbell 1982, 2015, Kirch 1984, 225, 230), but see Gunson (1979) for an alternative view on the institution and position of *hau*. The new arrangement differentiated the sacred role (which the Tuʻi Tonga retained) from the day-to-day administrative responsibilities (Collocott 1924, 177, Kirch 1984, 230). The ceremonial functions of the Tuʻi Tonga included receiving and presiding over the *ʻinasi* (the traditional first fruits) and other ceremonies (Gifford 1929, 75-76), as well as mediating with the deities (Kirch 1984, 230).[11] As part of this reform, and following the expansion into the various islands, junior lineage members were sent as emissaries or governors to islands, across the "empire", including Haʻapai and Vavaʻu (Gifford 1924, 62, 1929, 68-70, Herda 1988, 50, Kirch 1984, 232). The Tuʻi Haʻatakalaua junior kin established themselves on the subjugated

[10] The reasons given in oral traditions for this expedition vary across different islands.
[11] This analysis may rely more on observations late in prehistory by early European visitors.

islands, often by marrying the daughters of local chiefs (Bott 1981, 12). An alternative version of events is possible, since traditions speak of Kau‘ulufonua (24th Tu‘i Tonga) being domiciled in Sāmoa (Campbell 2015, Herda 1988, 52, 59-62). The supposed voluntary devolution of powers which created sacred and secular roles, might have been a *coup d'état* resulting from a power and status struggle within the dynasty, with the "voluntary" version of the tradition subsequently becoming the received history, thereby acting to validate the position of the victors (Campbell 1982, 181, Herda 1988, 51-53). Perhaps it was both.

The Tongan polity, under the Tu‘i Tonga and the Tu‘i Ha‘atakalaua, was centred at Lapaha on Tongatapu and was linked by the new alliances (or by obligation) to the outlying islands, whose people confirmed allegiance (or showed obeisance) by sending tribute (such as *‘inasi*) (Kirch 1984, 241). Lapaha was restructured following the changes in the polity, with the new spatial division reflecting sacred and secular roles; the Tu‘i Tonga and his kinsmen, known as Kauhala‘uta, occupied the inland side of the road, while the newly established Tu‘i Ha‘atakalaua and his kinsmen were known as Kauhalalalo and occupied the lower road in the area of reclamation on the lagoon (Campbell 2015, 48, Collocott 1924, 177, Herda 1988, 54, Kirch 1984, 227). Thus, the series of constructions, with increasing complexity, appeared to parallel political transformations with increased levels of hierarchy (Campbell 2015, 52-53, Kirch 1984, 230).

These apparently dramatic changes to Tongan chiefly lines, rituals and structures, under a "dual paramountcy", were short-lived, as the Tu‘i Ha‘atakalaua dynasty (as secular ruling *hau*) was eclipsed by the slightly later Tu‘i Kanokupolu dynasty (Gifford 1929).[12] Just as the 24th Tu‘i Tonga wrought institutional change, likewise in the early AD 1600s, the 6th Tu‘i Ha‘atakalaua created additional *hau* positions for his sons (Bott 1981, 13, Campbell 2015, 51-53), first sending the youngest son, Ngata, to Hihifo, ostensibly to bring this western district of Tongatapu into political alignment with eastern Tongatapu.[13] Again, an alternative reading might be that Ngata (subsequently the 1st Tu‘i Kanokupolu) seized power from his father after having subjugated the Hihifo chiefs (or perhaps in collaboration with these chiefs) (Campbell 1982, 181). Ngata was of Sāmoan heritage, and Sāmoan interventions in western Tongatapu are recorded in association with Ngata and the establishment of the Tu‘i

[12] Gifford (1929, 82-93) details the membership and functions of the two lineages.

[13] Campbell (2015, 52) also records that the 6th Tu‘i Ha‘atakalaua sent three of his sons to govern other parts of Tonga – Ngata to Hihifo, another to Hahake ("a large and fertile district in eastern Tongatapu"), and a third son to Ha‘apai.

Kanokupolu dynasty (Gifford 1929, 98-102). The story of the third dynastic lineage may conflate a series of events, during which the Tuʻi Kanokupolu lineage became ever more powerful, rather than an abrupt and deliberate act to create a new regime (Campbell 1989, 150). Whatever the processes of change, from the mid-1600s through the 1700s, dynastic transitions were far from orderly, with various sons and brothers setting up their own powerbases, not only in Tongatapu, but also as evidenced in the rise in power of the Tuʻi Haʻapai and Tuʻi Vavaʻu (Campbell 2015, 55-56).

3.2.4 Late prehistory and early European contact

Latukefu (1975, 2-4) relates that in later years, as the local chiefs rose in dominance, there was a corresponding decline in the power of the Tuʻi Tonga and the *hau*, so that the largest socio-political group was the *haʻa*, a loose grouping of related but autonomous chiefs. Nonetheless, the Tuʻi Tonga lineage persisted for some time, indeed the last Tuʻi Tonga, Laufilitonga, died only in 1865 (Collocott 1924, 166). In the late AD 1700s, Europeans arrived, adding further complexity. From the turmoil of the late AD 1700s and early 1800s, Vavaʻu and Haʻapai arose as unified independent political regions under the Tuʻi Haʻapai and the Tuʻi Vavaʻu, whilst Tongatapu remained ununified and fragmented, ruled mainly by local chiefs (Latukefu 1975, 14-19). By the end of the AD 1700s the Tuʻi Tonga was in decline, and regardless of the influence of Christianity, this created an opportunity for some new and powerful leader to emerge to create a new political regime (Collocott 1924, 184). This new force was found in the person of Taufaʻahau, later King Tupou I (George), who established a new regime under Christianity, styled after a European monarchy (Collocott 1924, 183).

3.3 Summary

This overview of the history of the Tuʻi Tonga dynasty and its successors has provided a glimpse into the intricacies of political organisation as played out primarily from Tongatapu. Reconstructing the past is fraught with challenges, with competing traditions and the tendency for one or another version to prevail. Some events may be emphasised, making them appear more prominent and either conflating a series of events or obscuring a longer process of more gradual change. The lack of a sure chronology (as can be provided in part by archaeology), as well as a reliance on genealogies and a preference for the Catholic List (as opposed to other versions) adds to the difficulty of determining a calendrical timing of events and their duration. Nonetheless, this brief history describes something of the Tongan dynasties as they played out over the twelfth to nineteenth centuries. The evidence from these sources is included in the data tables in the appendices.

Chapter 4 Palaeoenvironments

4.1 Introduction

The general physical characteristics, environmental setting and climatic regime of each island of interest are important in providing the ecological context for the human-environment interactions that are integral to the analysis in Chapter 6. This chapter provides a short description of island formation and geology, sea level and tectonics, climate and habitat. The Tongan archipelago is first described, then the islands of ʻUvea (Wallis and Futuna), with brief details of Sāmoa and Eastern Fiji. While the information is not comprehensive, it does provide a guide and a comparison of the different island environments. Additional detail on specific islands, where available, is provided in the case studies in Chapter 6.

4.2 Geography and geology

4.2.1 Tongan archipelago

The Kingdom of Tonga is comprised of a chain of more than 170 islands, with 700 km^2 of land, spread over 600,000 km^2 of ocean, lying between 23° and 15° south, and between 173° and 177° west. The islands of Fiji are some 320 km to the west, while Sāmoa lies 280 km distant to the northeast of Tafahi (and 880 km northeast of Tongatapu) (Fall and Drezner 2011, 2013). The island of ʻUvea (the French Overseas Collectivity of Wallis and Futuna) is found to the north of Tonga, and west of Sāmoa. Map 2 shows the Tongan archipelago.

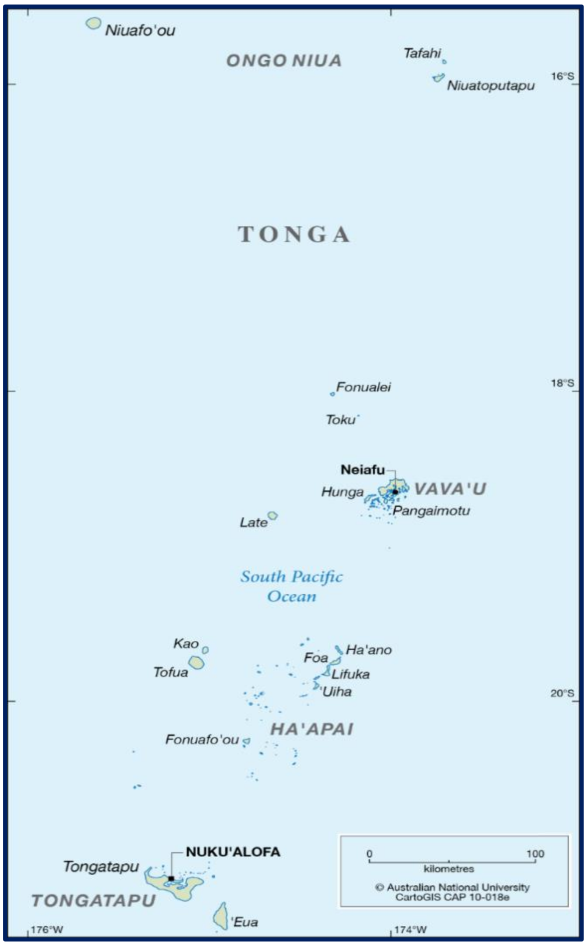
The Tongan archipelago lies at the eastern edge of the Indo-Australian plate, running parallel to the Tonga Trench, where the Pacific plate subducts the more westerly plate. The forearc islands (including the three main island groups of Tongatapu, Haʻapai, and Vavaʻu) are of non-volcanic origin, composed of Quaternary limestone, rising from shoals on top of the Tonga platform. A chain of volcanic islands to the west, from ʻAta in the south, stretching to Tafahi in the north, form the Tofua volcanic arc (Dickinson and Burley 2007, Fall and Drezner 2011, Mueller-Dombois and Fosberg 1998). The Tofua volcanic chain includes submerged volcanic seamounts, ephemeral islands (which appear only during periodic eruptions), strato-cones (e.g. Tafahi), remnants of eroded volcanoes (e.g. Niuatoputapu, and ʻAta), and collapsed caldera systems (e.g. Tofua) (Dickinson and Burley 2007). Of these volcanic islands, ʻAta and Niuatoputapu are dormant or extinct (Dickinson and Burley 2007). The largest volcanic island, Tofua in the Haʻapai group, is still active, with the last major eruption in 1959 (Fall and Drezner 2011). Most of the others remain active, and many have seen eruptive events in the last century.

Therefore, these two island arcs provide contrasting environments for habitation and for resources. Of the islands of the forearc belt, the largest is Tongatapu at 261 km^2 with a maximum elevation of 80m; islands of the Ha‘apai Group are mostly small at around 2 km^2, with the largest at 13 km^2; ‘Utu Vava‘u is the largest island of the Vava‘u group being 96 km^2 with a maximum elevation of 200m (Dickinson and Burley 2007, Fall and Drezner 2011). Somewhat isolated from these two chains of islands is the island of Niuatoputapu, and its near neighbour, Tafahi, 8 km distant to the north. While Niuatoputapu is an ancient eroded volcanic island surrounded by a limestone reef, Tafahi is a stratovolcano with no recent activity (Fall and Drezner 2013). Both are small, with Niuatoputapu having an area of 15.6 km^2 and a maximum elevation of 146 m, while Tafahi is only 3.4 km^2 but rises to 506 m (Fall and Drezner 2013). While the Tongan islands are plate-boundary islands, the islands of Sāmoa and of ‘Uvea are intra-plate islands formed over hot spots in the Pacific Plate (Mueller-Dombois and Fosberg 1998).

The frontal arc islands subside while also displaying localised tectonic uplift (Dickinson and Burley 2007) and this disparate tectonism is evident over quite short distances, such that each island or part of an island exhibits its own elevational and shoreline history (Dickinson 2018). Tongatapu is formed from an uplifted palaeoreef, and is tilted downwards to the northwest, while the uplifted southeast coast has a steeper coastal cliff edge (Dickinson and Burley 2007). Niuatoputapu shows evidence of the greatest degree of change in its southeast extent, due either to uplift or to falling sea level, or perhaps both (Dickinson, Burley, and Shutler Jr 1994). Palaeotsunami are likely to have been underestimated, if recent events are any indication of their frequency in the past. There is evidence of a tsunami at Futuna in circa AD 1480 (Goff et al. 2011, Lamarche et al. 2015). It appears likely that region-wide events emanating from the Tonga-Kermadec Trench (i.e., TKT-sourced tsunami), might have occurred. Overall, the Tongan archipelago is subject to both seismic and volcanic activity and hence is a dynamic setting for human habitation.

The periodic volcanism of the Tofua arc, including that of the recent past, has produced ash layers which have enriched the soils (Fall and Drezner 2013, Mueller-Dombois and Fosberg 1998) across the forearc islands. Thus, the fertile soils tend to vary with distance from the volcanic arc, e.g., Tongatapu’s younger tephra layer declines from approximately 2 m depth in the west, to 0.4 m at the eastern end (Dickinson and Burley 2007). This soil differential should indicate variability in Tongatapu’s agricultural potential, but the evidence on this appears contradictory. The agricultural soils are described by Gibbs (1976), and by Crane

(1992 cited in Burley 2007a, 182-183) using local names which likely reflect emic classifications of agricultural use. Cowie (1980) recorded that the underlying coral is undulating, so the thickness of overlying soils varies, which would result in localised variabilities. This degree of variation is discussed further in Chapter 6. The geological differences have created diverse or variable settings for vegetation and for human settlement (Fall and Drezner 2013). Vegetation, recognisably, consists of endemic and indigenous species, later Polynesian introductions, and more recent European additions. The original natural vegetation was tropical rainforest in inland areas, excluding wetlands and volcanic landscapes (Fall and Drezner 2011, 2013). Today little natural vegetation remains, and most of Tongatapu, at least, is under cultivation (Mueller-Dombois and Fosberg 1998). Overall, the environmental variation across the different islands might be expected to influence population distribution – both location selection by early colonising populations and subsequent intensification of agriculture, although coastal topography may also be relevant.



Map 2: Islands of the Tongan archipelago

Map source: Map reproduced with the permission of CartoGIS Services, ANU College of Asia and the Pacific, The Australian National University.

4.2.2 ‘Uvea (Wallis and Futuna)

‘Uvea (Îles Wallis) is a low island of volcanic origin, with several craters; it is 96 km^2, rising to a maximum elevation of 151 m; there is a surrounding fringing reef as well as a coral barrier reef with five passes; the lagoon contains twenty islets (Frimigacci et al. 2016, 20, Sand 1998). ‘Uvea lies midway between Fiji and Sāmoa. Further details are provided in the case study in Chapter 6. Futuna (Îles de Horne) lies 220 kms to the southwest of ‘Uvea and includes the larger volcanic island of Futuna at 46 km^2 with its highest peak rising to 760 m, and the smaller island of Alofi.

4.2.3 Islands of interaction sphere: Lau Islands of Fiji, and Sāmoa

Fiji is notably larger and geologically older than Tonga, although the Lau group of islands has different origins. The Lau archipelago is a remnant volcanic arc (Dickinson and Burley 2007), with no recent history of tectonic or seismic activity (Nunn 1990), and consists of 80 islands, stretching 450 km in a north-south direction, lying some 320 km west of Tonga (O'Day, O'Day, and Steadman 2004). The islands include both volcanic and coral limestone, and are inter-visible, with extensive fringing reef systems providing rich marine resources; most villages are on the coast, making access to these resources easy (O'Day, O'Day, and Steadman 2004).

The islands of Sāmoa lie to the northeast of the Tongan archipelago, and, while proximate, are remarkably different in geology and settlement landscape (Burley and Addison 2018). The Sāmoan archipelago is relatively young, and formed through hotspot volcanism, extending from Tuvalu, through ‘Uvea and to the eastern edge of American Sāmoa (Burley and Addison 2018). Sāmoa is a product of its volcanic history, providing variable features from coastal plains to upland plateaus, with steep valleys; soils are overlain by rich volcanic ash layers in some areas (Burley and Addison 2018). Savaii is 1694 km^2, elevation 1858 m; Upolu is 1125 km^2, 1100 m elevation. So, the nearest islands of Sāmoa are much larger and of higher elevation, and therefore exhibit a greater species diversity as well as greater habitat diversity than that found in the Tongan archipelago (Fall and Drezner 2011).

4.3 Marine environment

All islands of the Tongan archipelago, as well as those of adjacent groups, have access to good marine resources. Differences relate to the nature of reef systems and lagoons, varying from diverse and easily accessible to more limited and/or less accessible. Generally, the inhabited low elevation limestone islands have complex reef systems which provide diverse resources. As noted above, direct (easy) coastal access is not uniform along all island coasts, notably Tongatapu and Vavaʻu. This may be of particular relevance when considered together with the location of terrestrial resources, as the northern aspects of Tongatapu include extensive reef systems. Studies of the relationship of climatic variability and its effects on marine resources are limited, with some work in Sāmoa (Morrison and Addison 2008). The effect of adverse climatic events on marine resources would lead to stress, as Nunn (2000) outlines, with changes in temperature with increased El Nino frequency (AD 1270-1325) as well as turbidity from sedimentation following increased precipitation. As Morrison and Addison (2008) and, more recently, Tangri et al. (2018) have suggested, local climate proxy records are required to assess these variables and their influences on resources.

4.4 Climate

The Tongan archipelago has a tropical maritime climate and is dominated by the southeast trade-winds (Fall and Drezner 2013). A temperature gradient, and a concomitant gradient in mean annual rainfall (Mueller-Dombois and Fosberg 1998), runs south-north towards the equator. Mean annual precipitation for Tongatapu is 1780 mm, while for Vavaʻu it is 2340 mm (Fall and Drezner 2013), as rainfall generally increases along this south-north gradient. The Haʻapai mean therefore lies along this gradient, while Niuatoputapu, and ʻUvea, should be correspondingly higher than the more southerly islands. Tropical cyclones occur with some frequency across the area, affecting these small islands to a significant degree, with major damage and disruption to vegetation and crops (Fall, Drezner, and Franklin 2007).

Climatic regimes have importance at global, hemispheric and regional scale, but it is apparent that localised processes may result in significant differences across the area of Western Polynesia. Various authors have looked at regional-scale environmental change across the Pacific (see Allen 2006, Field and Lape 2010), and this type of Pacific palaeoclimate analysis assists in understanding regional interactions. It is both the variability in the climatic system and the longer-range environmental changes that provide important insights. Climatic variability in the Pacific, in some studies, has been linked with territoriality (see Field 2003, 2004, Field and Lape 2010). Other studies (Nunn 2000, 2007, 1998, Nunn and Britton 2001) have looked at climate and sea-level change over the last millennium, especially around AD 1300, and the co-occurrence of changes in diet, landscape, and settlement patterns.

The Pacific climate system has complex weather cycles, including ocean currents, wind patterns, and convergence zones (Field 2005, Field and Lape 2010). The South Pacific

Convergence Zone (SPCZ) is a permanent feature in the Southern Hemisphere (Wu et al. 2013). Tonga, Fiji and Sāmoa lie at the southeast edge of the SPCZ and are influenced by both the position of the SPCZ and the seasonally shifting surface ocean salinity front (Allen 2006, Wu et al. 2013).

The SPCZ is highly variable and shifts with El Niño Southern Oscillation (ENSO) activity and has moved east and west over the past centuries: during El Niño phases it moves northeast, and during La Niña phases it moves southwest (Allen 2006, Field and Lape 2010, Wu et al. 2013). The Interdecadal Pacific Oscillation (IPO) refers to interdecadal-decadal oceanic and atmospheric variability (with fluctuations in sea surface temperature and precipitation) in the South Pacific and is most pronounced in the area of the SPCZ, where the salinity front locates in the region of Fiji and Tonga (Linsley et al. 2008). The SPCZ also responds to the IPO and its alternating cycles – negative (cool dry phase) and positive (warm wet phase), and these IPO negative and positive phases tend to amplify their ENSO equivalents such that positive (warm) phases are associated with stronger and more frequent El Niño activity (as the SPCZ moves northeast), and negative associated with La Niña (Allen 2006, 2010, Folland et al. 2002, Linsley et al. 2008). Further, the movement of the Intertropical Convergence Zone (ITCZ), mid-millennium, may have resulted in drier conditions nearer the equator and wetter conditions further south than current, which aligns with the Northern Hemisphere LIA (Sachs et al. 2009). Thus, regional variations in climate response are a result of interactions between convergence zones and cyclical anomalies of ENSO (Field 2005).

Salinger and colleagues (1995) mapped regions of temperature and precipitation in proximity to the SPCZ and ITCZ (where convergence zones merge and interact with other climatic features) and have suggested different climate response regions resulting from these interactions in the southwest Pacific. Field (2004, 2005 citing Salinger et al. 1995) has suggested that there are different climatic responses (temperature and precipitation) between northern and southern parts of Tonga (and Fiji), based on these interactions between SPCZ and ENSO. The relationship of the different climate response regions may result in differences in the degree of ENSO effects, including the tendency to ENSO-related droughts. This demonstrates the importance of localised proxy data for specific locations within Western Polynesia. While regional data is indicative of climatic variability and the frequency and amplitude of ENSO events, these could vary significantly across the area of interest, i.e.

between Tongatapu and ‘Uvea. It cannot be assumed that climate proxy records are widely applicable.

4.5 Palaeoclimate variation

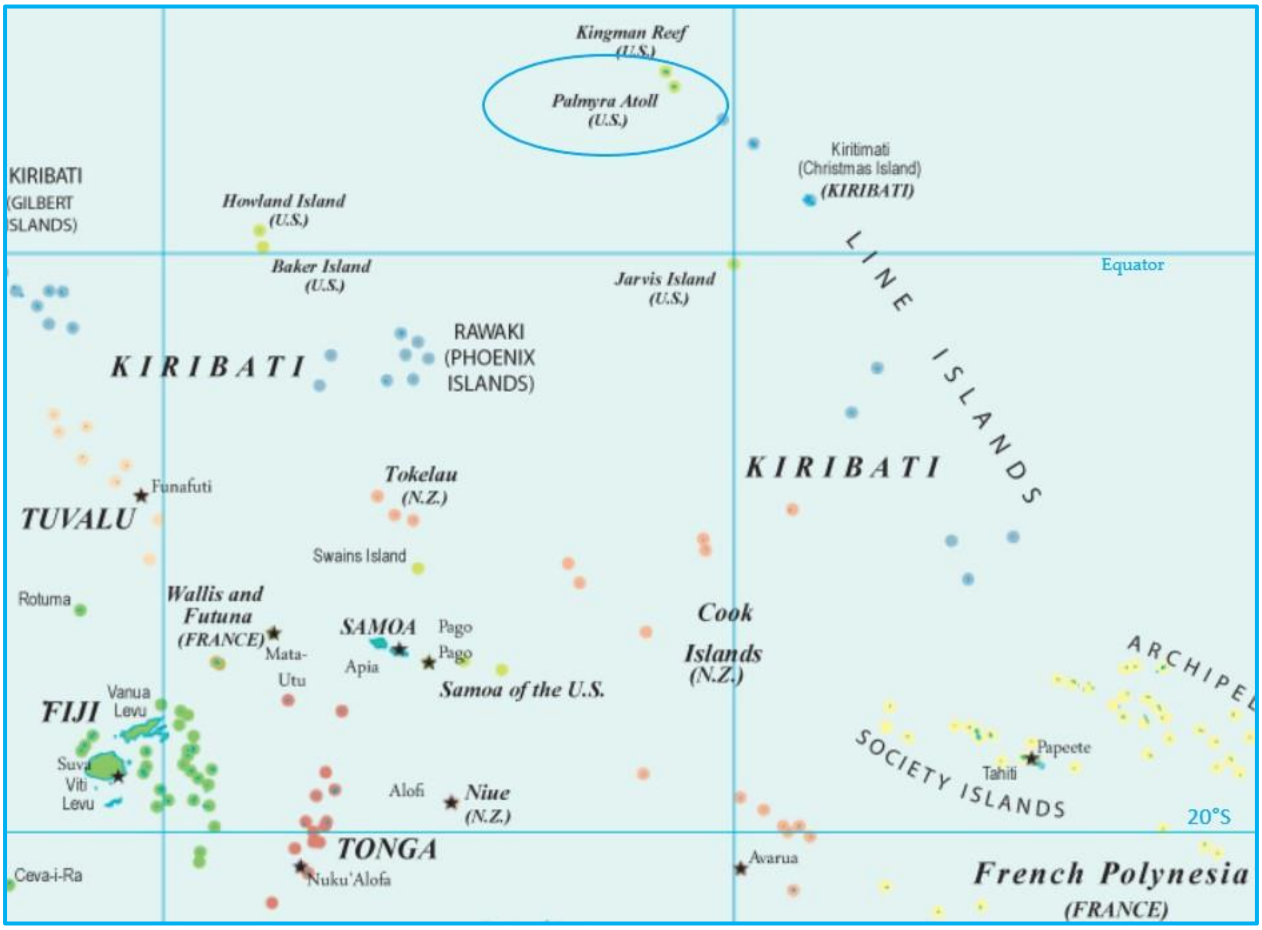
Earlier studies of palaeoclimate variation used models from the Northern Hemisphere and higher latitudes where two periods have been identified: the Medieval Warm Period (MWP) AD 900-1200 and the Little Ice Age (LIA) AD 1550-1900 (Allen 2006). Several recent studies suggest that there was likely greater variability and no simple direct correlation between the Northern Hemisphere temperate regions and the tropical Pacific (Allen 2006, Morrison and Addison 2008). For further on this see also Allen (2006, 521), Cobb et al. (2003, 275), and Jones et al. (1998, 462, 2001, 664). More current Pacific palaeoclimate proxy records from coral sequences have provided high-resolution reconstructions (Cobb et al. 2003, Hendy et al. 2002, Linsley et al. 2006, Linsley et al. 2015, Linsley et al. 2008) of climate variability over the past millennium, and have shown that previous climatic models, based on Northern Hemisphere patterns, and including data from New Zealand, (e.g. Bridgman (1983)), are not extendable to the tropical Pacific (Allen 2006). Cobb et al. (2003) compared the Palmyra data (see below) with the Northern Hemisphere and found that a cool/dry Palmyra coincided with the Northern Hemisphere MWP, while the height of the LIA in the Northern Hemisphere coincided with Palmyra’s seventeenth century warm period. Palmyra coral records also show ENSO activity was most intense in the seventeenth century, which is the same time as the coldest period of the LIA in other parts of world (Allen 2006).

Nunn (2000, 2007, Nunn and Britton 2001) has proposed a significant climatic change which he called the “AD 1300 Event”. A warmer, drier, stable climate of the Medieval Climate Anomaly (MCA)/LCO (AD 750–1250) transitioned at approximately AD 1300 to the LIA (AD 1350-1800), a cooler climate, with increased storminess, increased frequency of El Nino events, and greater climate variability, accompanied by sea-level fall, resulting in significant food resource depression (Nunn 2007). Nunn’s hypothesis proposed that this widespread climatic change resulted in widespread societal disruption, including resource depletion, a rise in conflict with construction of fortifications, and changing settlement patterns from coastal to inland, as well as an end to ocean voyaging.

The Palmyra data does not lend support to Nunn’s proposal for an abrupt temperature decline at AD 1300. However, as Allen (2006, 527) has remarked, a significant increase in temperature would be just as disruptive as a decline, e.g. in its effects on sensitive tropical reef systems. But Nunn (Goff and Nunn 2016) also makes a valid point that evidence of societal change, such as conflict, change in settlement patterns (from coastal undefended to inland/uphill defended in this example), and abrupt cessation of long-distance voyaging, can infer environmental perturbations such as sea-level changes and “large-wave” events like tsunami, as well as seismic events that cause region-wide disruption. It seems likely that there is some validity in Nunn’s view, and there is some evidence of environmental instability, but perhaps not of the magnitude or type he proposes (Allen 2006).

4.6 Palaeoclimate: proxy coral records

Coral records are used as a proxy for reconstructing climates, prior to instrumental records, but their age-range is limited to 300-400 years, and so, fossil-coral sequences are used to extend chronologies beyond this time limit (Neukom and Gergis 2012). There are several coral $\delta^{18}O$ sequences as well as Sr/Ca records across the tropical Pacific. These include New Caledonia (a 335-year record), the Great Barrier Reef (a 420-year record from AD 1565-1985) (Hendy et al. 2002), Fiji, Tonga and Rarotonga (a 271-year record) (Linsley et al. 2015, (and Linsley, Wellington, and Schrag 2000)), and Fiji-Tonga (a 350-year record) (Allen 2006, Field and Lape 2010, Linsley et al. 2008). The 1100-year Palmyra sequence is the most valuable for this TMC study, although located beyond the SPCZ, and some reservations will be acknowledged (Allen 2006, Cobb et al. 2003, Neukom and Gergis 2012). The relative location of Palmyra is shown in Map 3.



Map 3: Location of Palmyra Atoll relative to Tonga
Showing Palmyra Atoll north of the equator and the Tongan Archipelago between 15° and 23° south.
Map sourced from http://www.maps-world.net/oceania-political.htm

The Palmyra coral $\delta^{18}O$ sequence used fossil-coral sequences to build proxy records of climate variability over the last millennium (Cobb et al. 2003). The Palmyra climate is affected by ENSO variability and the coral records provide a proxy record of this variability. El Niño events bring wetter warmer conditions and positive SST and are reflected in lowered (more negative) coral $\delta^{18}O$, while La Niña is the converse, i.e., colder and drier conditions with more positive coral $\delta^{18}O$ (Cobb et al. 2003). While the fossil-coral sequences were several decades long, these were extended back in time, by overlapping fossil-coral records, and then splicing these together. Young fossil-corals, which overlapped the modern coral in the early twentieth century, were used to test dating accuracy (Cobb et al. 2003). The fossil-coral records included single coral $\delta^{18}O$ records from the tenth and twelfth centuries, five coral $\delta^{18}O$ records from the fourteenth to fifteenth centuries, and three coral $\delta^{18}O$ records from the seventeenth century (Cobb et al. 2003). The five intervals analysed included the single fossil-corals (the two earliest intervals), the spliced fossil-coral records from the two middle periods, and modern coral records of the twentieth century. Together these represented the following periods: AD 928-961, AD 1149-1220, AD 1317-1464, AD 1635-1703, and AD 1886-1998 (Cobb et al. 2003). See Figure 6.

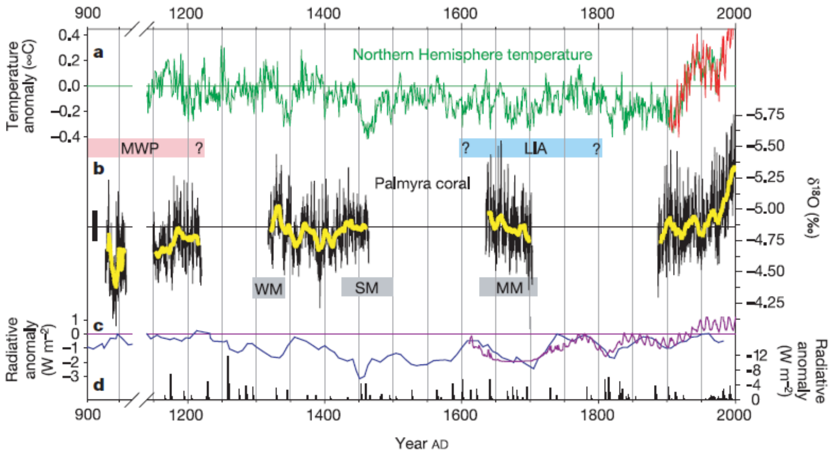


Figure 6: Palmyra coral records

Reproduced from Cobb et al. (2003, 274 Figure 5). Showing (from top to bottom): Northern Hemisphere temperature reconstruction (top); Palmyra coral $\delta^{18}O$ records, with black line indicating monthly resolved records and yellow line indicating 10-year running average for the periods examined (middle); solar irradiance anomalies and radiative forcing associated with volcanic eruptions (bottom).

The analyses of the coral $\delta^{18}O$ proxy records revealed that the AD 1149-1220 period was cooler and drier (than the present), while AD 1635-1703 was warmer (Allen 2006, Cobb et al. 2003, Morrison and Addison 2008). No decrease in temperature in the fourteenth century is apparent (contra Nunn). While the comparative temperatures and dryness are of relevance to this present study, the degree of climate predictability as indicated by ENSO events is also of interest. The corals revealed a broad range of ENSO variances (frequencies and amplitudes), even though the mean coral $\delta^{18}O$ appeared (for the fourteenth to fifteenth centuries) relatively stable. An intense period of ENSO activity was noted in the mid-seventeenth century (Cobb et al. 2003). Overall, the Palmyra data show increased ENSO frequency and magnitude in the late twelfth century to early thirteenth' century, and particularly the mid-seventeenth century, as compared with twentieth century (Morrison and Addison 2008). See Figure 7.

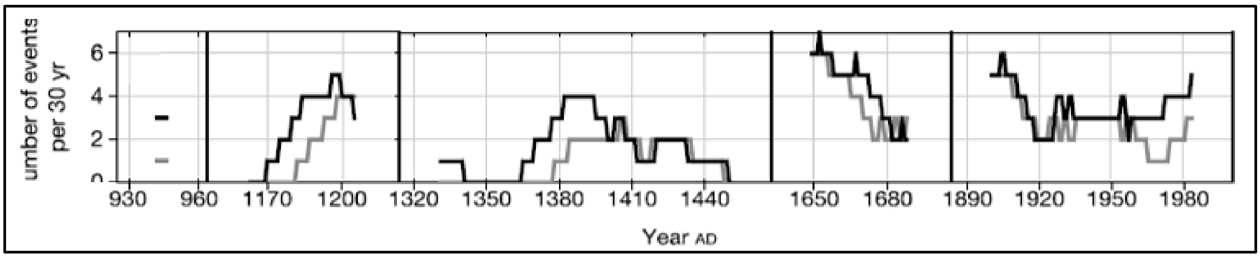


Figure 7: ENSO events from Palmyra corals

Reproduced from Cobb et al. (2003, 275 Figure 6). Palmyra coral proxy record showing number of El Niño (black) and La Niña (grey) events over periods analysed.

Coral records are also available from Fiji and Tonga, and although extending back only to AD 1650, they provide some contrast with Palmyra, some distance north (north-northeast) in the Northern Hemisphere (Neukom and Gergis 2012). Linsley and colleagues (2008) used annual average coral $\delta^{18}O$ time series from five coral cores, taken in Fiji and three Tongan islands, to build a region-specific IPO index, which they termed the IDPO (Interdecadal-Decadal Pacific Oscillation) index for Fiji-Tonga, showing climate variability over the last 350 years. Importantly, they noted a "consistent antiphase correlation" between the Fiji-Tonga IDPO and Palmyra (meaning opposite phases). They further suggested that it is the opposing movements of salinity fronts that cause the "antiphase interdecadal-decadal" variations between the SPCZ and the equatorial Pacific, as shown in the differences between Fiji-Tonga and Palmyra-Maiana near the equator (Linsley et al. 2008). Therefore, the limitations of the Palmyra data for this research suggest that there could be climatic differences across the south-north extent of Western Polynesia, and specifically between Tongatapu and the northern Tongan outliers. However, while variation in temperature and rainfall is debatable, the ENSO frequency and amplitude may indicate climate predictability. In the absence of location-specific data on palaeoclimate, an attempt is made to incorporate this data, but it is acknowledged as a significant limitation, and therefore must await further work on palaeoclimate records.

4.7 Summary

A brief summary of key environmental variables across the case study islands is provided in Appendix B. The data tables in Appendix C provide details for each case study. The treatment of environment and climate above has attempted to locate the Tongan archipelago, and Western Polynesia more generally, within the wider Pacific environment, and to highlight some locational differences. When considering climate variability and societal change, explanations invoking climate are often regarded as deterministic but environmental variability requires location-specific evaluation at various scales in order to understand human-environment interactions (Allen 2006). Examining specific environments also requires much more data on variables of climate, subsistence and resources. In periods of climatic perturbations, resource instability occurs, and thence socio-political systems change in response (Allen 2010). Spatial and temporal environmental variability, whether decreasing temperature or increasing aridity, is important to understanding the relationship between variable environments and human responses, and therefore regional and local scale data is required. A focus on major periods, and abrupt "events" leads to concentrating on short time-scales and seeking specific evidence of change, at the expense of longer term and broader change. Degrees of change, the amplitude and frequency of climate events, across larger timescales, needs to be evaluated in association with human behaviours (Caseldine and Turney 2010). It is important not to link a climatic event to some perceived societal response. Instead, a theoretical framework based in evolutionary ecology suggests it is more profitable, when considering drivers of change, to look at the human-environment interactions, in periods of stable, unstable, or unpredictable environment.

Chapter 5 Archaeology

5.1 Introduction

This chapter provides an overview of archaeological research relevant to the TMC, commencing with a brief review of why the Tongan archipelago attracted early interest. The overview is general in nature, providing a simple narrative, while further detail is included in the relevant case studies, and the databases (Appendix C) provide the evidence for each case study. For more comprehensive literature on Tongan archaeology the reader is directed to Burley (1998, 2007a), and Burley and Clark (2003).

The preceding "phase" of Tongan prehistory lies in an "archaeological dark age" (Davidson 1979, 95, see also Davidson 1978, 386, and Poulsen 1987, 255, citing Poulsen 1974, 265). This description still rings true, as there is a significant gap in the archaeological record for the post-ceramic, pre-monument period (and noting that recent evidence (Burley, Connaughton, and Clark 2018) suggests a short duration for the Polynesian Plainware phase). It is at the terminus of this little-known time that the Tongan chiefdom emerged. The study of the hegemonic regime's development requires an understanding of its antecedents, social organisation, demographics, and environment. This presents a challenge, since, as Burley and Addison (2018) opine, changes in (perishable) material culture and social organisation are not visible, and therefore not readily traceable in the archaeological record. The apparent sudden advent of monumental architecture, the most visible component of the late prehistoric archaeological record, especially evident on Tongatapu, prompts us to seek the proximate and ultimate causes for the emergence of these phenomena and behaviours, as well as their persistence through time.

5.1 History of early archaeological research

The Tongan archipelago has attracted archaeological and anthropological investigation from the 1920s. Many early visitors recorded their observations, which, together with oral traditions and recorded genealogies has formed the basis for understanding the observed hierarchical nature of Tongan societal organisation, and the Tu'i Tonga dynastic order. Archaeological correlates for socio-political processes included the appearance of monumental structures in the landscape and particularly the ceremonial precinct at Lapaha on Tongatapu. Consequently, archaeological work has focussed on monumental structures.

Tonga's earliest archaeological fieldwork was undertaken as part of the Bayard Dominick Expeditions of 1920-22. McKern (1929), while performing minimal excavation, undertook an extensive surface survey of monuments, mounds and other structures, including stone structures, fortifications, roads and depressions. McKern's maps of areas and structures have been an important resource for later archaeologists. Based on the traditional knowledge of local informants, McKern included a classification of monumental architecture, a functional or emic classification. These functional types were *'esi* (chiefly resting places); *sia heu lup*e (pigeon-snaring mounds); three sorts of burial mound: *tanuanga* (commoners' burial places), *fa'itoka* (chiefly burial places), and *langi* (burial places for Tu'i Tonga members) and an unclassified category (McKern 1929, 10-60). These functional types have had enduring influence, being used by subsequent investigators. It is noted that McKern (1929, 13) also had some difficulties in distinguishing mound types, e.g., explanations for the central pit or depression in a mound included the location of tree, a chiefly bathing well, a cooking place, a sitting place. McKern also described several fortifications (McKern 1929, 82).

Some years later, Golson (1957) and then Poulsen in 1963-64 (1967) undertook fieldwork, predominantly in Tongatapu. While Poulsen's work focussed around the Fanga 'Uta lagoon, Poulsen also noted the density of mounds in the area of Toloa (see below and at 6.3.2.1). Davidson (1969) excavated two burial mounds at Atele and was able to examine the skeletal remains of 129 individuals. Davidson's analysis also provided evidence of burial mound morphology and use but noted that McKern's classification did not serve well for her analysis. While these skeletal remains were initially dated to AD 1200 or earlier, new radiocarbon dates suggest a much later date of AD 1500-1670 (Stantis et al. 2015). The earlier dates had been considered confirmed by the lack of local knowledge about these burial mounds, a problem seemingly repeatedly encountered (as seen in some case studies in Chapter 6). These remains have been subject to further analyses of skeletal trauma, showing a pattern which may reflect ritualised violence or sporting activities like boxing, rather than warfare (Scott and Buckley 2014).

Green and Terrell in 1965 did further survey work on Tongatapu fortifications (mound and ditch), as subsequently reported by Swanson (1968). Fortifications were assumed to date predominantly to the civil war period, and higher densities in western Tongatapu were also apparent, although the recent work of Parton and colleagues (2018) has both confirmed and modified some of these earlier investigations. Groube (1971) in 1965-66 did a survey of the western extent of Tongatapu, and while his intention was to investigate earthwork forts, he was principally attracted by evidence of ceramics distribution (Groube 1971, 297).

The next major work programme in Tonga was that of Spennemann in the 1980s. Spennemann's (1989) thesis dealt with the transformation from Lapita culture to a highly stratified society, as recorded in oral traditions, and seen in monuments. He examined why stratification arose in the context of population increase and environmental circumscription, related to a greater reliance on horticultural economy. One of the components of his research included the origin and development of monuments as a sign of increasing hierarchical organisation. Spennemann cited Toloa in southeast Tongatapu as the possible origins of the Tu'i Tonga polity, prior to Heketā, and investigated the higher concentration of mounds there, a subject recently further pursued by Freeland (2018). In the detailed descriptions of the political centres of Toloa, Heketā and Mu'a (Lapaha), and later Kanokupolu in western Tongatapu, Spennemann has provided an important resource, complementing and adding to the earlier descriptions of McKern and others. As time has gradually eroded the vestiges of these signature landscape features, the earlier visitor and researchers' descriptions of the physical landscape remain valuable archives.

While the above section has broadly outlined early archaeological work, and this has focussed on Tongatapu, more recent work has extended this, both on Tongatapu and further afield.

5.2 Overview of archaeology of Tongatapu

This section provides a brief outline of key archaeological work. The locations are shown in Map 4. Heketā, on the northeast coast, is the first Tu'i Tonga ceremonial precinct to display monumental stone architecture. The Trilithon, or Ha'amonga-a-Maui, is a massive coral limestone and beachrock structure, the only example of its kind (see Figure 8).

Figure 8: Ha'amonga-a-Maui - the Trilithon at Heketā

This site, with its several monuments, has been recorded by McKern (1929, 38-39, 63-66), Spennemann (1989, 443-450) and more recently Geoffrey Clark's team (Clark and Reepmeyer 2014). There is evidence of earlier use or occupation of the area, as shown by radiocarbon dates from midden associated with house and sitting platforms, indicating a possible date range of AD 1100-1300 (Clark and Reepmeyer 2014, 1252-1253). There is an earlier earthen mound located to the east of Heketā, thought to be the house platform of the 10th Tu'i Tonga, which contrasts with constructions in stone attributed to the 11th Tu'i Tonga, with associated radiocarbon dates indicating stone architecture began AD 1320-1390 (Clark and Reepmeyer 2014, 1252-1253). These structures include *paepae* (house platforms), *'esi* (sitting platforms) and a *langi* (tomb), as well as an upright stone known as Makafakinanga, against which Tu'itatui (11th Tu'i Tonga) would rest his back, protecting him from attack (Spennemann 1989, 339-350). Spennemann (1989, 448 Figure 9.6) proposed a spatial layout (see Figure 9) for the ceremonial precinct, including the approach road, the Trilithon (as an entrance), a *mala'e*, and the *'esi* or sitting platform, with house platforms beyond. Heketā differs from Lapaha in having predominantly non-burial architecture, i.e. house and sitting platforms. The Trilithon itself has been the subject of several investigations to ascertain its size and volume and method of construction (see McKern 1929, 63-66, Spennemann 1989, 443-447). Its construction has been dated (radiocarbon dates from marine shell) at cal AD 1320-1460 (Clark and Reepmeyer 2014, 1252, 1253, Table 2). Its construction consists of three massive carved stones: two upright limestone pillars, and a lintel in beachrock (a mixture of materials that is also seen in the largest tomb at Lapaha).

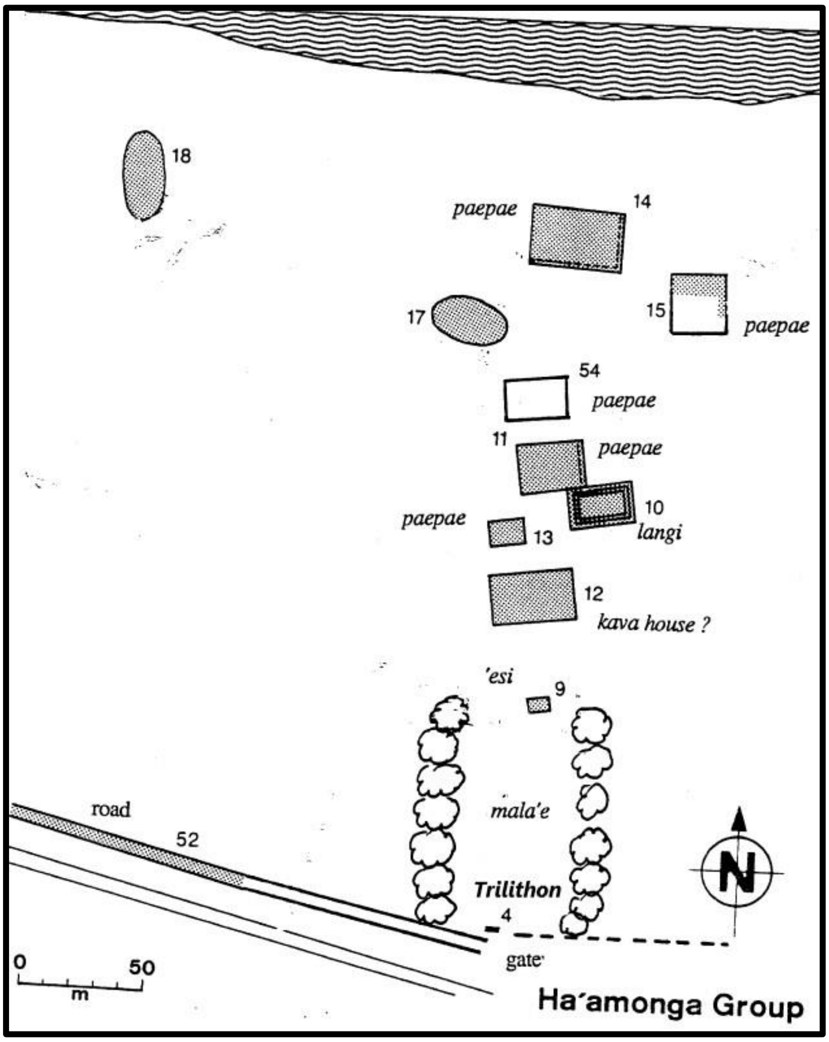


Figure 9: Heketā plan of layout
Reproduced from Spennemann (1989, 448 Figure 9.6)
Showing the Trilithon gateway to an area which may have been a *mala'e*, then sitting and house platforms beyond, and a *langi*; a road appears to lead to the Trilithon.

The Tu'i Tonga political centre of Lapaha at Mu'a has been the subject of considerable interest since the early visitors and explorers. McKern's records provided descriptions of Lapaha, including the area of Lapaha proper, the domain of the Tu'i Tonga, with its enclosure structure called Olotele, its *mala'e* and the royal tombs or *langi* (McKern 1929, 92-101). McKern also described the Tu'i Ha'atakalaua precinct, the burial area of Loamanu, and finally, the seventeenth century southern area of the Tu'i Kanokupolu (see Figure 10).

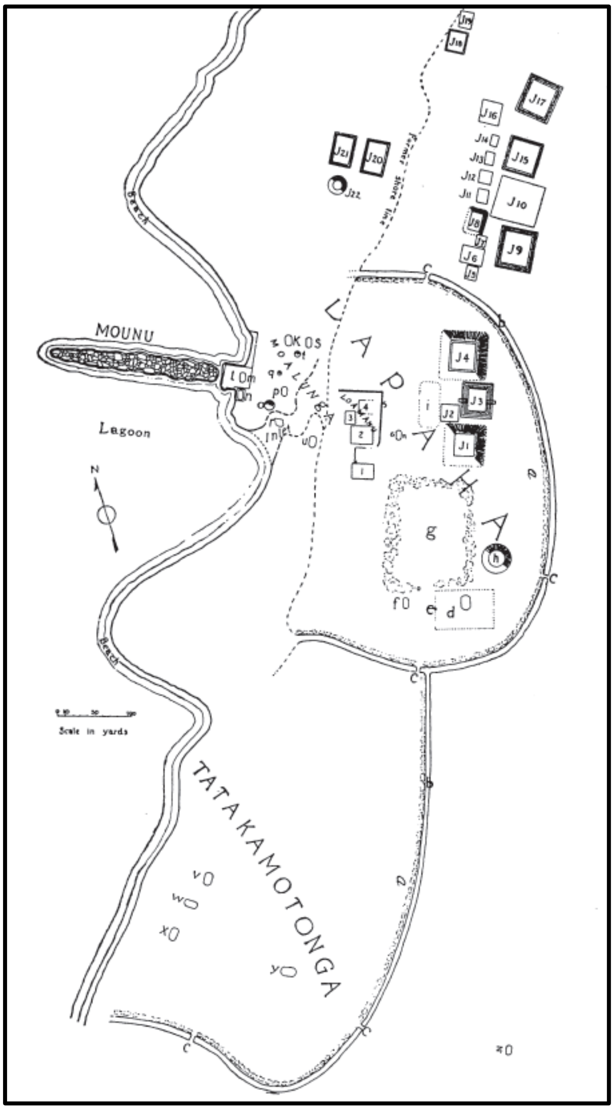


Figure 10: McKern's plan of Lapaha

McKern’s plan showing tombs labelled J01 – J21; Lapaha, the Tu‘i Tonga precinct; Moalunga, the Tu‘i Ha‘atakalaua precinct; Tatakamotonga, the Tu‘i Kanokupolu precinct; Mounu the wharf extending into the lagoon; and the former shoreline seen as the broken line running between Moalonga and Lapaha precincts. Reproduced from McKern (1929, 95 Figure 46).

Much recent archaeological work on Tongatapu, of relevance to the TMC, has been undertaken by Geoffrey Clark and colleagues. In 2006-2007, Clark and team mapped and surveyed the structures, shoreline, harbour and wharf at Lapaha. The tombs were measured and categorised into three “general” styles of architecture. As Clark and colleagues (Clark, Burley, and Murray 2008) noted, many have attempted to construct a sequence for tomb chronology – McKern, Gifford, Kirch, Spennemann – but in the absence of absolute dates have had to rely on construction features, traditional histories and genealogies. Traditions differ on the sequence, by or for whom structures were built, and whose burials are contained within the tombs. Thus, the Clark team (2008) mapped out a sequence, beginning with the

Olotele enclosure ditch, then reclamation and harbour AD 1310-1420, then only after that (as they thought at the time) were large tombs built. However, the investigation during tomb conservation work on *Paepae-o-Tele'a* (J20) at Lapaha, previously assumed to have been built after AD 1450, has now been dated much earlier to the AD 1300-1400 period (Clark, Reepmeyer, and Melekiola 2016), making it the earliest tomb at Lapaha, yet it is one of the most labour-consuming and complex of tombs. The linking in traditions of this largest of tombs to 'Uluakimata I (circa AD 1600) had seemed to correlate with the period when the Tongan state was at its greatest extent after the 24th Tu'i Tonga's campaign of conquest. Thus, correlating architectural complexity and labour-intensive works with increasing socio-political complexity seems to have lost some support, and also challenges the concept of a landscape as reflecting political domination. Clark, Burley, and Murray (2008, 999-1000) provided details comparing different measurements, by which the degree of labour might be assessed, e.g. fill volume and stone volume. This indicates the type of problem encountered with simple categorisations, based on tomb "size". Moreover, local information gathered (on burials in this case) must be recognised as having multiple interpretations, or at least it should be acknowledged that memories may be overshadowed by more recent events.

Importantly, stone tools have also been found in association with tomb J20, with the provenance of these tools indicating long-distance voyaging (Clark et al. 2014). The question of interactions, including migration and exchange, is an area with limited work to date, but of significant potential, and is important in considering the TMC (see further at 5.5). Fenner et al. (2015) examined a small tomb, J28, at Lapaha, which oral traditions recorded as the tomb of the half-Sāmoan son of the 15th Tu'i Tonga, Talakaifaiki. However, Fenner's analysis failed to show (the anticipated) evidence of spousal exchange, i.e. Sāmoan or Fijian immigration. The work of Stantis et al. (2015) on human diet and movement, using isotopic analyses, also failed to provide evidence of inter-archipelago voyaging. Thus, much investigation awaits, as many more questions arise from these limited examinations of diet and the burials.

Political complexity, it is generally surmised, can be seen in the landscape in the form of chiefly tombs, sitting mounds, earthwork fortifications, and other monumental construction. However, there are also many other burial mounds, presumably for non-elites, or just mounds generally, of unknown function. While some mounds are classed as monumental, many are low features of less than 50 cm in height, as revealed in recent work using LiDAR. Freeland (2018) has identified, mapped and characterised mounds, and this spatial patterning has shown that mounds appear clustered in particular locations. Kernel density and hot spot analysis maps (Freeland 2018, Freeland et al. 2016) show this clustering in the northeast area (Heketā and Lapaha) as well as around Fanga ʻUta lagoon, but also in the southeast (most southern part of Tongatapu) (see Figure 11).

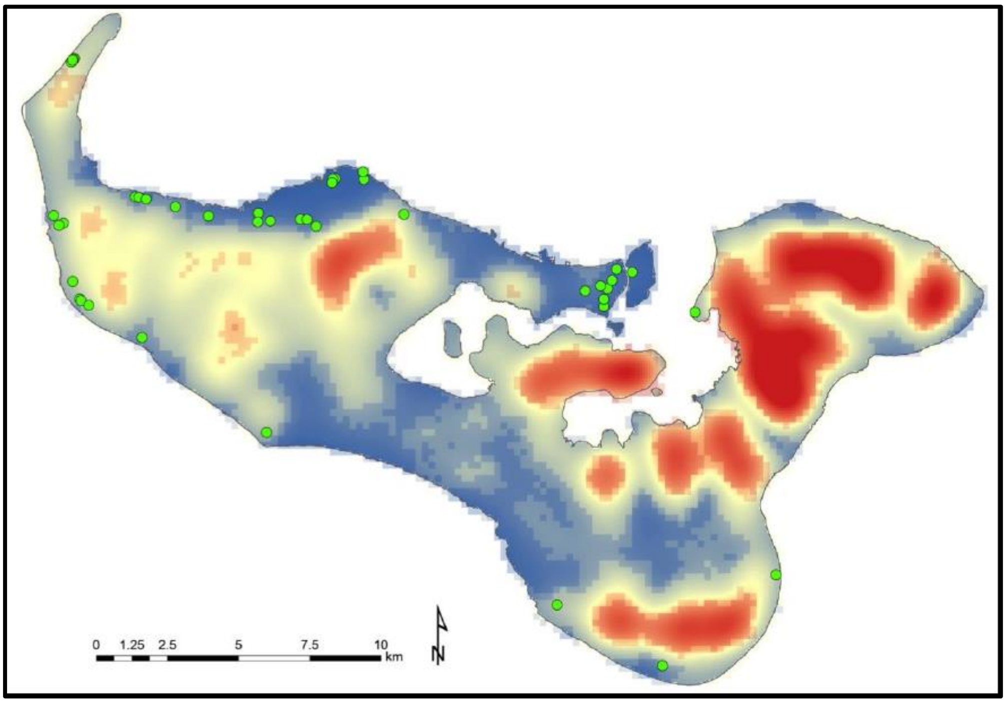


Figure 11: Tongatapu mound density
Hot-spot analysis showing general mound concentrations; green dots indicate pigeon-snaring mounds. Reproduced from Freeland (2018, 113 Figure 61).

Surprisingly, the pattern is more scattered in western Tongatapu, generally thought to have been the more densely populated area. Thus, while most attention has been on the chiefly centre, this LiDAR dataset and mounds survey (and the work of Freeland and others), has potential to use mounds to investigate settlement; indeed, historic accounts suggest that mounds are associated with settlement. Yet, this appears to contradict assumptions about both the extent of political control, and the population distribution, often considered to be higher in western Tongatapu (Burley 2007a), based on later observations.

Previous archaeologists (McKern, Swanson, Spennemann) have recorded earthwork fortifications, and Burley, Tuinukuafe and Clark (2016 cited in, Clark et al. 2018, 408) recorded at least 38. Until recently, most forts were thought to relate to the early AD 1800s civil war period, as indeed they do, although not all. Parton and colleagues (2018), using

LiDAR, have identified 51 enclosure earthworks and six linear defences on Tongatapu. This recent work of Parton and others has shown, similarly to the mound reappraisal, that there is a far more complex landscape of defensive works, and indeed some fortifications may have a much longer history. Evidence of conflict in the early establishment period of the chiefdom has been inferred from the ditch system around Lapaha and additional defensive structures recently identified. Clark et al. (2018) undertook excavations, theodolite and LiDAR mapping of another earthwork fortification at Lapaha (the Lapaha Kolotau), with radiocarbon dates also placing this structure at the early AD 1310-1410 emergent period, at about the same general period as other early works such as tomb J20 (see Clark et al. 2018, Clark, Reepmeyer, and Melekiola 2016), suggestive of some competitive threat to the Tuʻi Tonga establishment of power at Lapaha. Further work examining these landscape features will doubtless further modify and refine current evidence of conflict and competitive action or aggression.

An indicative chronology for the establishment of Tuʻi Tonga and associated lineages, at the political centres of Heketā and Lapaha is shown in Figure 12. For further details of radiocarbon dating the reader is referred to Clark, Burley, and Murray (2008, 1003 Table 3); Clark and Reepmeyer (2014, 1253 Table 2); and Clark, Reepmeyer, and Melekiola (2016).

Lineage establishment	Period	Feature dated	Indicative radiocarbon dates
Tu'i Tonga emergence at Heketā	AD 1200-1350	Heketā monuments	AD1320-1390
Tu'i Tonga establishment at Lapaha	AD 1350 onwards	Langi J20 (Paepae-o-Tele'a)	AD1300-1400
		Kolotau (fort)	AD1310-1410
		Lagoon reclamation	AD1310-1440
		Langi J03	AD1440-1490
		Langi J10	AD1450-1500
Tu'i Ha'atakalaua lineage establishment	From AD 1500	Tomb J04	AD1450-1630
		Canoe wharf	AD1490-1640
		Olotele ditch infilling	AD1500-1550
		Fisi Tea linear defence	AD1550-1650?
Fale Fisi lineage establishment	AD 1600s		
Tu'i Kanokupolu lineage establishment	AD 1600s		

Figure 12: Indicative chronology for Heketā and Lapaha
Adapted from Parton, Clark, and Reepmeyer (forthcoming). Radiocarbon dates for features at Heketā and Lapaha. Sources: (Clark, Burley, and Murray 2008, Clark and Reepmeyer 2014, Clark, Reepmeyer, and Melekiola 2016).

5.3 Overview of archaeology of Ha'apai

The archaeology of Ha'apai has been mainly surveys and some limited excavations, predominantly the work of Burley, covering two broad periods: the earlier mid-millennium period relating to Mata'uvave and the expansion of Tongatapu influence, and the later AD 1700s-1800s contact or pre-contact period. Again, a lack of dates means that much reliance has been placed on oral traditions and historical narratives. McKern (1929, 20-26) had provided a general survey of larger monuments, and recorded numerous *sia heu lupe*, particularly on Uoleva, as well as a large burial mound on Lifuka. His survey included some fortifications, such as Kolo Velata on Lifuka, which, he was told, was built at the time of Taufa'ahau (Tupou 1) to resist the latter (McKern 1929, 84-85). On Uoleva, McKern (1929, 89) also noted a road running the length of the island. Such cross-island roads appear also on Tongatapu and Vava'u. Beyond this, little else had been done until Burley's three field seasons in 1990-92 when seven islands of Ha'apai were surveyed, with several small excavations (Burley 1994b). The importance of this study was that it got away from a Tongatapu focus and looked at a range of constructions including burial mounds, sitting platforms, freshwater bathing wells, memorial upright stones, elevated house mounds, and sunken roads (Burley 1995). Numerous mounds in northern Ha‘apai were surveyed, specifically McKern's previously-recorded burial mound at Huluipaongo (on Lifuka), and the pigeon-snaring mound at Siaulufotu (on Uoleva), the two largest features in Ha‘apai (Burley 1995). Local traditions record that Mata‘uvave "claimed" Uoleva, and erected monuments, presumably by commanding *corvée* labour, to mark his authority, thereby, as Burley (1995) has proposed, "constructing a cultural landscape" in which his political order was maintained, reproduced, and legitimised. The Mata‘uvave chiefdom, according to oral traditions, had an important role in instituting central control over the area, perhaps a pivotal role in the 24th Tu‘i Tonga's assertion or reassertion of central control (Burley 1995). The archaeological evidence for this assertion of control includes Kolo Velata, a double-ditched fortification on Lifuka. The expansion of the Tongan hegemony, as seems evidenced archaeologically, can be seen in the emergence (and elaboration) of monumental architecture, as instituted by Mata‘uvave (Burley 1995).

Burley (1994a) also conducted research on Uiha Island, specifically looking at the royal tomb, called Mala‘e Lahi, first recorded by McKern in 1920. Burley outlined the difficulties in aligning McKern's "emic classifications" for burial mounds with morphological features of size, shape, style (Burley 1994a). Burley looked at monumental architecture as a symbol of the rise of socio-political complexity, correlating size, scale, and design characteristics with increasing political hierarchy. However, Burley (1994b) acknowledged that one cannot assume correlation between energy investment in tomb construction and rank or status of chiefs. Further evidence of chiefly presence is perhaps found in conical water wells on Lifuka and Uiha. While most wells are assumed to be from the historic period and associated with AD 1800s settlement expansion, there are also "chiefly wells" (Gifford identified these as bathing places) which are larger and named, differentiated by scale and form (Burley 1994b, 395).

As with other islands, much of the archaeological work relates to the earlier ceramic tradition. Any preliminary analyses on settlement and subsistence patterns suffer from a lack of chronological detail, particularly for late prehistory. Densmore (2010) undertook some analyses of fish for Vava‘u (from Burley's excavations) and compared fishing practices with

Ha‘apai (based on unpublished work of Cannon and Cannon (2001)[14]) and then also with Tongatapu, referencing Groube (1971). Across Tongatapu, Ha‘apai and Vava‘u, the fish component in assemblages led her to propose differences based on the relative distribution of small and large bodied fish species, such that on Ha‘apai the reef resource remained a mainstay of the subsistence economy, while on Vava‘u the agricultural resource, it could be surmised, was always an important component since the fish resource showed no evidence of resource pressure, and in Tongatapu, there was a move from marine resource to agriculture during the Polynesian Plainware Phase, as proposed by Groube (1971). A recent publication (Cannon et al. 2018) outlines a more complex system, incorporating variability in human population size and productivity of marine resource over time and in different locations. The overall conclusions (of Cannon et al. 2018) were that Ha‘apai fishing strategies consisted of opportunistic foraging, that there was no particular evidence of over-fishing or intensification, and that fishing cannot be considered in isolation, but in the context of the full range of subsistence options. More work in this area would therefore be invaluable.

A brief overview of the archaeology of Vava‘u is contained in Appendix D. Vava‘u provides an interesting contrast to Ha‘apai but is beyond the limits of this thesis.

5.4 Overview of archaeological research of Tongan outliers

5.4.1 Niuatoputapu

In his ethnographic fieldwork in Niuatoputapu in 1969-70, Rogers (1974) surveyed field monuments as well as ceramic locations. Just as Davidson (1971) had found on Vava‘u, Rogers noted that McKern’s ethnographical classification based on functional types would not work for Niuatoputapu, as many of the old sites could no longer be recalled by local informants. An additional problem he cited was that form and function did not appear to align consistently, i.e. some similar forms had different known functions, and some with different form shared the same function. Again, similarly to Davidson, Rogers’ solution was to develop a new classification using both ethnographic evidence and morphological features.

Kirch’s Niuatoputapu research built on the earlier work of Rogers. Kirch (1988) approached this by looking at the settlement pattern, and also looking at “Tongan-style” large mounds very much in evidence in areas of recent geological age, exposed since initial colonisation. Kirch incorporated ethnographic and ecological aspects into the Niuatoputapu programme.

[14] Cannon, Aubrey and Debbie Y. Cannon (2001) Variation and transition in Tongan fishing economies. Paper presented at the 66th Annual Meeting of the Society for American Archaeology, New Orleans.

Kirch also found McKern's classification not able to be applied to Niuatoputapu features, and hence, he developed a new classification based on various morphological criteria, distinguishing between archaeological and "emic" classification, and then compared these (see Kirch 1988, 48 Table4). The distribution of landscape components Kirch interpreted to determine the "socio-political implications" of distribution patterns. This kind of settlement pattern, Kirch proposed, might be expected in "conquest and political domination", as evidenced by the sudden appearance of monuments and the absence of such structures earlier. Of particular note in Kirch's work on Niuatoputapu was his incorporation of ecological parameters into a landscape analysis. This is further explored in the case study in Chapter 6.

5.4.2 'Uvea

Little archaeological work occurred before Kirch's ethnoarchaeological study of 1974. Kirch (1975) did a reconnaissance survey in the southeast, and located and described nineteen sites, with many features such as stone habitation platforms, sunken and elevated roadways, burial mounds, circular mounds with symmetrical ramps (which Kirch identified as *sia heu lupe*), and various fortifications (Kirch 1975, 378, 382). Since the 1980s, most work has been undertaken by French archaeologists of the ORSTOM-CNRS team, principally Frimigacci and Sand, Vienne and colleagues. Frimigacci and others undertook an inventory of sites, with some excavations in the 1980s and into the 1990s, including reconstruction work on three monuments: the residence of Kalafilia, the Malamatagata monument at Utuleve, and the Talietumu residence within the Kolonui fort (Frimigacci 2000, Frimigacci et al. 2016, 20-22). There has been little archaeological work since this period, although a recent publication (Frimigacci et al. 2016) provides a valuable compilation of data and interpretations.

5.5 Archaeology of interactions

As indicated above at 5.2, an important but under-represented area of research relates to the interaction sphere, of which the TMC was an integral part. Sāmoan oral traditions suggest that Sāmoa had direct and continuous contact with Tonga, particularly the closest northern islands of Niuafo'ou and Vava'u (Barnes and Hunt 2005), but also with 'Uvea. Interconnections between Fiji, Tonga and Sāmoa have prompted questions about how Sāmoan basalt arrived in the Lau Islands and how Tongans sourced hardwood for canoe construction (Clark 2002, 2010). Across the Fiji-Tonga-Sāmoa region, islands of variable size, geology and ecology provided diversity which may have provided the impetus for continuing interaction and exchange of material commodities such as raw materials and food

(Weisler 1997). In periods of adverse climatic events such as droughts and cyclones (destroying crops and infrastructure), connections might have been maintained, where reciprocal exchange enabled a risk management strategy.

One means of looking at interactions is by examining the spatial distribution of lithic artefacts (Reepmeyer, Clark, and Sheppard 2012). Until late prehistory, there is little apparent evidence of longer-distance transfer of raw material, despite the presence of sources, e.g. Tafahi obsidian was known but appears little traded or transferred (Davidson 1978). Volcanic glass sourcing does show Niuatoputapu/Tafahi as a source across the Tongan archipelago, but the pattern in archaeological sites shows this to be graduated, with most in Vava'u (at all periods), and then declining with increasing distance from the Niuatoputapu/Tafahi source - yet glass from Niuatoputapu is not found in Sāmoa which is at about a similar distance as Vava'u (Burley, Sheppard, and Simonin 2011).

The island of 'Ata to the south of Tongatapu was a basalt source and had a workshop manufacturing adzes and adze preforms (Weisler 2004). The Sāmoan island of Tutuila was an important source of high-quality fine-grained basalt (Clark et al. 2014, Clark, Wright, and Herdrich 1997), and during the TMC period Sāmoan basalt tools were widely distributed, including to Tongatapu, as evidenced by the proportion of Sāmoan basalt in an assemblage (Clark et al. 2014, Reepmeyer, Clark, and Sheppard 2012). Earle (1997) has argued that for the TMC, interactions were used as a political power source – a prestige goods economy which established and maintained power relationships via spousal and wealth exchanges with Sāmoa and Fijian chiefdoms. Tutuila basalt may have been used in preference to 'Ata basalt because of "prestige" value, or perhaps its transfer was a function of increased inter-archipelagic voyaging in the second millennium AD (Clark, Wright, and Herdrich 1997). Without larger datasets and more comprehensive analyses and comparisons with other locations, interpretations are constrained by data limitations (Cochrane and Rieth 2016).

A harbour and canoe wharf at Lapaha are the only large-scale maritime structures in Polynesia, suggesting the importance of voyaging and maritime operations (Clark 2010). This also suggests that maritime capability and connections were important in maintaining the political and ceremonial activities of the chiefdom, as one means of controlling wealth production is by establishment (and control) of specialist crafts, e.g. canoe technology, and perhaps stonemasons (Clark 2010, Earle 1997). In the last millennium, long-distance interaction and the increase or resumption of inter-archipelagic voyaging may have been a result of the TMC – or it may have been associated with a rapid population expansion and migration into East Polynesia (Reepmeyer, Clark, and Sheppard 2012).

Interactions cannot be directly observed, nor are these concepts necessarily directly equated with exchange or economy. Proxies for interactions may be used, such as basalt transfer, but care is required to determine what such proxies for interactions are actually tracking (Cochrane and Rieth 2016). Rather than linking "prestige" basalt to TMC political capital, consideration should be given to other processes that may account for interactions, e.g. a significant increase in voyaging (Cochrane and Rieth 2016). Overall, there is a need to assess interactions, including exchange and economy, social and political interactions, in the context of geographic locations and different populations, considering factors of both proximity and influence.

5.6 Conclusion

The above overview of some of the archaeological literature has provided a very brief account of the major archaeological work relevant to the last millennium. Some authors have worked over several islands (e.g., Burley and Kirch), providing valuable insights into how the material manifestation of the TMC might be assessed archaeologically. Others (e.g., Clark, Freeland, and Parton) have focussed on Tongatapu and started to provide detailed evidence on the homeland of the TMC. While Kirch has made extensive use of ecological contexts in his studies on 'Uvea and Niuatoputapu, there has generally been limited environmental data incorporated in analyses. That there are interpretive problems, created by different functional and morphological classifications of mounds, is very apparent from several researchers. Much focus for islands beyond Tongatapu has been on the Tongan conquest mid-millennium and evidence of "Tongan-style" structures, as indicative of Tongan domination or influence. In 'Uvea, the massive stone fortifications have attracted attention because they endure in the archaeological record. Clearly, more work is required to identify the ecological contexts of islands across the Tongan interaction sphere. While attempting to assemble a broader range of data has presented some challenges, there is a benefit in expanding the geographical area to include a more diverse range of variables with which to examine the mechanisms by which socio-political change occurred during the TMC expansion from its genesis in Tongatapu.

Chapter 6 Method and analysis

6.1 Introduction

This chapter begins with a review of the method using concepts and models from EE. The main body of the work is then presented in the case studies for Tongatapu, Ha'apai, Niuatoputapu and 'Uvea.

6.2 Use of concepts and models drawn from evolutionary theory

Evolutionary ecology explains variation in human behaviour by applying the tenets of Darwinism – transmission and competition for limited resources – to human socio-ecological systems. A key method is to conceptualise these systems using simple models that define the kinds of hypotheses we propose, as well as help us think about the problem, focus on relevant available evidence, and generate predictions. The method employed is iterative. First, hypotheses are generated using the concepts of the model and then these hypotheses are evaluated by testing against empirical evidence or observations. Predictions to further test the hypotheses can also be made and the hypotheses subsequently modified.

Optimality models are one form of simple model often used in evolutionary ecology, with two examples being the ideal free distribution (IFD) which is useful in examining individual behaviours in different environmental contexts, and the ideal despotic distribution (IDD), which considers differences in individual competitive ability and unequal resource access, leading to differential control. When behavioural variation itself is caused by the interactions between different behavioural types in a population, such as conflicts of interest between types or frequency-dependent effects, game theory is an appropriate investigative method. Game theory method employs models that result in evolutionarily stable strategies (ESS). An ESS is an optimal, stable mix of behavioural types in a population. These models, such as Prisoner's Dilemma (PD) and Hawk-Dove (H-D) are simplifications but serve to represent problems of competition and cooperation (Hawkes 1992, 276).

In summary, optimality models and game theory are, in effect, methods, derived from evolutionary theory, which allow predictions to be made about what is evident empirically. In other words, the models are used to link the theory of evolution to data of human socio-ecological systems. The process provides for the generation of hypotheses using evolutionary theory, hypotheses which can subsequently be tested.

6.2.1 Application of the method

The material for the analysis in this section is drawn from Chapters 3-5, as well as the data compiled in the tables at Appendix C. The analyses identify a series of events or phases, each one being a grouping of archaeological, environmental and oral tradition/ethnohistoric patterns. The events/phases, while somewhat loosely arranged, are developed to address questions about behavioural variation, as they reveal kinds of behaviour that are important in (or explicable by) evolutionary ecology theory. The events, while usually in some chronological order, are not intended to represent stages of development. In using the analytical units, termed "events" and "phases", it is important to note that ecological explanations are built for unchanging units of space and time, whereas evolutionary and ultimate explanations examine change in variant frequencies within populations over time. Therefore, the events and phases are units required for the analysis, are somewhat arbitrary and may be modified in light of new data. It is the behavioural variation, as evident in the archaeological and traditional/ethnohistoric data, which will be examined. Together with models from evolutionary ecology, these data sets will allow the development of testable hypotheses and thus potential explanations of the emergence and persistence of hierarchical socio-political organisation within the TMC. The hypotheses, proposed to explain the behavioural variation within and between events/phases, also rely upon environmental context, because environment is often correlated with expected behavioural strategies. It is emphasised that explanations are focussed on behavioural variation grouped into event types or phases, rather than on the TMC per se.

As a way to approach the rather large geographic area which the TMC encompasses, case studies are developed. Tongatapu is the first study, followed by Ha'apai,[15] Niuatoputapu, and 'Uvea, which provide a complementary evaluation of some of the competitive and cooperative strategies evident from the Tongatapu case study. Importantly, the additional individual case studies, where contrasting environmental and social structures are observed, provide for the evaluation of events and the different human behavioural responses to Tongan expansionism, within those distinct socio-ecological systems. These evaluations contribute to the overall analysis of the TMC.

Each case study is introduced with a summary of the relevant traditional accounts, archaeological evidence and the environmental context, as applicable. The arrangement of

[15] Vava'u is not included here, as indicated at 1.4, but a brief summary is provided in Appendix D.

these differs slightly with each case study. From these observations, key events (or patterns of behaviour) are identified as blocks of space and time that establish the difference between phases/events. Events are then examined, using the evolutionary ecological methods whose parameters likely provide the best fit to the event, for example using optimality methods for behavioural variation constrained only by environment. Hypotheses are then developed and evaluated using the evidence drawn from the data, and selected models from optimality and game theory method. The evidence may confirm or refute the hypotheses. It is important to note that this analysis does not provide absolute proof of any explanation, rather, it tests whether or not a hypothesis might be falsified on the evidence, using a particular model. Importantly, with new data or arguments, different methods can be applied. Additional testing of an explanation can be made by indicating what predictions should be seen in the records and what further data is needed to test these predictions. Where additional evidence is required to further clarify a hypothesis, this is suggested for further work. A map is provided with each case study.

6.3 Case study 1: Tongatapu

6.3.1 Introduction

In the Tongatapu case study, in order to address the key research questions on the TMC, the series of events, as identified in the tables, is differentiated as two phases. These two phases are broad, and somewhat contrived, as their purpose is to enable examination of records of archaeology and traditions, which are continuously generated, rather than being static phases. Firstly, the rise of the Tu'i Tonga dynasty focuses on the emergence of inequality. Secondly, the period of hegemonic expansion and fission examines the development of increasingly hierarchical social organisation, within and beyond Tongatapu as the birthplace of the TMC. There is a short interlude between the phases and an epilogue to provide further context.

6.3.2 Phase 1: Emergence of the Tu'i Tonga dynasty and the emergence of inequality

The period of the emergence of the Tu'i Tonga dynasty covers the centuries of the early to mid-second millennium AD.

6.3.2.1 Overview summary of evidence from environment, archaeology and traditions

A general overview of Tongatapu environment and climate is provided in Chapter 4. For this case study, the following details are noted. While Tongatapu soils are variable, they are not significantly so. On the western side of the island, soils have a tephra layer of up to 2 m in depth, while on the eastern side, as distance from the eruptive source increases, there is a thinner tephra layer of as little as 0.4 m (Cowie 1980, Gibbs 1976). The island is tilted up to the southeast and down to the northwest, creating cliffs along the southeast coast (thereby reducing accessibility), and sandy shores at lower elevations (Dickinson and Burley 2007, Gibbs 1976). The lagoon in the central northern area provides swampy margins, with possibly the best canoe access. The comparative subsistence contribution of marine resources is particularly relevant in an island of only 261 km^2; the small area of the island may lessen the impact of terrestrial environmental differences. The lagoon, reef system and ocean resources, and the access to those resources, are significant factors to consider in Tongatapu. The general regional Pacific palaeoclimate in the early part of the last millennium was relatively cooler and drier in the tenth to sixteenth centuries AD (compared with the twentieth century), with periods of increased ENSO activity and unpredictable climatic condition (Cobb et al. 2003). Nunn (2000, 2007, Nunn and Britton 2001) has proposed a significant event at AD 1300, which while differing from the Palmyra data (see Chapter 4), aligns, to a degree, with some of the regional indicators. However, it is noted that more specific palaeoenvironmental data is required for the area of Western Polynesia, and to determine variation across the Tongan archipelago (as Morrison and Addison (2008) note for Tutuila, Sāmoa).

In addition to the narrative on traditions and archaeology provided in Chapters 3 and 6, the following specific evidence is relevant to this phase. Traditions allude to an early chiefly centre in central or southeast Tongatapu and specifically relate that the Tuʻi Tonga dynasty did not originate around the Fanga ʻUta lagoon (an area of high population in earlier periods), but rather in the central and southeast area of lower population in earlier periods (Burley 2007a, 196-197, Gifford 1929, 52, Herda 1988, 36, Spennemann 1989, 439). In support of the early origins of the Tuʻi Tonga dynasty, numerous mounds were located by Spennemann (1989) in the area around Toloa (central southeast), indicating possible patterns of settlement or at least a density of mound features in central and eastern areas. The work of Freeland and others (2016, 2018) has revealed significantly higher densities of mounds in the eastern areas of Tongatapu, with some distinguishing features of mounds at Toloa, Heketā, Lapaha and at Kanokupolu. These are the four locations of the precincts of the Tuʻi Tonga and/or associated lineages. The timeframe over which these mounds were constructed is unknown, but presumably covers many centuries, perhaps beginning in the first millennium AD, as evidenced by a radiocarbon date of 1600 cal BP for a mound in the southeast (Phillip Parton PhD Seminar, Australian National University, 24 August 2018). Spennemann (1989, 440) also excavated an earth mound in the southeast area of Toloa, which, while undated, showed some evidence of continuity of occupation, with thirteen horizons.

Traditions relate that the "move" from the central southeast area to Heketā in the northeast (Gifford 1929, 78), the first precinct with stone monumental architecture, was due to the aggression of the people in the central-eastern area (Bott 1982, 92, Herda 1988, 37). The Heketā precinct was used for a brief period, beginning as early as AD 1100 (Clark and Reepmeyer 2014, 1252-1253), with its establishment as a centre of ritual (ʻ*inasi* and kava ceremonies) (Clark and Reepmeyer 2014, 1254-1257, Gifford 1924, 47, 1929, 75-77). Heketā's location did not seem to provide any obvious advantage, being a stormy coast, and indeed, appears quite remote from other population areas (Gifford 1924, 30, 46-47). Heketā's monumental architecture is dated to the fourteenth century AD (based on available radiocarbon dates) (Clark and Reepmeyer 2014, 1252, 1253). The Trilithon (see Figure 8) departs significantly from other (only slightly) earlier stone structures at Heketā, in being of large scale and greater skill in stone masonry – it comprises both limestone blocks and beachrock (Clark and Reepmeyer 2014, 1245). Its structural elements appear similar to the

Lapaha tomb of the same time period (see below). There is some evidence of defensive works near Heketā, with a linear defence at Afa, although this structure is of indeterminate date (Parton et al. 2018, 19, 21-22). Traditions also indicate conflict and possible assassination attempts on the 11th Tu‘i Tonga (Gifford 1929, 52-53). There is some limited evidence of a fortification at Niutao (Parton et al. 2018, 18-22) at the entrance to the Fanga ‘Uta lagoon, in a location said to have been an interim Tu‘i Tonga residence (Alexander, Wordsworth, and Campbell 2013, 78, Spennemann 1989, 239, 452). However, given the later historic period observations of the rapidity with which defences could be constructed (Mariner's account in Martin 1818), the archaeological visibility of defences may be low, and therefore under-estimated (as noted for Hawai'i by Kolb and Dixon 2002).

The relocation (of the Tu‘i Tonga ceremonial centre) to Lapaha occurred only slightly later, during the rule of the 12th Tu‘i Tonga, Talatama (Gifford 1924, 30, 46-47, 1929, 53, Herda 1988, 43), and the archaeological evidence is of rapid establishment at Lapaha, with a significant amount of construction having occurred (Clark, Burley, and Murray 2008, Clark, Reepmeyer, and Melekiola 2016, Clark et al. 2018). Early construction included Olotele, an enclosure with ditch around three sides of the precinct, with the fourth side formed by the lagoon or shoreline (Clark, Burley, and Murray 2008). This ditch may have had a defensive component, an infrastructure function (it taps into the aquifer), as well as delineating a boundary. Importantly, it was situated strategically on the lagoon. At the same time, outside the Olotele enclosure, a defensive fort (Kolotau Fort) was constructed (radiocarbon dates cal AD 1310-1410) (Clark et al. 2018, 414). Thus, there is evidence of defensive works, if not offensive actions.

Contrary to a seemingly logical order of events, the earliest tombs appear to be in the area of harbour reclamation. It appears that the reclamation occurred around these earliest tombs, at a slightly later time (radiocarbon cal AD 1310-1440 2σ) (Clark, Burley, and Murray 2008, 1001-1005). Thus, the earliest tombs were outside the “precinct” or residential area. The very earliest tomb, J20, exhibits characteristics similar to the Trilithon construction. Not only is its stonework of massive proportions, but it has basal and second layers in limestone with only the third layer in beachrock; this differs from all other tombs at Lapaha, which are built in beachrock (Clark 2014, 223-224, 232, Clark, Burley, and Murray 2008, 996-1001). Reclamation of the harbour also occurred at an early stage (radiocarbon cal AD 1310-1440 2σ) (Clark, Burley, and Murray 2008), but the subsequent order of events is unclear, although some time later, around the sixteenth century AD (radiocarbon cal AD 1490-1640 2σ), a wharf was constructed extending out from the area of reclamation (Clark, Burley, and Murray 2008).

6.3.2.2 Hypotheses

Having considered the evidence, it is proposed that the early emergence phase might be examined with the optimality method and the ideal despotic distribution (IDD) model. In accounting for the stabilisation of the emergent Tu'i Tonga dynasty, the Prisoner's Dilemma (PD) model is useful. The IDD and PD models (see Chapter 2) therefore inform the following hypotheses for the preliminary phase of emergence. The second hypothesis is consequent to the first.

Hypothesis 1: Inequality emerged when differing competitive abilities and differential access to resources allowed dominants to increasingly control resources; as environmental conditions became more unpredictable, cooperative collective actions became beneficial to both dominant and subordinates, resulting in greater social integration.

Hypothesis 2: Subordinates cooperated in the hegemonic regime because there was a greater cost in defecting (non-cooperation) than cooperating (acquiescing to inequality) in a period of poor or unpredictable environmental conditions.

6.3.2.3 Model predictions

To evaluate the hypotheses, for the emergence of inequality, the predictions from the IDD model suggests a despotic distribution should be evident as:

- Spatial distribution of resources should be heterogeneous.
- Population distribution or settlement of variable density relates to habitat quality.
- Some level of intergroup aggression.
- Clustered settlement in periods of unfavourable environment.
- Unequal resource acquisition and control related to spatial distribution.
- Individuals attracted to the dominant's sphere under conditions of submission.
- Population distribution reflecting grouping around competitive leaders.
- Territoriality emerges where resources are dense and predictable, or resource value is higher.

And the predictions from the PD model suggest cooperative behaviours within a despotic regime should be evident as:

- Cooperation most apparent when resource acquisition is uncertain or unpredictable, or there is risk of shortage.
- An (unequal) exchange of resources between dominant and subordinates.
- Some differential benefits between dominant and subordinates.
- Within group cooperation is beneficial, within and between dominants and subordinates.
- Competitive actions are less evident than cooperation.

6.3.2.4 Evaluation

A preliminary comment is required on the use of dominant and subordinate relationships in the distribution models. It is not intended to imply that the dominant-subordinate relationship was hitherto unknown. Rather, these comparative terms are useful for analytical purposes in the context of the models. Commencing with the proposition that the Tu‘i Tonga dynasty originated in central or southeast Tongatapu, if the earlier population (first millennium AD and earlier) was free to disperse across Tongatapu, then individuals should occupy the best habitats for agricultural production, in tandem with optimal access to marine resources. This would likely be in the central area around Fanga ‘Uta lagoon but extending “inland” into the areas with the best available soils, in an ideal free distribution (Fretwell and Lucas 1969, McClure, Barton, and Jochim 2009). As population increased, individuals would move into new areas, whilst still maintaining coastal access. It is assumed, based on evidence from the Polynesian Plainware (PPW) ceramic period that by the end of the first millennium AD (although see Burley, Connaughton, and Clark 2018), population spread was across all Tongatapu, and density was therefore relatively high everywhere (Burley 1998, 367, 2007a). An even population spread might occur while resources were homogeneous or evenly distributed, but variation in resource distribution, or a change in resource structure, or population density, would change these dynamics, meaning that an IFD might no longer obtain, and an IDD might arise (Jazwa et al. 2017). If population growth increased more in some locations (across eastern Tongatapu or indeed across the whole), altering the relative resource value, individuals (or groups) might redistribute based on the relative costs of remaining in an increasingly constrained area or moving to more marginal environments with reduced competition and thus being relatively better off (Kennett, Anderson, and Winterhalder 2006). It is important to consider that resource distribution must include the marine environment, as well as terrestrial resources. Evidence to determine that population size and density varied from that generally assumed (at the end of the PPW period[16] as indicated above) would contradict the assumption of an even population distribution in the early predynastic (and pre-inequality) period, which informs hypothesis 1 for the emergence of inequality.

Since the traditions speak of aggression, it can be proposed that there was some resource differential, at least in the central/southeast area proximate to the lagoon, and this might have resulted in a degree of intergroup conflict and competitive exclusion, with groups acting to defend an economic resource. Resources are economically defendable when they are densely distributed and predictable (see Chapter 2.7 on ED and territoriality), and so the relative distribution of resources on Tongatapu is of relevance. The soils evidence for potential agricultural productivity does not indicate any significant disparities, but an additional factor might be the distribution of marine resources, and, indeed, access to those resources. While population appears to have spread across Tongatapu, evidence indicates that densities remained higher near the northern coast and lagoon. The lack of clear agricultural productivity differences suggests that the focus of resource activity was more likely to have been around central areas and near the lagoon. Alternative evidence showing spatial differences in agricultural productivity would refute this suggestion. It is noted that there is currently extremely limited data on subsistence throughout the aceramic period. The Heketā location presents an (unresolved) problem of access, which runs counter to the suggestion that a central location was important.

Another factor which might influence resource structure is environmental change. Early in this period of emergence, generally drier climatic conditions (if this holds for Tongatapu – see Chapter 4) could have led to resource stress, to temporal unpredictability and more uneven resource distribution. Such changes might result in greater reliance on marine resources. If additional perturbations such as cyclones adversely affected the availability of marine resources, an increase in resource stress would result in increased levels of conflict, with access to this resource contested, and consequent changes in social structure. Palaeoclimatic evidence differing from that relied upon above might perhaps show the reverse conditions. If environmental stressors were significantly at variance from the hypothesis, then the predictions of the model would not be met. For example, if climatic conditions favoured agricultural intensification, this should be reflected in the population

[16] The PPW period was previously thought to extend into the first century AD.

distribution and a more homogeneous resource distribution, given the evidence of minimal differentiation in soils across the island.

If this emergence period was indeed one of climatic instability, as suggested by Nunn (2000, 2007), and as seems suggestive in the Palmyra data (Cobb et al. 2003), and the movement of people was no longer an ideal free choice, as some individuals or groups were either forced into more marginal environments or willing to forfeit some fitness to remain within a group, this then could provide the conditions for exploitation of subordinates by dominants. Traditions speak of competing chiefs at this period, and thus, individuals or groups, gathered around some chiefs, may have been driven out by competing chiefs.

In considering this change in distribution, how cooperation becomes advantageous is integral to the transformational process of increasingly hierarchical organisation. Cooperation would have been particularly beneficial in periods of instability as a means of reducing risk and maximizing resource value. The problem of whether individuals should share takes the form of the PD (see Chapter 2.7; see also Smith and Winterhalder (1992); Hawkes (1992)). It is noted that within kin (genetically similar) or small groups, a PD can be an evolutionarily stable strategy (an ESS), if, rather than following the self-interest option, individuals cooperate on a tit-for-tat basis, whereby interactions "even out" (Boone 1992, 308). This is known as an iterated PD (see Chapter 2).
Importantly, while sharing of resources is dependent on reciprocity, as group size grows, asymmetries can occur from an uneven flow, which can lead to inequality, and the development of dominant-subordinate (or patron-client) relationships (Boone 1992, 307-308, 323-327). This will be exaggerated in higher risk areas or periods. Groups can also provide economies of scale so that individuals benefit from collective action in resource defence (in effect, by competitive exclusion and territoriality). The evidence for increasing group size is the pattern and higher density of mounds[17] in eastern Tongatapu, supposing that this mound density can be taken as a proxy for population. Freeland (2018, 143) notes that most small mounds are probably the burial mounds of commoners. This perhaps indicates an association between people and chiefly lineages. Unfortunately, there is currently no chronology for these structures, but it could be proposed that they were constructed over a longer rather than shorter timeframe. Conversely, there is an apparently lower mound density in the (perhaps slightly more productive) western areas of Tongatapu. This remains unexplained, from an

[17] This evidence is used at 6.3.3.4 (for phase 2), which is to imply that there was ongoing population growth.

evolutionary ecology perspective, as do the origins of mound construction. Whatever the cause of population movement into eastern areas, or population increase or concentration in the east, with perhaps slightly inferior soil conditions for agriculture, there would have been potential for the unequal access to resources in a patchy environment. This factor, coupled with unpredictable environmental conditions with limited freshwater availability, might eventually lead to competitive land tenure, i.e., the emergence of territorial behaviours, encouraging strategies of control and defence. This is one path by which social inequality and/or hierarchies can emerge.

In an IDD, despots may encourage people to a location under conditions of submission (Bell and Winterhalder 2014, Codding and Bird 2015). The Tu‘i Tonga might be expected to adopt strategies that altered the social and environmental constraints of people, thereby influencing their behavioural choices. The mechanisms by which dominants may assume control include economic and ideological. Such strategies of control, for the dominants, would be less than the cost of aggressive campaigns (which incur costs of injury and death) and should succeed, as long as others perceive that the benefits of cooperation incur minimal costs. Here again is the PD. Ideological manipulation could occur via the creation story of the Tu‘i Tonga dynastic origins as semi-gods, linking the divine world to the secular, and thus allowing the Tu‘i Tonga to act as intermediaries (see Figure 5) between people and the gods who controlled valuable commodities such as fertility and prosperity. Direct benefits to subordinates then occurred in the form of access to land (or coast) for subsistence, but also indirect benefits to subsistence through the Tu‘i Tonga’s mediation with the gods on their behalf.

This opportunity for dominant control would be expected to occur in times of unpredictable environment or resource stochasticity (Mattison et al. 2016), when behaviours of cooperation were beneficial. Thus, cooperation would occur in tandem with the rise of dominants’ control. In perpetuating the dogma that people’s physical and social prosperity was bound to the Tu‘i Tonga administration, the use of ideological manipulation would be integral to establishing and maintaining control. DeMarrais, Castillo, and Earle (1996) have suggested that ideology is given material form, i.e. it is materialised, enabling control and manipulation by a dominant group, and that this ideological control and manipulation can then be extended beyond the local group. The material manifestations of ideological control and empirical expectations then require a causal link to be identified. Monumental architecture was an ideological mechanism for Tu‘i Tonga control, as it symbolised divine status (as mediator) and control over land (or the appropriation of territory), and authority and power (dominance and hegemony). This monumental architecture might be considered as a means of signalling Tu‘i Tonga authority. An alternative (to DeMarrais and others above) and testable approach to explanation is found in Costly Signalling Theory (CST), as used in the next case study. Costly signalling displays are an effective means of validating authority, as the greater the apparent costs, the greater the validity of the signaller's authority (Bird and O'Connell 2006). CST provides a model with ecological expectations. For further discussion on CST see DiNapoli and Morrison (2017), and DiNapoli et al. (2018). The visual assertion of Tu‘i Tonga authority signalled the sacredness of the monumental precinct also as a place for sacred gatherings (‘*inasi* and kava ceremonies). Ceremonial activities were therefore an administrative means via which economic manipulation might occur. The practice of payment of tribute, bound up in the ceremonial activities and ideological realm, was an important element in the process of economic and social control. However, such major construction requires significant labour inputs, so the question arises of why subordinates should allow exploitation by dominants to provide labour for aggrandising behaviours. This is again the prisoner's dilemma of cooperation.

An alternative means of establishing control might have been through warfare. While there is some evidence of aggression in the time of the 11th Tu‘i Tonga at Heketā, and possibly in the transition to Lapaha, this is not as strong, nor as convincing, as the evidence outlined above, suggesting that militaristic strategies were not employed, i.e. territorial gains were not achieved via aggressive warfare, but more likely via cooperation, competitive exclusion and by coercion. This is consistent with a stable ESS using the PD model, although its continuation requires some mechanism to enforce cooperation as group size increases. This mechanism is examined in the next section (Phase 2).

At Lapaha, there is little evidence of aggressive or sustained warfare, in this early emergence stage, beyond defensive structures associated with the Lapaha precinct. Instead, there is evidence of a strategy of domination, on an increasing scale, via manipulation of ideologies and economic constraints, possibly through increasing control of navigation and voyaging, as evidenced in the choice of location at Lapaha and the extent of monumental construction and the rapidity with which the precinct was established, and harbour reclamation undertaken. In this case, the authority signalled related to the Tu‘i Tonga's ability to control economic resources (voyaging and exchange, perhaps).

Although the lack of chronology is a major impediment, the density of mounds around Lapaha confirms that people gathered around the Tu‘i Tonga and participated in the hegemonic regime. The PD model would suggest that this was because cooperation had beneficial consequences. However, cooperation is only an ESS while certain conditions prevail, these occurring particularly in an unpredictable environment. Changes in environmental or social context will alter costs and benefits of cooperative strategies, so that cooperation might cease to be the best option. This could occur if environmental conditions improve and there is reduced risk and uncertainty in resource access and availability. The minimal evidence for conflict following the initial rise of the Tu‘i Tonga suggests that a period of stability may have followed, which the "quietness" of the traditions would tend to support. Alternatively, social changes such as an increase in group size will lead to intragroup competition, as optimal group size is exceeded (DiNapoli (2014, 67-73) contains a useful discussion). This leads into the next phase of conflict, expansion and fission.

6.3.2.5 Overall assessment

While the primary testing of the hypotheses has used the IDD model and PD, the evaluation has also briefly considered two other EE methods, the concept of ED and territoriality, and also CST. These could be pursued to further test the hypotheses. This is the value of EE models. The above evaluation was predicated on environmental conditions being both variable and sub-optimal through this early period, which traverses a considerable period of transformation, as the dynastic regime established. The rise of despotism, in a heterogeneous environment, with differential access to resources set the stage for the development of greater inequality, but this required that cooperative behaviours were beneficial to both dominants and subordinates. In order for the Tu‘i Tonga regime to develop (in this place at this time), a set of circumstances (conditions and constraints) prevailed, which elicited both competitive and cooperative behavioural responses. The ingredients for this set of behaviours were the environmental and locational context, and the payoffs for both dominants and subordinates.

6.3.2.6 Interlude: explanatory narrative linking the two phases

Evidence of inter-archipelago interactions, through the mid-millennium, points to the importance of location for the establishment of political control of economic transactions, and for continuing social exchanges (such as marriage alliances). Harbour reclamation suggests Lapaha's increasing role as an administrative and economic centre. The evidence of Sāmoan-sourced basalt adzes (Clark et al. 2014) supports these types of interactions, especially when considered in conjunction with traditions of Talakaifaiki, the 15th Tu‘i Tonga's rule/stay in

Sāmoa (Gifford 1929, 71). While the traditions relate continued marriage alliances between Tonga and Sāmoa, the 15th Tu'i Tonga's subsequent expulsion may be a symptom of increasingly competitive actions. These different events appear to be in conflict, but they are suggestive of both cooperative and competitive behaviours, i.e. intragroup competition and at the same time seeking alliances as a mechanism for deflecting that competition and controlling rivals for elite positions. This interplay of aggressive and passive behaviours could be considered using the H-D model, given the evidence. While this is not addressed here owing to scope and data limitations, it could be suggested that some degree of equilibrium appeared, at intervals.

The western area of Tongatapu remains an enigma, with no strong evidence of integration under the Tu'i Tonga, although the traditions make brief references to local chiefs remaining independent. Interactions between east and west might be modelled using a variation of the H-D model, by the addition of a third strategy (bourgeois) in the H-D-B model (see Chapter 2.7), to test hypotheses. This would suggest that the best strategy and the unbeatable one would be to defend one's territory, but when invading the opponents, back off to avoid injury. An alternative way of thinking about this is, if the cost of defence (by the western area) was greater than the benefits of excluding eastern intruders, then this might be considered as tolerated theft or access, where the value to the intruder is greater than the value to the resident community. Such a condition would rely on better conditions prevailing in western Tongatapu, i.e. higher resource value, which might then refute the hypothesis at 6.3.2.2. There is currently limited evidence to further explore these hypotheses.

6.3.3 Phase 2: Conflict, expansion, alliances and fission – increasing stratification

The mid-millennium (fifteenth to seventeenth) centuries constitutes this period.

6.3.3.1 Overview summary of evidence from environment, archaeology and traditions

Little palaeoenvironmental data specific or relevant to mid-millennium Tongatapu is available. The Palmyra fossil-coral $\delta^{18}O$ sequences do not cover the late fifteenth century to the early seventeenth century period (Cobb et al. 2003). The 'Uvean data (see Chapter 6.6) indicates this was a particularly dry period, but, as outlined in Chapter 4, neither the Palmyra nor the 'Uvean data can automatically be assumed to apply (as directly) to southern Tonga, given the relationship between the SPCZ and the ITCZ and the salinity front (Linsley et al. 2006, Linsley et al. 2008). Sachs et al. (2009) suggest a southwards movement of the ITCZ occurred during the (Northern Hemisphere) LIA AD 1450-1600. However, from the early-mid AD 1600s, the Palmyra data does indicate increased ENSO frequency and amplitude, albeit that the Fiji-Tonga IPO core data for the period from AD 1650 shows there is an anti-phase correlation between the Fiji-Tonga region and Palmyra (Linsley et al. 2008). For further on ENSO variability and interpreting the relationship between ENSO and movements of the ITCZ and SPCZ, see Cobb et al. (2003), Dai and Wigley (2000), D'Arrigo et al. (2005), and Linsley et al. (2008). In addition, the evidence of Tasman's observations in AD 1643, describing western Tongatapu as a landscape of agricultural productivity, does not suggest environmental or climatic instability. However, it is noted that, as a passing observation, it was not necessarily inconsistent with ENSO variability. No observations were made on marine environmental productivity.

Considering all the above, it can be proposed that there was climatic and environmental variability across the Tongan archipelago and the regional extent of the expanding TMC, with at least some islands experiencing deteriorating or unstable climatic conditions. As previously stated, without more location-specific analyses, hypotheses are tentative, and subject to change as new data becomes available.

Archaeological evidence for this period suggests both movement and defensive actions. The canoe wharf is dated to AD 1490-1640 (Clark, Burley, and Murray 2008, 1002-1004), which is perhaps suggestive of an increase in voyaging generally, or a change in the use of craft, and possibly longer-range travel requiring larger vessels, for which the Tongans were later known. At the same time, there is a change to the layout of the Lapaha precinct, as evidenced by the infilling of the Olotele ditch AD 1500-1550; presumably, several of the tombs date to this era, e.g. J04 (AD 1450-1630) (Clark, Burley, and Murray 2008, 1003-1004). Importantly, the recent work of Parton (Parton, Clark, and Reepmeyer Forthcoming) on the linear defence feature known as Fisi Tea, is provisionally dated to AD 1550-1650. This structure appears to delineate a boundary which segments the northeast area of Tongatapu, dividing it, near Lapaha, from the land to the south. Presumably, the harbour and wharf also formed a defensive barrier on the seaward front. This apparent retreat or withdrawal raises further questions, which await further (and pending) investigations. For the later Tu‘i Kanokupolu establishment period, further construction is apparent at Lapaha, in addition to the ceremonial centre at Kanokupolu in western Tongatapu (Spennemann 1989).

Apart from this minimal evidence from the archaeological record, most evidence comes from the traditions. After the Sāmoan interlude (the stay and expulsion of the 15th Tu‘i Tonga), several assassinations of Tu‘i Tonga occurred, between the 15th and 23rd members, about whom little is known (Campbell 2015, 44, Gifford 1929, 54). Some traditions record that the assassinations were by people of Hamula and Toloa, who wished to install their own people as wives of the Tu‘i Tonga, and thus gain office (Parton et al. 2018, 22-23 citing Thomas in Statham 2013, 29). The following period (mid-millennium) was one of both expansion and fission as evidenced in traditions of campaigns of territorial expansion and changes to the Tongan dynastic regime. The assassination of the 23rd Tu‘i Tonga provoked an allegedly aggressive campaign by his son and successor, Kau‘ulufonua, to pursue the perpetrators and to exact revenge, generally interpreted as an expedition to expand Tonga's control over islands near and far (see Chapter 3).

As outlined in Chapter 3, at approximately the same time, there occurred a division of roles, resulting in a dual paramountcy, along with the delegations to islands, across the extent of the TMC, of junior members of the dynasty (Gifford 1929, 67-70). These delegations are explored further in the relevant case studies (6.4 - 6.6). The reforms instituted at this time, i.e. the establishment of an additional secular ruling lineage, as briefly outlined in Chapter 3, may also have been the opportunity for usurpation of the Tu‘i Tonga's power by other lineage members (Campbell 1982, 181, Herda 1988, 51-54). Campbell (1982, 180-182) considers it was probably a *coup d'état* and the variant traditions are after the fact explanations of political upheaval. Evidence of this may be surmised in the tradition of the 24th Tu‘i Tonga living in Sāmoa, it could be suggested, in exile, or at least taking refuge there. Kau‘ulufonua took Sāmoan wives and bore sons, who were his successors, either by generational succession or possibly fraternal successors, given the apparently short duration between the expedition of conquest and the subsequent events (Herda 1988, 59-60). One of Kau‘ulufonua's successors, the 26th or 27th Tu‘i Tonga, attempted to restore the dynasty, with Sāmoan support, but only reaching Vava‘u, where they were said to have been defeated by Tu‘i Ha‘atakalaua forces (Herda 1988, 60).[18] As it is recorded, Tapu‘osi (28th Tu‘i Tonga) finally returned the residence to Tongatapu (and Lapaha), although by what means is unclear in the traditions (Campbell 2015, Herda 1988, 62). Reconciliation between the two lineages occurred with the establishment of a tradition of marriage alliances between Tu‘i Tonga and Tu‘i Ha‘atakalaua (Campbell 2015, 48-49). The time period over which these events took place is also uncertain, but possibly less than a century, as from approximately AD 1600, a new era of consolidation and alliances, and a new regime emerged.

[18] There appears to be more than one explanation of the conflict at ‘Utungake on Vava‘u.

To the next (29th) Tu‘i Tonga (‘Uluakimata I) is attributed much endeavour, both at home (Tongatapu) and abroad (particularly ‘Uvea) (Herda 1988, 63). Traditions record him in association with the great ship Lomipeau[19] (perhaps indicative of voyaging capability) and the construction of further works at Lapaha (Gifford 1929, 56-57, McKern 1929, 52, 75, 92-101, Spennemann 1989, 453-475). The separation of roles and the division of the Tongan regime is reflected in the spatial layout at Lapaha (Bott 1982, 79, Collocott 1924, 177, Herda 1988, 54). In the time of ‘Uluakimata and/or his son, Fatafehi (30th Tu‘i Tonga), a new alliance was created with Fijians of the Lau Group (Bott 1981). Fatafehi’s sister (the Tu‘i Tonga Fefine) married the Fijian chief Tapu‘osi, thus founding the new lineage of the Fale Fisi (Campbell 2015, 50-51, Collocott 1924, 178-180, Herda 1988, 68-69). Further strategic alliances and protocols were designed to ensure that there were no direct challenges to the Tu‘i Tonga dynastic succession, and that allegiances were maintained (Bott 1981, 32, 1982, 99, Campbell 2015, 51).

However, shortly after these new alliances were established, fresh challenges arose, with an uprising by local chiefs in western Tongatapu and/or competition from within the Tu‘i Ha‘atakalaua lineage (Bott 1981, 13, Campbell 1982, 181, 2015, 51-52, Gifford 1929, 86-87). Thus, the focus shifted away from Lapaha and eastern Tongatapu, as outlined in Chapter 3. In western Tongatapu, the Tu‘i Kanokupolu ceremonial and administration centre (as observed by Tasman in AD 1643) was established for the first time, challenging the supremacy of eastern Tongatapu. Hence the rise of the rival Tu‘i Kanokupolu lineage appears to have been rapid and occurred only a few decades after the creation of (and/or usurpation by) the Tu‘i Ha‘atakalaua lineage (Bott 1981, 13, Campbell 2015, 51-52, Herda 1988, 79). Thus, by the seventeenth century an increasingly hierarchical structure had been created within the dynastic system, presumably accompanied by population expansion and an increase in agricultural productivity such that the Tongatapu landscape became, just as Tasman in AD 1643, and later Cook in AD 1777, described it, with numerous fenced plantations, fallow areas providing timber, and many public roads and footpaths (Gifford 1929, 7 - citing Cook 19, Vol. 1, p314 , Kirch 1984, 221-222 - citing Beaglehole 1969). This then was evidence of an intensified agricultural system on Tongatapu, as is generally recorded in Tongan historical writing (Kirch 1984, 221-222).

[19] See Finney (2006) for discussion on Lomipeau, and the use of canoe voyaging in inter-archipelagic relations.

6.3.3.2 Hypotheses

This apparently unstable period, with evidence of aggressive competitive actions, and intervals of cooperation, was also a period when the establishment of an increasingly hierarchical regime occurred. Game theory models are well suited to examining social interactions, where there are conflicts of interest and frequency-dependent effects (Smith and Winterhalder 1992). The Hawk-Dove (H-D) model is useful for frequency-related behaviours where competitive and aggressive actions predominate. A preliminary, explanatory note on the application of the H-D model to this period is helpful here. Repeated aggressive competitive behaviours, as evident in the traditions, without any apparent resolution or restabilising of the regime, suggest that strategies were not evolutionarily stable. In H-D game theory, a repeatedly aggressive hawk behaviour, where the costs of a behaviour are greater than the value of the resource (fitness gain), cannot be stable. While hawk behaviour beats dove, as hawk behaviours increase and encounters are more often between hawks, so a hawk behaviour cannot outcompete itself, as the hawk's payoff in fitness declines with each encounter. Fighting and losing exacts a larger cost when faced with another hawk. If an evolutionary equilibrium is to be achieved, a mixed strategy should prevail. If there are constantly changing variables of resource distributions, resource value and resource ownership, the relative costs would also be changing such that no ESS was attainable over any amount of time. Such instability might account for the apparent fissioning within the Tu‘i Tonga lineage.

Therefore, the evolutionary game theory (Hawk-Dove) model informs the following hypothesis:

Hypothesis 3: Increasingly competitive actions predominated as the numbers of Tu‘i Tonga lineage members rose, creating an unstable ESS (too many hawk behaviours); expansionist warfare or foreign assignments provided a means for Tu‘i Tonga to maintain control, while also providing competing collaterals with alternative (and less costly) options as junior governors, thus resulting in a more stable ESS (with increasing dove behaviours in the population).

The maintenance of hierarchical organisation requires the continuance of cooperation, and that there be some mechanism to enforce cooperation amongst subordinates. To elucidate the type of social structure and interactions that perpetuate cooperative behaviours, the H-D model is supplemented by EE models which consider the problem of collective action and cooperation in larger groups.

Hypothesis 4: The concomitant establishment of administrative roles within Tongatapu was a mechanism to maintain the Tu‘i Tonga elite position while delegating the costly tasks of administration and maintenance of the political structure to competing lineage members. Creation of further junior titles and specialist roles provided a mechanism for elites to enforce cooperation of subordinates at less cost (others pay cost of control), and thereby creating multiple levels within the hierarchy.

6.3.3.3 Model predictions

In the period of increasing competitive actions and instability, there were intervals of cooperation, and then increasingly hierarchical organisation. To evaluate these hypotheses, the H-D game theory predictions suggest that changes in interactions and evolutionary stability should be evident as:

- Changes in resource structure or environmental conditions or demographics, in tandem with the rise in aggressive behaviours or competitive actions such as warfare.
- If competition is for subsistence resources, evidence of the differential distribution of resources; if political capital is the resource, then the evidence may be of economic controls, e.g. exacting of tribute, establishment of infrastructure.
- Continued instability (aggressive hawk behaviours) until alternative acquiescent behaviours emerge.
- Return to stability (ESS) as competitive and cooperative behaviours reach equilibrium, i.e. neither strategy dominates.
- Further changes in environmental or social structure would prompt modified strategies and a return to increasingly competitive behaviours and instability.

And further, in the maintenance of cooperative behaviours in increasing group size, i.e. collective action, the predictions include:

- Evidence of rank differentiation in social structure, i.e. administrative levels with differential access to resources (including socio-political).
- Limited options for relocation of rival lineage members or subordinates.
- Costs for subordinates, of remaining within the group, are less than costs of relocation to lesser quality habitats.
- Benefits to dominants of retaining (potential) rivals within the group, as intermediate managers, is less than the costs (including tax or fee to be paid for services).

6.3.3.4 Evaluation

In this evaluation, it is necessary to suspend any attempt at, or adherence to, chronology (limited as it is), and consider the competitive and cooperative strategies as occurring at multiple levels. The majority of evidence with which to evaluate these hypotheses comes from traditions, with little archaeological or palaeoenvironmental data available. After a series of Tu‘i Tonga assassinations, traditions speak of the aggressive campaigns, to islands of varying environments and social structures. Examples of these different islands appear in the case studies that follow. For this section, the analysis is restricted to the preliminary competitive actions, the increasing aggression, the stabilisation with more cooperative behaviours, and the development of a dual hegemony, and subsequent further socio-political change, with an increase in hierarchical structure.

There are two broadly contributing conflicts of interest, reflected in the two hypotheses listed above. Firstly, the hierarchical organisation of an increasingly large hegemony was perhaps beginning to disintegrate with intragroup conflict, with different lineage members vying for power (essentially seeking to enhance their individual fitness). Secondly, at the same time there was a collective action problem in maintaining cooperation within large group size, and the potential for rival groups to originate from competing lineage members, but in a spatially constricted environment.

Addressing these in turn, firstly hypothesis 3. An increase in the number of dominants (lineage members in a hereditary and kin-based political system), in the absence of mechanisms to control or limit successors to the elite offices of Tu‘i Tonga, would lead to intragroup conflict, i.e. an increasing frequency of hawk behaviours. One possible response to this might be territorial expansion, but available territory on Tongatapu was restricted by the small island size, regardless of the extent of subsistence resources. If all land was allocated, then the cost of aggressive expansion (warfare) within Tongatapu might be greater than the fitness benefits. Of course, this would depend on the economic defendability (see Chapter 2) of territories and resources across Tongatapu, and the type of resource being “defended”, i.e. agricultural land, or access to marine resources, or economic control and political capital, or indeed, a combination of any of these. In the absence of evidence of competition over some subsistence resource such as productive land for agriculture, it is reiterated that the resource of concern for the Tu‘i Tonga dynasty was primarily political capital (which is expressed in various types of control of social and material resources). If, as has been proposed, the initial growth of the Tu‘i Tonga regime occurred in eastern Tongatapu, it would be reasonable to expect that western Tongatapu would be a focus for expansion. However, there is no strong tradition of warfare between east and west Tongatapu, rather the evidence indicates that intragroup and intergroup conflict occurred either primarily within the Tu‘i Tonga ruling regime or between the Tu‘i Tonga and other chiefly rulers of eastern or central Tongatapu. Nor is it evident that Tongatapu was subject to pan-island rule by the Tu‘i Tonga even at this mid-millennium stage. If expansionist warfare was a means of controlling or limiting population pressure on Tongatapu in a period of declining productivity associated with population growth, unpredictable resources and deteriorating climatic conditions, as has been hypothesized by some (see Aswani and Graves (1998) for discussion; also Burley (2007a); Kirch (1984, 221-223); Spennemann (1989)), then it would be expected that control would be exerted over all Tongatapu, and western Tongatapu would show evidence of increasing population density. Instead, the focus seems to be in eastern Tongatapu, and specifically the northeast area around Lapaha, with conflict amongst the ruling elite.

Turning to the H-D model, in symmetric contests, a hawk strategy should outcompete dove, but in increasingly aggressive competitive interactions, as hawk strategies increase, so there will be a greater likelihood of an encounter being with another hawk rather than a dove. In an environment of increasing numbers of lineage members, an increase in hawk strategies in the population would occur, and thence there would be an increasing chance of hawk encounters. Initially, if resource value is high, competitive encounters by aggressive individuals may result in benefits even when encounters are between competing hawks. However, if resource value declines, perhaps because of increased numbers, or some other change in resource structure or another environmental variable, so benefits relative to costs decrease. Also, as hawk strategies increase, and encounters are more often between hawks, so the payoffs reduce as the costs increase, until a dove strategy becomes the better option. Whether a hawk or dove strategy is employed may depend not only on resource value (RV), but on who “owns” the resource or territory (resource holding potential or RHP). In the variant asymmetric H-D-B model, an alternative strategy is to play hawk if you are the resource holder but play dove in the alternative. This could be applicable to the Tu‘i Tonga lineage with current holders having the advantage. Thus, senior elites would compete aggressively, while junior members should retreat when faced with resource owners. As the number of Tu‘i Tonga lineage members (dominants) to be supported by the regime rose, so the benefits reduced to individual participants, and hence, the elite (resource owners) would try to exclude junior members vying for the same positions. An expansionist strategy with the creation of new territories or colonies could neutralise competing rivals’ claims to office. Junior members would have a choice to stay and compete (a hawk behaviour) with potential for greater losses (perhaps suffering lower status and therefore lower quality resources) or to acquiesce (a dove behaviour) and accept new positions to establish themselves as junior governors in new territories. As some lineage members adopted a dove strategy, with an increase in doves an ESS might eventually be established, at least for a period. While such examples of strategies pertain only to the elite, and therefore reflect competition not so much for natural resources but for social resources, i.e. the resource constraints experienced were more about political capital, nonetheless, political capital must be exercised over some resource, whether that be prestige goods or exchange or tribute (i.e. agricultural surplus). Thus, the campaign expeditions would have served to deflect competition away from the Tu‘i Tonga and Tongatapu, whilst also providing potential benefits to new leaders and their retinue. For the junior leaders, overseas campaigns involved aggressive campaigns including warfare with costs of injury, but with the benefits of access to resources (direct and tribute) and the potential to establish themselves in new territories.

The second part (hypothesis 4) considers how the hierarchy developed and was perpetuated through cooperative collective action, whilst also incorporating variables of intragroup rivalry and increasing group size, and the problem of non-cooperation. Accompanying the territorial expansion and the appointment of junior emissaries to other islands, the traditions relate the creation of the secular position of the Tu‘i Ha‘atakalaua (*hau*), and further delegations of administrative roles. While this could also be indicative of a strategy to deflect competition, by providing new roles as administrators with potential benefits, these new levels within the hierarchical organisation should effectively perpetuate socio-political hegemony by ensuring the maintenance of the hierarchical system. As noted in Chapter 3, the dynastic system contained many social rules and complexities and was indeed very stratified.

To explore further the idea of increasing group size and maintenance of hierarchy, the following evidence is applicable. The series of assassinations, together with Lapaha evidence of construction of defences (Fisi Tea), suggest that there was also increasing competition between different members and/or rival groups within the Tu‘i Tonga sphere of control, as well as rivalry between Tu‘i Tonga lineage members or leaders of different factions. In the emergence of inequality, an increase in group size creates asymmetries in the flow of, and access to, resources (Boone 1992, DiNapoli 2014). As group size grows, there are economies of scale, particularly in territorial defence, which depends upon cooperative behaviours within the group (Boone 1992, Field 2003). However, increasing group size may also result in increased intragroup conflict, particularly when competing for the same scarce resource, and there is a relative decline in available resources (Hooper, Kaplan, and Boone 2010).

There is also a limit to which both dominants and subordinates will tolerate increasing numbers in the face of a declining resource. The dominant may move to control group size, but equally, as group size grows, subordinates suffering lower fitness (decreased share of benefits) may do better by relocating, so long as this remains a possibility (Boone 1992). This is an important consideration in the spatially restricted Tongan archipelago, if the spread of the TMC was already reaching its maximum extent. Intragroup rivalry then begins to challenge the power, authority and control of the dominants. Thus, for the Tu‘i Tonga (dominants), ensuring that subordinates, at whatever level within the hegemony, continued to cooperate in providing services or labour, rather than defecting to a rival group,[20] required that there be continued benefits to the individuals participating in such cooperation (Boyd and Richerson 1992, Smith and Choi 2007).

The defensive boundary structures, such as Fisi Tea (tentatively dated to AD 1490-1640) near Lapaha, are likely indicative of territoriality and competitive exclusion. The best evidence of increasing group size is the density of mounds, as noted previously, in eastern Tongatapu, and specifically those surrounding the Lapaha precinct. The lack of evidence for pan-island integration suggests additional factors operated to maintain different territories within Tongatapu. This is an avenue for future research. What appears evident here is that as the hegemonic (group) size increased, the question was how the requisite cooperation was to be enforced, i.e. who ensured that subordinates did not “defect”. As Boone (1992) has proposed, this problem of maintenance of reciprocity between hierarchical levels (dominants and subordinates), can be addressed if there are “special interest groups” or intermediate level individuals (or managers) who enforce cooperation (thereby maintaining evolutionary stability) (see also DiNapoli 2014, Hooper, Kaplan, and Boone 2010, and Smith and Choi 2007). There is then an additional cost and benefit analysis required. This is when the costs of ensuring cooperation (enforcement) need to be countered by additional benefits (perhaps greater status or better resource share) to the enforcers, i.e. lower order administrators (such as the *hau* or administrators in this case) in an increasing hierarchy. Second-order collective action problems also arise (see Boyd and Richerson 1992). Thus, the establishment of a dual paramountcy, with administrative roles, appears to correlate with increasing population and the problem of ensuring the maintenance of cooperation within the hegemony.

[20] This was a period of fissioning with title-splitting creating rival groups. It is acknowledged that this argument is akin to attacking a strawman.

This hypothesis is premised on environmental conditions being uncertain and risky, or perhaps highly variable, and thus temporally unpredictable. However, if this title-splitting was temporally associated with environmentally productive or good conditions, this would falsify the hypothesis based on competition for economic control. Equally, if new (pending) dating evidence of Tongan forts shows continuous construction and use of forts through this period, and across Tongatapu, this would falsify the H-D derived hypothesis of cyclical conflict and acquiescence, and intragroup conflict with evolutionary stability established through collective cooperation, and it would counter the evidence relied upon for higher densities in eastern areas.

6.3.3.5 Epilogue

Reassertion of Tu‘i Tonga authority and control appears to have occurred under the 29th Tu‘i Tonga, ‘Uluakimata, who established or re-established alliances and connections with Fiji, Sāmoa and ‘Uvea. The expansion of alliances is also suggestive of system changes. This shift from the more competitive and aggressive behaviours of the preceding events to one of greater cooperation via strategic alliances may have occurred as a result of further changes in environment and resource structure. Since these events are located in the early AD 1600s, there may be some correlation between the changing climatic conditions, with a gradual change to wetter and warmer conditions, and so the system changes, albeit only for a brief time. The western Hihifo district of Tongatapu, at this late juncture, appears in traditions which tell of the uprising of chiefs, which a junior Tu‘i Ha‘atakalaua lineage member (Ngata) was sent to quell, possibly in a repeat of earlier expansionist strategies. As previously, a change in the system can result in a return to an unstable mix, with an increase in aggressive hawk behaviours.

This episode is portrayed in traditions as a further delegation of powers, providing a junior kinsman, Ngata, with roles and responsibilities, and associated status. Alternatively, this may be another example of usurpation by a junior lineage member, this time supported by formerly independent western chiefs (as well as Sāmoans). This period in early AD 1600s also saw increased ENSO activity, and so again changing environmental conditions would likely lead to changes in social structure with the increase in competitive strategies, and, at the same time, the need for cooperative strategies to manage risk and uncertainty. This would suggest that while Ngata, and others, may have attempted to usurp authority, at the same time, the creation of further titles, and a new level of hierarchical organisation, was a mechanism to enforce cooperation in a continuation of, or return to, unpredictable conditions.

6.3.3.6 Overall assessment

In this second part of the case study, the H-D model has been useful in evaluating both hypotheses, where conflicts of interest repeatedly occur, but the role of cooperation in the establishment of hierarchical levels has required an evaluation of the "collective action" problem, where benefits and costs appear unequally apportioned, and therefore contradict the self-interest principle.

Intragroup rivalry occurred with the increased number of elite members vying for political dominance and territorial control, resulting in aggressive encounters predominating, until declining resource value selected for alternative acquiescent strategies. Increasing hierarchical organisation can be seen as the outcome of several episodes of change, emanating from the benefits of cooperation in territorial behaviours in an unpredictable environment, but interspersed with periods where competitive actions constantly arose and sometimes predominated when individuals with conflicting interests sought to maximise their own fitness.

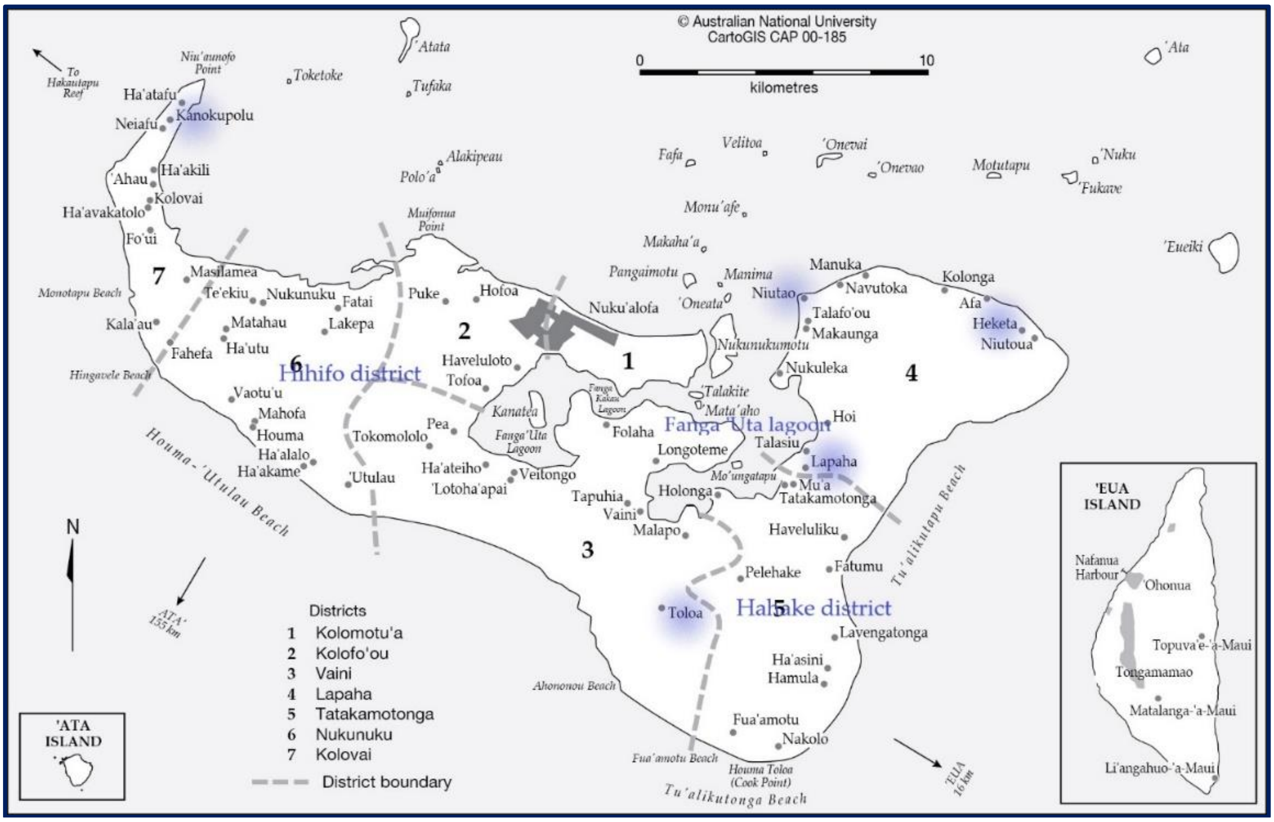
It is suggested that in the absence of cooperative strategies, there was an inability to maintain an extensive polity and this led to the increase in independent factions or chiefs reasserting control. Equally, the inability to control junior members sent to control the extensive "empire" led to further intragroup conflict and competition among lineage members – as will be explored in the case studies that follow. Nonetheless, cooperation (collective action) was a mechanism through which stratification was able to establish, and social hierarchies persisted when the benefits of cooperation within the hegemony were greater than the costs, and thus were, variably, evolutionarily stable. The constantly changing variables of a stochastic environment and social structure meant that this stability was subject to contingent strategies.

6.3.4 Summary

The first research questions asked how inequality emerged and where the Tu'i Tonga dynasty originated. It is evident that its genesis was in eastern Tongatapu but there was no evidence for significantly contrastive environments across Tongatapu, and yet there was evidence of differential access arising from differences in competitive ability, resulting in a despotic distribution. Environmental pressures and population growth, while important elements, could not alone explain the rise of dominant-subordinate relationships, with the advent of monumental architecture and the performance of rituals and ceremonies. The emergence of inequality and the subsequent hierarchy of the Tu'i Tonga hegemony were seen as resulting from both competitive and cooperative behaviours, likely through periods of environmental change, with periods of risk and uncertainty when subsistence resources were less predictable.

In the expansion and fission phase, there were increasing conflicts of interest between dominants and subordinates, with competitive behaviours predominating. The endurance of the regime was correlated with more cooperative behaviours, giving rise to a collective action problem. Collective action problems occur in dominant-subordinate relationships, when groups grow to a size where the cost of enforcing cooperation requires repeated delegations to lower order ranks, necessitating an increasingly hierarchical structure, which then is difficult to maintain, particularly over large territories, since there is the risk of collaterals or juniors taking the opportunity to assert (usurp) and compete – which is what is seen in the Tongatapu study, and in the case studies that follow.

Map of Tongatapu



Map 4: Tongatapu

Showing places mentioned in the text: Toloa, Heketā, Lapaha and Kanokupolu; the Fanga 'Uta lagoon; and the western district of Hihifo, the eastern district of Hahake. Base map source: Map reproduced with the permission of CartoGIS Services, ANU College of Asia and the Pacific, The Australian National University.

6.4 Case study 2: Ha‘apai

6.4.1 Introduction

The Ha‘apai Group contrasts with the island of Tongatapu in several ways – in its environmental context, being a scatter of small islands, and in its history of chiefly rule. The event which the case study focusses on is the mid-millennium period following the campaign of the 23rd Tu‘i Tonga, and the appointment of governors to islands across the Tongan archipelago. The Tongan nominee, Mata‘uvave, is recorded as a powerful ruler who established in the Northern Ha‘apai Group, centred principally on the main island of Lifuka.

6.4.2 Event: Tongan expansionism and the dominance of Mata‘uvave

6.4.2.1 Overview summary of evidence from environment, archaeology and traditions

Each island in the Ha‘apai Group has only a small land area, and although the tephra soils support horticulture, water sources are limited, and so there are constraints on population and agricultural subsistence potential but generally good and accessible marine resources, courtesy of the extensive reef system (Burley 1994b, 385). Subsistence included a significant marine resource component, but the full subsistence regime was likely diverse, including horticulture, particularly as there is no evidence of marine resource depression (Cannon et al. 2018, Densmore 2010). While total population was low (constrained by land area), population density may have been relatively high, given the known site distribution (Burley 1994b, 386, 402). A degree of differentiation in natural environments and resources occurred across the group, with some islands being uninhabited sand cays with limited terrestrial resources (e.g. Uoleva), while others displayed more varied habitats and topography (e.g., Foa). On the main island of Lifuka, the leeward coast was a favoured location for its reef access and slightly better soils, with settlements clustered, perhaps around local chiefs (Burley 1994b, 391-392). In addition, it appears that plantations were diffusely spread into the interior, perhaps reflecting a more even distribution of resources on the main islands (Burley 1994b, 393-402, Martin 1991, 370 - Mariner's account of Lifuka in the early 1800s); Beaglehole (1967, 873 cited in Burley 1994b, 398) noted better soils in the island centre with its fenced plantations. There were not any highly contrastive environments, as in ‘Uvea or Niuatoputapu. Limited water resources would be a constraining factor for agricultural production and thence population. The variations in palaeoclimate were perhaps similar to Tongatapu, but without specific locational data it is not possible to further evaluate environmental variables.

Mata‘uvave, of the Tu‘i Tonga lineage, was sent as an emissary from Tongatapu to “govern” Ha‘apai (Burley 1995, 157-159, Gifford 1929, 68-70, Herda 1988, 50). He led an aggressive campaign to assert control over Ha‘apai. Local resistance to imposition of Tongan rule is evident in traditions and in archaeological evidence of fortifications on the four main northern islands (whether or not these fortifications were pre-existing) (Burley 1995, 159-160, 169-170). Mata‘uvave (it has been proposed) constructed an architectural “landscape” of burial mounds, *sia heu lupe*, and conical wells for chiefly bathing (Burley 1995, 163-168, 1996, 424-434). In addition, the fortification of Kolo Velata, on Lifuka, is attributed to Mata‘uvave (Burley 1995, 159, Gifford 1929, 70). Labour requirements for these constructions were extensive, but traditions indicate that local labour was at Mata‘uvave’s command and that this was part of Ha‘apai’s subjugation (Gifford 1929, 70). Uoleva, an uninhabited sand cay (accessible from Lifuka at low tide[21]) appears central to Mata‘uvave’s assertion of authority and control, as it contains numerous structures attributed to him, with at least ten *sia heu lupe,* including the largest known example across the Tongan archipelago (Burley 1995, 166-168, 1996, 427-429, Gifford 1929, 68-70, McKern 1929, 19-26). A named road or boundary marker also runs the length of the island (McKern 1929, 89). Lesser chiefs appear to have been dispersed in less favourable locations, archaeologically expressed on Lifuka with Mata‘uvave’s monumental architecture compared with the lower-level chiefs’ less complex burial mounds (Burley 1994b, 396-402). Monumental architecture (burial mounds and wells) were spread across several islands, with higher densities on Lifuka; burial mounds and conical water wells co-occur on the four main islands, which is presumed to reflect the domains of the elite Mata‘uvave rulers (Burley 1994b, 396). Land was partitioned into chiefly estates or plantations, demarcated by road networks, fencing or ditch and mound enclosures, reflecting local chiefly affiliations with local populations (Burley 1994b, 393-402), although the timeframe for this pattern is unclear. To some extent, local chiefly systems appear to have remained intact, with social and economic functions determined by associations between chiefs and followers, and to this was added the overarching Tu‘i Tonga-imposed hegemony (Burley 1994b, 402). This is similar in many ways to relationship structures on other islands, perhaps indicating that at times a strategy of the governor was to “encourage” or incentivise cooperation, although for Ha‘apai, the traditions and genealogies do not record the typical degree of marriage alliances (Burley 1995, 170). At some point, Mata‘uvave (the lineage) assumed the title of Tu‘i Ha‘apai (Burley 1995, 160, 162, 170-171,

[21] Gifford (1929, 70) records a tradition that a road was built linking Lifuka and Uoleva

Gifford 1929, 135), and further conflict arose, as the Tu‘i Ha‘apai increased his degree of independence from Tongatapu (Burley 1994a, 506, 1995, 162, 170-171).

6.4.2.2 Hypotheses

Based on the evidence briefly outlined above, the H-D model seems most suited and therefore informs the following hypothesis. This is supported by a brief analysis using costly signalling theory.

Hypothesis 5: At the advent of aggressive incursions from Tongatapu, valuable resources within Ha‘apai favoured behaviours of competitive exclusion by the resource holders. An initial predominance of aggressively competitive strategies was followed by a more stable mix of lower frequencies of aggressive-competitive and more acquiescent (bluff-yield) strategies. An additional competitive strategy of the elite included asserting domination and control over labour and resources though ideological manipulation and by signalling competitive ability.

6.4.2.3 Model predictions

The H-D model suggests:

- Prior to the incursion event, an evolutionarily stable mix of competitive and acquiescent behaviours.
- Increasing frequency of aggressive competitive hawk strategies with the assertion of Mata‘uvave control.
- Evidence of cooperative exclusion where resource value was high for Ha‘apai resource holders.
- Period of unstable predominance of hawk strategies reflected in offensive and defensive actions.
- Some change in social or resource structure with subsequent changes in strategy choices resulting in lower frequency of hawk behaviours or lower-level competition.

The CST model should be seen in:

- Evidence of seemingly wasteful behaviours to signal ability.
- Evidence of link between resource and signal.
- Moderation of behaviours with a decrease in aggressive interactions (where signal is valid).

6.4.2.4 Evaluation

While the Tongan expansion campaign might have had a common driver (see 6.3.3), responses would have been local and highly variable. In the northern Haʻapai islands, with the main islands (of Uiha, Uoleva, Lifuka, Foa and Haʻano) all in close proximity, the environmental and resource structure might better be considered as the whole “land and sea scape”. The density and predictability of resources might vary from island to island, and be subject to spatial limitations, and vary over time, but the overall resource structure generally remained at a stable equilibrium (on the limited evidence). Incursions from Tongatapu, while perhaps not previously unknown, would be expected to cause pressure on these limited resources, and thence changes to the social and economic system. It is the overall resource value (RV) and resource holding potential (RHP) that is relevant in considering the range of interactions.

There is some evidence to suggest that defensive structures predated Mataʻuvave’s intensive and aggressive campaign. This would indicate a degree of intergroup rivalry or competition over resources, or perhaps competitive exclusion, including repelling earlier incursions. The resource structure across Haʻapai, while reasonably certain, was subject to some temporal variability, and so, changes in social and environmental context would be expected to trigger variable behavioural responses.

Led by Mataʻuvave, it appears that Tongan incursion was by aggressive force. Given Haʻapai’s resource structure of relatively predictable, although spatially variable subsistence resources, such an incursion could be expected to be resisted, because of the resource holding potential of the inhabitants. Both traditions, and archaeological evidence of fortifications, at the period of Mataʻuvave’s arrival, imply resistance by the local population. The benefits of protecting the resource would suggest a strategy of (aggressive) competitive exclusion by the resource holder, i.e., the resource value suggests territorial defence would be the best strategy. In addition, cooperative efforts for exclusion would be beneficial for the resource holder (Haʻapaians). So, both competition and cooperation should be evident.

The conflict and interactions might be modelled using the Hawk-Dove model. Assuming a low level of conflict, prior to the Mataʻuvave incursion, the H-D model would suggest an ESS comprised of a mix of hawk and dove behaviours with neither predominating for any length of time. Hawk behaviours would see some low level of aggressive encounters, while dove behaviours might be expressed in acquiescence. At the arrival of Mataʻuvave, and confronted with aggressive competitive actions, an increase in hawk strategies is predicted.

Equally, this would require that Ha‘apaians work co-operatively to exclude and protect their resource (based on RV and RHP). The evidence for both competitive actions and exclusion is found in the defensive works at Kolo Velata, while aggressive competition is also evident in traditions relating the assertion of control by Mata‘uvave. Kolo Velata is said to have been built by Mata‘uvave, but this might equally be interpreted more generally as evidence of conflict. Cooperative actions are less evident, possibly because the tradition of subjugation is very strong, i.e. hawk strategies predominated.

At the same time, increasingly aggressive tactics by competitors, or changes to the resource value (declining resource from environmental factors or population increase) could reach the point where costs started to affect payoffs, and therefore fitness. This change to relative costs and benefits would see an alternative strategy or set of strategies as more favourable. An alternative strategy would see an accommodation reached which provided for local chiefs to maintain their estates, perhaps arising from a need for greater agricultural productivity. This would imply that Mata‘uvave’s ability to maintain control by force was limited, and that there was advantage in incentivising cooperation, not by imposing sanctions, but by providing benefits, possibly some delegation of authority and independence to rule individual land holdings, which the landscape patterns would seem to support. The proportion of hawk behaviours would be expected to eventually modify the selection and frequency of behaviours, such that a mixed ESS with neither hawks nor doves predominating might result in stability, in time.

The power and authority of Mata‘uvave was linked to the architectural landscape of Uoleva (as described at 6.4.2.1). Uoleva was “connected” to Lifuka, at least at low tide, and despite its seeming unsuitability for habitation, it must have been deemed a valuable resource to the resource holder (in order for costly labour for construction to be beneficial or fitness-enhancing). Seemingly wasteful behaviours such as construction of monumental architecture can be analysed using CST, which employs evolutionary game theory to examine contests between individuals. These behaviours are a means of dominants to display power and the ability to defend a resource and thereby to inhibit rivals. In general, the more costly the signal, the greater the validity, thus indicating the ability of the signaller to bear the costs of signalling. More specifically, costly signalling evolves if it decreases the cost of competitive actions for all, by avoiding contests which lead to greater risks and worse losses. Mata‘uvave’s dominance over the landscape of Uoleva, and the acquiescence of Ha‘apaians in this control, appears to fit this model. But time and effort costs must have some fitness-related benefit. A requirement for costly signalling is that monuments (in this example) should be located relative to some resource (DiNapoli et al. 2018). Uoleva, at face value, would not appear to represent a critical resource location. However, Uoleva is easily accessible from Lifuka by foot at low tide, and traditions imply a close association with Lifuka (Gifford 1929, 70). In addition, Uoleva, being slightly away from populated areas, and with suitable vegetation, provided good habitat for pigeons. This is similar to evidence seen on Tongatapu where pigeon-snaring mounds are located along the northern coast (see Freeland 2018). It could be proposed that by using Uoleva (in proximity to, and in conjunction with, Lifuka) to signal his authority, this was a lower risk strategy for both Mata‘uvave and local chiefs on adjacent habitable islands. Conversely, the local Ha‘apaian chiefs might see the costs of defending the resource (or the ability to command resources and labour, i.e. political economy) of Uoleva as greater than the benefits. Thus, Mata‘uvave was able to display and signal his political power and authority to others and enforce cooperation by ideological manipulation.

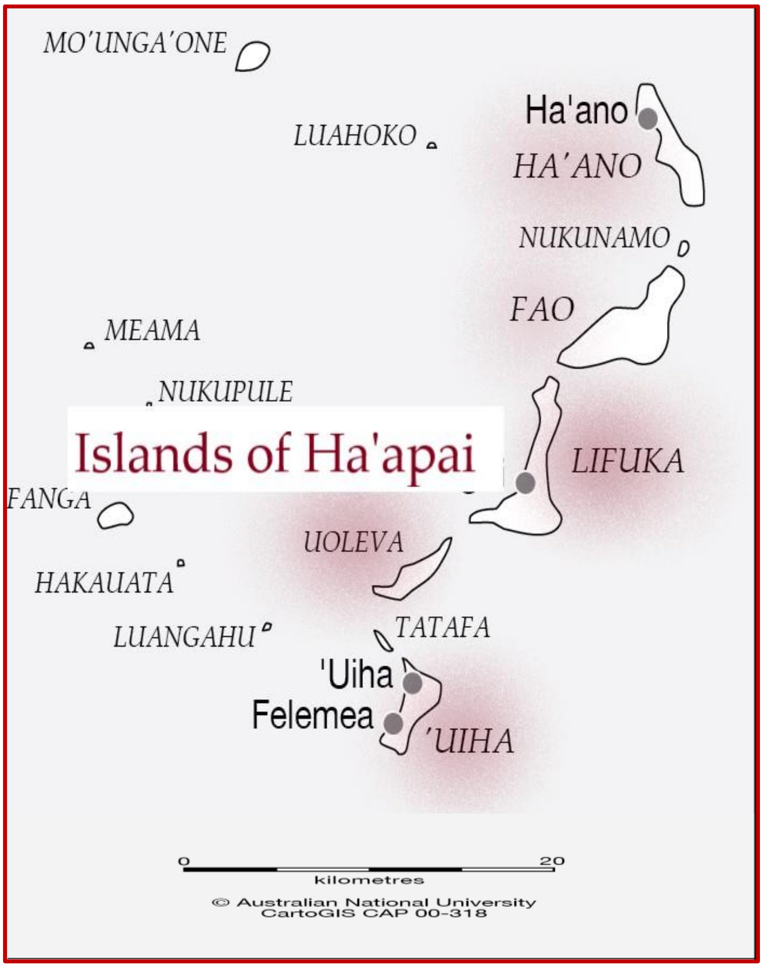
There are some reservations that must be recognised in this analysis. Applying CST to this example, where Uoleva appears not directly related to a (subsistence) resource, appears to fail on that criterion, but if the resource is political capital, then aggrandising behaviours might be explicable using CST in this case. In addition, if the view is taken that the land and sea are as one subsistence regime, then the proposition appears better to meet the predictions of CST. Setting aside these reservations on the use of CST in this example, these competitive and acquiescent behaviours can be considered as stabilising, i.e. a return to equilibrium.

6.4.3 Overall assessment and summary

The environments of the northern Ha‘apai islands provided a range of resources across a diverse seascape but a more restricted landscape, with some islands suitable for human habitation, while others offered limited or different resources. These resources were likely relatively evenly distributed across the spectrum, but subject to temporal and locational variation, and some level of unpredictability, with water sources being a critical factor to a stable regime. In the era of Tongan expansion mid-millennium, the incursion was resisted, and a competitive campaign ensued. This indicates that resources (overall including both marine and terrestrial) were economically defendable. While dependent on population numbers and group size, the high costs of defence would have been compensated for by the benefits of competitive hawk strategies. When there was a change in the structure of resources, the payoff structure would also change. This change might result in mixed strategies, depending on the resource value, and how this changed over time, but would effectively select for different adaptive behaviours.

How Mata‘uvave’s dominance was achieved was a function of socioeconomic variables mediated by ecological factors but appears to have included both tactics of aggression (warfare) and ideological manipulation by signalling competitive ability. The period of Mata‘uvave control may have been of short duration but a level of cooperation must have been instrumental to his regime, as local chiefs were incorporated into a new social structure. In the subsequent period (beyond this analysis) it appears that there was increasing independence of the rulers within Ha‘apai, and most particularly the Tu‘i Ha‘apai (Mata‘uvave lineage), and thus the balance of power was shifting, i.e. the Tu‘i Tonga hegemonic control was being challenged from within, by junior members of the elite lineages.

Map of Ha'apai Northern Group



Map 5: Ha'apai - Islands of Northern Group
Showing islands of Ha'ano, Foa, Lifuka, Uoleva and 'Uiha.
Base map source: Map reproduced with the permission of CartoGIS Services, ANU College of Asia and the Pacific, The Australian National University.

6.5 Case study 3: Niuatoputapu

6.5.1 Introduction

The case study on Niuatoputapu continues to explore the differences across the TMC, specifically how differences in social and environmental context informed variable behavioural responses, the interactions between the Tongan governor and local chiefs, and those relationships with the Tu‘i Tonga dynasty.

6.5.2 Event: Tongan incursion and integration: Mā‘atu alliances with chiefs of Niuatoputapu

6.5.2.1 Overview summary of evidence from environment, archaeology and traditions

Niuatoputapu and the neighbouring volcanic cone of Tafahi are remote islands, lying between Tonga's main islands and Sāmoa (Clark et al. 2011, 54, Kirch 1988, 16-17, Rogers 1974, 309, 311). At 15.2 km^2 Niuatoputapu is small; it has a volcanic ridge with a maximum elevation of 157 m, surrounding coastal plains, beyond which lies the lagoon, and fringing and barrier reefs (Clark et al. 2011, 54, Kirch 1988, 17). Tectonic uplift[22] of the former reef platform and lagoon, on its windward southeast extent, has resulted in a significant increase in land area, but this land area is of low productivity and supports only scrubby trees (Kirch 1988, 17, 20-23). There is therefore a distinct environmental gradient across the island. Niuatoputapu's population today, as in the past, resides in villages on the leeward northwest coast with its lagoon and reef system (Clark et al. 2011, 54, Kirch 1988, 17, 70-71, Rogers 1974, 309-312). The weathered volcanic ridge has steep bush-covered slopes, then a gently sloping terrace, dissected by several stream valleys; rich composite soils support the main crops as well as large timber trees (Kirch 1988, 22-23, Rogers 1974, 312). While there are no permanent streams, there are a few freshwater springs along the coast, and wells dug into the coastal plain to tap into the Ghyben-Herzberg aquifer (Kirch 1988, 24). Kirch (1988) proposed "microenvironmental zones", as part of his 1976 survey and analysis (Kirch 1988, 26-27), these being a summation of all the factors of geology, geomorphology, climate, flora and fauna. The importance of these zones relates to the archaeological features in the landscape as detailed below.

Tongan oral traditions record that the conquest of Niuatoputapu occurred under Kau‘ulufonua, the 24th Tu‘i Tonga; subsequently, a governor was appointed[23] to Niuatoputapu (Bott 1982, 96, Gifford 1924, 62, 1929, 68-69, 135, 283-286, Kirch 1984, 234). However, an associated saying of Kau‘ulufonua records that he told the people of

[22] Or alternatively relative sea level decline (see Dickinson, Burley, and Shutler (1994))
[23] Accounts list different names for appointees, not all include Mā‘atu

Niuatoputapu that they should "push away the boats of the Tongans" and not let them land (Gifford 1929, 283-286, Rutherford 1977b, 35). This is interpreted as a privilege accorded the people of Niuatoputapu by the Tu'i Tonga, that they should remain independent (Gifford 1929, 283-286). Genealogical reckoning indicates Niuatoputapu's incorporation into the Tongan chiefdom was after AD 1600, via the local paramount lineage, Māʻatu, a collateral branch of Tuʻi Tonga (Gifford 1929, 283-286, Kirch 1990, 211). There is therefore some disagreement between the Niuatoputapu record of Tongan association, and the account of Tongan expansionism associated with Kauʻulufonua, tied by genealogical reckoning to AD 1450.[24] In AD 1616, Le Maire and Schouten aboard the Dutch vessels the Eendracht and the Hoorn, came across a "Tongan double canoe" (Finney 2006, Langdon 1977, 41-42), and soon after, sighted Tafahi and Niuatoputapu, where they encountered the chief (king), called 'Latou' (Kirch 1988, 1). This Latou was probably Latumailangi, of the line known as Māʻatu, and descended from the younger brother of the Tuʻi Lakepa of the Fale Fisi. This connection to the Fale Fisi and ultimately the Tuʻi Tonga is important in the Niuatoputapu story. The Fale Fisi titles (Bott 1982, 106) all descend from Tapuʻosi, the Fijian who married the Tuʻi Tonga Fefine, the daughter of the 29th Tuʻi Tonga, ʻUluakimata (c AD 1600). Le Maire, in AD 1616, recorded a short list of thirty-two words, forming the first vocabulary (Langdon 1977, 42), analysis of which led to the language being classified as a Samoic-Outlier subgroup of Polynesian, rather than as belonging to the Tongic group; this linguistic evidence, slender though it is, implies that the language only became more closely related to Tongan sometime after AD 1616 (Kirch 1984, 234, 1988, 12 citing Biggs (1971, 49)).[25] Latumailangi ('Latou') was sent by the Tuʻi Tonga to seek an alliance with the people of Niuatoputapu; in this he was said to have succeeded (Bott 1982, 106). Thus, Niuatoputapu was ruled in late prehistory by the hereditary lineage of the title Māʻatu, of the Fale Fisi lineage of the Tuʻi Tonga (Kirch 1988, 9). The existing local chiefly titles became subordinate to the Māʻatu "king", who also created some sub-titles and divided the land amongst them, and in return these chiefs provided tribute to Māʻatu (Bott 1982, 106, Gifford 1929, 283-286). The local chiefs may have retained their own chiefly lineages, upon which the Māʻatu lineage was superimposed from the AD 1600s (Kirch 1988, 260). Tribute was paid to the Māʻatu, as the representative of the Tongan paramountcy, yet the local chiefs

[24] Gifford (1929, 54) gives the date of AD1450 for the reign of the 23rd Tuʻi Tonga, and AD1470 for the establishment of the Tuʻi Haʻatakalaua lineage (1929, 83)

[25] This point is contested. Burley (pers. comm) suggests that there is insufficient linguistic evidence for this assertion.

maintained some degree of autonomy (Kirch 1988, 260). Thus, Tongan control was not overt, and differed to that seen in other islands of Tongan expansion, such as Haʻapai.

Kirch undertook an intensive survey in 1976 and found ninety-two monument sites, representing a range of mound types (Kirch 1988, 37-38). The largest mounds were unfaced, many having a central depression, which local informants identified as *sia heu lupe* (Kirch 1990, 211). The faced mounds were *faʻitoka* (burial mounds), but with five identified as *langi*[26] according to the informants (Kirch 1990, 211). The most impressive monuments appeared near Vaipoa on the leeward coast, which was the seat of the Māʻatu chiefs (Kirch 1988, 76, 1990, 211). On the liku coastline in the southeast area of geologically uplifted reef platform,[27] excavation of a large mound complex provided the only (for this period) radiocarbon date of 270 ± 85BP (Kirch 1988, 133-137). Corrected to cal AD 1420-1815 (see Kirch 1988, 140-141 Table 13 1σ) this indicates a date perhaps in the seventeenth century (Kirch 1988, 244).

In his assessment of Niuatoputapu, Kirch (Kirch 1988, 26-27) proposed biotopes, or “microenvironments” across the island. Based on the pattern of site distribution of mound features, Kirch (Kirch 1988, 69-78) proposed twelve radial territorial units (*tofiʻa*), which crosscut the island’s environment (biotopes), in a manner similar to Hawaiʻian *ahupuaʻa*. Burial mounds appeared in clusters near habitation areas around the coast, although the largest were predominantly on the leeward side; by contrast, unfaced mounds which include the *sia heu lupe* appeared spread across the interior non-arable recently emerged land (of suitable pigeon habitat). Thus, each radial unit might function as the semi-autonomous political units of local chiefs, having its own burial complex and *sia heu lupe* (Kirch 1988, 69-78, 1990, 213). As Kirch notes, this interpretation of the Niuatoputapu settlement landscape requires testing with further excavations and dating of monuments (Kirch 1988, 260). Interestingly, Burley (Burley 1998, 376) described Kirch’s twelve chiefly estates on Niuatoputapu as “applying a radial land division model typical of Polynesian land tenure systems elsewhere” but which, when applied to the socio-political landscape of northern Haʻapai, where Burley had noted paired burial mounds and wells (see 6.4.2.1), failed to reveal such a clear pattern. The differences between Niuatoputapu and Haʻapai are a function of both the landscape and human interactions with that environment. This suggests that it is

[26] Identification of burials as *langi* is significant for Niua since these were reserved for Tu’i Tonga family members and were not generally located except where Tu’i Tonga were present.
[27] Or resulting from sea level fall as noted at 4.2.1

important to assess the variation in interactions across the range of environments encountered in the interaction sphere of the TMC, rather than simply assuming that "Tongan-style" monuments indicate Tongan domination. It appeared that the Māʻatu lineage (as an expression of Tongan domination and the subjugation of Niuatoputapu, as Kirch asserts) was superimposed over the existing autochthonous political structure, and these local chiefly structures continued to exist but owed obeisance to the overriding Tuʻi Tonga-sponsored governor (Kirch 1988, 260). And finally, Kirch (1988, 37) noted that Niuatoputapu lacked smaller stone structures, such as terrace walls and platforms, but also lacked fortifications, or defensive works, although Rogers (1974, 336) noted three ancient earthworks, possibly associated with fortifications or defence, although two of these long wide depressions could possibly have been former sunken roads or even just geological features; no recorded traditions relate to these structures (Rogers 1974, 336). Rogers also noted that the sitting platforms constructed of stone were relatively recent, except in the northeast extremity of the island, the two huge stone mounds called Mata-ki-ʻUvea and Mata-ki-Haʻamoa (meaning looking towards ʻUvea and looking towards Sāmoa) (Rogers 1974, 328, 339-340). Not only are these unusual mounds quite distinct from anything Niuan or Tongan, but locals could not recall their function, which led Rogers to suppose that they predated Tongan incursion (Rogers 1974, 339). Thus, the relevance of these is unknown, but it is worth noting that traditions speak of relationships between Niuatoputapu and ʻUvea, including alliances (see Gifford (1929, 283-286) for the Māʻatu genealogies, as provided to Gifford, by the 10th Māʻatu title holder).

It is important to recall that interactions had been occurring over a much longer period, even if only intermittently. Tongan incursion via Māʻatu, was not without some precursor. A legend of Niuatoputapu relates the origin of the Tuʻi Tonga, with the earthly mother of the first Tuʻi Tonga being ʻIlaheva, the daughter of a chief of Niuatoputapu; ʻIlaheva was wooed by the god Tangaloa and gave birth to the semi-divine ʻAhoʻeitu, the first Tuʻi Tonga (Rutherford 1977b, 27). Thus, the legend ties Niuatoputapu into the Tongan royal lineage of Tuʻi Tonga (Rutherford 1977b, 27). According to the legends, the construction of Haʻamonga-a-Maui and the two langi at Heketā, on Tongatapu, called on labour from across Tonga, from the Niuas, ʻUvea, Sāmoa and even Rotuma (Rutherford 1977b, 33). So again, this is tying Niuatoputapu (as well as ʻUvea) to an early and prominent Tuʻi Tonga. During the years of the Māʻatu rule, the traditions of the Māʻatu lineage record relationships with ʻUveans (Gifford 1929, 283-286). Marriage alliances also occurred with Niuafoʻou, as well as members of the later Tu‘i Ha‘atakalaua lineage. The extent to which this reflected Tongan influence, or something of a "Tongan empire" is debatable, but at a minimum, these associations and interactions were common across the "empire".

6.5.2.2 Hypotheses

From the evidence, as summarised above, the pre-existing social and resource structure of Niuatoputapu might best be evaluated using the optimality model IFD and the game theory model PD. For the subsequent events of Tongan incursion and integration, a game theory model which is a variation of the PD model, but incorporating a despotic system, and explicitly based on dominant-subordinate interactions, is proposed. These models inform the hypothesis.

Hypothesis 6: An egalitarian social system, where social and resource structure favoured an ideal free distribution, subsequently transitioned to a low-level hierarchical social order based on predominantly mutualist interactions between dominant and subordinates.

6.5.2.3 Model predictions

To evaluate this hypothesis, the predictions of the IFD model are:

- Low population density.
- Spatial variability of habitats between the leeward and windward sides of the island.
- Resources evenly distributed across the leeward side.
- Individuals select the best habitats.
- No constraints to population distribution across habitats.
- Habitat and resource quality remain fairly predictable; some temporal variability.

And the predictions of the (iterated) PD model are:

- A level of cooperation in periods of environmental perturbation.
- Interactions with small groups of either related individuals or continuous/repeated interactions between the same individuals.
- Cooperation and reciprocity maintained while group dynamics remain stable.

The dominant-subordinate model, as outlined by Boone (1992, 323-324), is introduced further, in the evaluation below, but a preliminary explanatory note is provided here. In this model, interactions can range from mutualism, to exploitation or benevolent despotism, to antagonism. At equilibrium, interactions might be similar to an IFD or IDD. The ratio of dominants to subordinates is one determinant in a stable system. Hierarchical organisation develops from asymmetry in these dominant-subordinate interactions. Resources are shared or exchanged, with both dominants and subordinates receiving (unequal) payoffs. The degree of tolerance between dominants and subordinates is determined by resource value, where resources include any benefits to fitness (resource control and access, as well as provision of services or labour). As previously noted, the use of dominants and subordinates in this model is an analytical device.

The predictions of the dominant-subordinate model for Niuatoputapu are:

- Dominants interactions with subordinates are predominantly patronising.
- Subordinates interactions tend to be serving.
- Some inequality in resource control and access.
- Status differentiation.
- Overall interactions are predominantly mutualistic.

6.5.2.4 Evaluation

6.5.2.4.1 Prior to Tongan incursion and integration

On a small island, with the only other neighbouring island being the Tafahi volcanic cone, population mid-millennium was likely always low, with local autonomous chiefs but little hierarchical social organisation and therefore limited group formation or territoriality. Given the environment described above, the early period resource distribution might dictate a continued preference for the leeward coast for habitation. The (presumably gradual) increase in land area on the windward side would have been of little immediately realisable value. Further, the spatially restricted (to the horticultural terrace) terrestrial resources were supplemented by an adequate marine component, indicating that overall resources, while spatially variable, were sufficient for the population, but possibly subject to temporal unpredictability. This indicates that resources were probably not dense and predictable (and therefore not economically defendable) but nor were they significantly constrained. Thus, competitive exclusion was not cost beneficial, but equally, there was little incentive for significant cooperative ventures. The IFD model seems to fit this, as it predicts that there is equal access to resources, and thus little inequality. Evidence of greater spatial and temporal variability in resources and/or a more despotic social structure would contradict these assumptions, but there is currently no archaeological evidence of the former, nor indication in traditions of the latter.

However, through the period of early-mid millennium climatic instability (refer Chapter 4), if this holds for Niuatoputapu, a decline in marine resource, together with the limited freshwater resource and production land, might be expected to result in severe effects on a small island. In this circumstance, where environmental conditions were variable and thus resources unpredictable, rather than competitive behaviours, some cooperation would be expected, with groups sharing to reduce risk. In the absence of any significant degree of differentiation between group members (as per the IFD), cooperation by reciprocity (reciprocal altruism, as Hawkes (1992) describes it) might usefully be illustrated by the game of PD. This model can be considered in addition to the IFD model. Given the environmental and social structure described, in this model, sharing and cooperation should prevail, since, regardless of self-interested individual choices to cooperate (pay the cost) or defect (do nothing and freeride), the constant interactions amongst a small population might be tit-for-tat, and so an ESS. PD and iterated PD is explained in Chapter 2.7, and also applied in case study 6.3. However, there is insufficient evidence to further examine this. Overall, the system, prior to Tongan incursion, might be described as an IFD, with free access to (fairly) equally distributed resources, but also some cooperation when adverse climatic conditions arose, but no obvious competition or territoriality, and thus minimal inequality.

6.5.2.4.2 Tongan incursion

When the Tongan (Māʻatu lineage) was sent as an emissary to Niuatoputapu, the population of Niuatoputapu (individuals or collectives such as local chiefs) presumably had a choice of excluding or admitting the new arrival. The costs of admitting vs the costs of excluding, and who would pay these costs would depend on several factors, including the existing social structure, i.e. the degree of group formation and cooperation in resource acquisition and use, but also the resource structure itself. Assuming that the reason for Tongan arrival, even in part, was resource pressure (on Tongatapu), and that resources were better on Niuatoputapu (which appears doubtful on the above evidence), then the Tongan suite might employ tactics to increase the cost to Niuans of excluding them, by means of aggression or sanctions or coercive power. The Niuan response would depend on the Niuan resource structure (generally, rich resources engender competition, poor resources lead to cooperation), and the cost of defending those resources relative to their value. However, the evidence for aggressive competitive interaction is not strong, as there is no substantive evidence of Niuan resistance, either archaeologically or in traditions, and little evidence of aggressive actions by the Māʻatu governor. Therefore, the Niuans appear to have acquiesced in the Tongan migration. It is important to consider the resource of value that was under contest. Niuatoputapu's subsistence resources, while adequate for a small population, were not such that they represented a motive for Tongan goals (equally, they were not expendable to the

Niuans). Therefore, as an alternative, the resource sought might be political capital, as outlined in case studies 6.3 and 6.4.

Another way of considering this intrusion is as tolerated theft. Here, group size would be relevant, such that the cost of the addition of new members would vary with the relative value of resources or the payoff differences to different members. The tolerated-theft model considers that a degree of theft may be tolerated because the cost of defending that portion or value of the resource exceeds its value to the resource owners. In the Niuan case, the cost of additional Tongan individuals might not be so great, if resources were adequate and Tongans were few in number. Further palaeo-environmental analyses would clarify the nature of resource structure to determine its relative value, and therefore support or refute the hypothesis. The presence of defensive works would also result in modification of the hypothesis.

While the above analysis provides an alternative explanation for seemingly acquiescent behaviours of the Niuans, it does not adequately address the payoffs to the Tongan Māʻatu. The resource therefore may have been political capital, rather than material resources. If the reason for Tongan incursion was a strategy of deflecting potential competitors away from the Tuʻi Tonga, as Tongatapu evidence seems in part to suggest, and this was achieved not by aggressive competitive behaviours but by persuasive tactics (seeking alliances with Niuan chiefs), then the range of interactions may differ from the aggressive competitive model seen in the Haʻapai case study. Since the evidence indicates Niuan behavioural strategies were more cooperative than competitive, the dilemma to be resolved is, by what mechanism did the Māʻatu rulers achieve this incentivised cooperation and integration? A chronology for the beginning of the Māʻatu interactions would help distinguish the different expressions of Tongan expansionism, since Niuatoputapu appears both late (circa AD 1600) and features more cooperative strategies.

6.5.2.4.3 Tongan integration

The relationship between the local chiefs and the Tongan Māʻatu after the initial incursion might be reconsidered as follows. From the evidence of traditions, supported by an absence of evidence of competitive exclusion, it seems that the Māʻatu emissary achieved dominance by establishing strategic alliances with chiefly families. The Tongan emissary Māʻatu had higher rank and status by virtue of peerage, being directly linked to the Tuʻi Tonga dynasty, via the Fale Fisi. Māʻatu assumed the role of sponsor of the local chiefs but also had the ability to dismiss and appoint, or reappoint, local chiefs, indicating obeisance to his rule. It can be surmised that such an association conferred benefits of associated prestige on the local chiefs with whom alliances were forged. This associated prestige might then incentivise cooperation. Ultimately the local chiefs must have some advantage to gain from the costs incurred in cooperating in the new social organisation.

The relationship might now be seen as one of dominant and subordinate, with the local (subordinate) chiefly system maintained by Māʻatu as a strategy of mutualist interaction. In this system there should be mutual benefits to both subordinates and dominants, i.e. both must achieve some gain from "sharing" of resources (both social and economic). A useful way of considering these types of interactions, where dominants and subordinates negotiate conflicting interests in optimising behaviours, is to identify the gains and losses in a simple matrix, as Boone (1992, 324 Table 10.2) illustrated – reproduced here.

		Dominant strategy	
		Exploit	Patronise
Subordinate strategy	Steal	Antagonism (loss, loss)	Benevolent despotism (gain, loss)
	Serve	Exploitation (loss, gain)	Mutualism (gain, gain)

Figure 13: Dominant-subordinate strategy
The costs and benefits are indicated as simple loss and gain, in brackets, with the first indicating loss or gain to subordinate, and second indicating loss or gain to dominant.

As Boone (1992, 323-324) outlines, dominants have the unequal proportion of power and access to resources, and therefore potential for greater fitness gains. This can be achieved by different strategies with different outcomes, depending on the interactions (or negotiations). These interactions can change over time, in response to variable social and environmental constraints. If the Māʻatu dominant provided benefits to the local chiefs as subordinates there must be greater benefits than if subordinates were to act alone, i.e. it would be in the interests of the Māʻatu dominant to advance the interest of the local chiefs as *ʻeiki* and *hau*. These interactions could also be replicated at lower levels within the social hierarchy (and in effect creating social hierarchy). Local chiefs acting as *‘eiki/hau* might incentivise co-operation amongst Niuans, by punishing non-cooperators. However, there are costs and benefits to the individual or collective that does this enforcing, hence the potential for the (albeit not highly differentiated) development of social hierarchy within Niuatoputapu. This collective action problem is discussed at 6.3.3.4.

There is some evidence of cooperation within such a hierarchy (Māʻatu, local chiefs and commoners), as significant labour would be required for construction of the large monuments. While the construction of labour-intensive architecture was considered in Haʻapai using the CST model, because of the lower resource value on Niuatoputapu and the absence of a link between resource and signal, that model was not selected. The spatial distribution of mounds (burial, *‘esi*) is predominantly in the leeward settlement areas, but monumental constructions (including burial mounds) and especially *sia heu lupe* also occur across the windward southeast coast, away from productive zones. This does not present as a public good, but rather, as some indication of a degree of territoriality, with territorial division of the island (perhaps as the domains of the local chiefs at Māʻatu’s direction) for non-habitation structures especially burial mounds and *sia heu lupe*. There is a possible correlation between territorial divisions (as indicated by monumental architecture, especially non-habitation) and the ecozones proposed by Kirch, which may reflect a degree of intergroup (chiefly) competition (territoriality), but this requires further assessment. Beyond these examples, there is little evidence of public works such as defensive works (forts), networks (roads), or co-operative production such as irrigation. This also supports the proposed low level of hierarchical social and political organisation, and predominantly mutualistic interactions between Tongans and local chiefs.

If fortifications and defensive works were present, this would refute the hypothesis that interactions tended to be mutually beneficial. It would also negate the hypothesis that a degree of theft was tolerated. As noted in the Tongatapu case study, identification of possible defensive works requires more than the traditional survey methods; LiDAR has proved useful in this area (see Freeland 2018, Freeland et al. 2016, Parton et al. 2018). This could also mean that competitive behaviours were correlated with higher resource value than predicted, and thus economic defendability and perhaps territoriality. Earlier evidence of inequality in resource access and control would point to a greater degree of despotism than envisaged in a simple IFD. The predictions of the models when compared against the available evidence, show a reasonable alignment between the predictions and the evidence, but this is limited by the extent of available archaeological evidence and paleoenvironmental data.

6.5.3 Overall assessment and summary

The pre-existing Niuatoputapu environment could be described as one of low-density population where individuals or groups were distributed across a small island and were able to select the best available resources, and although those resources were restricted to particular zones, they were relatively predictable, and thus individual fitness was comparable. Local group or individual interactions tended to reciprocity. At the advent of the Tongan Māʻatu rule, the group and resource structure meant that the cost of excluding Tongan rulers (of which numbers were likely low) outweighed the benefits of maintaining exclusive access to a resource that was not (on balance) economically defendable. This was reflected in a predominance of acquiescent behaviours; or could be considered mutualistic. A degree of tolerance was also possibly afforded this intrusion "theft", because of the resource structure. Mitigating factors in the tolerance of Tongan elite might have included the beneficial alliances created through links to the Tuʻi Tonga. Subsequent interactions between the Māʻatu and local chiefs were of the patron-client or dominant-subordinate type, which might have been replicated at lower levels of social organisation. Interactions, based on a dominant-subordinate hierarchical system, likely ranged through antagonism to mutualism but the degree of hierarchical organisation appeared commensurate with the level of conflict and competition. So, this indicates that social hierarchy developed in Niuatoputapu in a manner that reflected the particular environmental and social structure, resulting in a more moderately differentiated socio-political hierarchy.

Map of Niuatoputapu

Map 6: Niuatoputapu
Showing reef system to northwest; volcanic ridge in the centre; uplifted southeast extent with area of *toafa*, and the Houmafakalele burial mound; the two large mounds Mata-ki-Uvea and Mata-ki-Ha'amoa are at the northern point.

6.6 Case study 4: ‘Uvea

6.6.1 Introduction

‘Uvea provides a contrasting case study by which to examine Tongan interactions mid-millennium. While many islands have traditions of early relationships with Tonga and the Tu‘i Tonga (often including origin myths), ‘Uvea has some particularly strong traditions, perhaps indicating interactions over a longer period (see Burrows 1937). The stories of the ‘Uvean craftsmen, with ‘Uvean stone used for monument construction at Tongatapu, is an example (Burrows 1937, 18, Sand 2008, 77), signalling the importance of ‘Uvean resources and skills, within the Tongan interaction sphere (Neich 2006). The sending of ‘*inasi* or tribute by ‘Uvea is often emphasised (Herda 1988, 42, Urbanowicz 1975, 42-44) but perhaps overshadows other types of exchange or interaction. Archaeological evidence on ‘Uvea has included surveys and mapping, but its interpretation is constrained by the lack of dates. Importantly, ‘Uvea’s environmental context differs from islands of the Tongan archipelago, and thus, social and political structure might similarly contrast with other islands within the Tongan maritime regime.

6.6.2 Event: ‘Uvean context and Tongan interventions

It must be emphasised here, that the chronology of events relating to Tongan conquest and subsequent ‘Uvean political organisation is far from settled, with the traditions providing confusing and conflicting series of events and characters (see Herda 1990, Pollock 1996, Sand 2008, 93-94). It is not the intention here to adjudicate these histories, as the exact order of events is of less significance than the overall assessment of broad patterns of behavioural variation.

6.6.2.1 Overview summary of evidence from environment, archaeology and traditions

The following evidence summarises the environment, traditions and archaeology. Appendix C contains the datasets, but for a fuller review of ‘Uvean background material, from which the following summary is drawn, see Appendix E.

6.6.2.1.1 Environment

‘Uvea lies midway between Fiji and Sāmoa, with Futuna, its nearest neighbour, 180 km to the southwest. The island of ‘Uvea is 96km^2 in area, 15 km long and 7 km wide, and is of volcanic origin, with a fringing reef and a coral barrier reef forming a lagoon; the barrier reef has four main passes with twenty-two islets in the lagoon or on the reef (Burrows 1937, 8-10, Frimigacci et al. 2016, 20, Sand 1998, 92). The lagoon in the southeast is deeper than in the northwest, and thence has a greater diversity of marine resources (Kirch 1975, 381). ‘Uvea has a gently undulating topography, with its highest point of 151 m in the north. The vegetation traverses four zones (see Sand 1998, 92-93 citing Barrau 1963, 157-160). Most gardens are in the central southern area, while the central northern area is what the Wallisians call the desert, *toafa*, with heavily laterised soils, being somewhat limited for cultivation (Frimigacci and Hardy 1997, Kirch 1978, Sand 1998, 92-93). Kirch (Kirch 1975, 378-380) noted that the southern areas of ‘Uvea have the best biotopes, with basaltic soils which are less laterised (than those of the north) and are near to the crater lakes, as well as the marshy lowlands for intensive drainage system agriculture, and access to the adjacent fertile arable upland plateau for swidden agriculture. In the littoral swampy margins, with humid lagoonal soils of 75% calcareous sand, taro is grown (Kirch 1978).

‘Uvea’s tropical maritime climate is warm and humid, and while average annual rainfall exceeds 3000 mm, there is a distinct wet/dry seasonality. There are no permanent streams or watercourses, although there are springs and seeps at the base of shore cliffs (Kirch 1976, 1978, Sand 1998, 92, Sichrowsky et al. 2014, 333-334). There are seven crater and depression lakes, predominantly in southern ‘Uvea (Burrows 1937, 8, Sichrowsky et al. 2014, 333-334). It is apparent that some natural resources, especially freshwater, were not evenly distributed, making this is a “patchy” environment, with associated constraints (Kirch 1976, 33). In the southwest, Lake Lalolalo is revered, and protected by a surrounding “taboo forest” (*vaotapu*), recognised by ‘Uveans for its ability to attract rainwater, even though rainfall may be intermittent, and so acting as a guaranteed water storage facility, with the supply then filtering through the ground to emerge as springs near the coast to the irrigated taro fields (Guiot 2008, 108-109). The *vaotapu* incidentally provides habitat suited to pigeons, a point relevant to the location of *sia heu lupe* (Guiot 1998).

The palaeoclimate of ‘Uvea, given its latitude, may more closely follow that of Palmyra, i.e. a period of drier conditions in the eleventh to thirteenth centuries, and a comparative increase in wetter conditions from the seventeenth century onwards. Recent limnological investigations in ‘Uvea support the Palmyra evidence of drier conditions but also reveal that this period was extended into the sixteenth century (a gap in the Palmyra coral sequence), with the driest conditions occurring in the AD 1500s, before becoming gradually wetter from the seventeenth century onwards. Matthew Prebble (pers. comm) comments that “initial indications of δD^2H hydrogen isotopes from algal lipid extractions (dinosterol, see Sachs et al. (2009) and Richey et al. 2016) are revealing that between AD 1100-1500, Wallis [i.e. ‘Uvea] was relatively dry compared to the present day, but became even drier during the sixteenth century, then rainfall appears to have steadily increased, reaching current levels by the twentieth century. Similar trends have been observed from preliminary δD2H lake records from Vanuatu and the Western Solomon Islands”.

6.6.2.1.2 Traditions

The work of Burrows (1937) provides much of the resource material for this section. Henquel, between 1896 and 1910, recorded oral traditions and genealogies in the ‘Uvean language *Faka‘uvea*, forming the first written history, *Talanoa ki ‘Uvea* (Miller-Helu 2011). Burrows incorporated a translation of Henquel’s traditions in his 1937 volume. Later in the twentieth century, traditions have been collected from local informants, by Frimigacci and Vienne (see Frimigacci 2000, Leleivai 2003, Sand 1998). Among the above multiple sources, there is no “correct” original version of oral traditions (Leleivai 2003, 339). Earlier traditions appear to have been overwritten by subsequent events and by competing narratives. Indeed, some Tongan traditions appear to have become incorporated into ‘Uvean histories, relating earlier Tongan events as if they were part of ‘Uvean history. An example is the tale of Tu’itatui (11th Tu‘i Tonga), where traditions speak of Tu‘itatui Tongan possessions including ‘Uvea, and that ‘Uvean craftsmen built the Trilithon (Herda 1988, 39-40, Sand 2008, 77), yet this must predate the Tongan incursion into ‘Uvea, as recorded in most traditions, at least.

Henquel’s accounts of early chiefs indicated these were independent rulers, and Burrows suggested Tu‘i Alangau and Tu‘i Lauliki were likely examples of independent chiefs, residing in the southwest part of ‘Uvea, and that there were many battles arising amongst rival chiefs, and thus there was no united pan-island rule (Burrows 1937, 40). Henquel’s genealogy (in Burrows 1937, 18-19) listed seven “ancient kings” commencing with Tauloko, covering a period from AD 1150-1600. Miller-Helu (2011) revised this to show Tauloko as the first king commencing AD 1450, presumably to better align with genealogies, and the expansionist campaign of Kau‘ulufonua. Henquel’s list, which begins with the first Tongan appointment, does not include earlier ‘Uvean rulers, if indeed, such did exist.

Oral traditions record the rapid development of Tongan political control of southern ‘Uvea, according to genealogical reckoning, in the fifteenth century (Sand 1993, 45). Kau‘ulufonua led a war of conquest across the region (Herda 1988, 50-51, Rutherford 1977b, 35, Sand 1993, 45). Both ‘Uvean and Tongan traditions include an assassination as the motivation for Kau‘ulufonua’s maritime campaign, although they differ on who was assassinated (Sand 2008, 82). Most accounts relate that it was in ‘Uvea that the assassins were finally caught (Frimigacci 2000, Kirch 1984, 224-225, Rutherford 1977b, 35, Sand 2008). The different accounts of an assassination support the occurrence of the event, or at least some major upheaval. Yet other traditions relate that in the time of 23rd Tu‘i Tonga, Takalaua, Tongans "came and built forts", as recorded by Gifford (Gifford 1929, 40-52). This major intrusion (with associated strong traditions) was known in ‘Uvean history as the period "of the forts" (Frimigacci 1997, 343). However, the sequence of events is far from clear, with confusing and conflicting tales.

At the centre of the confusion is the nature and order of appointments, and subsequent re-appointments of governors or kings to ‘Uvea. This may reflect the ongoing instability on Tongatapu, with the establishment of the dual paramountcy, or the possible seizing of the Tu‘i Tonga's authority by rival lineage members. Tauloko, the first ‘Uvean *hau* or king, in the ‘Uvean version was sent by the Tu‘i Tonga at the ‘Uveans request (Burrows 1937, 18). Henquel tells of Tauloko being of the Tu‘i Tonga lineage and being appointed as governor of ‘Uvea and crowned by "Hoko", a Tongan chief (Burrows 1937, 18, Sand 2008). This suggests that he was the Tu‘i Tonga appointee, following Kau‘ulufonua's conquest of ‘Uvea. Tauloko lived in south-eastern ‘Uvea, at Ha‘afuasia, and traditions record that he was buried in a stone house (*fale maka*) – a burial vault (Burrows 1937, 43). This is perhaps the first burial vault and is thought to be an indication of the introduction of Tongan cultural traditions and systems to ‘Uvea (Sand 2008, 83). However, in an alternative reading, it is possible that Tauloko, rather than dying in office, was deposed, and replaced, just as other replacements of governors to subjugated islands occurred, following the new (or rival) Tu‘i Ha‘atakalaua lineage assuming power on Tongatapu (Sand 2008, 96). This is seen in ‘Uvea where the second ‘Uvean *hau* was Ga‘asialili of Tu‘i Ha‘atakalaua lineage. He was accompanied by two noble Tongan families (Kalafilia and Fakate) but also by guardian warriors (men of the lineages of Ha‘amea and Ha‘avakatolo) (Burrows 1937, 18). At this time, the land of ‘Uvea was partitioned into three (see Figure 14), centred on Lake Lanutavake, with Kalafilia taking the west, Fakate the north and central desert plateau (*toafa*), and Hoko the south (Burrows 1937, 18, Sand 2008, 84). This partitioning appears as some sort of *détente* between Tongan lineages, but perhaps of greater note is the water resource at the centre of this division. Lake Lanutavake is recorded as the first fortified place on ‘Uvea (Burrows 1937, 20), and from here at least seven roads radiated out, linking to other forts. Chief amongst these forts was Kolonui, but smaller forts also appeared along the linking road network – these roads were either cut into the ground or enclosed by raised stone walls (Sand 2008, 85). This construction activity, which also included large platforms, wells and burial mounds, occurred in southern ‘Uvea (see Frimigacci et al. 2016).

In some versions of the tradition, Ga‘asialili appears not to have remained long on ‘Uvea, but was killed in Futuna, after a failed attempt to seize control there. In ‘Uvea he was succeeded by a harsh ruler, Havea-Fakahau (Burrows 1937, 20), during whose reign the great canoe Lomipeau was built (Burrows 1937, 23-24). The Lomipeau story (see Neich 2006) began with a dispute, following which the two opponents sought direction from the Tu‘i Tonga (29^{th}) Tele‘a, on “his island of ‘Uvea” (Burrows 1937, 24). So, the double-hulled canoe may be a metaphor for a dispute over boundaries or property in ‘Uvea, or perhaps the right of Tongans to exercise control. This may also reflect a reinvigoration of Tu‘i Tonga authority under Tele‘a.

Descendants of Kalafilia and Fakate (two of the three amongst whom the island was divided) are said to have disputed boundary locations, each claiming that Lake Lalolalo (the deepest lake in the west) belonged to him, and again the dispute is said to have been resolved by seeking the counsel of Tele‘a (Burrows 1937, 22). This dispute suggests that water resources were critical, and worth defending. Further indications of this importance of water access and rights is recorded in Henquel’s account (Burrows 1937, 20) when the two Tongan lineages appear to be seeking habitation places with springs, in the vicinity of the lakes. The description provided by Henquel (translation in Burrows) appears to indicate that the forts were established within and around, or between, several of the lakes, including Lanutavake.

The subsequent successions to the ‘Uvean title appear to have been the subject of much rivalry, with numerous traditions of intrigue and assassinations (see Burrows 1937). This involved not only rival lineage members but also Tu‘i Alangau who appears to have entered into both political and marriage alliances with Tongan rulers.

The ‘Uvean dynasty of Takumasiva (AD 1600-1660, according to Henquel), when ‘Uveans perhaps sought to bring to bear their own style of rule, was recorded as an initial period of stability. This was followed by a period of upheaval, with indications that Tonga tried to reassert control in ‘Uvea (Burrows 1937, 30-34). If this was indeed in the AD 1600s, then it may parallel events in Tonga, where political instability was apparent, with different groups vying for power. The ‘Uvean system, while perhaps established in the era of Tongan control or influence, nonetheless eventually developed a particular ‘Uvean character, such that it was distinguishable from the Tongan style, as Sahlins (1958) described in his status levels (see

Chapter 2). While beyond the scope of this research, the process of the development of the ‘Uvean system likely involved both competitive and cooperative behaviours, between ‘Uveans, as well as with external parties.

6.6.2.1.3 Archaeology

Archaeological work on ‘Uvea, as previously outlined at 5.4.2, includes Kirch’s 1970s study, and Frimigacci and Sand, Vienne and colleagues in the 1980s-1990s. There are very few dates resulting from these archaeological endeavours, and thus some basic chronology has to be established, albeit with great difficulty, from traditions. Figures 15-16, with their brief descriptions, illustrate the spatial distribution of some archaeological features.

Apart from early ceramic sites, the oldest “sites” which provide evidence of ‘Uvean socio-political systems, occur at Lausikula Point and at Lauliki in Hahake. Both these are associated in traditions with independent chiefs: Tu‘i Alangau and Tu‘i Lauliki. At Lauliki (in Hahake) Burrows (1937, 41-42) recorded named back-rest stones, presumed to be those of old chiefs (predating Tongan incursion). More recent work has shown this to be a significant site of settlement with many features, but regrettably without any dates.

Through the second millennium AD, while there is evidence that settlement occurred around the northern coast, in southern ‘Uvea there is an apparent higher density, including into the interior (see Frimigacci 1997, 2000). Southern ‘Uvea has many archaeological features, principally earthen mounds and stone structures such as platforms, (*mala‘e* and *paepae*), fortification walls, boundary walls, road markers, and wells. Southwest ‘Uvea in the area of Utuleve and Lausikula Point has a longer history of occupation, with Utuleve being the site of initial Lapita colonisation (Sand 1998). Hence, Utuleve and the surrounding southwest area has seen much more archaeological work; it includes the large platform known as Malamatagata, as well as the second platform known as the residence of Kalafilia. The very large size of monuments (Malamatagata, and particularly Talietumu in Kolonui) suggests the ability to commission and mobilise a large workforce – which is assumed to have been a result of Tongan arrivals. Conversely, the numerous habitation mounds of earth with stone facing, oval or rectangular in shape, are assumed to be ‘Uvean.

Burial mounds with stone vaults are recognised (or assumed) as Tongan in origin. Frimigacci and colleagues found more than 70 burial sites during surveys, ranging from 2 m in diameter and 20 m in length, either stone faced or without surrounding wall; traditions say the large

burial mounds contain burial vaults, although there is almost no confirmatory evidence (Sand 1998, 97).
At Lausikula point, near Utuleve, Atuvalu, meaning “row of 8 tombs”, is the location of the burial excavation which identified a high-ranking male. Radiocarbon dates from skeletal material provided a date in the early fifteenth century. However, there was no evidence of inner vaults to signal Tongan influence. Frimigacci has proposed that this burial is that of the mythical chief Puhi (Frimigacci 1997). This is then interpreted as being prior to the major Tongan incursion, but not necessarily precluding Tongan interventions in southern ‘Uvea. It is noted that burials in this location were “excavated” by missionaries in 1896, who reported that they had found burials, within stone vaults, of eight chiefs, including the third ‘Uvean king (Burrows 1937, 41-42, Sand 2008, 88). This then might suggest a Tongan style of burial for high-ranked individuals, but these records, are doubtful and unclear. In discussing the architecture of the mounds at Utuleve, i.e. Malamatagata, Sand (2008, 99) noted that the several episodes of construction make it difficult to suggest that these are Tongan style or influence. Rather they are simply ‘Uvean or ‘Uvean-Tongan, but reflecting the natural landscape, which differs from that of Tongatapu. This may not correlate well with oral traditions, but it appears that there is a much more complex history than related in traditions (Sand 2008, 100).

Much of the archaeology of ‘Uvea could best be described as prehistory, as it seeks to align archaeological evidence with traditional accounts and legends. As Frimigacci (1997, 333) relates, linking stratified sites and surface monuments with oral traditions was an important aspect of their work programme. The starting point was the oral traditions,[28] with the aim of locating archaeological evidence to confirm these stories (Frimigacci 1997, 333). Monuments are classified (categorised according to shape, size, facing, material), but these typologies are not further developed. The example of the excavation of the Atuvalu burial seeks to connect a legend with archaeological evidence and thence to relate that to Tongan-‘Uvean interactions – in this case suggesting an earlier period of Tongan interactions in the time of 11th Tu‘i Tonga (c AD 1200). Other monuments excavated (Malamatagata and Kolonui) have similarly revealed evidence of earlier use of the sites and effectively provided possible commencement dates for the monuments, although linking this evidence to a Tongan presence in ‘Uvea in the early dynastic period (10th – 11th Tu‘i Tonga), as Frimigacci (1997, 344) attempts, is

[28] Traditions are often a starting point for archaeologists, and provide a valuable resource, as noted in Chapter 3.

problematic. The similarity of burial mounds to those of Tongatapu has been seen as indicative of early Tongan intervention, i.e. before AD 1400 in southern ‘Uvea (Sand 1993, 45).

The most impressive monuments are the fortifications, such as Kolonui and Lanutavake. Lanutavake is 700m in diameter, with eighteen gates and a surrounding ditch 4 m deep in places (Sand 1998, 98). Kolonui is a vast fortified structure, within which is situated the Talietumu residence; it is linked to Lanutavake and other forts by a road network (Frimigacci et al. 2016, 106-107, 239-250). As with Malamatagata, a structure underlying the platform has been radiocarbon dated to the end of the first millennium AD (cal AD 714-1010) (Frimigacci 1997, 343), indicating earlier site use. Several other fortifications appear along the roads and near the lakes, some with numerous house platforms in the vicinity (Frimigacci et al. 2016, 108-114, Kirch 1975, 400-401), an association which Kirch (1975, 397) emphasised.

Many of the monuments of southern ‘Uvea are said to appear Tongan in origin, on typological grounds at least, as Sand (1998, 115) avers. The evidence for this is found in the large raised burial mounds with chambers, and the use of tapa cloth to wrap bodies (Sand 1998, 115, 2008, 88, Sand and Valentin 1991, 240). The evidence appears to indicate that Tongans introduced three types of monuments – buried vaults within raised mounds, *sia heu lupe*, and stone wells (Sand 2008, 88-89). Kirch (1975, 393-396) considered that the mound at Fugauvea (MU-96) looked similar to the Tongan *sia heu lupe* (Kirch 1975, 396, 1976, 50), although it is not noted as such by Frimigacci et al. (2016, 99-100). The presence in ‘Uvea of pigeon mounds and stone-walled fortifications, Kirch asserted, provided “solid archaeological evidence” of Tongan-‘Uvean contact (Kirch 1976, 59). Again, one cannot conclude that Tongan control occurred or even that Tongans introduced structures, without further analysis of this apparent similarity. There is evidence (without chronology) for horticultural plots in the area between Lanutavake and Utuleve, again linked to forts via the road network (Sand 1998, 115 citing Di Piazza 1992, also Sand 2008, 86-87). These are also said to be of Tongan influence but do suggest that agricultural productivity was important in this area (see Figure 16).

The war of Molihina was supposed to have been an uprising by northern chiefs against Tongan domination (Sand 1993, 47), but archaeological evidence of burials from Pela Pela and Petania, linked in traditions, does not align with the main event of Tongan incursion in the period "of the forts".

In summary, there is little archaeological data that can be used to distinguish between 'Uvean construction of stone monuments or defensive works and the subsequent Tongan period "of the forts". Whether these various "Tongan-style" structures relate to earlier in the conquest period, or are a manifestation of subsequent intergroup rivalry and competition, requires much more detail, including dates and analysis of architecture, building on the work of Frimigacci and others in their examination of Malamatagata and Talietumu, both of which provide evidence of continuity of occupation. There is somewhat limited evidence of Tongan-style structures such as chiefly bathing wells or *sia heu lupe* or even burial mounds. What we see in 'Uvea is possibly a function of the 'Uvean landscape, i.e. basalt lava rock is widely available as a building material, in the southern area at least. We would therefore expect to see stone structures, including walls and habitation platforms. If a strong Tongan presence indeed resulted in a proliferation of Tongan-style structures then this requires some classificatory analysis, which of course relies on robust data, and general theory to guide class formation. The inability to make appropriate comparisons across Tongan "colonies" limits such endeavours. An analysis of environmental changes (whether a changing climatic regime or anthropogenic change) would also better delineate constraints.

6.6.2.2 Hypotheses

The evidence summarised suggests that three models might usefully be employed. The optimality model IDD is used for the first two hypotheses (7 and 8) which examine the 'Uvean system prior to the mid-millennium Tongan expansion; applying the Allee principle to the IDD model in addition to the game theory iterated PD model then looks at the development of cooperation as environmental conditions changed. The significant event of Tongan expansionism and incursion resulted in a more abrupt change to social systems, and for this, the game theory H-D model informs the third hypothesis (9).

Hypothesis 7: Early in the millennium, a heterogeneous spatial distribution of resources, with some higher quality environments being economically defendable and others being of greater risk and uncertainty, created conditions for a despotic regime, with a low level of hierarchical organisation, and some degree of intergroup competition.

Hypothesis 8: A changing climatic regime brought unstable environmental conditions which changed the social system such that economic defence of dense and predictable resources favoured cooperative within-group behaviours, and competitive exclusion of others.

Hypothesis 9: At the advent of Tongan incursion, in continuing adverse climatic conditions, intergroup conflict and competition for spatially circumscribed resources of high value tended to a predominance of aggressive behaviours in an unstable Hawk-Dove mix.

6.6.2.3 Model predictions

In the early ʻUvean phase, prior to Tongan expansionism, for the evaluation of hypothesis 7, the IDD model predictions should be evident as:

- Resources unevenly distributed or patchy, with some areas with dense and more predictable resources, while others are lower quality and/or less predictable.
- A degree of inequality with differences in competitive ability and thence resource control.
- Population settles in the best habitats (dense and predictable resources or high resource value) but under conditions of submission to dominant.
- Some degree of territoriality is evident in economically defendable areas.

And with changing environmental and social structure, for hypothesis 8, the IDD model with Allee effect and the iterated PD model predictions suggest:

- Population group size increases in areas of best habitat as other areas become constrained by changing environmental conditions.
- Increased (agricultural) productivity and territorial defence in the areas of best habitat.
- Increased labour inputs evident in construction of public good works in areas of higher resource value where despots exert some control.
- Clustering and sharing in areas of denser resources as environmental conditions deteriorate.
- Evidence of shared effort in production and labour, also in territorial defence of resource.
- Predominance of cooperative behaviours within groups where interactions are repeated.

Finally, in the Tongan expansionist phase, the “period of the forts”, for hypothesis 9, the H-D model predictions include:

- Additional individuals or groups join or invade existing ‘Uvean groups.
- Interactions are no longer predominantly between familiar individuals in an iterated PD.
- Predominance of cooperative strategies (in the iterated PD above) between existing ‘Uvean group members changes with the addition of external individuals or groups.
- The system changes with different types of interactions including an increase in competitive strategies.
- Aggressive competitive behaviours predominate, especially in areas of high resource value.
- Amongst Tongan rivals, intragroup competitive hawk behaviours increase where political capital is the resource of value.

6.6.2.4 Evaluation

6.6.2.4.1 Early interactions

In the period preceding Tongan expansionism, it is assumed from the traditions that ‘Uvea was ruled by autonomous and independent chiefs (Sand 2008, 78), spread across ‘Uvea. If an IFD were to prevail in the early period, the expectation would be that access to the full range of resources was not spatially constrained, i.e. through periods of variable environmental and climatic conditions, individuals and groups were able to range across the various ecological zones. The implications of this social structure would be that groups were possibly loosely clustered and affiliated with local chiefs, moving within resource areas, marine, coastal and interior, supplementing staple terrestrial with increased marine resources, as required seasonally or in years of unfavourable climate. So, while there might be some level of risk, overall, the environment was not highly unpredictable. However, given the spatial differentiation within ‘Uvea, as outlined at 6.6.2.1 above, together with the evidence in traditions of intergroup rivalry, and as further examined below, an IDD may be indicated.

Locational variation in resource distribution might also delimit chiefly boundaries, especially since terrestrial resources were spatially variable across the island, with a clear spatial differentiation between north and south. Given this resource gradient, differences in competitive abilities and thence unequal access to, and control of, resources could be expected to result in a despotic distribution. The area around ‘Utuleve (and Lausikula Point) in southwest ‘Uvea appears always to have been a major area of activity, as evidenced by continuity of use from initial colonisation. Tu‘i Alangau is said to have ruled in this southwest location, and while he may have been a pre-eminent or paramount chief, there is no suggestion of a pan-island polity. Some intergroup rivalry between local chiefs is indicated in the traditions, so the natural defensive features of Lausikula Point might be a reason for the selection of this location. Tu'i Lauliki, who is also mentioned in traditions as an independent early 'Uvean chief, ruling presumably from Lauliki (near Lake Lalolalo), which is associated with the Lomipeau legend, is another likely example where low-level despotism might occur.

At this period, beginning possibly in the thirteenth century, drier conditions started to prevail (see 6.6.2.1.1). While the northern interior on 'Uvea was arable, water resources in the north were restricted, largely confined to springs near the shore. At some period, the inland area was burned to encourage sprouting of wild plants and yams, and thus the area came to be known as desert or *toafa*. Terrestrial resource distribution in northern 'Uvea was therefore uneven or patchy, of poorer quality in some locations, and habitation was focussed on coastal areas for the limited freshwater availability, plus access to the marine resource. Optimal areas for habitation would thus be predominantly in the south, with access to marshy lowlands for intensive drainage system agriculture, to the arable interior for swidden agriculture,[29] and to the lake freshwater resource, as well as better access to a deeper lagoon, and greater diversity of marine resources. Given the subsistence regime incorporating agriculture, with constraints in freshwater access, increasing competition for the southern lacustrine resource could be expected.

If, as appears evident from regional palaeoclimatic studies (Cobb et al. 2003) and confirmed by recent data (see at 6.6.2.1.1 above, Prebble pers. comm), commencing in the thirteenth and fourteenth centuries, the climatic regime started to change to an increasingly unpredictable environment with an extended period of lower average rainfall and drier conditions (or periodic droughts), and with increased resource stress, the expected behavioural response would be increasing intergroup competition but also a degree of cooperation within groups, as outlined below. Chiefly rulers might be expected to begin to exercise greater control over resources, thereby maximising their own fitness, but leading to more dominant-subordinate relationships, in an increasingly despotic regime (an IDD). This period of unstable or deteriorating climatic conditions should also see an increase in the use of marine resources, as well as risk management strategies such as breadfruit storage or inducing growth by firing scrublands in the northern *toafa*, as aridity reduced productivity of some of the staple starchy

[29] The advent of intensive drainage system agriculture in coastal lowland areas (with the taro gardens or tarodière) might result in increased population in advantageous areas (period unknown).

food items. These predictions should be evident archaeologically, given the necessary investigations.

In southern ‘Uvea, where there are several freshwater lakes, greater use of areas of richer resources in proximity to the lakes would be advantageous. This, in turn, would result in increases in local group size, with advantages from an Allee-like effect where additional group members provide individual benefits from within-group cooperation and in territorial defence (see Codding, Parker, and Jones 2017), as explored further below. The evidence of higher settlement density in southern ‘Uvea, while there is no associated chronology, does suggest that individuals or groups may have been attracted into more productive areas. There must, however, be some trade-off to this action. In increasingly unpredictable conditions, it may be better for individuals to forfeit some fitness in order to benefit from the higher resource value in the despot’s location. In effect, additional group members may be attracted under conditions of submission into a despot’s higher quality environment.

The evidence of structures in proximity to the southern lakes, with associated habitation areas, and connections via an extensive network of roads, while generally associated with later Tongan conquests, may have had an earlier origin. Initially, an increase in densities might have developed as clusters of habitations around areas of higher agricultural productivity in the southwest. Figure 16 shows the spatial extent of horticultural plots bounded by low walls in the southwest, which, while possibly a result of later patterns, nonetheless suggests that this area was suitable for horticulture. Indeed, while it has been assumed that agricultural intensification was a Tongan initiative (Sand 1993, 48) there is no apparent reason to suggest these plots were not an earlier ‘Uvean activity. Assuming some contemporaneity of roads and walled areas, it can be proposed that the clustering of habitations was initiated during a period of adverse environmental conditions, which resulted in cooperative ventures to facilitate access between interior arable land near water sources and coastal areas with lagoon and ocean resources (and also the tarodière). These structures, such as the walled (lake) Lanutavake, appear more as bounded areas with communicating roads than as purely defensive structures. Lanutavake has more than eighteen access points which could be associated with network communications rather than being defended gateways, in the first instance, albeit that their subsequent use, with extensive ditch systems, may have been as fortified places. It should be noted that Lanutavake has not been subject to the same investigative archaeology as has Talietumu and Malamatagata. The apparent partitioning of land (see Figure 14) is indicative of territoriality and intergroup competition, i.e. in an area where resources were relatively more predictable and evenly distributed, a strategy of resource defence would be economically viable. But it is also suggestive of cooperation, which might be explored using the PD model in game theory.

Territoriality implies exclusive use of territory, archaeologically expressed in land partitioning and defensive features such as fortifications, so it is expected that there would be evidence seen in conflict, fortifications and territorial boundary markers (DiNapoli and Morrison 2017, 5-6). The archaeological evidence is unclear in the extent to which there was conflict prior to the "Tongan incursion", so this hypothesis cannot be adequately tested. However, given the necessary data, the economic defendability (ED) model might usefully be used to test the second hypothesis.

If an IDD model appears to explain southern 'Uvea at a period of increasing environmental instability, the benefits of cooperative behaviours with increased productivity, as well as the improved ability for territorial defence with more people to defend resource location, can be seen as an Allee-like effect, where additional individuals create a positive density dependence, at least until some saturation point is reached. In the Allee principle, as group size grows, there are economies of scale. There is evidence (in habitation platforms, although without chronology) for higher population densities in these locations. In this case, the benefits of investment in subsistence productivity and territorial defence provided by greater numbers of co-operators outweigh the costs of the non-cooperators (the free riders). In 'Uvea, the benefits of group cooperation would appear high, because of the critical water resources, where access to the resource provided large benefit, and group cooperation provided lower costs of defence of a critical resource. However, as group size increases, inevitably the point is reached where fitness declines and costs increase, as resources are depleted, and so benefits to individuals decrease. Further application of an extended model, including the issue of group size, is beyond this present research. Given more detailed evidence, the differences between excludable and non-excludable resources, here evident in examples of stone-walled precincts or fortifications (excludable) and route networks (non-excludable) could also be usefully explored. The walled horticultural gardens provide interesting material for further analyses.

The PD model is also useful in considering how cooperation may be maintained. Where the same individuals are interacting, the PD of whether to cooperate or to freely receive benefits of a public good, without paying the costs, takes the form of an iterated PD. In an iterated PD, the consequences of cooperating or defecting are spread across the group, such that cooperative actions are perpetuated because they are mutually reinforcing. However, as further additions to the group occur, the system changes, as interactions are no longer mainly between related individuals, and a disruption occurs to the system based on cooperation. In the ‘Uvean case, where additions are from outside as a result of the Tongan incursion, there is a major system disruption. Thus, an additional model is required to examine the new range and frequency of behaviours appearing.

6.6.2.4.2 Tongan incursion

For the purposes of this (second) evaluation, the interactions and behaviours of relevance are those associated with the cited conquest and subjugation event. This was the period of major turmoil and socio-political change occurring mid-millennium, as indicated in numerous, though often conflicting, traditions. Using H-D game theory and taking the Tongan incursion as an act of conquest, i.e. more or less a singular event, it can be surmised that given the resource and social structure outlined above, in the “early interactions” period, the H-D model would suggest there was an equilibrium of hawk and dove strategies, and a stable ESS.

The apparently intense period of Tongan activity in ‘Uvea was then imposed on this pre-existing environment and occurred predominantly in the south. Therefore, it could be proposed that there was a differential advantage for Tongan parties in pursuing competitive strategies in this location, i.e. resources were available, controllable and defendable. Tongan incursion would change the dynamics of the game and the payoffs since the resource would remain the same. Resource value (RV) is important in the consideration of H-D strategies, as it is the payoff structure of resources, the costs and benefits, which drives the distribution of strategies (see 2.7). Thus, the RV would be reflected in the relative proportion or frequencies of hawk and dove strategies. The response of the resource holder is also related to the RV and whether the resource is economically defendable. In the case of conquest, Tongan incursion would be expected to be strongly resisted, as the southern ‘Uvean resource was dense and predictable and therefore economically defendable. Equally, given the higher RV, the best strategy for Tongans would also be aggressive competition. Thus, the RV would select for an increase in frequencies of hawk behaviours. The evidence from traditions tends to support this level of conflict, as does the evidence of “fortifications”. Although it has been suggested (above) that these structures had their genesis in cooperative and territorial behaviours at the earlier onset of environmental perturbations, these walled structures might readily have been modified for defensive purposes. Whether these structures were appropriated by Tongans, and when, is a matter requiring more detailed evidence. It seems unlikely that Tongans “built the forts”[30] although they may have been further used and developed, as is referenced in traditions. Further, as Frimigacci (2000, 153) has suggested, Tongans may have used fortifications (with significant rebuilding or additions) to signal their power and authority. This can be considered as signalling their ability to absorb the costs of aggrandisement and thereby reinforce their status and authority to rule. See comments at 6.3.2.4 and 6.4.2.4 on costly signalling theory.

The traditions outline that ‘Uvea was divided amongst three Tongan rulers. The division of the three territories was from the central point of Lanutavake (described above). The purpose of Tongan expansion into ‘Uvea has previously (at 6.3) been suggested as rising either from resource pressure on Tongatapu, or competition within the ruling elite, or both. If it were that political capital was the resource of value, it could be argued that expansion into northern ‘Uvea should also occur. Other than the apportionment of the northern district to Fakate, there is no direct evidence of incursion into the north, at least in the initial conquest period, where the (terrestrial) subsistence resource value was lower. In this environment, if the Tongans did seek to achieve political dominance, the lack of evidence of an ‘Uvean defensive response might reflect the lower subsistence RV. In the absence of some fitness-enhancing benefit, linking dominant gain to resource control (people or material), it is difficult to see how this would be advantageous to Tongan dominants. This suggests that in this northern area of low RV, hawk behaviours would not be an ESS. The implication is that political capital has to be correlated with some actual resource. If controlling the north resulted in control over all ‘Uvea, then this might be a plausible hypothesis. Ladefoged’s (1993) Rotuma study found that leaders emerged on the resource-poor side of the island. However, on ‘Uvea there is no evidence of the rise of elites in the north,[31] nor the attempt by Tongan rulers to usurp the position of northern chiefs – all focus appears in the south, at least until later in prehistory. Another possibility arises if the ‘Uvean environmental structure was more severely affected by drier conditions than was elsewhere in the sphere of Tongan control. Examining these variables, across the numerous islands of interest, would provide valuable insights into the variability of social interactions.

[30] There is no incontrovertible evidence on Tongatapu of investment in fortifications and particularly not of this style which required a stone resource.

[31] There is a later tradition of a major uprising in the north, led by a chief opposing Tongan control in the south, but this is not portrayed as an attempt to assume control over additional territory.

The traditions contain numerous accounts of hostilities, frequently arising amongst Tongan families of the two Ha‘a lineages of the south. This period of turmoil apparently follows soon after the supposed subjugation of ‘Uvea. Therefore, it is proposed that ongoing environmental and social perturbations may have led to increased intragroup competition, leading then to further intergroup conflict. Turning again to the H-D model, we might now expect the intensity of competitive behaviours to increase. Where the value of the resource is high, this tends to sustain a level of hawk behaviours. However, as the frequency of aggressive strategies increases, so the system becomes unstable, as hawk strategies predominate with a lower frequency of dove behaviours. This appears to correlate with the evidence of ongoing instability, indicating that aggressive hawk strategies had driven the system to fixation. There was no resolution or stabilisation of the regime.

6.6.2.4.3 Epilogue

At some point, this period transitioned to a more stable regime and socio-political structure. While this is not pursued in this analysis, for completeness, a brief outline is provided here. The advent of a uniquely ‘Uvean hierarchical hegemony appears with an island-wide paramount, but not with the sort of divine powers of the Tongan version. Chiefs based on villages retained local control (Burrows 1937, 70), while loosely united under *hau*, which perhaps reflects ‘Uvean natural and social structure, rather than being a copy of the Tongan system. The importance of this epilogue is to reinforce one of the key purposes and findings of the case studies – to determine variability across the range of TMC interactions.

6.6.3 Overall assessment and summary

The first and second hypotheses are predicated on increasingly deteriorating environmental changes providing conditions for the emergence of hierarchical organisation and within group cooperation. If contradictory palaeoenvironmental evidence is adduced, this hypothesis is clearly refuted. The chronology of the structures across southern ‘Uvea is also fundamental to this hypothesis, and with only two dates currently available, additional archaeological evidence may well challenge the assumptions presented in the argument. It is quite likely that a more complex series of events contributed to the southern ‘Uvean landscape, so a chronology for the structures is critical for re-evaluation of the hypotheses. Observations that would refute the third hypothesis also include dating evidence for monumental architecture – if fortifications were constructed only after the major Tongan incursion, this would imply that “conquest and subjugation” was achieved more immediately, and suggest a different set of strategies, essentially requiring a greater frequency of acquiescent behaviours.

This evaluation of the ‘Uvean archaeology, traditional history and environment, has provided a different view of ‘Uvea in the second millennium AD, and challenged the interpretation of the ‘Uvean social structure, and of the relationships between ‘Uveans and Tongans. In this it departs from a strict examination of the TMC, yet, given the repeated evidence of interactions between ‘Uvea and Tonga, it is hoped that this will invite new avenues of research to further explore these links.

In considering the competitive actions outlined in the above evaluation, the issue it is not so much whether Tongans conquered ‘Uveans and built forts, but rather it is about the event seen as a collection of individual behaviours. Whether or not ‘Uveans were subjugated is not the primary question, rather, the important reflection is that ‘Uvean-Tongan relationships can better be examined by evaluating the range or variability or frequency of behaviours.

Map of ‘Uvea

Map 7: Island of 'Uvea (Wallis)
Showing surrounding reef system, with islets.
Reproduced from Frimigacci and Hardy (1997).

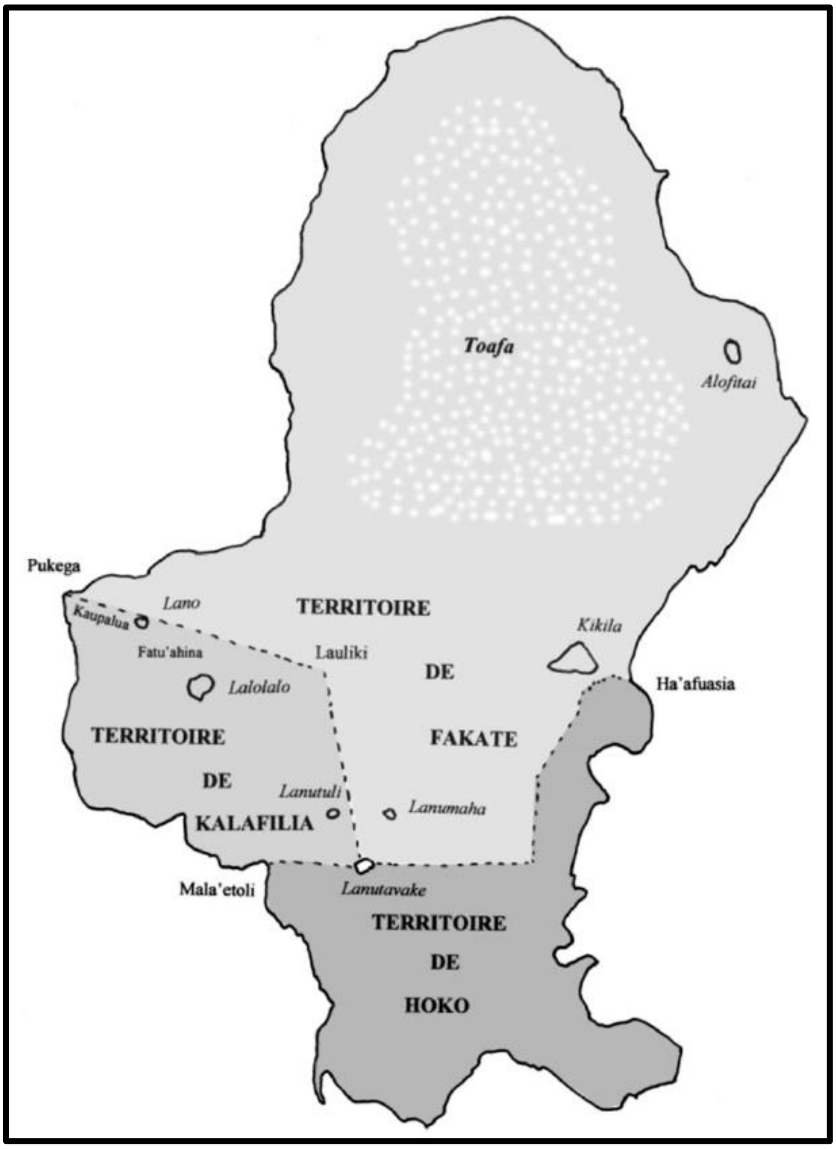


Figure 14: Partition of 'Uvea from Lanutavake

Showing ‘Uvea partitioned from the central point of Lake Lanutavake with portions to Hoko, Kalafilia and Fakate.

Reproduced from Vienne and Frimigacci (2006, 44 Figure 3).

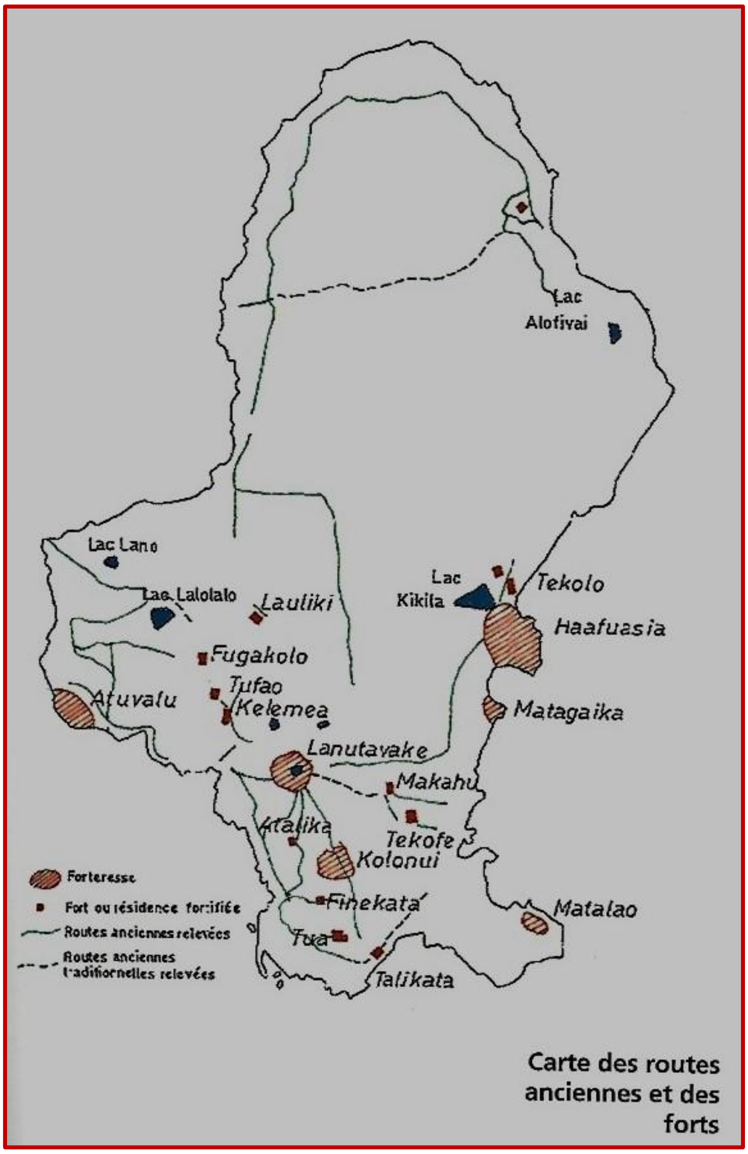


Figure 15: Southern 'Uvea with forts and road network

Large fortified areas, and small forts are shown red, lakes are in blue, and roads indicated.

Reproduced from Frimigacci and Hardy (1997, 53).

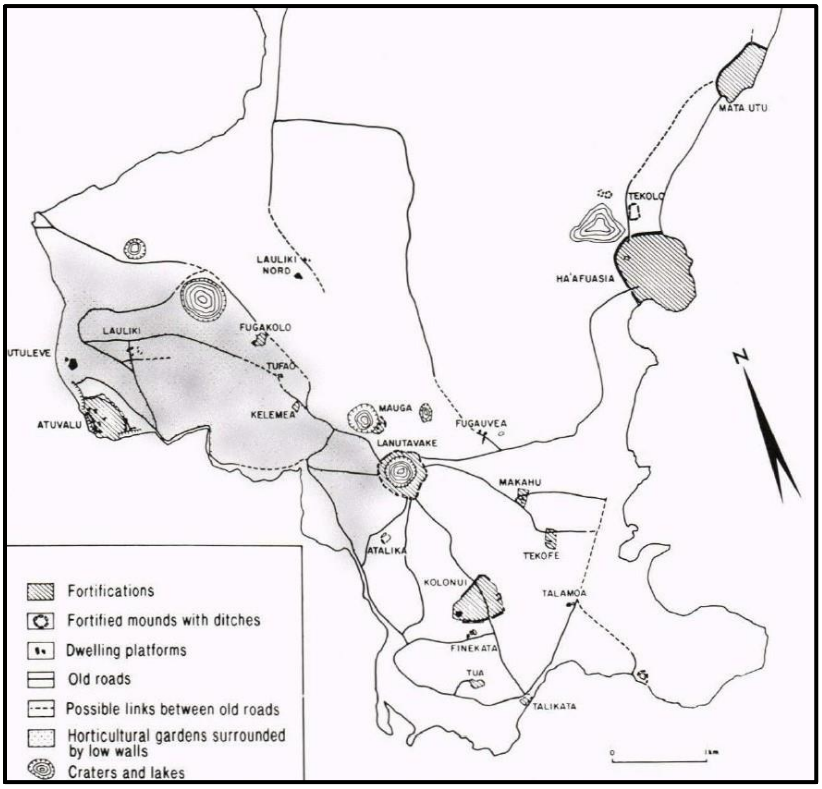


Figure 16: Southern 'Uvean lakes, forts, roads, gardens
Crater lakes, fortifications, small forts and roads; horticultural gardens surrounded by low walls occur in the southwest (stippled) area. Reproduced from Sand (2008, 86 Figure 4.4).

Chapter 7 Discussion and conclusions

7.1 Introduction

This discussion commences with an overview of the material addressed in the preceding chapters. The questions posed at the beginning of the thesis are restated, and the hypotheses that seek to answer those questions are reviewed. The discussion revolves around the case study evaluations, and then considers how these explanations have addressed the research questions. The EE models used in the case studies are reviewed and the reasons for their selection discussed. The point of difference in this research is outlined, noting how it departs from some previous studies. The limitations of the data and methods are acknowledged, and suggestions proposed for further work. Final comments draw the thesis to a conclusion.

7.2 Overview of chapters

The preceding chapters, and particularly the supporting case studies, have provided a broad, although necessarily brief, examination and evaluation of the TMC, or rather its expression in competitive and cooperative behavioural variation, and the evolutionary mechanisms that operated to direct strategic interactions between individuals, and between individuals and their environments. It is acknowledged that the work is centred on the chiefly elites, or the dominants, rather than the many individuals who formed part of this vast "empire", individuals who appear silent, in the main. This is largely because the traditions relate the stories of those remembered, rather than being an account of the inhabitants who make up populations. Archaeology has tended to follow this, as monumental architecture has inevitably attracted the most attention, arguably because, similarly to traditions, it is what has been memorialised in the landscape.

In the first chapter the scene was set for the challenging task of explaining the emergence, and increasingly hierarchical nature of the Tu‘i Tonga dynastic regime, by identifying the evolutionary mechanisms that influenced these changes. Chapter 2 looked at the way we try to make sense of cultural evolution and how and why chiefdoms, states, increasingly complex societies and socio-political structures developed from formerly more egalitarian systems. Some limitations of explanations of cultural evolution were identified, and an alternative approach proposed using evolutionary ecology models founded in the tenets of Darwinian evolutionary theory. Specifically, models that were useful in examining behavioural variation, both in strategic contexts and within environmental constraints, were identified. These included optimality models and game theory, as well as the economic defendability model. The models were developed to examine competitive and cooperative behaviours, as important factors in the emergence and persistence of social hierarchies; essentially, the models were used to explain why individuals, or groups, competed or cooperated and in what social and environmental conditions different behaviours were likely adaptive. An important consideration was the ability, using the models, to generate testable hypotheses deduced from the empirical data. Chapter 3 provided the background history to the Tuʻi Tonga and the TMC, drawing on traditional and ethnohistoric evidence. It noted both the great value and the inherent risks in the use of oral traditions. In the following chapter, the environment (island geography, geology and resource structure) was described, as well as an examination of the available palaeoclimate data. The limitations of this climate data for application to the Tongan archipelago remains a severe constraint in the interpretation of environmental context, upon which the case studies rely. The archaeology chapter provided a general account of investigations relevant to the case studies, noting the focus on monumental architecture and a general absence of available evidence on subsistence and settlement, and on agriculture, although acknowledging the incorporation of ecological context in some studies, principally those of Kirch.

The method and analysis chapter, using the evolutionary theory concepts outlined in Chapter 2, with models from EE, used a series of case studies to develop testable hypotheses to explain some of the observed phenomena. These case studies revealed a number of contrasts not only in environmental context, but also in the interactions between the Tongan paramounts or governors and local inhabitants, and in some cases Tongan intragroup rivalry. Accordingly, behavioural variability was evident across the different locations, resulting in quite different expressions of social hierarchy. This diversity and variation lie at the heart of the changing expression of the island empire.

7.3 Research questions

The hypotheses in the case studies were designed to address the research questions. The following discussion is therefore structured around those hypotheses. The research questions and the hypotheses are repeated here, for reference.

<u>The research questions</u>:

1. What evolutionary mechanisms explain the emergence and endurance of the Tongan socio-political hegemony?

- What explanations can be proposed for the emergence of inequality and the associated development of hierarchical socio-political organisation?
- What mechanisms operated to maintain these increasing levels of social stratification?

2. How did the Tu‘i Tonga hegemonic regime develop across the range of the TMC?

- How did differing socio-ecological environments contribute to variability?
- What evolutionary explanations can be considered for these diverse relationships?

The hypotheses:

Tongatapu phase 1

Hypothesis 1: Inequality emerged when differing competitive abilities and differential access to resources allowed dominants to increasingly control resources; as environmental conditions became more unpredictable, cooperative collective actions became beneficial to both dominant and subordinates, resulting in greater social integration.

Hypothesis 2: Subordinates cooperated in the hegemonic regime because there was a greater cost in defecting (non-cooperation) than cooperating (acquiescing to inequality) in a period of poor or unpredictable environmental conditions.

Tongatapu phase 2

Hypothesis 3: Increasingly competitive actions predominated as the numbers of Tu‘i Tonga lineage members rose, creating an unstable ESS (too many hawk behaviours); expansionist warfare or foreign assignments provided a means for Tu‘i Tonga to maintain control, while also providing competing collaterals with alternative (and less costly) options as junior governors, thus resulting in a more stable ESS (with increasing dove behaviours in the population).

Hypothesis 4: The concomitant establishment of administrative roles within Tongatapu was a mechanism to maintain the Tu‘i Tonga elite position while delegating the costly tasks of administration and maintenance of the political structure to competing lineage members. Creation of further junior titles and specialist roles provided a mechanism for elites to enforce cooperation of subordinates at less cost (others pay cost of control), and thereby creating multiple levels within the hierarchy.

Ha‘apai

Hypothesis 5: At the advent of aggressive incursions from Tongatapu, valuable resources within Ha‘apai favoured behaviours of competitive exclusion by the resource holders. An initial predominance of aggressively competitive strategies was followed by a more stable mix of lower frequencies of aggressive-competitive and more acquiescent (bluff-yield) strategies. An additional competitive strategy of the elite included asserting domination and control over labour and resources though ideological manipulation and by signalling competitive ability.

Niuatoputapu
Hypothesis 6: An egalitarian social system, where social and resource structure favoured an ideal free distribution, subsequently transitioned to a low-level hierarchical social order based on predominantly mutualist interactions between dominant and subordinates.

‘Uvea
Hypothesis 7: Early in the millennium, a heterogeneous spatial distribution of resources, with some higher quality environments being economically defendable and others being of greater risk and uncertainty, created conditions for a despotic regime, with a low level of hierarchical organisation, and some degree of intergroup competition.

Hypothesis 8: A changing climatic regime brought unstable environmental conditions which changed the social system such that economic defence of dense and predictable resources favoured cooperative within-group behaviours, and competitive exclusion of others.

Hypothesis 9: At the advent of Tongan incursion, in continuing adverse climatic conditions, intergroup conflict and competition for spatially circumscribed resources of high value tended to a predominance of aggressive behaviours in an unstable Hawk-Dove mix.

7.3.1 Question 1: Tongatapu case study

One of the primary research questions asked how the Tu‘i Tonga dynasty originated, but it also asked how and why social inequality emerged through the establishment of this hegemonic regime on Tongatapu, and why an increasingly hierarchical socio-political structure developed. Hypotheses 1 and 2 addressed these questions by proposing that some individuals had greater competitive abilities and thus a competitive advantage in the access to, and control of, resources. However, since inequality requires more than the imposition of power and control by dominants, i.e. it also requires acquiescence by subordinates, the hypotheses also proposed that there may be conditions in which such acquiescence was beneficial, and for this to endure, there must be cooperative behaviours, which in turn must have beneficial fitness consequences.

During the establishment of the dynasty at Heketā, and then Lapaha, environmental variability and population growth were relevant considerations but were not sufficient to explain the construction of monumental architecture and the institution of ceremonial rituals. Instead, the analysis suggested that the emergence of inequality and the subsequent hierarchy of the Tuʻi Tonga hegemony resulted from both competitive and cooperative behaviours, likely through periods of environmental change, with periods of risk and uncertainty when subsistence resources were less predictable. The importance of cooperative strategies (strategies driven by the mutual benefits of cooperation as a fitness-enhancing behavioural adaptation) was emphasised in the analysis. These behavioural responses can be explained in evolutionary terms. Natural selection has favoured phenotypes that allow variable behavioural responses to optimise fitness in differing environmental contexts. This is the fundamental theoretical premise in which evolutionary ecology is based. There is no inherent process by which societies progressively become more complex – rather, in some social and environmental conditions, evolutionary mechanisms operate such that certain behaviours are adaptive in those conditions.

Building on this primary research question, the analysis turned to ask why, in the period of lineage fissioning and expansionism, there was a higher frequency of aggressive competitive behaviours, and further, as social organisation became increasingly hierarchical, what mechanisms ensured maintenance of the social structure. Hypothesis 3 in response to these questions, proposed that increasingly competitive behaviours arose as the Tuʻi Tonga dynastic system increased in size, and intragroup conflict saw competing members vying for position, such that expansionism became an option of mutual benefit to individuals, with potentially lesser costs.

Coincident with this expansionist strategy was the establishment of the secondary Tuʻi Haʻatakalaua lineage and the delegation of administrative tasks to collaterals, and, a (presumably gradual) increase in the number of levels of administration and the range of specialist roles within the system. Hypothesis 4 therefore proposed that in an ever-growing regime, the need to maintain cooperation amongst subordinates resulted in the creation of multiple levels within the hierarchy and this was achievable by enforcing cooperation (addressing the collective action problem) which in turn required the incentivisation of those enforcing cooperation (with potential for a second order collective action problem).

The evaluation of the two hypotheses demonstrated that both competitive and cooperative strategies were employed. Modelling behaviours in terms of costs and benefits, i.e. in terms of maximising fitness, is helpful in exploring behavioural variation. In evolutionary ecology this is enhanced by considering not just fitness but what strategies are stable over evolutionary time. In times of significant stress, or resource scarcity, an increase in conflict or competition for resources is likely, but at the same time some degree of cooperation occurs. The predominance of competitive behaviours in a population, as occurred in Tongatapu and other islands of the Tongan Maritime Chiefdom, was inherently unstable, as demonstrated in the Hawk-Dove model, and thus the system eventually modified to a more stable mix when cooperative behaviours became more beneficial. This is because competition and cooperation are interlinked with environmental parameters, and the behavioural choices of others (see Boone 1992).

Rather than dichotomising competition and cooperation, the hypotheses here considered how competitive and cooperative strategies were maintained over the longer term. For the Tongatapu case study, the subject of evaluation was the evolutionary mechanisms of adaptive and labile phenotypes, expressed in behavioural variation in competition and cooperation which operated to establish and then maintain a stratified society.

7.3.2 Question 2: Islands of interaction case studies

Consequent to Tongan expansionism, several islands across the Tongan archipelago were incorporated into the Tongan Maritime Chiefdom. In examining the different island case studies, the evidence suggested that the relationships between Tongan rulers and local chiefs and inhabitants, differed from island to island. On Niuatoputapu there was little evidence of conflict, either in traditions or in archaeology. In comparison, ‘Uvea appeared to be in constant conflict – repeated in traditions and evident in archaeology. Ha‘apai appeared to have a strongly assertive imposition of control by the Tongan emissary, whereas on Niuatoputapu the relationship appeared more benign without any overt imposition of control. The research question then addressed how the hegemonic regime was variably reproduced and how differences in social and ecological structure contributed to that variability. The following hypotheses examined these questions for the relevant islands.

For Ha‘apai, hypothesis 5 addressed the evidence of aggressive competitive behaviours of both the Tongan rulers and the local inhabitants. While the analysis focused on the major incursion event, it suggested that competition for high value resources resulted in an unstable predominance of aggressive strategies, i.e. competition for resources. However, this instability gradually moved to a more stable mix with an increase in acquiescent behaviours, likely as a result of changes in population distribution and environmental structure. The hypothesis also proposed that the Tongan ruler, by signalling competitive ability, was able to gain dominance and control over both labour and resources, but at a lesser cost to all. Thus, in Haʻapai, competitive behaviours eventually resolved, but the lower frequency of cooperative interactions appears to have resulted in ongoing instability, albeit with some quiet intervals.

For Niuatoputapu, hypothesis 6 proposed a different relationship. Starting from a more egalitarian social structure (possibly a function of a small population on an isolated island), the changes to social organisation on Niuatoputapu were proposed to have been maintained in a low-level hierarchy with predominantly mutualistic relationships between the Tongan regime and the local chiefs and inhabitants. The apparently acquiescent behaviour of the Niuans was suggested to have been a consequence of social and resource structure and the cost of excluding Tongan parties compared to the benefits of maintaining exclusive rights to resources which were adequate but not rich. For the Tongan governor, the resource of value appeared to be political capital rather than subsistence resources. This was also suggested in the case for Haʻapai and Tongatapu. In contrast to Haʻapai, where the Mataʻuvave ruler signalled his authority and aggressively asserted his independence, the Tongan governor of Niuatoputapu appeared to operate largely independently of Tongatapu and was permitted to do so. While both Haʻapai and Niuatoputapu have monumental features marking out landscapes with “Tongan-style” burial mounds and pigeon-snaring mounds, the “ownership” appears to differ, i.e. on Haʻapai, Mataʻuvave “marked the landscape” on his domain of Uoleva, whereas there is no strong indication on Niuatoputapu that Māʻatu assumed such dominance.

For both Niuatoputapu and ʻUvea, the pre-existing environment and social structure was evaluated, as this was seen to be determinative in subsequent responses to, and interactions with, the Tongan contingent. This was particularly important for ʻUvea, since the relationships within the Tuʻi Tonga and the Tuʻi Haʻatakalaua lineages, and between these and southern ʻUvea, were complex, and involved protracted and aggressive negotiations. The hypotheses 7 - 9 for ʻUvea proposed that the heterogeneity in resource distribution across ʻUvea, led to the rise of a despotic distribution similar to that described for Tongatapu. On ʻUvea, a key variance was that there was a clearly identifiable spatial differentiation in resource structure, with economic defence of high value resources being cost-beneficial. The locational specifics of this resource structure suggested that cooperative behaviours would be preferentially selected, and repeated when environmental conditions changed such that there was increased risk and uncertainty. In this analysis, it was proposed that the construction of habitation platforms and walled boundaries around lacustrine resources in areas of higher agricultural productivity was of ‘Uvean origin, rather than being entirely attributable to later Tongan incursion. It was further proposed that the benefits of an investment in subsistence productivity and territorial defence resulted in an evolutionarily stable mix of group cooperation where fitness benefits were high and countered the costs of noncooperating free-riders. However, with the addition of Tongan parties, this stable mix of predominantly cooperative strategies changed to an unstable mix with higher frequencies of competitive behaviours, as evident in the “period of the forts”. That there was ongoing intragroup rivalry between Tongan and ‘Uvean parties suggests that constantly changing variables of resource structure, resource value and resource ownership meant that relative costs were also changing such that no evolutionary stability was attainable over any length of time.

7.3.3 Overall

Why did the hegemonic regime persist? Firstly, there was not one regime, but a continuous movement or process of adaptations to constantly changing variables, resulting in different expressions and degrees of stratification. Some regimes were more successful than others and persisted. Thus, it was not progressive, but an iteration between competitive and cooperative behaviours, responding to different variables through time, and across different locations.

In evolutionary terms, this can be explained as natural selection acting on behavioural variation such that the behaviours that persisted, i.e. were replicated, were those that increased benefits relative to costs – in this analysis seen in competition and cooperation. This differential replication of the optimal (in the sense of best alternative) behavioural strategies means that less advantageous variants occurred at lower frequencies or disappeared.

Unstable mixes of behaviours were evident through the period of fissioning albeit that different individuals (or collectives) experienced constraints differently and thus the costs and benefits differed. In the expansion and fission “events” (or patterns of behaviour) at several periods of the Tu‘i Tonga regime, these were related in part to a collective action problem. Collective action problems may occur in dominant-subordinate relationships, when groups grow to a size where the cost of enforcing cooperation requires repeated delegations to lower order ranks, necessitating an increasingly hierarchical structure, which then is difficult to maintain, particularly over large territories, since there is the risk of collaterals or juniors taking the opportunity to assert and compete – which is what was seen in the Tongatapu study, and also in the case studies of the other islands.

7.4 Models selection

The evolutionary ecology models selected were those with parameters providing the best fit to the patterns of behaviour. Where behavioural variation was constrained only by environment, optimality methods were used, e.g. the ideal distribution models. Where a strategic analysis was required to examine conflicts of interest and frequency dependence effects, game theory models were selected. Additional models useful in the analysis were also noted in some evaluations. Thesis limitations dictated some economy. Figure 17 below provides an overview of the principal models used, with additional models referred to in the evaluations also indicated.

	IFD	IDD	IDD Allee	PD / Iterated PD	H-D	ED	CST	Dominant-Subordinate	Collective action
Tongatapu *Phase 1* *Hypothesis 1*		✓		✓		(✓)	(✓)		
Phase 1 *Hypothesis 2*		✓		✓					
Phase 2 *Hypothesis 3*					✓				
Phase 2 *Hypothesis 4*					✓				✓
Ha'apai *Hypothesis 5*					✓		✓		
Niuatoputapu *Hypothesis 6*	✓			✓				✓	
'Uvea *Hypothesis 7*		✓							
Hypothesis 8			✓	✓			(✓)		
Hypothesis 9					✓				

Figure 17: Overview of EE models used
Arranged by island, and in hypothesis order. Ticks indicate principal models used; bracketed ticks indicate additional models mentioned in the evaluations.

Among the models used are some that are familiar and often-used, e.g. the ideal distribution models, while others appear to be modifications or adaptations, e.g. dominant-subordinate (Boone 1992) and collective action (Hawkes 1992, Hooper, Kaplan, and Boone 2010), both of which examine cooperation. Since models used in EE are heuristic devices, more than one model can be used to formulate a hypothesis; it follows that if one model is not useful another can be employed, meaning that there is not one that is the absolutely correct model for that explanation (DiNapoli and Morrison 2017, 9).

The selection of models could be challenged, but models were selected based on the data, and most importantly, as outlined at 6.1 and 6.2, the value of models in EE is that they are used to link the theory of evolution to empirical observations, and to generate hypotheses that can then be tested. Importantly, hypotheses may be confirmed or refuted by the evidence, but do not provide absolute proof of any explanation. Hypotheses may be modified, or alternative models may be selected, where fresh or contrary evidence is adduced. The scale of analysis might also dictate model selection. In this thesis, where the research aim is generally concerned with how inequality emerged in Tongatapu, and then how the hegemony was extended to other islands, the analytical focus is qualitative rather than quantitative.

7.5 Comparison of research frameworks

The point of difference in this work is the use of an explanatory framework which makes explicit its theoretical tenets, linking these to empirical data, using methods which allow the generation of testable hypotheses, and leaving an avenue open for new or different questions. A further difference is that it considers behavioural variability, not at the scale of societies or populations, but as the aggregate of individual behaviours.

Much previous work has focused on increasing levels of social complexity, and its progressive nature, by identifying stages of development, e.g. how chiefdoms were transformed into states. Tonga is particularly attractive for examining “archaic states” and complex societies, as it has many traditions as well as monumental architecture which can be examined archaeologically to explore when and how “state formation” emerged and developed (see Clark, Reepmeyer, and Melekiola 2016). The focus has been on monumental architecture and the expansionism of the TMC through conquest and warfare – as evidence of a powerful despotic regime. This has emphasised the competitive element but overlooked the role of cooperation in the transformation of societies.

Recent research has compared elite tombs data with categorised periods of state emergence, state establishment and lineage fissioning, and state collapse and reconstitution (see Clark 2016). Based on quantification of stone slabs, this comparative study used tomb size as a proxy for rank. On this evidence lineage fissioning is explained as an expansion of political hierarchy and a response to increasing social complexity. The correlation of (proxy) data with essentialist periods, delineated into rise, stabilise, and fall, has some appeal, as it aligns with accounts in traditions, but while this may seem to follow a logical sequence of events, there are limitations. Firstly, the development of hierarchical systems may have been more complex than this, i.e. waxing and waning (Parton pers. comm), and secondly, as a corollary of the first, categorising periods does not require any ultimate causation to explain why and how variable behaviours led to the emergence and persistence of complex societies (Aswani and Graves 1998).

Another interesting approach uses the concept of globalisation to assess Tonga as a centralised polity, based on an urban centre from which Tongan lineages controlled interaction spheres, trade and exchange, and ideology (e.g. *inasi*) (see Clark 2017). In this proposal, Tonga should exhibit central urbanisation, the evidence for which is found in the significant infrastructure investment in reclamation, harbour and wharf, which collectively signal Lapaha as an "urban centre" with centralised government. Parton (pers. comm) has suggested that the focus on Lapaha needs to be broadened to incorporate the entire cultural landscape – in essence, an urbanisation framework would assess the cultural landscape at island-wide scale, including (for Tongatapu) not only settlement nodes, mounds and fortifications, but the network of ancient roads. Herein lies both the promise and the risk. The new cultural landscape, arising from the development of a centralised polity at the beginning of the second millennium AD, should be considered in the context of a dynamic social structure as well as environmental change (Sand and Addison 2008, 3-4) . While several processual analyses have sought to bring some order to a complex and apparently chaotic social and political system, this order does not provide any explanatory mechanisms with testable ramifications that underlie the establishment and development of the system.

Another point of departure in this thesis is the inclusion of analyses of other "islands of interaction" drawn into the sphere of influence of the Tongan regime. This has provided new insights into relationships across the TMC and allowed a comparison of variable human behaviours in different environmental contexts. In particular, this has challenged the assumption that Tongan expansionism was exponential. Variability seen in interactions across the islands of the TMC has invited new interpretations.

It is sometimes noted (e.g. Clark et al. 2018) that evolutionary ecology requires high-resolution environmental data, and climate records. It is agreed that this data is invaluable, but it is suggested that the value is not confined to evolutionary ecology approaches. Indeed, much more archaeological and environmental data, as well as paleoclimatic data, is required, regardless of theoretical approach or methods used. As stated earlier, the focus on monumental architecture has tended to distract from the behavioural variation that underlies the rise of complex societies and the institution of conflict and warfare. By incorporating multiple datasets, and particularly looking at entire landscapes, as is now possible using LiDAR, new light will be shed on the questions of Tonga's past.

While the environmental or ecological context of societies and the nature of their social organisation has been noted in many investigations, there has been an emphasis on processual and adaptation approaches whereby groups respond adaptively to environmental and population pressures, or indeed the mode of subsistence within the environment. In addition, while much attention is paid to the dominant competitive role of chiefs and rulers, little consideration is given to the individual decision-making, and behavioural variability of individuals (or groups) who cooperate in organisational change. Thus, it is the behaviours of "the others" that need to be incorporated into the method employed. These are the adaptive strategies that are based in evolutionary theory and operationalised in evolutionary ecology.

7.6 Limitations and further research

The analyses in this work have been qualitative, and thus, to further test the hypotheses, quantitative analyses are required. This requires that data be generated, data which may not currently be available. Key amongst these datasets is archaeological evidence of subsistence and settlement. Further analyses might look also at the spatial structure of resources and the relationship to features in the landscape. LiDAR, as can be seen in the immense value of the recent work of Freeland (2018) and Parton (Parton et al. 2018), has the potential to deliver at landscape level that which might otherwise not be revealed. As has often been commented upon, the need for an "agreed typology" for archaeological features (Burley 1994a, Davidson 1969, Kirch 1988, Rogers 1974) is outstanding. This might address the problem of what is or is not "Tongan-style", i.e. the question of homologous and analogous similarity. Aswani and Graves (1998, 151-152) made a tentative move towards differentiating functional and stylistic attributes by developing a seriation of burial mounds, which might identify the extent to which islands were integrated into the TMC. An unambiguous classification (see Cochrane 1998, 2002, Graves and Cachola-Abad 1996) of (selected) features would be well worth the effort, as Aswani and Graves (1998) have suggested.

There is a need to distinguish between resource stress resulting from demographic pressure as opposed to climatic changes, and indeed to examine diet to compare changes in marine or terrestrial productivity with climate variability (Allen 2006, 531). In unpredictable or variable environments, behavioural responses can include storage and exchange (evident archaeologically and in sourcing studies across the interaction sphere) (Allen 2010, 98).

A major limitation in the case study analyses is the palaeoclimatic data, most importantly rainfall and longer-range cycles of drought which would have been critical to the development of risk management strategies. With minimal location-specific climatic data, the extent to which resource shortages resulted in uncertainty or unpredictability is itself uncertain. What has been highlighted are the differences in resource value between locations, dependent to a degree on island size, but more particularly on the balance between different resources, population distribution and resource access. The use of agent-based modelling would allow more detailed analyses of a range of variables, given the requisite datasets.

A significant impediment is the very limited number of dates meaning that chronology is difficult to ascertain. Drawing on ethnohistory and traditions has been helpful in providing a chronological framework, but this evidence has become embedded in the literature, often as both description and explanation. This makes it difficult to assess what is empirically supported and what is simply shoring up the gaps in the record. An example is the AD 1450 date for Tongan conquest and expansion, derived by genealogical reckoning, which is applied broadly to the events of the TMC over the last millennium. While new work on Tongatapu is adding immeasurably to the knowledge base, many other islands – and there are many – await further archaeological attention. An interesting avenue for further exploration is ‘Uvean-Niuan relationships, as briefly alluded to, the types of interaction, and how these influenced relationships between Tonga and ‘Uvea or Niuatoputapu, as well as further afield, principally Sāmoa.

Another question arising from the analysis might be whether, even in the absence of an unpredictable environment, a despotic distribution might lead to hierarchy, if cooperation was enforced, i.e. the collective action problem (see Boone 1992, DiNapoli 2014, Hooper, Kaplan, and Boone 2010, Smith and Choi 2007). This perhaps relies on the degree of hierarchy envisaged. In the measure of social inequality – or of dominant-subordinate differentiation – it is not intended that there was no pre-existing differentiation in social inequality early in the millennium. Much more analysis is required to further investigate how dominant-subordinate relationships transform into hierarchical social organisation.

7.7 Concluding comments

There have been comparatively few applications of evolutionary ecology models to questions of social complexity in Pacific archaeology. There is a wealth of programmatic literature developing potential models and encouraging their use, e.g. Smith and Choi (2007), but rather fewer substantive studies employing them (but see DiNapoli 2014).

This literature-based research thesis has taken a step in that direction in taking up the challenge issued twenty years ago by Aswani and Graves (1998), and has provided a fresh evaluation, incorporating new and additional evidence of the evolution of socio-political complexity, as variably expressed across the Tongan sphere of interaction.

As part of the overall analysis, two types of transformation were considered – the emergence of inequality as seen in the rise of the Tu‘i Tonga dynasty on Tongatapu – and the development and persistence of social stratification and political organisation. A corollary of this developmental process was the extent to which political integration occurred across the extended Tongan archipelago, at least in the islands in the case studies.

Across the range of islands, different expressions of societal organisation emerged. The development of the TMC could not be said to be progressive, as over a period of several centuries, its influence and political domination fluctuated. Human responses to changing environmental and socio-political structure led to this variability in expression.

In this work, hypotheses were proposed to explain these phenomena. These explanations were based on concepts drawn from evolutionary ecology, to link behavioural variation to empirical evidence. The observations, which additional data on subsistence, resource structure, palaeoclimate and population distribution would generate, might result in modifications of the hypotheses, or entirely new hypotheses, or the use of different models to explain behavioural variation. Nonetheless, the value of using theoretically derived concepts and evaluative criteria, is that where conflicting evidence is adduced, or additional questions emerge, new and challenging possibilities are revealed which could lead the investigation in new directions.

Evolutionary ecology sets out an integrated method to examine human-environment interactions and to answer questions of how and why variable human responses emerged in differing socio-ecological contexts. In the journey across the Tongan Maritime Chiefdom the range of these relationships has been illustrated.

It is hoped that this thesis will augment the research of others and inspire future endeavours in Tongan prehistory to pursue further the ideas presented herein.

This thesis' exploratory journey ends here.

Appendix A Comparison of Tu‘i Tonga lists

Comparison of Tu‘i Tonga Lists: The Catholic List and The Baker List

(adapted from Rutherford (1977b, 29)).

The left column shows the 39 members in order.

The middle column shows where Baker’s List aligns with The Catholic List.

The right column lists those members from the Baker list that do not align.

Lists of Tu'i Tonga: The Catholic List and Rev Shirley Baker's List (from Rutherford 1977b, 29)						
	Catholic List	**Dates**		**Baker's List**		**Baker's non-aligning**
1	'Aho'eitu		3	'Aho'eitu		
2	Lolofakangalo		4	Lolofakangalo		
3	Fanga'one'one		5	Fanga'one'one		
4	Lihau		6	Lihau		
5	Kofutu		7	Kofutu	10	Kaliu
6	Kaloa		9	Kaloa	11	Lingolingoa
7	Ma'uhau		8	Ma'uhau	12	Kilukilua
8	'Apuanea		13	'Apuanea	16	Lomi'aetupu'a
9	'Afulunga		14	'Afulunga	17	Ha'avakafuhu
10	Momo		15	Momo	18	Tu'itongailepo
11	Tu'itatui		26	Tu'itatui	19	Puipuikifatu
12	Talatama		27	Talatama	20	Tu'itonga Puipui
13	Tamatou		28	Tamatou	21	Kau'ulufonua
14	Talaiha'apepe		29	Talaiha'apepe	22	Tapu'osi
15	Talakaifaiki		23	Talakaifaiki	24	Ha'avakafuhu
16	Talafapite				25	Talafata
17	Ma'akatoe				30	Tupu'osi
18	Puipui				31	Fatafehi
19	Havea I				32	Havea
20	Tatafu'eikimeimu'a				33	Kau'ulufonua
21	Lomi'aetupu'a				34	Tapu'osimonu
22	Havea II					
23	Takalaua		35	Takalaua		
24	Kau'ulufonua Fekai		36	Kau'ulufonua Fekai		
25	Vakafuhu					

26	Puipuifatu					
27	Kau'ulufonua II					
28	Tapu'osi I		37	Tapu'osi		
29	'Uluakimata I (Tele'a)		38	Tele'a		
30	Fatafehi	(AD1600)	39	Fatafehi		
31	Tapu'osi II or Kau'ulufonua II		40	Kau'ulufonua		
32	'Uluakimata II	(AD1643)	41	'Uluakimata		
33	Tu'ipuloto'ilangi Tu'ofefafa	AD1650-??	42	Tu'ipulotu		
34	Fakana'ana'a		43	Fakana'ana'a		
35	Tu'ipulotu'ilangi Tu'oteau	AD1750-1770	44	Tu'ipulotu'ilangi Tu'oteau		
36	Paulaho	AD1770-1790	45	Paulaho		
37	Ma'ulupekotofa	AD1790-1806	46	Ma'ulupekotofa		
38	Fuanunuiava	AD1806-1810	47	Fuanunuiava		
39	Laufilitonga	AD1800-1865	48	Laufilitonga		

Appendix B Comparison of island environments

The table provides a comparison across the case study islands, showing some key aspects of environment and climate.

Environmental variables island comparison				
Environmental factors	**Tongatapu**	**Ha'apai (Northern Group)**	**Niuatoputapu (and Tafahi)**	**'Uvea**
Land area	261km²	2km² (largest 13km²)	15.6km² (Tafahi 3.4km²)	95km²
Elevation	Low, maximum 80m	Low, maximum 60m	Low, maximum 146m (Tafahi 506m)	Low, maximum 145m
Geological origins	Uplifted limestone	Uplifted limestone	Volcanic with limestone reef (Tafahi stratovolcano)	Volcanic with limestone reef
Tectonics	Localised tilting up in southeast	Minimal but variable across islands	Tectonic uplift of windward southeast	
Volcanism	Exposure to adjacent Tofua arc islands	Exposure to adjacent Tofua arc islands	Dormant or extinct (Tafahi no recent activity)	Not active
Reef system	Extensive along northern coast	Extensive fringing and barrier reefs	Fringing and barrier reefs mainly northwest coast	Surrounding fringing and barrier reefs
Lagoon	Large lagoon in north		Small shallow lagoon to northeast	Extensive lagoon, deeper in south
Coastal access	Principally northern coasts	All, principally leeward coasts	Principally leeward coasts	All
Windward/leeward differentiation	Some differentiation	Some differentiation	Strong differentiation	No strong differentiation
Mean annual rainfall	1780mm	c2000mm	>2500mm	3000mm
Freshwater sources	No streams; occasional springs; subsurface aquifer	No streams; subsurface aquifer	No streams; occasional springs along coast; subsurface aquifer	No streams; crater lakes; springs and seeps near shore
Vegetation	Primary vegetation cleared for cultivation	Variable across the numerous islands	Eugenia forest on former reef platform in southeast	Remnants of tropical rainforest in south; northern interior is scrub
Soils	Andesite tephra layer (2-0.4m depth) on limestone; slight west-east gradient in tephra layer; sandy soils along northern coast; shifting cultivation	Andesite tephra layer; slight west-east gradient; best soils in southern Lifuka	Weathered andesitic; anthropogenic soils in zone between ridge and coast; poor soils in uplifted southeast	Laterised basaltic; notable south-north distinction; agricultural soils predominantly in south; wetland taro gardens in swampy coastal margins

Appendix C Data tables for case study islands

Data tables for case study islands

Tongatapu							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
Phase 1 Emergence of the Tu'i Tonga dynasty							
Early dynastic period							
				AD 900-1100 (regional climate evidence) relatively cooler and drier climate, with likely increase in level of ENSO activity		Cobb et al. 2003	
Early period before AD 1100s-1200s	Nascent dynasty in central or southeast Tongatapu (perhaps more marginal for agriculture)	'Aho'eitu, first Tu'i Tonga, was semi-divine, born of a god father and mortal mother, AD 950 by genealogical reckoning; first 9 Tu'i Tonga resided in Vahe Loto district near Toloa; dynastic origins are in Toloa/Fuamotu area; the mythical Lo'au (often associated with Tu'i Tonga events) was a Tu'i Ha'amea chief of central Tongatapu; earliest Tu'i Tonga tombs are said to be in central and southeast area	Numerous mounds at Beulah and Toloa in southeast; evidence of continuity of occupation (mound with 13 horizons, excavated by Spennemann); LiDAR analysis of mound distribution showing areas of high density, especially east and southeast Tongatapu		Some evidence of intergroup aggression	Burley 2007a:196-197 Collocott 1924:169-171 Freeland et al. 2016:70-71 Freeland 2018 Gifford 1929:52, 71, 78, 130 Herda 1988:36 Spennemann 1989:439-443	NB: Herda cites Koe Fafangu 1909(7)81-83 - Tongan Catholic Church magazine

Tongatapu							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
				Soils with shallower ash layer and more clay in east; loam soils in west; shallower and sandy soils along northern coast; swampy soils around lagoon; but overall soil quality suited to horticulture		Burley 2007a:196-197 Cowie 1980 Gibbs 1976	Little significant environmental distinction east-west, but some local variability
Move from central/southeast to Heketā in northeast							
Early period AD 1100s -1300s	Move from central/southeast to northeast Tongatapu near the coast indicates some significant environmental driver, or conflict leading to expulsion or retreat from southeast	10^{th} Tu'i Tonga (Momo) moved the centre to Heketā; move was purportedly due to aggression of the Tu'ifaleua people; Momo's principal wife was the daughter of the mythical Lo'au (who was also Tu'i Ha'amea of the Vahe Loto district)		Central southeast is closer to Fanga 'Uta lagoon, while Heketā's proximity to the coast provided better access to limestone and beachrock resources, yet was farther from the lagoon with its access and marine resources; soils are predominantly clay, and possibly inferior to central southeast	Lo'au (a mythical figure) is often related in traditions at periods of transformational change	Bott 1982:92 Burley 2007a:182-183 Cowie 1980 Gibbs 1976 Gifford 1929:52, 78, 130 Herda 1988:37 McKern 1929:5	

Tongatapu							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
				AD 1100-1200 (regional climate evidence) relatively cool and dry, initially low frequency of ENSO activity, then increasing in frequency; 1200-1300 dry with slight warming but increasing ENSO activity; overall some temporal unpredictability in environmental conditions		Cobb et al. 2003	
c AD 1030-1300	Heketā earlier site use or occupation prior to Tu'i Tonga establishment		Evidence of early site use in midden deposits; earliest midden deposits dated AD 1030-1300			Clark & Reepmeyer 2014:1252, 1253 (table 2)	
Establishment at Heketā with ceremonial activities and monumental architecture							
c AD 1000s -1300s	Efflorescence of Tu'i Tonga dynasty at Heketā on northeast coast; early phase of earthen mound construction transitioned to later stone phase; some indications of conflict and/or rivalry	10th Tu'i Tonga Momo is associated with Heketā in oral traditions; Momo's house platform east of Heketā was an earthen mound; 11th Tu'i Tonga Tu'itatui is associated with first stone architecture (house platforms, '*esi* and tomb), but also the '*esi* Makafakinanga (large upright stone) against which Tu'itatui protected his back whilst holding court	Overlying earlier site use are large platforms (*paepae* - house foundations); small platforms ('*esi*) and 3-tiered structure (*langi*); associated midden deposits give earliest construction dates cal AD 1030-1300 and 1070-1410; midden associated with house platform gives dates cal AD 1050-1220 and 1030-1300; site use continued with tomb attached to (and post-dating) house platform; tomb radiocarbon dated (pooled age range cal AD 1290-1380 2σ); the '*esi* is a beachrock-faced low mound with a large upright coral piece		Earliest dates (AD 1030-1410) for construction of '*esi* and *paepae*; house platforms have associated radiocarbon dates cal AD 1050-1220; AD 1030-1300; AD 1070-1410; and tomb radiocarbon date cal AD 1290-1380	Bott 1982:92 Burley 1998:373 Campbell 2015:38 Clark & Reepmeyer 2014:1245-1252, 1253 (table 2), 1257 Collocott 1924:171-173 Gifford 1929:52-53, 71 Rutherford 1977b:33 Spennemann 1989:443-449	Heketā is represented by a landscape of earthen mounds and stone architecture, including house platforms (*paepae*) and sitting platforms ('*esi*), tombs, possibly a *mala'e*, and the Trilithon

Tongatapu							
Time period	Event	Traditions	Archaeological evidence	Palaeoenvironment	Other supporting evidence	References	Notes
	Period of instability evidenced by apparent risk of injury or assassination	*Falefā* of Tu'i Tonga consisted of functional head and matāpule, first associated with 11th Tu'i Tonga; Lo'au advised on the reorganisation of *Falefā*; see also reference above to Tu'itatui and '*esi* Makafakinanga	Linear defence at Afa, near Heketā, of unknown age		In traditions, Lo'au is generally associated with periods of significant change	Collocott 1924:171-173 Gifford 1929:63-66 Herda 1988:39 Parton et al. 2018:19	
AD 1300s-1400s	Appearance of monumental architecture - Ha'amonga-a-Maui (Trilithon); ideological and ceremonial initiatives signalled the sacred authority and temporal power of the early Tu'i Tonga dynasty	Trilithon construction included labour as far away as Sāmoa and Rotuma; '*inasi* and kava ceremonies first established at Heketā, and linked with Trilithon; 11th Tu'i Tonga Tu'itatui is linked to first kava ceremonies	Stone architecture began c AD 1320-1390; Trilithon monumental gateway built (radiocarbon dates indicate cal AD 1320-1460); Trilithon is the first example of massive and well-dressed stonework; a road appears to lead to the Trilithon	Proximity to coast provided better access to limestone and beachrock resources	Langi Heketā, Langi Mo'ungalafa (first stone-faced *langi*) also built at Heketā (Herda 1988:39-40); most Heketā stonework is small and poorly-dressed, but Ha'amonga-a-Maui (Trilithon) is significant departure (Trilithon postdates the *langi* linked to Tu'itatui)	Burley 1998:373 Clark & Reepmeyer 2014:1252, 1253 (table 2), 1254-1255, 1257 Collocott 1924:172-174 Gifford 1924:47,49 Gifford 1929:75-77 Herda 1988:39-40 McKern 1929:5, 63-66 Rutherford 1977b:33 Spennemann 1989:443-449	
Transition from Heketā to central lagoon location							
AD 1300s-1400s	Possible intermediate location between Heketā and Lapaha at Niutao Point near Navutoka, at entrance to Fanga 'Uta lagoon may reflect access requirements and/or conflict	Local tradition of interim Tu'i Tonga residence and/or defensive earthworks at Niutao Point	Langi and 3 unfaced mounds; defensive earthworks at Niutao	Niutao Point is near entrance to Fanga 'Uta lagoon, thus better access and possibly more sheltered location	Alexander and Wordsworth found sites during 1957 survey work, and recorded stories of local informants - some place names appear confused	Alexander & Wordsworth 2013:77-81 Parton et al. 2018:18-22 Spennemann 1989:439, 452	Possible relocation to more suitable (sheltered) environment and/or may indicate turmoil or conflict

Tongatapu							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
AD 1300s-1400s	Interim (13th) Tu'i Tonga known as wooden king indicates some succession irregularity or perhaps marking a transitional phase, or associated with conflict at transition between Heketā and Lapaha	13th Tu'i Tonga was a "wooden king" buried in langi at Makaunga (between Niutao and Mu'a); traditions relate that no human remains lie within	McKern's excavation found no stone vault within the langi			Herda 1988:43-45 McKern 1929:55, 113 Spennemann 1989:452	
				AD 1300-1500 (regional climate) drier with variable frequency ENSO activity; possibly somewhat unstable environmental conditions		Cobb et al. 2003 Nunn 2000	
Rapid expansion of Tu'i Tonga precinct at Lapaha							
AD 1300s-1400s	Move to Lapaha signified locational changes with shelter and canoe access and also perhaps a strategic location for resource access and in time of increased intra- and inter-archipelagic voyaging and hegemonic expansionism	Move to Lapaha was attributed to 12th Tu'i Tonga Talatama; the reason recorded was the need to move from the rough coastal seas at Heketā to quieter shores of Fanga 'Uta lagoon with safe harbour and canoe anchorage		Sheltered lagoon environment		Burley 1998:373-375 Clark & Reepmeyer 2014:1255 Gifford 1924:30, 46-47 Gifford 1929:53 Herda 1988:43-45 Rutherford 1977b:33 Spennemann 1989:451	Herda 1988:43 notes traditions symbolically represent the expansion of the Tongan regime

Tongatapu							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
AD 1300s	Rapid development after relocation to Lapaha may indicate phase of rapid expansion	Olotele is the Tu'i Tonga compound and residential area of the Tu'i Tonga; within this is a large basalt stela; with the advent of the Tu'i Ha'atakalaua lineage, this became the Tu'i Tonga compound i.e. distinction between Kauhalauta and Kauhalalalo	Earliest structure was the Olotele precinct development with boundary delineated by dual purpose enclosure ditch/waterway; the enclosure ditch cut into the aquifer in places, ending at the former shoreline, indicating it predated the reclamation; does not appear to have had a defence function (at this period); therefore, an early AD 1300s date is presumed		Significant infrastructure development would require large labour inputs; Olotele refers to the enclosure ditch, the precinct with large basalt stela, and the Tu'i Tonga residential area	Clark, Burley & Murray 2008:1001-1004 Gifford 1929:71 Parton et al 2018 McKern 1929:9, 92-102	
AD 1300s-1400s	Rapid development at Lapaha indicates significant expansion with construction of the fort at an early stage an indication of anticipated or actual conflict	Local informants associated Kolotau Fort with 12th Tu'i Tonga Talatama; note that while the J20 langi, known as Paepae-o-Tele'a, is associated with 29th Tu'i Tonga, recent radiocarbon and Ur-Th dates indicate its original construction in AD 1300s, i.e. contemporaneous with earliest structures	Kolotau fort (fortification with ditch and rampart, located outside precinct), as well as the largest tomb (J20) and adjacent tomb (J21), date to the AD 1300s (fort ditch radiocarbon AD 1310-1410; tomb J20 and J21 radiocarbon AD 1310-1440; debris associated with tomb construction Ur-Th AD 1272-1302)		Construction features of J20 bear some resemblance (size and materials) to the Trilithon at Heketā, which is radiocarbon dated to a similar period; notably, its basal block and 2nd layer is in limestone, while 3rd layer is beachrock; it is constructed in the intertidal zone, with reclamation occurring subsequently around it	Clark 2014 Clark, Burley & Murray 2008 Clark, Reepmeyer & Melekiola 2016:1038-1053 Clark et al. 2018:414	Lapaha tombs are numbered according to McKern's original allocation - see Clark 2014:223; Clark, Burley & Murray 2008:996
AD 1300s-1400s	Further expansion in construction of the harbour, with a large area of reclamation, perhaps reflecting importance of marine and/or maritime resource		Harbour reclamation appears only slightly later at AD 1300s - early 1400s (pooled radiocarbon cal AD 1310-1440 of material around J21 tomb - but reclamation occurred around tomb, so the reclamation post-dated the tomb)			Clark, Burley & Murray 2008 Clark, Reepmeyer & Melekiola 2016	

Tongatapu							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
AD 1400s-1600s	Further expansion with wharf addition may relate to increased voyaging and interactions, i.e. incremental development of the political centre based on maritime network		Wharf construction appears after reclamation, with radiocarbon dates AD 1490-1640; radiocarbon dates for several tombs range between AD 1450-1630 but noting the (more recent) earlier date for tomb J20 and probably J21		Wharf construction was contemporaneous with tombs; analysis of adze flakes and grave pebbles from tombs shows significant proportion of Sāmoan-sourced basalt for stone tools	Clark, Burley & Murray 2008 Clark et al. 2014	Source analysis of stone artefacts places most "pre-state" adze-flakes as local source, and 66% of "state" adze artefacts being of Sāmoan source, however, the distinction between state and pre-state is unclear
Interlude with both conflict and inter-archipelago interaction							
Unknown (AD 1400s-1500s)	Period of aggressive expansionism including Tonga-Sāmoa warfare	15th Tu'i Tonga, Talakaifaiki, had control over Sāmoa, but he is also recorded as living in Sāmoa, and at the same time associated with the end of Tongan domination in Sāmoa, following a Sāmoan rebellion and subsequent Tongan defeat; son of 15th Tu'i Tonga, Talakaifaiki, was half-Sāmoan, said to be buried in J28 tomb	Isotopic analyses on enamel and bone collagen from tomb J28 for evidence of individual being an immigrant gave ambivalent results		Herda suggests end of Tonga-Sāmoa war resulted in a treaty negotiation, as evidenced by the next 3 Tu'i Tonga marrying Sāmoan women; J28 tomb is in the land block called "Aponima", a name cognate with Apolima Island in Sāmoa	Campbell 2015:41 Collocott 1924:175 Fenner et al. 2015:644 Gifford 1929:54, 71 Herda 1988:45-46 Rutherford 1977b:34	For the tomb J28 analysis, a possible reason is there was no intermarriage, or wrong attribution or wrong tomb

Tongatapu							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
c AD 1500s	Period of 16th - 23rd Tu'i Tonga was one of turmoil with many assassinations, indicative of intra- and intergroup competition for political control	Little is known of these Tu'i Tonga, other than that several were assassinated; some assassinations were attributed to people of Hamula and Toloa who wished to install their own people as Tu'i Tonga wives and thus gain office	Several linear ditch fortifications and earthworks occur around Lapaha, including Ha'amea and Hautama, and Fuiono ditch fortifications with Fisi Tea extending across the peninsula, although it cannot be determined that they relate to this series of events; Olotele ditch and bank was possibly rebuilt as a fortification (said to be for 23rd Tu'i Tonga)			Campbell 2015:44 Gifford 1929:54 Kirch 1984:227 McKern 1929 Parton, Clark & Reepmeyer (forthcoming) Thomas in Statham 2013:29 cited in Parton et al. 2018:22	Hamula and Toloa are in the area of the purported beginnings of the Tu'i Tonga dynasty
Phase 2 Conflict, expansion, fission and alliances - increasing stratification							
Conquest, expansion and fission							
c AD 1500s-1600s	A series of assassinations and associated turmoil and an aggressive campaign to assert and extend control; conquest and subjugation	After the assassination of 23rd Tu'i Tonga, Takalaua, his son, Kau'ulufonua, waged an aggressive campaign to avenge his father's death, pursuing the assassins across the length of the Tongan archipelago and as far north as 'Uvea, where the assassins were finally caught				Bott 1982:95 Campbell 2015 Gifford 1924:61-62 Gifford 1929:54-55 Herda 1988:48, 50 Kirch 1984:224-225 (see Burrows 1937:27 for 'Uvean version)	

Tongatapu							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
c AD 1500s-1600s	Fissioning within the Tongan dynasty and expansion of political control across subjugated islands	24th Tu'i Tonga, Kau'ulufonua, appointed secular rulers to assume an administrative role in Tongatapu and across all "subjugated" islands, whilst retaining sacred status, creating a division of authority and rank between Tu'i Tonga and newly-created Tu'i Ha'atakalaua dynasty	Lapaha spatial separation between the Tu'i Tonga (Olotele) compound, and the Tu'i Ha'atakalaua (Moalunga) compound, the latter being between the lagoon foreshore and the Tu'i Tonga precinct; this spatial division was reflected in names "Kauhalalalo" for lower seaward side and "Kauhalauta" for upper landward side		While an alternative interpretation of traditions might suggest a *coup d'etat* occurred, with rival lineage members seizing power, the end result would have been the same, i.e. Tu'i Ha'atakalaua as secular rulers	Bott 1982:79 Campbell 1982:181 Campbell 2015:48 Collocott 1924:177 Gifford 1929:82-85 Herda 1988:51-54 Kirch 1984:227 McKern 1929:92-102 Spennemann 1989	
c AD 1500s-1600s	In an aggressive expansionist phase, junior collaterals were sent to subjugated islands where control was exerted, and tribute exacted	Envoys or governors (usually in pairs) were sent to Ha'apai, Vava'u, Niuas, 'Uvea; some changes were subsequently made to appointments (perhaps by new rival Tu'i Ha'atakalaua rulers on Tongatapu)			The mythical Lo'au appears again in traditions, indicating a period of turmoil	Bott 1982:96 Gifford 1924:62 Gifford 1929:67-70, 134-135 Herda 1988:50-53 Kirch 1984:232	See case studies and tables for other islands for details
c AD 1500s-1600s	'Uvea was conquered by force during 24th Tu'i Tonga's campaign with subsequent appointments and replacements of governors indicating turmoil, but also perhaps the difficulty of controlling distant islands	24th Tu'i Tonga was directly involved in 'Uvea's subjugation; appointments to 'Uvea included not only governors, but also supporting warriors; Tonga also appointed an 'Uvean "king"			The 'Uvean narrative relates considerable resistance as well as difficulties in managing this remote outpost; there is some agreement between 'Uvean and Tongan traditions on 'Uvea being "conquered" and "subjugated"	Bott 1982:95-96 Burrows 1937:27-30 Gifford 1929:55,68-69 Herda 1988:51	See 'Uvea case study and tables; Bott 1982:95 notes: "Because 'Uvea was so far away, Tonga's grip on it was not firm, and even the two Niua islands were fairly independent."

Tongatapu							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
c AD 1500s-1600s	Following the expansionist campaign, there was fissioning of the Tu'i Tonga lineage with intergroup conflict, and the Tu'i Tonga residing in Sāmoa; the Tu'i Tonga appears to have been eclipsed by Tu'i Ha'atakalaua rulers who predominated in Tongatapu	After the campaign period, the 24th Tu'i Tonga lived, or took refuge, in Sāmoa, supposedly weary of power and the travails of war, although it is more likely he was in exile; the 25th - 28th Tu'i Tonga also lived in Sāmoa - these may have been fraternal succession, rather than successive generations, as Sāmoan traditions record that Kau'ulufonua had 3 sons by different women			Absence of the Tu'i Tonga in Tongatapu suggests Tu'i Ha'atakalaua was in control of Tongatapu, i.e. rival members assumed control by forceful means, rather than a voluntary division of labour; Sāmoa appears as place of refuge	Campbell 2015 Herda 1988:51-52, 59-60	Herda observes that the Tu'i Tonga absence was unlikely to be voluntarily (or due to travails of war, or being weary of power) and it is more likely that the Tu'i Tonga sought refuge there
Late AD 1500s-early AD 1600s	Ongoing conflict in a period of unresolved succession irregularities, with attempted resumption of Tu'i Tonga authority	26th or 27th Tu'i Tonga attempted, after the refuge in Samoa, to regain control in Vava'u (assisted by Sāmoan allies) but was defeated by Tu'i Ha'atakalaua forces at 'Utungake in Vava'u; Tapu'osi 28th Tu'i Tonga finally returned Tu'i Tonga residence to Tongatapu				Campbell 2015 Herda 1988:52, 59-62	See Vava'u appendix
Re-establishment of Tu'i Tonga control and new alliances							
				AD 1600-1700 (regional climate) relatively warm, slightly wetter, increasing frequency and amplitude of ENSO activity; unpredictable environmental conditions		Cobb et al. 2003	

Tongatapu							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
Early AD 1600s	A period with a strong ruler seeming to reassume secular authority, while establishing strategic alliances	29th Tu'i Tonga 'Uluakimata was associated with many traditions of voyaging, exchange (Lomipeau legends) and asserting control over 'Uvea; Lo'au reappears in traditions, signalling major transformation or turmoil	Largest tomb known as Paepae-o-Tele'a has been attributed to 29th Tu'i Tonga, thought to be the height of the Tu'i Tonga development (expressed in stone construction), but a recent radiocarbon date indicates its original construction is much earlier; this does not preclude an association of the 29th Tu'i Tonga with the tomb - nor even his burial therein		There are strong links in traditions between 29th Tu'i Tonga and Lomipeau – the 29th Tu'i Tonga is recorded as having drowned or been lost at sea - or buried in Paepae-o-Tele'a; similarly, Lomipeau is said to have been buried at Lapaha	Clark 2014:232 Clark, Reepmeyer & Melekiola 2016 Gifford 1929:56-57 Herda 1988:63-64 McKern 1929:52, 75 Martinello 2006 Spennemann 1989:453-475	The implication is that 'Uvean rebellion followed 24th Tu'i Tonga's campaign to subjugate 'Uvea, i.e. no significant interval between 25th and 29th Tu'i Tonga
Early AD 1600s	Alliances were established between Tonga and Fiji, with the founding of the Fale Fisi and a shift in balance of power away from Tu'i Ha'atakalaua lineage dominance	Founding of the Fale Fisi, by marriage of the 29th Tu'i Tonga's daughter (the Tu'i Tonga Fefine) to Fijian chief Tapu'osi from Lakepa; this tradition is also linked to Lomipeau as symbolising a major event; the creation of new hereditary titles (or lineage) under the Ha'a Fale Fisi (subsequent title-holders were Tu'i Lakepa or Tu'i Ha'ateiho); the eldest female child was the Tamahā	Spatial layout at Lapaha again distinguished between different lineages: Tu'i Tonga compound, Tu'i Ha'atakalaua in the reclaimed area, and the Fale Fisi area located to the north		There is a story of Lomipeau being sent to fetch a Fijian chief to marry the Tu'i Tonga Fefine	Bott 1981:32 Campbell 2015:50-51 Collocott 1924:178-180 Herda 1988:63, 68-70 Martinello 2006 McKern 1929:92-101 Reid 1977:7-8 Spennemann 1989:405, 453-475	
Early AD 1600s	Marriage, between Tu'i Tonga and the secular Tu'i Ha'atakalaua lineage, maintained alliances and obligations between the lineages	There was a tradition of Tu'i Tonga marrying the daughter of Tu'i Ha'atakalaua; this occurred from as early as the 30th Tu'i Tonga Fatafehi				Bott 1982:99 Campbell 2015:49, 51 Gunson 1979:38	

Tongatapu							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
Further conflict and lineage fissioning							
AD 1600s	Further lineage fissioning and establishment of subsidiary Tu'i Kanokupolu lineage, or alternatively, a rival dynasty; this is associated with the rise of Tongatapu local chiefs, perhaps in concert with intragroup rivalry within Tu'i Ha'atakalaua lineage	In a further devolution of powers, Ngata was sent by his father (6th Tu'i Ha'atakalaua) to rule western Hihifo district, (or alternatively) Ngata was sent to quell a rebellion of independent chiefs of Hihifo district in western Tongatapu (or a third alternative is that intragroup rivalry within Tu'i Ha'atakalaua led to fissioning); the first Tu'i Kanokupolu was established with the aid of Ngata's Sāmoan mother's supporters			Ngata's sons founded new sets of titles forming the Ha'a Ngata, Ha'a Havea, etc.; continued principle of sending sons and brothers to establish in other locales (low rank in central "court" yet high rank in outlying village/island); the *ha'a* concept applied also to Tu'i Tonga and Tu'i Ha'atakalaua titles	Bott 1981:13, 27 Bott 1982:115-123 Campbell 1982:181 Campbell 2015:51-52 Collocott 1924:180 Fenner et al 2015:645 Gifford 1929:86-87 Herda 1988:79 Rutherford 1977b:36	Establishment of Tu'i Kanokupolu lineage could be either an initiative of the Tu'i Ha'atakalaua, or the usurping of power by juniors in conjunction with local chiefs and possibly Sāmoan allies, given Ngata's Sāmoan mother who may not have been the principal wife
AD 1600s-1700s	Strategic marriage alliances continued	The tradition continued of Tu'i Tonga taking either a Tu'i Ha'atakalaua or Tu'i Kanokupolu daughter as his principal wife, who then became the moheofo and thence the mother of the next Tu'i Tonga	At Lapaha there was a spatial separation between Tu'i Tonga, Tu'i Ha'atakalaua, and Tu'i Kanokupolu compounds			Gifford 1929:49, 59-61	
By AD 1643	A major change in political structure with the rise of the Tu'i Kanokupolu lineage establishing for the first time in western Tongatapu, challenging Mu'a (Lapaha) and decentralising power	Tu'i Kanokupolu established at Kanokupolu in western Tongatapu with a ceremonial and administrative centre (as well as residential), whilst also retaining a presence at Lapaha (Mu'a)	Many fortifications evident in western Tongatapu (not all related to later Civil War period) - this contrasts with spatial distribution of mounds, which show higher densities in eastern areas	Abel Tasman in AD 1643 noted extensive cultivations on Tongatapu	The Tu'i Tonga at AD 1643 was the 32nd ('Uluakimata II) - the observation of Tasman; the eyewitness account of Tasman in AD 1643 recorded the *mala'e* at Kanokupolu and residence	Freeland et al. 2016 Freeland 2018 McKern 1929:98 Spennemann 1989:477	Decentralisation of power created opportunities for competition and rivalries

Tongatapu							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
Late AD 1600s - early AD 1700s	The rival Tu'i Kanokupolu lineage gained greater power and rank via marriage into the Tu'i Tonga lineage (or were being recognised as more important than the Tu'i Ha'atakalaua members)	Tu'i Tonga now took Tu'i Kanokupolu daughters as their wives, rather than Tu'i Ha'atakalaua, indicating Tu'i Kanokupolu had replaced Tu'i Ha'atakalaua as the dominant lineage; the third Tu'i Kanokupolu married the most sacred female, the Tamahā			According to Bott (1981:48-49) marriage was a commodity which provided support and rank	Campbell 2015 Collocott 1924:181	The Tu'i Kanokupolu power base was in the west, presumably aligning with the greater population by now residing in the west
AD 1700s				AD 1700-1800 slightly warmer, wetter			
Protohistoric period							
Late AD 1700s	The impression of Tongatapu was of having a dense but dispersed population, and well laid out plantations under intense cultivation	Cook in his AD 1773 visit noted extensive cultivations at Hihifo (western island); Cook later noted numerous plantations, fenced, with some fallow areas which provided timber trees			Enclosures, small cultivation plots bounded by palisades; narrow road with palisades both sides but no "villages"; Cook described “many public and well-beaten roads” and “abundance of footpaths leading to every part of the island”	Burley 1998:376 (citing Beaglehole 1969:262) Gifford 1929:7 (citing Cook 19, vol. 1, p314) Gifford 1929:7 (citing Labillardiere 37, vol. 2, 135, 136, 153) Wood 1932	According to Burley, Cook should have observed chiefly hamlets with a burial mound, well, and other structures - as Burley had noted for Ha'apai

Ha'apai							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
Early to mid-millennium							
				AD 900-1500 (regional climate evidence) relatively cooler and drier (than the present) with periods of increased ENSO activity; overall some temporal unpredictability in environmental conditions		Cobb et al. 2003	
Early to mid-millennium	System of independent chiefs across islands of northern group, with low level of intergroup conflict possible	Traditions record chiefs of four main islands of Ha'ano, Foa, Lifuka and Uiha	Continuity of occupation along leeward coasts since colonisation; reef resource remained important to subsistence economy	Cluster of small islands with extensive reef systems but terrestrial productivity limited by freshwater resources; soils with tephra layer thicker on western leeward side of islands; largest area for plantations is in south Lifuka	Fortifications (if attributed to this period) reflect intergroup competition	Burley 1994b:388-393 Burley 1995:159-160 Densmore 2010 Marais 1995	
Conquest and subjugation							
				AD 1400-1500 (regional climate data) initially slightly cooler, and drier, increased ENSO activity initially		Cobb et al. 2003	
Mid-millennium	Aggressive expansion by Tu'i Tonga dynasty across Tongan archipelago, including Ha'apai (asserting or re-asserting control)	Campaign of conquest led by Kau'ulufonua 24th Tu'i Tonga (in response to assassination of 23rd Tu'i Tonga)				Burley 1995:157-158 see also Tongatapu table	

Ha'apai							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
Mid-millennium	Extension of Tu'i Tonga control over Ha'apai	Pair of governors (Mata'uvave and Kolomoe'uto) appointed to Ha'apai following the campaign of 24th Tu'i Tonga, although only Mata'uvave is remembered as governor			Traditions relate that Mata'uvave initially lived on Lifuka but then moved to Uoleva, perhaps a result of Ha'apaian resistance to incursion	Burley 1995:157-159, 161-162 Gifford 1924:62 Gifford 1929:69-70, 135-136 Herda 1988:50	
Mid-millennium	Ha'apai resistance to aggressive campaign by Mata'uvave (Tu'i Tonga emissary); Mata'uvave took control by force	Opposition by local chiefs to Mata'uvave's assertion of control with numerous traditions of conflict; Mata'uvave attacked forts on Foa, Ha'ano and Uiha Islands; construction (or perhaps rebuild) of Kolo Velata fort on Lifuka is attributed in traditions to Mata'uvave, although it is also associated with 19th century civil war	Fortifications on four main islands of Ha'ano, Foa, Lifuka, and Uiha (no dates); Kolo Velata was a large fortification linked in traditions to Mata'uvave, but survey evidence identified only a single construction phase (no dates)	Kolo Velata is in central area of Lifuka, where there are good soils, evidently used extensively for agriculture	Forts, including Kolo Velata, are often associated with Tonga's civil war period, but traditions link Kolo Velata to Mata'uvave; archaeology and traditions together indicate significant conflict at Mata'uvave's incursion	Burley 1995:159-162, 169-170 Gifford 1929:70, 84-85, 228 Marais 1995:37-72	
Establishment of domination and authority of Mata'uvave							
Mid-millennium	Mata'uvave established his authority, with Ha'apai subject to social and political domination	Mata'uvave had *sia heu lupe* built on several islands, but Uoleva was his personal domain with the largest *sia heu lupe* and associated chiefly well; labour for construction was by Ha'apaians at Mata'uvave's command	Large-scale monument construction including 14 *sia heu lupe*, 10 of which were on Uoleva, including the largest known example (across Tonga)	*Sia heu lupe* occur primarily on uninhabited sand cays with suitable pigeon environment, and on the pigeon's flight path; Uoleva was known as a pigeon reserve; also has reef stone quarries	*Sia heu lupe* are often cited as a significant component of monumental architecture, symbolising the establishment of authority over Ha'apai	Burley 1995:158, 164-168 Burley 1996:424-434 Gifford 1929:69-70 McKern 1929:20-26, 32	Archaeology is predominantly survey, with some limited excavation, e.g. Burley 1996 for *sia heu lupe*

Ha'apai							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
Mid-millennium	Highly visible architectural landscape signals authority of dominant Mata'uvave ruler, with focus on main island of Lifuka and nearby Uoleva	Traditions record many building works, generally attributed to Mata'uvave	Monument construction, with burial mounds, wells, *sia heu lupe*; the large burial mound (Huluipaongo) is on the southwest shore of Lifuka facing Uoleva, and is said to be the burial mound of Mata'uvave title holders; while most of the 43 wells identified on Lifuka are historic, some chiefly wells are distinguishable by their size and form		The large burial mound in southern Lifuka was observed by Cook in AD 1777 and surveyed by McKern in 1920	Burley 1994b:394-395 Burley 1995:158, 164-166 Gifford 1929:70 McKern 1929:32	"Mata'uvave" is a title, so there may be a conflation of events between title holders
Unknown	Increasing independence of Mata'uvave ruler with increasing tension between Ha'apai and Tongatapu central	Mata'uvave ruler was known as a powerful chief, and became Tu'i Ha'apai; Mata'uvave exceeded his mandate and stopped sending *'inasi*; there was rising rebellion in Ha'apai and resistance to Tongatapu (Tu'i Tonga) control; Mata'uvave was ordered to leave Uoleva (his domain)				Burley 1995:160, 162, 170-171 Gifford 1929:135	Since "Mata'uvave" is a title, the reference may be to many title holders; the origin of the title "Tui Ha'apai" is unclear – it means simply chief of Ha'apai

Ha'apai							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
Restabilisation of social structure							
Mid-late millennium	Dispersed settlement with lesser chiefs possibly re-assuming more control, reflecting some accommodation between ruling Mata'uvave and local chiefs; dispersion of population and land partitioning implies changing leadership and possible population expansion in late prehistory	System of land tenure was hereditary and hierarchical *tofi'a* (land units); in AD 1777 it was noted that the Lifuka interior had numerous and extensive fenced plantations (Burley 1994b:398 citing Beaglehole 1967:873); observation of Mariner (1806-1810) was most commoners lived around their great chief, while inferior chiefs lived at their plantations (Burley 1994b:396 citing Martin 1991:371)	Large conical wells appear in association with burial mounds - 17 paired wells/burial mounds occur on Lifuka, Uiha, Foa and Ha'ano - several in named locales associated with early chiefs; Toumu'a well (bathing well) with burial mound complex, and ditch and mound defensive enclosure in southern central Lifuka has radiocarbon dates of associated midden material 540-310 cal BP	Most conical wells are on Lifuka and Uiha, perhaps reflecting differences in agricultural potential; the co-occurrence of mounds and wells implies aggregated settlements and control of water resource by chiefs; may coincide with better climatic conditions as noted for Tongatapu	Population expansion and agricultural intensification is implied from land segmentation (*tofi'a*) with aggregations of mounds, wells, fortifications, observed archaeologically; these may represent hereditary estates where chiefs and their followers lived	Burley 1994b:396-398, 400, 402 Steadman et al. 2002:576	It is assumed that this was the system under Mata'uvave chiefs; there is no chronology, either in traditions or archaeology for any transition from conquest and conflict to a more stable system
				1600s (regional data) slightly wetter and warmer with intervals of greater frequency and intensity of ENSO activity		Cobb et al. 2003	
Mid-late millennium	Continued interactions with Tu'i Tonga on Tongatapu, but possibly increasing independence and change from within Ha'apai	On Uiha Island, the Makahokovalu tomb is linked with the Lomipeau legend and Tele'a (Uluakimata, 29th Tu'i Tonga)	Single radiocarbon date 290±70BP (uncal) on human bone eroding from outside tomb provides the only indicative date range		Lomipeau is associated with interactions between 'Uvea and Tongatapu, and with the construction of Paepae-o-Tele'a on Tongatapu, suggesting this tomb was of some importance; the radiocarbon date aligns with 29th Tu'i Tonga period	Burley 1994a:512-513 Gifford 1923:48 McKern 1929:69	It is unclear for whom the tomb was constructed, as it appears subsequently to have been "deconsecrated" and lost from memory

Niuatoputapu							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
Early to mid-millennium Niuatoputapu							
Prior to, or over, the last millennium	Changing environmental structure		In the ceramic and aceramic period, evidence of occupation on the leeward coast	An increase (since colonisation) in terrestrial extent of the windward southeast coast with development of *Eugenia* forest on the emerged former reef platform	While providing a significant (almost three-fold) increase in land area, the former reef platform was unsuited to agriculture	Kirch 1988:17, 20-23, 247-248	
				AD 1100s-1500s (regional data) indicate increasingly dry conditions through this period; if the AD 1450 tsunami (as evident on Futuna) reached Niuatoputapu, it would have had catastrophic effects, similar to the AD 2009 event		Cobb et al. 2003	
	A distinct environmental gradient, with the leeward coast preferred for habitation			Leeward coast sheltered, a shallow lagoon for marine resources, better canoe access; the volcanic ridge with surrounding terrace with garden soils; no permanent streams but a few freshwater springs on the coast, and wells tapped into the aquifer		Kirch 1988:37, 70-71, 247-250 Rogers 1974:309-312	

Niuatoputapu							
Early Tongan dynastic period							
Early millennium	Existing system of local chiefs, with Niuatoputapu woven into origins of Tu'i Tonga, and connected via legends to 11th Tu'i Tonga, Tu'itatui	'Ilaheva, the daughter of a chief of Niuatoputapu, was mother of the semi-divine 1st Tu'i Tonga, 'Aho'eitu; labour of Niuans (as with 'Uveans) called upon to construct the Trilithon and langi at Heketā, in period of Tu'itatui, 11th Tu'i Tonga		Regional climate may have tended to be relatively drier with periods of increased ENSO activity; if comparable to 'Uvea, the AD 1100-1600 period may have seen increasing aridity		Cobb et al. 2003 Collocott 1924:173 Clark et al. 2011 Rutherford 1977b:27, 33	Little or no memory of Niuan traditions of the early era
Tongan expansion							
Mid-millennium	An aggressive campaign of expansion but with some concession accorded Niuatoputapu, suggestive of alliance rather than conquest	24th Tu'i Tonga, Kau'ulufonua's aggressive campaign across the Tongan archipelago, including Niuatoputapu (refer to Tongatapu table); Kau'ulufonua told the people of Niuatoputapu they should "push away the boats of the Tongans", interpreted as affording Niuatoputapu independence				Bott 1982:95 Gifford 1924:61-62 Gifford 1929:55, 283-284 Herda 1988:48 Kirch 1984:224-225 Rutherford 1977:35	The saying of Kau'ulufonua is similar to the 'Uvean "release from *fatogia*"; however, the outcome appears to have been very different

Niuatoputapu							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
Tongan incursion							
c AD 1600	Niuatoputapu was incorporated into the TMC (in part) by a strategic alliance to the Tu'i Tonga via Fale Fisi and the Tu'i Tonga Fefine	Tongan traditions record envoys sent to Niuatoputapu (various names recorded, including Mā'atu); the first Tongan envoy, Latumailangi, was sent to Niuatoputapu to seek an "alliance"; Latumailangi, was a junior grandson of Tapu'osi (Fijian chief) and the Tu'i Tonga Fefine (30th Tu'i Tonga Fatafehi's sister), but also the son of the Tu'i Tonga Fefine				Bott 1982:96, 106-107 Gifford 1924:62 Gifford 1929:68-69, 135, 284-285 Kirch 1984:234	This appointment reflected a high-ranking, high status relationship (compared to 'Uvea); Bott (1982:107) states that Fale Fisi (because of their high status) did not have to send *'inasi*
AD 1616	Niuatoputapu was incorporated into TMC only in early AD 1600s	In AD 1616, the first European encounter of Niuatoputapu and Tafahi was by Schouten and Le Maire, who came across a tongiaki (canoe) carrying Niuans; they recorded that "Latou" was king			Le Maire recorded 32 words in the Niuan language; analysis suggests Niuan belonged to Samoic-outlier subgroup rather than Tongic group, indicating Tongan influence on the Niuan language at AD 1616 was not advanced	Biggs 1971:491 cited in Kirch 1988:12 Finney 2006 Kirch 1984:234 Kirch 1988:1 Langdon 1977:41-42	Latou was presumably Latumailangi, who later became known as Mā'atu

Niuatoputapu							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
Tongan integration							
AD 1600s	The Mā'atu emissary retained independence and achieved alliances with the Niuans while also maintaining close relationships with Tongatapu	Mā'atu was from the third house (title) of Fale Fisi; the four Fale Fisi titles had residences at Mu'a on Tongatapu; however, Mā'atu rarely left Niuatoputapu and remained "independent"; having successfully achieved an alliance with the Niuans, he became a great chief (*'eiki*) and almost an independent king, while existing Niuan chiefly titles became subordinate to him	Kirch surveyed 92 monument sites, including burial mounds, and *sia heu lupe*; the largest mounds were near Vaipoa village, the seat of the Mā'atu paramount, on the north-central coast (Kirch 1988:260); many faced mounds were identified by informants as *fa'itoka*, 5 being identified as *langi* (indicative of the status of the Mā'atu lineage); sitting platforms appeared to be of more recent age; many of the largest mounds had a central depression and informants identified these as *sia heu lupe*	Regional climate data suggests warmer and wetter conditions from AD 1600s, but with periods of ENSO variability	*Sia heu lupe* were away from habitation zones, in the area of dense *Eugenia* forest (pigeon habitat)	Bott 1982:106 Cobb et al. 2003 Kirch 1988:9, 11-12, 76, 37-78, 260 Kirch 1990:211 Rogers 1974:328	
AD 1600s on	Continuation of local minor chiefly structures under the dominant Tongan ruler, may be reflected in the landscape pattern	Mā'atu is said to have created chiefly titles and divided the land among them; in return, the chiefs provided tribute to Mā'atu	Mound distribution pattern analysis revealed clustering of burial mounds around the coast, with *sia heu lupe* spread across the southeast area of recent tectonic uplift; radiocarbon determination for the burial mound Houmafakalele was 270±85BP (AD 1420-1815)		12 *tofi'a* or radial units cross-cutting different environments may have provided for 12 chiefly estates (as proposed by Kirch); burial complexes and *sia heu lupe* appear to have aligned with local chiefly lineages	Gifford 1929:283-286 Kirch 1988:37-78, 26-27, 133-137, 260 Kirch 1990:211	
AD 1600s on	Relative stability of rule	An absence of traditions on warfare or conflict within Niuatoputapu	Kirch noted an absence of fortifications or other defensive works, although Rogers noted some earthworks (but these may have been roads); also lacking were small stone structures or platforms (reasons unknown)			Kirch 1988:37, 77 Rogers 1974:336	

Niuatoputapu							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
AD 1600s on	Maintenance of relationships via alliances; also, relationships between Tongan outposts with indications of social interaction, both competitive and cooperative, and possibly other exchanges	The third Mā'atu married the daughter of Fotofili (title-holding king of Niuafo'ou); traditions recount relationships and interactions (of Mā'atu lineage) with other parts of the Tongan archipelago (Niuafo'ou), and also 'Uvea, and possibly Sāmoa	Two large stone mounds in the northeast extremity at Hikinui Point are called Mata-ki-Ha'amoa and Mata-ki-'Uvea (meaning looking towards Sāmoa, and 'Uvea, respectively) - informants did not know their function or meaning; they are in the area of *Eugenia* forest - there is no chronology	The two mounds, in an exposed location, were damaged by the AD 2009 tsunami; evidence of several extreme climatic events in the recent past are indicative of the dynamic nature of environment and exposure of low-lying Niuatoputapu to such events	Mā'atu maintained status and relationships to the Tu'i Tonga, by continuing to marry into the Tu'i Tonga lineage, and the later Tu'i Ha'atakalaua and Tu'i Kanokupolu lineages	Clark et al. 2011:61-64 Gifford 1929:283-286 Kirch 1988:11, 61 Rogers 1974:328, 339	

'Uvea							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
Early 'Uvean chiefs and political structure							
Early millennium				AD 900-1100 relatively cooler and drier climate, some level of ENSO activity			
	Early autonomous chiefs with some political divisions, but no pan-island rule	“Tu'i Lauliki” is an old independent 'Uvean title; note that Tu'i Lauliki and the village of Lauliki are associated with the Lomipeau legend and its construction	At the ancient village of Lauliki (HA-19-20) is a large oval stone-paved platform, a possible *mala'e* with backrest stones bearing the names of extinct chiefly titles, a burial mound and a road traversing the site; the 'Uvean southwest has been occupied over a long period (since Lapita colonisation) with changing land uses (and changing coastal geomorphology)	'Uvea has an extensive lagoon and reef systems; of volcanic origin, soils are basaltic but heavily laterised in the north; the south has better soils, together with water resources in crater lakes; there is a distinct north-south (terrestrial) environmental gradient	Lauliki village here refers to the interior Hahake district location (HA-19-20), rather than the Lauliki site (MU-140), between Lalolalo and Utuleve in Mu'a district	Burrows 1937:40-42 Frimigacci et al. 2016:94-96 Sand 1998:101, 114 Sand 2008:78	There are some differences between Burrow’s survey description of Lauliki (see his plan 1937:42) and that of the later Frimigacci team
			Lauliki village in Mu'a district (MU-140) has remains of the ancient village, including platforms; ancient roads traverse the site			Frimigacci et al. 2016:100-101	Included here to distinguish it from Lauliki in Hahake
	Independent early chiefs	“Tui Alangau” is another old independent title, associated with the 'Uvean southwest				Burrows 1937:40 Frimigacci 1997:334; Sand 2008:78-79	

'Uvea							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
	(Possible) early chief	The mythical chief Puhi "rests" at Atuvalu on Lausikula Point; Puhi is the subject of the chant of Lausikula, and may be another old 'Uvean title; "Atuvalu" means "a row of 8", referring to the row of tombs, and forms part of Lausikula Point - see later entry	See later entry	Lausikula Point location is a naturally and artificially defended site	Lausikula Point overlooking the sea was an early burial place, also used by later 'Uvean *hau* and Tongan elites	Burrows 1937:41-42, 90 Frimigacci 1997:334-335 Sand 2008:79-81	One chant links Lausikula and the mythical Puhi, but traditions do not provide any chronology for the Atuvalu burials or the Lausikula fortified promontory
	Indications of early intergroup conflict (likely predate the second millennium AD)	Oral traditions tell of small refuge zones in the *toafa* (desert area in north)	Sherds present in small hideouts in refuge areas in the *toafa*, but absent elsewhere in the *toafa*			Sand 1998:95, 107, 109, 114	The end of the ceramic period on 'Uvea is debated: Sand suggests likely by the beginning of the first millennium, whereas Frimigacci proposes well into the second millennium AD

'Uvea							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
Early interactions - 1100s - 1400s							
				AD 1100-1200 relatively cool and dry; AD 1200-1300 slight warming and dry but with increasing frequency of ENSO activity; more unpredictable environmental conditions		Cobb et al. 2003	
Period of 11th Tu'i Tonga, Tu'itatui	Early interactions between Tonga and 'Uvea, possibly indicating exchanges or alliances	Several traditions relate to 11th Tu'i Tonga, Tu'itatui: Tu'itatui brought 'Uvean basalt to Tonga for Langi Heketā and Ha'amonga-a-Maui (the Trilithon) which was built by 'Uvean craftsmen	Evidence does not support use of 'Uvean stone in the Trilithon (see Tongatapu archaeology section), but this does not preclude other materials or labour		May be indicative of interactions and exchange during a period of increased voyaging, i.e. early relationships and alliances rather than political control	Bott 1982:94 Burrows 1937:18 Frimigacci 1997:341 Herda 1988:39-40 Pollock 1996:435 Rutherford 1977b:33 Sand 2008:77-78	The story links 'Uvea to a prominent Tu'i Tonga (Tu'itatui) and to an important monument (Trilithon), so this may be a retrofitting of the tradition
				AD 1300-1500 increasingly drier conditions; the AD 1450 tsunami (recorded for Futuna) may have affected 'Uvea, but also other parts of the Tongan archipelago		Cobb et al. 2003	
	Early site with long period of use		Resistivity on burial mounds concluded an absence of vaults in burial mounds at the early site of Atuvalu (MU-20) which is the oldest complex burial structure known for 'Uvea		This aligns with evidence from Heketā where burial vaults are noted as absent (but later present at Lapaha)	Sand 2008:79 citing Sand 1990:9-13	It is not clear how these burials mounds are differentiated from later vaulted burials at Atuvalu

'Uvea							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
Early-mid millennium		Mythical chief Puhi rests at Atuvalu (meaning row of 8 tombs) on Lausikula Point, in southwest 'Uvea - see also entry above	Excavation of Atuvalu (MU-20), the largest burial mound in "row of 8" revealed the burial of man of apparently high rank, together with a female, in a central tomb (without vault) on the highest point; radiocarbon determinations from 2 human bone samples provided a pooled date range of cal AD 1301-1410 (ANU-7394A; 7394B)	Atuvalu is on a promontory with a steep fall to the reef below	Burial at this date was without vault and without evidence of tapa wrapping, i.e. no evidence that Tongan influence on burial style was yet dominant	Frimigacci 1997:334-339 Frimigacci 2000:149, 161 (tableau 5) Frimigacci et al. 2016:253-257, 301 (tableau IV.4) Sand 1998:103-104 Sand 2008:79-81	There is no evidence to link this burial to the mythical Puhi; radiocarbon determinations from the two human bone samples were: cal AD 1301-1380 2σ ANU-7394A (646 ± 200 BP); cal AD 1410 2σ ANU-7394B (536 ± 100 BP)
Period "of the forts" - Tongan expansionism - Tongan incursion							
Mid-millennium	Chronology here is difficult to outline, with possible conflation of events between Tu'i Tonga lineage Tauloko, Kau'ulufonua and the subsequent Tu'i Ha'atakalaua lineage Ga'asialili and the associated *Ha'a* lineages	In the reign of the 23rd Tu'i Tonga, Tongans came to 'Uvea and built forts - known in 'Uvea as the "period of the forts"		AD 1500s driest conditions	This may indicate that it was a period of heightened tensions or conflict, rather than having a literal meaning	Frimigacci 1997:341, 343	Note this differs from the more common version that the Tongan incursion occurred after the assassination of the 23rd Tu'i Tonga
		Pending the invasion by the Tongan (24th Tu'i Tonga), a new fort (Tukituki o Kolonui, with 8 gates) was built, extending a network near Kolonui				Burrows 1937:27-28	The implication is that there were already forts built in southern 'Uvea, prior to 24th Tu'i Tonga's invasion, indicating existing or ongoing conflict

'Uvea							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
	A prolonged and aggressive campaign of revenge, indicating extended period of conflict	The 24th Tu'i Tonga's campaign of conquest, allegedly seeking assassins of his father, the 23rd Tu'i Tonga; the assassins were finally located on 'Uvea			While many islands were named in relation to this campaign, there is considerably more focus on 'Uvea	Bott 1982:95 Burrows 1937:27-30 Frimigacci & Hardy 1997:61-66 Gifford 1924:61-62 Gifford 1929:55-56 Herda 1988:48, 50 Pollock 1996:436 Sand 2008:81-83	Traditions vary on who was assassinated and by whom, with the 'Uvean version differing from the Tongan; the 'Uvean version relates that it was the mother who was murdered
		After the assassins were apprehended, Kau'ulufonua (24th Tu'i Tonga) declared 'Uvea independent of Tonga (delivered from *fatogia*); Kau'ulufonua then travelled to Futuna but failed to successfully invade			This is similar to the Niuatoputapu tradition where Kau'ulufonua told the Niuans to "push away the boats of the Tongans"	Burrows 1937:29 Frimigacci 2000:152 Frimigacci & Hardy 1997:66 Herda 1988:50 Sand 2008:83	This is the 'Uvean version of the tradition

'Uvea							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
Tongan incursion - increasing Tongan presence in 'Uvea - Tauloko and Ga'asialili							
Mid-millennium	First evidence of Tongan assertion of control, by the introduction of an "'Uvean king", with Tongan-style burial architecture, indicating the introduction of Tongan customs	Hoko appointed Tauloko (both of Tu'i Tonga lineage) as hau or "king" of 'Uvea; Tauloko's residence was at Ha'afuasia on east coast; Tauloko died or was deposed; he was buried in a *fale maka* (stone house) in the burial complex known as Niuvalu (HA-04)	Tauloko's tomb, called Fugasia, described as a stone house (*fale maka*) i.e. a burial vault, faced with uncut volcanic rock, and a top slab; this is the first known use of a burial vault in 'Uvea; burial vaults are associated with Tongan burial style; Ha'afuasia appears to have been on a fortified promontory, with evidence of earthworks and a defensive ditch		Ha'afuasia is a royal residential area with associated royal burial complex of early 'Uvean kings	Burrows 1937:19, 43 Frimigacci 2000:152 Frimigacci & Hardy 1997:49-50 Frimigacci et al. 2016:59-60, 93-94 Sand 2008:83	The timing is uncertain - Frimigacci & Hardy (1997:49) suggest prior to the 24th Tu'i Tonga; Sand 2008:83 links it firmly to the 24th Tu'i Tonga
	Significant increase in Tongan presence, associated with changed power structure in Tongatapu - conflict and assertion of Tongan rule	After the death of Tauloko, 'Uveans requested a new king/*hau* from Tonga; Ga'asialili (of Tu'i Ha'atakalaua lineage) was sent from Tonga as second king/*hau* of 'Uvea, arriving in southern 'Uvea accompanied by two chiefs, Kalafilia and Fakate from the Ha'avakatolo and Ha'amea lineages of Hihifo in Tongatapu (this continues the "period of the forts")				Burrows 1937:18 Frimigacci 1997:343 Pollock 1996 Sand 2008:84	
		Ga'asialili reigned only a short time before departing, travelling to Futuna, where he was killed some time later			This may indicate a power vacuum in 'Uvea during the period of Ga'asialili, with intra- or intergroup conflict	Burrows 1937:19	Unclear whether Ga'asialili's departure to Futuna was a campaign of aggression or the result of conflict in 'Uvea

'Uvea							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
Tongan incursion - the three Tongan chiefs Hoko, Kalafilia and Fakate							
Mid-millennium	Assertion of Tongan control of southern 'Uvea	The three Tongan chiefs: Hoko, Kalafilia and Fakate, partitioned 'Uvea into three districts from the central point of Lake Lanutavake; Lanutavake was the "first fortified place" and had numerous gates (continuing the "period of the forts")	Lanutavake is a fortified crater lake with defensive ditch and embankment stone wall; the fort is 700m in diameter, with 18 access points around the perimeter, and a surrounding ditch 3m deep in parts, with chicanes and defensive ledges; Lanutavake fort was large and well-protected with sufficient room for growing crops, with freshwater access; there are at least 7 roads radiating out		The previously established Hoko (title) was of Tu'i Tonga lineage but Kalafilia and Fakate were of Tu'i Ha'atakalaua lineage; district division names followed those of Tongatapu, with the southern Mu'a being the political "centre"	Burrows 1937:18, 20 Frimigacci & Hardy 1997:50 Frimigacci et al. 2016:108-110 Sand 1998:98 Sand 2008:84, 85, 90, 96	A major water source being the central dividing point perhaps indicates the importance of the water source
Mid-millennium	Increasing aggression associated with Tongan presence, continuing the "period of the forts"	The Tongan "warrior chiefs" of Ha'avakatolo and Ha'amea lineages built forts and a road network radiating out from Lanutavake, linking the forts; high population density is inferred in traditions relating that messages were passed by people "calling one to another"	Southern interior 'Uvea surveys have revealed numerous stone house platforms, in the vicinity of some fortifications; roadways both elevated and sunken, leading directly into or between forts; many earthen burial mounds, and circular mounds (perhaps *sia heu lupe*), as well as fortifications (with house platforms clustered around) - see further individual entries below		Successive establishment of Ha'amea and Ha'avakatolo lineages in the south with gradual construction of forts, large platforms, wells	Burrows 1937:20; Frimigacci & Hardy 1997:52-55 Frimigacci et al. 2016:85-87 Kirch 1975:388-389, 396-398 Sand 2008:84	Note these are interior locations rather than coastal; local informants provided site locations and traditions; these constructions likely occurred over time, but there is no chronology

'Uvea							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
Mid-millennium	Conflict - intragroup and intergroup rivalry and competition but also some cooperative actions required for ongoing construction	Forts were built in southern 'Uvea at Atalika (earthen - by Ha'amea) and at Kolonui (stone - by Ha'avakatolo)	Kolonui fort in southwest 'Uvea (MU-97) is a 20ha fortified structure with stone wall enclosure (1m to 15m wide and up to 4m high), moats and platforms with watch posts; it also contains the large raised platform called Talietumu; a road crosses through the fort		Division and re-division of land together with fort construction indicates conflict	Burrows 1937:20 Frimigacci & Hardy 1997:71-99 Frimigacci et al. 2016:110, 112, 239-249 Sand 1993:49 Sand 2008:85	Period of intense activity, possibly contemporaneous with disorder in Tu'i Tonga and Tu'i Ha'atakalaua successions in Tongatapu
Mid-millennium			Talietumu residence (MU-29) is a large platform including a *mala'e* and *paepae* (habitation platform) in the southwest corner of the Kolonui fort (MU-97) - this monumental structure was built and enlarged over a former structure - see entry below			Frimigacci & Hardy 1997:89-99 Frimigacci et al. 2016:106-107, 239-250	
(Evidence from end of 1st millennium AD)	Evidence of earlier site use at Talietumu site in southern 'Uvea; likely reconstruction over pre-existing site, indicative of ongoing tensions		Umu in platform beneath Talietumu residence (MU-29) within Kolonui fort (MU-97) in southern 'Uvea - charcoal from umu is radiocarbon dated cal AD 898-944 2σ ANU-9097 (1126 ± 60 BP)			Frimigacci 2000:150, 160 (tableau 3) Frimigacci et al. 2016:301 (tableau IV.2)	Frimigacci 1997:343-344 gives date as: cal AD 714-1010 ANU-9097 (1150 ± 60 BP); Sand 2008:99 citing Frimigacci 2000:150 gives date as: cal AD 770-1020 2σ ANU-9097 (1125±60BP)

'Uvea							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
Tongan incursion - Havea-Fakahau, the third 'Uvean hau							
Mid-millennium	Ongoing instability with changes in 'Uvean king successions	On news of Ga'asialili's death in Futuna, Havea-Fakahau was appointed third *hau* (Havea-Fakahau in Henquel's genealogy or Fakahenga in Mgr Blanc's correction to Henquel)			Havea-Fakahau, of Ha'avakatolo lineage, was a harsh ruler, ruled 60 years, while Fakahenga was of Ha'amea lineage and portrayed as cowardly	Burrows 1937:20-22	This genealogical confusion may reflect intergroup rivalry
	Intergroup conflict (amongst Tongan groups or lineages)	From Havea-Fakahau, appointments were from within, rather than from Tongatapu - resulting in conflict between descendants of Fakate and Kalafilia (and Hoko)				Burrows 1937:22 Sand 2008:91	
	Move of central focus from east to west side of southern 'Uvea	Havea-Fakahau (3rd 'Uvean *hau*) was buried at Lausikula on southwest coast but Tauloko (1st 'Uvean hau) was buried at Ha'afuasia on southeast coast				Frimigacci 1997:335	There are some contradictions in traditions on burial locations of 3rd - 6th 'Uvean hau
		A missionary's letter of 1896 (cited by Burrows) described an excavation of tombs of 8 chiefs, including Havea-Fakahau, the 3rd 'Uvean king	An "excavation" of 8 skeletons in a burial vault, presumed to have been at Atuvalu (MU-20)		Site used for burials over extended period from earlier non-vault burials to "Tongan style" of burial in a vault	Burrows 1937:41-42 Sand 2008:88	Note that the east coast site also continued to be known as the burial place of 'Uvean hau
Tongan incursion - Kalafilia in southwest 'Uvea							
		Kalafilia (a title, but one of the three Tongan warrior chiefs) resided at (or near) Utuleve	The "Residence of Kalafilia" (MU-45) was a large raised house-mound at Utuleve, near the Malamatagata platform (MU-46)			Frimigacci et al. 2016:218-238 Sand 2008:99	

'Uvea							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
Mid-millennium	In southwest 'Uvea, first evidence of Tongan chiefly influence and monumental architecture; marriage alliance between Tongan and 'Uvean chiefly lineages	Tongan chief Kalafilia's daughter married son of Tu'i Alangau and gave birth on the Malamatagata monument in southwest 'Uvea (monument built by Kalafilia (Ha'avakatolo lineage) for his daughter)	Malamatagata is a large stone platform 30m by 15m with a surrounding wall and lookout posts to the east, with a path leading to Kalafilia's residence; there are also burials			Frimigacci 1997:343 Frimigacci et al. 2016: 131-180 Hardy 2009:71-72	
(Evidence from 13th or 14th century; and still earlier evidence from the end of the first millennium AD)	Activity at this location over an extended period is suggested by the different construction episodes; the Malamatagata monument postdates the underlying structure radiocarbon dated to 13th or 14th centuries		Dating of an earlier structure at site of Malamatagata, i.e. construction of Malamatagata monument must postdate this radiocarbon date from charcoal from the base of a hearth cal AD 1281 2σ ANU-10071 (736 ± 60 BP); the earliest structure beneath platform of Malamatagata (MU-46) has a radiocarbon date of cal AD 888 2σ ANU-10072 (1166 ± 80 BP) - see also entry above		Another radiocarbon date from the base of the monument provides cal AD 1333-1399 cal 2σ ANU-4091 (576 ± 300 BP)	Frimigacci 1997:343 Frimigacci 2000:150, 160 tableau 2 Frimigacci et al. 2016:131-180	Frimigacci et al. 2016:300 (tableau IV.1) lists rempl. du mon. as cal AD 888 2σ ANU-10072 (1166 ± 80 BP)
Mid-millennium		Ha'avakatolo and Ha'amea lineages built at least 4 wells - Burrows calls them springs - so not clear if they are naturally occurring or built wells	Numerous wells occur across 'Uvea, often formed simply by piling up of stones; others have better construction with surrounding pavement, assumed to be for the elite			Burrows 1937:20 Frimigacci et al. 2016:77-79 Sand 1998:100 Sand 2008:89	There is little archaeological evidence on wells

'Uvea							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
Mid-millennium			Kirch identified *sia heu lupe* at Fugauvea (MU-96), noting they were almost identical to those described by McKern; Frimigacci described these as habitation platforms and burial mounds; Sand noted the difficulty in distinguishing between mound types; Guiot noted that *sia heu lupe* are found in or near *vaotapu* (which provide pigeon habitat)			Guiot 1998 Kirch 1975:393-396 Sand 1998:89, 100	
Mid-millennium			Frimigacci and colleagues located 33 parts of roads with a total distance of 6 km; these were sunken or raised, earthen or using stone (with stone most commonly in Mu'a district); Kirch noted that roads travelled between forts			Frimigacci et al. 2016:283-286 Kirch 1975:388-389	
Mid-millennium			Stone house platforms - numerous house platforms noted in the vicinity of fortifications; these occur predominantly in the interior		Sand notes numerous habitation mounds, raised earth mounds, oval or rectangular, with stone facing, which occur across 'Uvea, but differ from the large platforms built in basalt (and associated in traditions with Tongans)	Kirch 1975:387-388 Sand 1998:96	

'Uvea							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
Mid-millennium			A series of forts, linked by road networks, occurs across southern 'Uvea with several forts near Lanutavake or Lalolalo, ranging from large (Makahu MU-120) to small (Fugakolo MU-95); Kolonui is by far the largest fortified structure; no chronology is available			Frimigacci et al. 2016:103-114 Sand 2008:85	
Mid-millennium	Walled plots with habitation areas suggests intensive occupation over an extended period		Many abandoned walls (horticultural plots) occur between Utuleve and Lanutavake; there are low walls surrounding plots with raised habitation platforms, remnants of which remain visible; horticultural structures appear associated with roads and forts; the density indicates a large population in southern 'Uvea		Southwest is divided into numerous fields marked by low walls - see Figure 16 in Chapter 6; evidence of intensified gardening activities across southwest area from Utuleve and Atuvalu extending inland as far as Lanutavake	Sand 1993: 45 Sand 1998:115 - citing Di Piazza 1992 thesis (unavailable) Sand 2008:86-87	Intensification of horticulture is related to the Tongan period, but may reflect population and environmental factors; Di Piazza (1992) undertook survey and mapping of fortified horticultural villages around Lauliki (PhD not accessed) - Lauliki (MU-140) is a densely settled location but with surrounding wall suggesting a need for ongoing defence

'Uvea							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
Mid-millennium	Significant intragroup and/or intergroup conflict between rival Tongan families, perhaps destabilising previously established alliances with 'Uvean chiefs	Havea-Fakahau (3rd or 6th hau) was a harsh ruler, faced an uprising, and was defeated by his rivals, who then assumed the title of 4th and 5th 'Uvean hau; the 'Uvean chief Tu'i Alangau sent assistance to Havea-Fakahau in the uprising but after the defeat of Havea-Fakahau was himself killed by the two victorious leaders			These kings were of Ha'avakatolo lineage (Tu'i Ha'atakalaua rather than from Tu'i Tonga)	Burrows 1937:20-25	
Mid-millennium	Ongoing instability and rivalries between Tongan groups, including rival claims to titles and land	Short period of stability during reign of two victorious rival lineages, until further conflict between rival Tongan lineages (Ha'avakatolo and Ha'amea)				Burrows 1937:24-27	
Further intra and intergroup conflict on 'Uvea							
c AD 1600 period of 29th Tu'i Tonga		Great canoe "Lomipeau" was constructed in 'Uvea (using 'Uvean skilled craftsmen) and then sailed to Tonga under the orders of 29th Tu'i Tonga (Tele'a), bringing 'Uvean stone for his platform at Tongatapu	Note that Tongatapu evidence of the date of construction of largest langi predates 29th Tu'i Tonga	AD 1600-1700 relatively warm, slightly wetter, increasing frequency and amplitude of ENSO activity; unpredictable environmental conditions	The 'Uvean version of the Lomipeau legend, while differing from the Tongan, also relates a dispute over property	Burrows 1937:23-25 Herda 1988:63	There are many myths about Lomipeau but the 'Uvean version links the powerful 29th Tu'i Tonga and 'Uvean domination but may also relate to allegiances between this Tu'i Tonga and 'Uvea

'Uvea							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
c AD 1600 period of 29th Tu'i Tonga	Intragroup or intergroup conflict (amongst Tongan lineages), but may be competition for water resource, as Lalolalo is the deepest lake	Boundary disputes over Lake Lalolalo between descendants of the two chiefs (of Kalafilia and Fakate lineages); the two factions enlisted the aid of the 29th Tu'i Tonga to resolve the dispute		Lalolalo is the largest water resource		Burrows 1937:22	Note references are now to Tu'i Tonga, rather than to Tu'i Ha'atakalaua as Tongan authority, suggesting a return of Tu'i Tonga authority under the 29th Tu'i Tonga
Takumasiva dynasty and northern 'Uvea uprising							
AD 1600-1660	New dynasty brings short period of stability followed by further ongoing turmoil - intragroup competition and intergroup aggression	Takumasiva dynasty established with a short period of peace, followed by further instabilities with assassinations and further Tongan chiefs either seeking alliances through marriage with 'Uvean chiefs' daughters or wresting control by force				Burrows 1937:30-40	
AD 1600-1660	Uprising by northern chiefs, defeated, spread of Tongan control to northern 'Uvea, achieved in part by marriage alliances	War of "Molihina" led by northern (independent) 'Uvean chiefs of Alele in Hihifo against Tongan aggressor in south - chiefs including Tu'i Alangau ('Uvean chief aligned with Tongan by alliances) resulted in Alele people being exterminated; then repopulated by marriage between Tu'i Alangau's daughter and the son of defeated Alele chief	Pela Pela near Alele village on northeast coast, alleged site of Molihina battle, burials on 2 levels have been disturbed, but 3rd level below reveals skeleton probably wrapped in tapa cloth (evidence of Tongan influence); no dates from this site		The extensive damage to Pela Pela burial mounds limited information retrieval, but certainly there was not a large number of burials; traditions record that 'Uvean warriors killed in Molihina war were buried at Lausikula	Burrows 1937 Sand 1998 Sand 2008:91-92	No traditions linking north at early period of Tongan interventions; northern 'Uvea remained independent; open conflict between north and south 'Uvea (resistance of north to gradual extension of control by south)

'Uvea							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
AD 1600s-1700s	Major conflict between north and south, indicate no "unified" 'Uvea i.e. still local chiefs in control in north	Battle between southern 'Uveans and villagers of Vailala on north coast; traditions relate mass burial, including many buried alive	Petania burial mound in Vailala village with >150 individuals interred together in lower horizon; higher proportion of adult males does not suggest pandemic; skeletal trauma includes ulna fractures, but not necessarily warfare; no evidence of live burials; no dating		Upper horizon of burial mound includes post-contact burials, as evidenced by presence of blue glass beads; there are more than 50 burials	Sand 1998 Sand & Valentin 1991 Sand, Valentin & Frimigacci 2006	

Vava'u Table

Vava'u							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
Vava'u environment							
All			Low density of fish in Lapita assemblages, then decreased density over time could indicate the reef resource was secondary and agriculture was always an important component	Extended coastline and lagoons provided good access to marine resources; fertile soils with a volcanic layer over limestone provided agricultural potential from the early period; freshwater was limited to springs and shallow wells	Soils have a thick volcanic ash layer over coral limestone; west to east differs with thicker and weakly weathered silty soils in the west; less depth and strongly weathered clayey soils in the southeast	Davidson 1971 Densmore 2010 Orbell 1971	The differences in agricultural productivity between Vava'u environment and Ha'apai appear significant factors in subsistence
All			Low Lapita population, only slightly expanded in the PPW phase - contra Tongatapu and Ha'apai; early settlements appear in locales suitable for taro cultivation	The north and west of 'Uta Vava'u Island have high cliffs (179 m, 213 m) on the shoreline; tectonic changes include slow subsidence at equivalent rate to sea level fall so that relative change land/sea is minimal; cyclonic events cause destruction of vegetation	'Uta Vava'u (main and largest island) elevation ranges from highest 215 m in southwest, 100-200 m along north and northwest coast, to <100 m for the majority of the island	Burley 2007b Fall et al. 2007	Relative population density, compared with Tongatapu and Ha'apai during the Lapita and PPW phases, might apply to a degree in later periods also, although Vava'u could support a larger pop (as it does now)
Tongan expansion mid-millennium							
Mid-millennium	Assertion of Tu'i Tonga authority over Vava'u	A pair of governors was appointed to Vava'u at the time of 24th Tu'i Tonga's reforms and establishment of Tu'i Ha'atakalaua hau	Without some chronology for the fortifications outlined below, defensive works cannot be ruled out for this period as well			Bott 1982:96 Gifford 1924:62 Gifford 1929:68-69, 134, 136 Herda 1988:50	Gifford cites different versions for governors' names

Vava'u							
Time period	**Event**	**Traditions**	**Archaeological evidence**	**Palaeoenvironment**	**Other supporting evidence**	**References**	**Notes**
Unknown			Fortifications (assumed to be from civil war period but may be pre-existing structures); roads (ditch and embankment construction) and stone walls may be linear fortifications, similar to linear defences on Tongatapu; chronology unknown			Davidson 1971 McKern 1929:89	
Tongan expansionism and fission							
Mid-millennium	An attempted return, via Vava'u, of the Tu'i Tonga and the re-assertion of Tu'i Tonga authority and dynasty, after possible Tu'i Ha'atakalaua usurpation	The 26th or 27th Tu'i Tonga (returning from stay or refuge in Sāmoa) attempted to regain control in Vava'u (assisted by Sāmoan allies) but were defeated by Tu'i Ha'atakalaua forces at 'Utungake in Vava'u			The 25th to 28th Tu'i Tonga lived in Sāmoa, most likely in semi-exile, rather than as rulers; that this attempt is via Vava'u perhaps indicates geographical proximity	Campbell 2015 Herda 1988:59-60	

For bibliography, see main the main bibliography. Additional references include: Martinello (2006); Reid (1977); Wood (1932)

Appendix D Vava‘u overview

Overview of archaeology on Vava‘u

McKern (1929) surveyed a number of mounds on the islands of Vava‘u, including ‘*esi* and *sia heu lupe*, as well as fortifications at Feletoa and Neiafu (1929, 82-84); and Davidson (1971) did a reconnaissance of all Vava‘u, both confirming some of McKern’s mounds, and adding to his list, then re-categorising in an attempt to address the disparities between local informants’ knowledge and observed construction features. Davidson also located ditch and bank fortifications and sunken paths. Kirch (1980), while awaiting transport to Niuatoputapu, took the opportunity to investigate eighteenth century Vava‘u burial structures, linking these to societal structure. Kirch’s aims were to record several burial sites to determine how these structures related to the socio-political system.

Further work in Vava‘u occurred under Burley, with a survey in 2003 and then excavations in 2004-2005 at four sites where Lapita and Polynesian Plainware occupation strata were located (Burley 2007b, 188-189, see also Connaughton 2007). Of particular interest, Burley noted that horticulture was possibly part of initial subsistence, since settlement locations included a “small inland swale” suitable for taro cultivation (Burley 2007b, 194). This was further investigated by Densmore (2010) in an analysis of fish assemblages from these excavations. While these are earlier period sites, Densmore concluded that the colocation of accessible marine resources and rich fertile soils for agriculture suggested the latter was always an important component of subsistence strategies, probably throughout the occupation phases on Vava‘u. Doubtless, further evidence and analysis awaits future investigators.

Vava‘u mini-case study

1. Introduction

Vava‘u lies among the scatter of islands along the Tongan island arc and shares some common history with Ha‘apai but presents an interesting contrast to Ha‘apai. This overview briefly looks at its environment and history. Further evaluation, with more data, would provide valuable insights into the relationship of Vava‘uans with other parts of the Tongan archipelago, and beyond to ‘Uvea and Sāmoa.

2. Summary of evidence

Vava‘u has a greater land area than Northern Ha‘apai, with its largest island, ‘Utu Vava‘u, exhibiting greater landscape diversity than the limestone islands of Ha‘apai. There are limited freshwater resources, but this is compensated for by a comparatively higher rainfall (Davidson 1971, Fall and Drezner 2013). The sheltered cluster of islands extending from the south up to the main island of ‘Utu Vava‘u, provided both a subsistence base, and safe navigation for canoe voyaging, although in much of the steeply-cliffed northern coast of ‘Utu Vava‘u, access is restricted by its topography (Burley 2007b, Davidson 1971). This diversity provided adequate, though perhaps not abundant resources. In Vava‘u, both marine and agricultural components were important in the subsistence economy through all periods (Cannon et al. 2018, Densmore 2010). Early (Lapita) settlements appear clustered in areas suited to taro cultivation, signifying agriculture was an important component from initial colonisation; there is some evidence of continuity of this subsistence regime (Cannon et al. 2018, Densmore 2010). Compared with Ha‘apai, the reef system is more limited and does not present the same resource potential along much of the western and northern coasts (Burley 2007b, Roy 1990), and therefore may have been an inhibiting factor for populations if there were periods of reduced agricultural productivity (Burley 2007b), although the extended coastline and lagoons in the windward southeast provide good access to marine resources (Davidson 1971). The population density is assumed to have been relatively low, with no evidence of densely distributed settlements, but equally no evidence of resource depletion (Burley 2007b).

As with other islands, governors were sent by Tongatapu rulers mid-millennium (Gifford 1924, 62, 1929, 134, Herda 1988, 50), but these interactions in Vava‘u have been less well examined in association with archaeology. There are a number of earth mounds, including burial, pigeon-snaring and those loosely termed *‘esi* (Davidson 1971, Kirch 1980, McKern 1929, 10-20), and while at least some of these might relate to the AD 1600s to early 1700s expansionist period, there is currently too little evidence to determine relationships to local chiefs or any governors appointed from Tongatapu. While there is evidence of some defensive works in parts of Vava‘u (Davidson 1971, McKern 1929, 83, Marais 1995), none have been dated, although apparently some relate to the civil war era (Mariner’s accounts in Martin (1818)), and thus it is difficult to correlate interactions and conflict. Vava‘u’s importance in inter-archipelago interactions may be indicated by its relative position between Tongatapu and more northerly islands, including Sāmoa. There is evidence of ongoing interaction with Niuatoputapu, e.g. Tafahi obsidian is more commonly found in Vava‘u compared with southern Tonga (Burley, Sheppard, and Simonin 2011). During the volatile transformation of the Tu‘i Tonga regime, Vava‘u appears as a stepping stone, by which Tu‘i Tonga lineage members domiciled in Sāmoa sought to regain position on Tongatapu (Gunson 1990, 178, Herda 1988, 60, Petersen 2000). The tradition of the attempted return of the 26th or 27th Tu‘i Tonga via Vava‘u also indicates that Tu‘i Ha‘atakalaua control was present to some degree (traditions record that Tu‘i Ha‘atakalaua forces repelled Tu‘i Tonga), and further, that there was some defence at ‘Utungake (Herda 1988, 60).

3. Evaluation

Perhaps an important question in this early period (supposing that it is correct that population density remained low) is why there was not greater population growth, given the apparent potential for agricultural production. The marine resource was less accessible from the largest island of ‘Utu Vava‘u, although this does not appear so for all islands of the group. The marine resource was perhaps less abundant than that of Ha‘apai with its more complex reef system (Burley 2007b; Burley pers. comm.) yet the evidence (albeit not focussed on the last millennium) is that there was no resource depletion on Vava‘u (Densmore 2010). These insights require further exploration, to understand population levels[32] and density, or settlement patterns and resource distribution.

While there is as yet little detailed evidence from archaeology or traditions for this mid-millennium period, it is assumed that there was some pre-existing chiefly structure. There does not appear to be a strong tradition of a harsh and powerful ruler, as in the case of northern Ha‘apai and the Mata‘uvave lineage, at the comparable period. Therefore, it could be postulated that the relationship between Vava‘u and Tongatapu at the expansionist period differed from that of Ha‘apai. The imposition of Tu‘i Tonga authority may have been by means of alliances rather than by force, as in Ha‘apai. Given the resource structure and low population, the model that would appear to fit is an ideal despotic distribution. The evidence of linear defences (Davidson 1971), similar to Ha‘apai and Tongatapu, suggests some degree of competitive exclusion, but

[32] The earliest population census in 1891 recorded a population of 7308 in Tongatapu, 5632 for Ha‘apai, and 5292 for Vava‘u (Burley 2007a).

without chronology this is difficult to analyse. What is evident is that Vavaʻu societal and environmental structure was dissimilar to Tongatapu, and thus responses should be considered as specific to Vavaʻu.

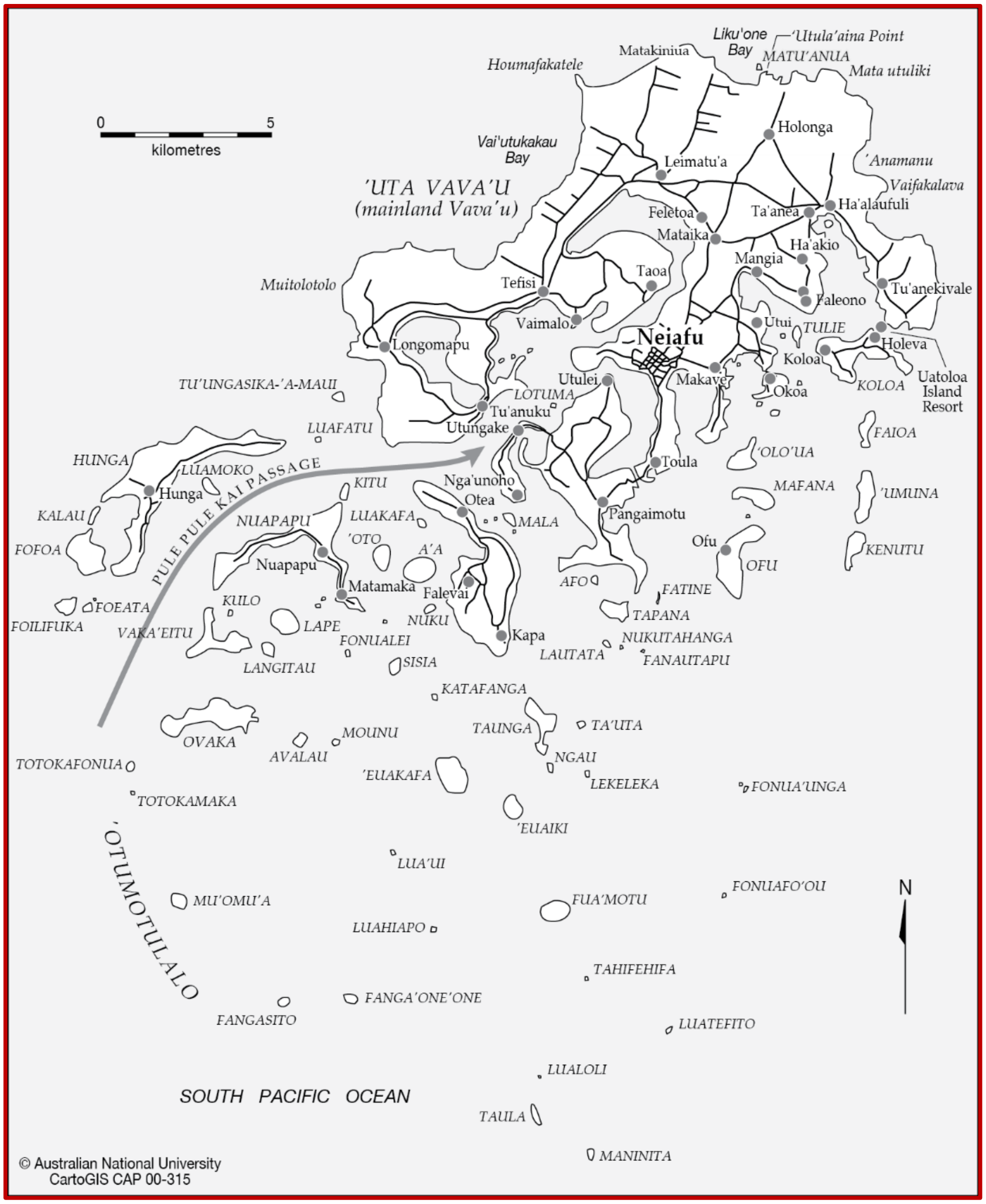
4. Epilogue

The Tuʻi (Vavaʻu and Haʻapai) as distinct lineages seem to appear late in prehistory, so do perhaps reflect significant changes on Tongatapu and the need to establish strong rule – or perhaps it was just opportunity, of which strong leadership contenders took advantage. In the prehistoric era, Vavaʻu became a theatre where lobbying for control by rivals within the Tuʻi Kanokupolu dynasty played out (Campbell 1982, 1989). The rise of the Vavaʻuan Finau ʻUlukālala lineage is important in Tongan archipelago-wide conflict and social structures. Conflict and rivalry between Tuʻi Tonga and Tuʻi Kanokupolu lineages played out between Finau (Tuʻi Vavaʻu) and Paulaho (Tuʻi Tonga), whereby Paulaho sought refuge with Finau but at the same time was a threat to Finau's ambitions (Campbell 1982, Gunson 1979). The balance of power was indeed precarious, as portrayed in events at the end of the seventeenth and beginning of the eighteenth centuries on Vavaʻu (Gunson 1979), and across the three island groups of the Tongan archipelago, during the civil war period.

For data table see Appendix C

For bibliography, see the main bibliography.

Map of Vava‘u Group



Map 18: Vava'u Islands

Showing the main island of ‘Utu Vava‘u; Pangaimotu Island and Kapa Island; the main settlement of Neiafu; fortified places at ‘Utungake, Feletoa and Tefisi.
Map reproduced with the permission of CartoGIS Services,
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Appendix E ‘Uvean environment, traditions and archaeology

1. Introduction

The material provided in this appendix is the full version from which the case study summaries are derived. It is provided here as a resource.

2. ‘Uvea environment

‘Uvea lies midway between Fiji and Sāmoa, with the nearest neighbour being Futuna, 180 km to the southwest. ‘Uvea is 96 km^2 in area, 15 km long and 7 km wide, is of volcanic origin, with a fringing reef and a coral barrier reef (forming a lagoon, 3-8 km wide); the barrier reef has four main passes with twenty-two islets in the lagoon or on the reef (Burrows 1937, 8-10, Frimigacci et al. 2016, 20, Sand 1998, 92). ‘Uvea’s administrative centre, Matā’utu, lies at latitude 13° 16' 59.88" S and longitude 176° 10' 59.88" W.

‘Uvea (Wallis) together with Futuna is now a French Overseas Collectivity. The 2003 census recorded a population of 10,071 for Wallis; in 2013 this fell to 8,584 (www.statistique.wf). The island of ‘Uvea has twenty-one villages in three districts: Hihifo with five villages, Hahake with six, including the administrative centre of Matā’utu, and Mu‘a with ten villages (Sand 1998, 93-95). See also http://www.outre-mer.gouv.fr/wallis-et-futuna.
Hihifo district is in the north, Hahake in the centre and Mu‘a in the south; these district names are the same as those of Tongatapu, albeit in a different geographical configuration (Sand 2008, 90). Burrows (1937, 9) noted that Alangau in the west (shown on some old maps) may be an ancient district. The name or chiefly title Alangau (or Alagau) appears often in the traditions (see below).

‘Uvea’s tropical maritime climate is warm and humid, with (current) average annual rainfall in excess of 3000 mm; the driest month is August in the slightly cooler May to September season, while October to April are wettest and hottest.

Lying east of the andesite line, and volcanic in origin, ‘Uvea has a gently undulating topography, with its highest point of 151 m a.s.l. at Mont Lulu in the north. ‘Uvea’s soils are weathered basalt; there are no permanent streams or watercourses, due to the high permeability of the rock, although there are springs and seeps at the base of shore cliffs (Kirch 1976, 1978, Sand 1998, 92, Sichrowsky et al. 2014, 333-334). There are seven crater and depression lakes, predominantly in southern ‘Uvea, ranging in depth, from the western Lac Lalolalo at 88.5 m, to the often-dry Lac Kikila in the east (Burrows 1937, 8, Sichrowsky et al. 2014, 333-334).

‘Uvea’s vegetation can be divided into four zones: the coast has littoral vegetation of a classic oceanic type, i.e. Barringtonia, Calophyllum, Cordia, Terminalia, Thespesia, and gardenias (*siale* in ‘Uvean), as well as some areas of mangroves; inland of the shore, domestic plants such as coconut, breadfruit and cultivated Pandanus are grown; the central southern half of the island and the west coast up to the hills has diverse secondary tropical forest - most gardens are in this zone; in the central northern area, Pandanus and Scaevola scrub, some fern, and straggly hibiscus predominate (Barrau 1963, 157-160 cited in Sand 1998, 92-93). Most gardens are in the central southern area, while the central northern area is what the Wallisians call the desert, *toafa*, with heavily laterised soils, being somewhat limited for cultivation (Frimigacci and Hardy 1997, Kirch 1978, Sand 1998, 92-93). In the littoral swampy margins, with humid lagoonal soils of 75% calcareous sand, taro is grown (Kirch 1978). While the centre is arable in parts, it is an arid region; the less cultivable areas occur in the districts of Hihifo and Hahake, while the Mu‘a district in the south has greater horticultural productivity (Burrows 1937, Kirch 1978).

The main aroid crop is the more drought-tolerant Alocasia rather than Colocasia; yams however are the most important plant species, as they are better suited to the wet-dry seasons of ‘Uvea (Kirch 1975, 150-156). The villages have areas of intensive drainage systems, as well as large areas of swidden land for shifting cultivation (Kirch 1975, 163). The *toafa* in northern ‘Uvea is largely an anthropogenic landscape, a result of burning in periods of famine to encourage sprouting of wild plants and yams (Kirch 1975, 165-166).

Most importantly, ‘Uvea has a diverse marine resource, since it has both fringing and barrier reefs and a large area of lagoon (Kirch 1976). The southeast area of lagoon is deeper than the northwest and thence has a greater diversity of marine resources (Kirch 1975, 381).

2.1 Comment - ecological context

Climates are dynamic over decadal scales, so understanding prehistory requires good palaeoclimate data. Kirch (1978) identified that an important ecological driver in ‘Uvea was the pronounced wet/dry seasonality and its influence on food production, especially yams. This is central to any discussion on ‘Uvean human-environment interaction. Recent hydrological studies (Sichrowsky et al. 2014), and ongoing analysis from limnological work will provide valuable evidence of palaeo-environments.

Kirch (1975, 89, 1976) noted that both ‘Uvean and Futunan contemporary settlement patterns are radial, running from a central inland point to the reef, thereby cross-cutting the various zones (interior, lowland, coast, reef) and providing access to a range of resources. Whether it can be assumed that this settlement pattern also occurred during the period in question is uncertain. However, what seems clear is that some natural resources, especially freshwater, were not evenly distributed, making this is a “patchy” environment, with associated constraints (Kirch 1976, 33). Burrows (1937, 12) noted in the 1930s that most settlements were around the east and southeast coast, and it may have been similar in the prehistoric period, although Burrows notes that in earlier times, many habitations and forts were inland (Burrows 1937, 12). This is confirmed in archaeological surveys. Kirch (1975, 378-380) noted that the southern and eastern areas of ‘Uvea have the best biotopes, with basaltic soils which are less laterised (than those of the north) and are near to the crater lakes, as well as the marshy lowlands for intensive drainage system agriculture, and access to the adjacent fertile arable upland plateau for swidden agriculture. Traditions (Burrows 1937, 20) suggest that there was competition over the lacustrine resources (Kirch 1975, 380), and fortifications in this vicinity perhaps confirm resource defence.

3. Oral traditions and ethnohistorical accounts

The work of Burrows (1937) provides a rich corpus of ethnographic material, including a section on traditions and genealogies. Kirch (1975, 1976) conducted the first major (ethnoarchaeological) survey of ‘Uvea, and this was followed by work in the 1980s by French archaeologists, principally Frimigacci and Sand (see Frimigacci 2000, Leleivai 2003, Sand 1998). Both Kirch and the ORSTOM team sought, and relied on, the information provided by local informants.

James Oliver, the earliest non-missionary literary source, arrived in 1831 and his accounts were later edited and published by William Dix in 1848 (Oliver 1848). Father Bataillon, the first Marist missionary on ‘Uvea in 1837, recorded traditions (Burrows 1937, 7), and something of agriculture in 1843 (Kirch 1978). Father Joseph Henquel (Marist missionary), between 1896 and

1910, recorded oral traditions and genealogies in the ‘Uvean language *Faka’uvea*, forming the first written history, *Talanoa ki ‘Uvea* (Miller-Helu 2011), which Burrows (1937, 17-40) translated and incorporated into his *Ethnology of ‘Uvea*. Burrows in 1932 had undertaken an ethnological survey, recording this fieldwork, which formed the basis for his written volume; he also provided a brief section on archaeological sites (1937, 41-45), and evidence of tactics, weapons and forts, indicating that warfare was significant and recurring in ‘Uvea (1937, 79-84, also Kirch 1975, 396). More recently, Mayer, from 1969-1971, collected oral traditions taken from tales and legends; Frimigacci and Vienne from 1982-1988 collected oral traditions at the time of their excavations and restorations, and finally, traditions are also recorded in chants (see Burrows (1937, 42) for an example) (Leleivai 2003). Among the above multiple sources, there is no “correct” original version of oral traditions - all may be accepted and at the same time questioned (Leleivai 2003, 339).

Earlier traditions may be overwritten by subsequent events and by competing narratives. Some Tongan traditions appear to have become incorporated into ‘Uvean histories, e.g. relating earlier Tongan events as if they were part of ‘Uvean history. Tongan traditions record that the 11th Tu‘i Tonga (Tu‘itatui) brought ‘Uvean basalt to Tonga for tomb construction, while an ‘Uvean tradition records Tongan journeys to ‘Uvea and return to Tonga, where Tu‘itatui constructed a monument, the Ha‘amonga-a-Maui to mark this journey (Frimigacci 1997, 341). Traditions speak of Tu‘itatui’s Tongan possessions including ‘Uvea, and that ‘Uvean craftsmen built the Trilithon (Herda 1988, 39-40, Sand 2008, 77), yet this must predate the Tongan incursion into ‘Uvea (as recorded in most traditions at least), although it does not preclude interactions and exchange. Perhaps these exchanges signify ongoing interactions.

On a first reading, ‘Uvea’s genealogy and oral traditions appear to go back only a few centuries, recording that Tongans first settled ‘Uvea (Burrows 1937, 18, Sand 1993, 44), which is contrary to archaeological evidence (Sand 2008, 77). Tongan traditions also record that in ancient times Tonga had control over Sāmoa, eastern Fiji and ‘Uvea, but these accounts are complex, often mythical, and may seek to promote local power, and so are difficult to use in outlining historical events (Sand 2008, 75). As Sand has noted, this may be rather more about establishing connections between people and places, seeking to link oral traditions with landscapes.

Interactions across Western Polynesia, and involving Tonga, were likely ongoing and diverse. Tongans voyaging to ‘Uvea and establishing networks and alliances are hinted at, albeit obliquely, in legends. Despite the vagueness of descriptions, a general picture emerges of some preliminary interactions, links, alliances, or evidence of Tongans in ‘Uvea, prior to the strong oral tradition of Kau‘ulufonua's campaign. The timing (broadly speaking) of these events is important when placed in the context of regional events, both socio-political and environmental.

In a brief allusion to earlier ‘Uvean social structure, Henquel's accounts of early chiefs indicated these were independent, i.e. independent rulers over some areas. Burrows (1937, 40) suggested Tu‘i Alangau was a likely example of an independent chief, residing in the southwest of ‘Uvea; Tu‘i Lauliki was another, similarly in southern ‘Uvea. The exploits of Tu‘i Alangau, and other chiefs indicated that in the early period, as related in the histories, there were many battles arising amongst rival chiefs, but there was no united pan-island rule (Burrows 1937, 40). The state of these chiefdoms early in the last millennium is unclear, as there are conflicting accounts in oral traditions about chiefly titles (including in the time of the first Tongan inhabitants), within the political units in the southern part of ‘Uvea (Sand 1993, 44). However, a general picture emerges of some low-level chiefly structure, at least in southern ‘Uvea, and likely also in the north.

Henquel's genealogy (in Burrows 1937, 18-19) listed seven "ancient kings", commencing with Tauloko, covering a long period from AD 1150-1600. Miller-Helu (2011) revised this to show Tauloko as the first king (Tongan nominee), commencing AD 1450, presumably to better align genealogies with traditions. Initial Tongan interventions (as opposed to ongoing interactions), are difficult to outline because of overlapping stories of Tongan-appointed governors, and because the strong tradition of Kau‘ulufonua tends to dominate. While the following outline does not purport to reflect a particular chronological order, the story of Kau‘ulufonua is provided first, followed by brief details of the governors appointed by the Tu‘i Tonga and/or successors.

Kau‘ulufonua led a war of conquest, not only against ‘Uvea, but many islands of Western Polynesia and Eastern Fiji, as attested to in many oral traditions "throughout the region" (Herda 1988, 50-51, Rutherford 1977b, 35, Sand 1993, 45). Different traditions relate his campaign of expansion in different ways, with many overlapping stories which have become elided over time (Pollock 1996). The traditions generally point to a northward expansion of the Tongan sphere of control, or interest, at least (Sand 2008, 75). In the ‘Uvean version (Burrows 1937, 27-30, Sand 2008, 82), some actual or perceived slight to Kau‘ulufonua’s mother, and her subsequent murder was the trigger for Kau‘ulufonua’s campaign. In the Tongan version, it was the murder of Takalaua, the 23rd Tu‘i Tonga, and father of Kau‘ulufonua (Gifford 1924, 60-62), that led to his seeking revenge and establishing authority in ‘Uvea. These parallel accounts of an assassination lend credence to the occurrence of this event, or at least some major upheaval. Regardless of the justification for the campaign, the “events” associated with Kau‘ulufonua signify a period of turmoil and changing relationships between Tonga and ‘Uvea. There also appears to be more than one “invasion”, as traditions relate that in the time of the 23rd Tu‘i Tonga (Takalaua), Tongans came and built forts (Gifford 1929, 40-52, Frimigacci 1997, 341, 343), so that this period in ‘Uvean history was known as the time “of the forts” (Frimigacci 1997, 343). It is unclear whether there was an extended period of conflict or multiple attempts by Tonga to assert control in ‘Uvea. After Kau‘ulufonua’s campaign, in Henquel’s account, Kau‘ulufonua declared that the people of ‘Uvea would be independent (Burrows 1937), but the meaning of this is unclear. Whatever the actual course and cause, these were clearly major events, or a political upheaval, and possibly mirrored events in Tongatapu at around the same time. Oral traditions do record the rapid development of political control of southern ‘Uvea after Kau‘ulufonua’s campaign.

While there are many references to Kau‘ulufonua and Tongan expansion, dates vary. Some writers (Burley 1995, 158, Gifford 1929, 56) suggest AD 1470 as a date of Tongan incursion, this being the period of the 23rd or 24th Tu‘i Tonga, arrived at through genealogies. The sequence of events at this period is far from clear, with confusing and conflicting tales, and (as yet) too few absolute dates provided in archaeological investigations, to unravel the mid-millennium period. Just as there is confusion over the timing and justification for the Tongan campaign, so is there concerning the first and second *hau*, or governors of ‘Uvea. Tauloko, the “first ‘Uvean Hau”, in the ‘Uvean version, was sent by the Tu‘i Tonga at the ‘Uveans request (Burrows 1937, 18). The ‘Uvean version may be retrofitting a more suitable explanation or is perhaps a metaphor for, or an indication of, negotiation or exchange between ‘Uvea and Tongatapu. Henquel tells of Tauloko being of the Tu‘i Tonga lineage and being appointed as governor of ‘Uvea and crowned by “Hoko”, a Tongan chief (Hoko appears to be a title) (Burrows 1937, 18, Sand 2008). Tauloko lived in south-eastern Uvea, at Ha‘afuasia; according to oral traditions he was buried in a royal burial complex described as a stone house (*fale maka*) – a burial vault (Burrows 1937, 43), this being perhaps the first such type of burial with a vault, and as has been suggested, may be an indication of the introduction of Tongan cultural traditions and systems to ‘Uvea (Sand 2008, 83). This south-eastern establishment of a Tongan governor contrasts with Tu‘i Alangau (who appears as a dominant ‘Uvean paramount chief) who resided on the southwest coast.

The second ‘Uvean *hau* was Ga‘asialili, a Tongan war chief, of Tu‘i Ha‘atakalaua lineage, thus suggesting he is linked to the period following the introduction of the second paramount lineage in Tongatapu (Burrows 1937, 19, Frimigacci 1997). He was accompanied by two noble Tongan families (Kalafilia and Fakate) with guardian warriors, men of the Ha‘amea and Ha‘avakatolo lineages from Hihifo on Tongatapu (Burrows 1937, 19-20, Frimigacci 1997). Interestingly, Ha‘avakatolo and Ha‘amea were said to have come from Hihifo in western Tongatapu, rather than from the central area of Mu‘a (Burrows 1937, 18). Since western Tongatapu does not appear influential in Tongatapu until the seventeenth century, this may indicate the relative period.

At this time, the land of ‘Uvea was partitioned into three, with Kalafilia taking the west, Fakate the north and central desert plateau called the *toafa*, and Hoko the south (Burrows 1937, 18, Sand 2008, 84). This partitioning occurred from the central location of Lake Lanutavake, which is suggestive of the importance of a water source (Burrows 1937, 18, Frimigacci and Hardy 1997, 50, Sand 2008, 84). While Kalafilia and Fakate seem to be new arrivals, Hoko (presumably a title) who received (or took) the southern part, was the inaugural Tu‘i Tonga-sponsored chief, who appointed the first ‘Uvean king or *hau* (see Sand (2008, 96) for a discussion on the issue of the three titles of Hoko, Kalafilia and Fakate).

Oral traditions record a series of “forts”, many around Lake Lanutavake, the “first fortified place on ‘Uvea” (Burrows 1937, 20), where the three divided areas met, perhaps an ideal location with freshwater and areas for gardening (within walled enclosures). From this fort (with its more than thirty gates as Burrows (1937, 20) relates), at least seven roads radiated out, linking to other forts (Sand 2008, 85). Chief amongst these forts was Kolonui, but smaller forts appeared along the linking road network – these roads were either cut into the ground or enclosed by raised stone walls (Sand 2008, 85). Southern ‘Uvea thus clearly became the focus of activity, with most construction occurring there - forts, large platforms, and wells (see Frimigacci et al. 2016, for comprehensive details). There is some confusion over Ha‘amea and Ha’avakatolo, the two lineages accompanying Ga‘asialili. Burrows relates that they built forts – Ha‘amea at Atalika (near Mt Atalika in southwestern ‘Uvea), and Ha‘avakatolo at Kolonui (Burrows 1937, 20). How that relates to Hoko is unclear. Also unclear is what then happened in the north (Fakate’s division) since the Ha‘avakatolo and Ha‘amea appear to have remained in the south.

In some versions of the tradition, Ga‘asialili appears not to have remained long on ‘Uvea, but was killed in Futuna, after a failed attempt to seize control there (Burrows 1937, 19). In ‘Uvea he was succeeded by a harsh ruler, Havea-Fakahau, who nonetheless ruled for sixty years (Burrows 1937, 20-22). It was during his reign (in one version of events) that, according to the famous legend, the great canoe Lomipeau was built (Burrows 1937, 23-24), which took ‘Uvean stone to Lapaha for (‘Uluakimata I, 29th Tu‘i Tonga) Tele‘a’s *langi* (burial mound) (Kirch 1984, 235). The Lomipeau legend is recorded in both Tongan and ‘Uvean traditions, indicating the importance of this as an ‘Uvean symbol, albeit that periods, people and explanations are confused. The ‘Uvean tradition, as related by Burrows (1937, 24), is that Lomipeau was at Tele‘a’s disposal, because ‘Uvea was under the command of Tele‘a. The reasons for Lomipeau’s construction vary, for example there is a story of Lomipeau being built as a result of insults, and of being built in two parts (possibly a reference to boundary disputes, or perhaps the alliance of different factions) (Pollock 1996). In relating that Tele‘a directed that Lomipeau return to ‘Uvea and bring back stones for the royal tomb, the legend speaks of the relationship between ‘Uvea and Tongatapu – perhaps as ‘Uvea fulfilling obligations – or perhaps as showing ‘Uvean prowess and the capability to fulfil those obligations (Pollock 1996, 439). The ‘Uvean version of the Lomipeau story began with a dispute over boundaries, following which the two opponents sought direction from the Tu‘i Tonga (‘Uluakimata I, known as Tele‘a) on “his island of ‘Uvea” (Burrows 1937, 24). The story of the construction of Lomipeau also involves (in the ‘Uvean version) a dispute or some perceived slight between a chief of Tonga and the ‘Uvean *hau* Havea-Fakahau. The tradition relates that a Tongan chief attempted to take Fakahau’s wife, and so this was possibly also a property or boundary dispute requiring resolution. Hence, the double-hulled canoe may be a metaphor for the dispute over boundaries or property in ‘Uvea – and perhaps the right of Tongans to exercise control. This may also relate to ‘Uvea-Tongatapu interactions in the time of ‘Uluakimata (Tele‘a), as the traditions relate that Tele‘a ordered stone to be brought from ‘Uvea for the construction of a platform at Lapaha (Burrows 1937, 24).

From the time of Havea-Fakahau (3rd ‘Uvean king), appointments were from within, rather than from Tongatapu, resulting in conflict between descendants of Fakate and Kalafilia (and Hoko) (Burrows 1937, 22, Sand 2008, 91). This period of heightened tensions between Tongan lineage members, played out across southern ‘Uvea, resulting in numerous assassinations, with dynastic transitions far from smooth, and also seeing the involvement of Tu‘i Alangau in supporting one side (Burrows 1937, 20-27). There were boundary disputes over Lake Lalolalo (largest water resource) between descendants of Kalafilia and Fakate, the two chiefs of northern and western portions of ‘Uvea (excluding that of Hoko) (Burrows 1937, 22). This is referenced to the time of ‘Uluakimata (29th Tu‘i Tonga, Tele‘a), who is said to have adjudicated in this dispute.

The dynasty of Takumasiva (AD 1600-1660 in Henquel, but AD 1500 in other versions) was recorded as an initial period of stability, with a “good king”, Takumasiva, perhaps indicating that ‘Uveans sought to bring to bear their own style of rule, with the first reference to a “Tu‘i ‘Uvea” (Burrows 1937, 33-34). Traditions also record strategic marriage alliances between Tongan chiefs and the daughters of local ‘Uvean chiefs (Burrows 1937, 30-34). This was followed by a period of upheaval, with indications that Tonga tried to reassert control in ‘Uvea (Burrows 1937, 30-34). If this was in the AD 1600s, then it may parallel events in Tonga, where political instability was apparent, with different groups vying for power. While most activity seems to relate to southern ‘Uvea, in the following century there was an uprising from northern ‘Uvea, led by local chiefs of Alele. They were opposed by (Tongan) Ha‘avakatolo and Ha‘amea lineages (Fakate, Kalafilia and Hoko), apparently gathered about the Tu‘i Alangau from the southwest. This was the Molihina battle, noted as a war by northern ‘Uveans to gain independence from Tongan control (Sand 2008, 92 citing Frimigacci et al. 1995:70-73), although this may actually reflect a series of battles. The Alele people were exterminated, and it appears that the “Tongan-influenced” ‘Uvean-style political structure spread over all ‘Uvea.

The first European contact with ‘Uvea was the passing visit in 1767 of Captain Samuel Wallis, after whom Wallis was named (Burrows 1937, 4). Unfortunately, there are no records of these first interactions, nor observations of the social and environmental landscape of ‘Uvea until the early 1800s.

4. Archaeology of ‘Uvea

4.1 Introduction

Little archaeological work occurred before Kirch’s ethnoarchaeological study of 1974. Kirch did a reconnaissance survey in the southeast, located and described nineteen sites, with many features such as stone habitation platforms, sunken and elevated roadways, burial mounds, circular mounds with symmetrical ramps (which Kirch identified as pigeon mounds or *sia heu lupe*), and various fortifications (Kirch 1975, 378, 382). Since the 1980s, most work has been undertaken by French archaeologists, of the ORSTOM-CNRS team, principally Frimigacci and Sand, Vienne and colleagues. Frimigacci and others undertook an inventory of sites, with some excavations in the 1980s and into the 1990s, including reconstruction work on three monuments: the residence of Kalafilia, the Malamatagata monument at Utuleve, and the Talietumu residence within the Kolonui fort (Frimigacci 2000, Frimigacci et al. 2016, 20-22). There has been little archaeological work since this period, although a recent publication (Frimigacci et al. 2016) provides a valuable compilation of data and interpretations.
A preliminary comment is necessary at this point to counter the oft-repeated contention that all ‘Uvean monuments are of Tongan origin. Evidence indicates that there were some pre-existing structures, and Tongans may have enhanced or added to these, as well as introducing new elements such as pigeon snaring mounds (Sand 2008, 100). In addition, there is evidence that defensive works already existed on ‘Uvea, at the fortified promontories of Lausikula in the southwest, and also Niuvalu on the opposite southeast coast (Sand 2008, 100). Burrows (1937, 27-28) records a tradition of the construction of an additional fort by ‘Uveans in preparation for the Tongan invasion of Kau‘ulufonua, indicating that forts were not new to the ‘Uveans.

The following overview of archaeological work is organised, as a matter of expediency, following the organisation of Frimigacci et al. (2016), into different types of features.

4.2 Structures – habitations

Kirch (1975, 387) noted the habitation sites in the southeast featured raised oval platforms (*paepae*) of stacked lava rock (although many of these structures, particularly in the interior, had been disturbed by agricultural activities). Kirch noted three concentrations of these features, each associated with a stone-walled fortification, implying some settlement density in the southeast but also indicating conflict, perhaps between groups, leading to this residential focus around a fortification (Kirch 1975, 388). Burrows (1937, 12) had similarly commented that habitations (house platforms) and forts had been common in the interior. Burrows (1937, 41-43) briefly surveyed several habitation platforms as recorded in ʻUvean traditional history: at Havaiki near the southeast coast (a low mound supposed to be the house site of Tauloko, the first ʻUvean paramount chief), at Lauliki in the western interior (a large house platform, as well as back-rest stones on a *malaʻe*), and two other large house platforms near Point Lausikula in the southwest. Kirch was able to locate Havaiki and Lausikula, but not Lauliki (Kirch 1975, 388). These three locations are addressed below under burials, and platforms and villages.

4.3 Structures – platforms and villages

Confusingly, there are two locations named Lauliki, one in the Muʻa district and one in Hahake, although the distance between them is not far, approximately 2 km. Lauliki, in Muʻa, is an area between Lac Lalolalo and Utuleve, containing numerous structures that could be remnants of an ancient village, including many platforms, all stone-faced with some round, some rectangular, and one oval, and with ancient roads traversing the site (Frimigacci et al. 2016, 100-101).

Lauliki, in Hahake, east of Lalolalo, is the place which Burrows had identified, that Kirch was unable to locate, but which has been described by the ORMST team of Frimigacci. Burrows (1937, 41) described this place as associated with the Lomipeau construction; Burrows (1937, 41-42) also recorded a large platform for habitation, and a *malaʻe* with chiefs' backrest stones for kava ceremonies (Kirch 1975, 401-402). Frimigacci (2016, 94-96) described a stone oval structure with paved surface, of unknown function, but which may have been something other than habitation. The Frimigacci team was unable to find the six stones described by Burrows as backrest stones for chiefs during kava ceremonies, although they did find a group of upright stones and a very large basalt stone with a "*vasque*" (basin, bowl) filled with water. Again, this site also features a burial mound and has a section of ancient road running through it (Frimigacci et al. 2016, 94-96).

The monument of Malamatagata is within the larger site of Utuleve and was allegedly built for the Tongan Kalafilia (of the Haʻavakatolo lineage – see oral traditions section) (Frimigacci 1997, 343). Utuleve is a large site with evidence of a long chronology of human activity from the earliest Lapita colonists (see Frimigacci et al. (2016), including radiocarbon dates pp300-301).

Excavations prior to the reconstruction of Malamatagata involved detailed recording of the stratigraphy and cultural material (see Frimigacci et al. 2016, 131-180) and also of the adjacent residence of Kalafilia (Frimigacci et al. 2016, 218-238). The monumental architecture is a large and complex structure, associated with traditions of the Tongan Kalafilia lineage. It is evidently underlain by a former structure dated to the thirteenth or fourteenth century AD (Hardy 2009, 72). The complex traditions of events at this location are beyond the scope of this research but involve the relationships and interchanges between ʻUvean and Tongan elites. For details the reader is referred to Frimigacci (1997), Frimigacci (2000), and Hardy (2009).

4.4 Structures – burials

ʻUveans distinguish between *faʻitoka* (tombs of chiefs) and *tano* (commoners' burials) (Frimigacci et al. 2016, 288). There are no burials known as *langi* (as are found in Tonga for the Tuʻi Tonga lineage). The most common type of burial mound across ʻUvea is the unfaced round or oval shape; named tombs are more variable with a mix of faced and unfaced with a round or rectangular shape (Frimigacci et al. 2016, 286-294).

At Lausikula Point in the southwest, Burrows had observed the site called Atuvalu, (meaning a row of eight tombs), which had been the subject of an "excavation" in the late nineteenth century. Burrows (1937, 41-42) references a letter of AD 1896 describing missionaries' excavations, during which tombs were opened and skeletons discovered, purported to be those of eight "ancient rulers", kings or chiefs including Havea Fakahau, the third of the ancient kings. See also Kirch (1975, 391). Oral traditions do not identify a chronology for the fortified Lausikula promontory and the Atuvalu burial area, but there is a chant which refers to this as the king's assembly place and tomb of Puhi and Kakahu (Burrows 1937, 42, 90). It is not clear to which period these kings belong, but the lack of association with Tongan figures tends to suggest it predates Tongan "invasion" (Sand 2008). Atuvalu was excavated in 1983 to reveal a shallow burial of a high-status male, buried with a female (Frimigacci 1997, Sand 1998, 2008). Based on the chant of Lausikula, Frimigacci (1997, 334, 2016, 253) has proposed that this burial is that of the mythical ʻUvean king/*hau* Puhi. Skeletal material from the presumed Puhi has been dated to cal AD 1301-1410 (Frimigacci 1997, 339, Frimigacci et al. 2016, 253-257, Sand 1998, 103-104, 2008, 80-81). This is one of the few available dates for the last millennium. Thus, it might be proposed that this location served over a period of time beyond the Tongan period. However, linking this to possible Tongan interactions early in the millennium is problematic. Frimigacci (2016, 253-257) noted that many of the traditions for this area are confusing, but this location appears to have been a sacred burial site, including burials of both ‘Uveans and Tongans killed in conflicts (of unknown time period). Lausikula had natural defences, as it is on a promontory (formed by the side of a caldera of an old volcanic crater) overlooking the sea, and these natural features were augmented by artificial defensive structures (Sand 2008, 80-81). Thus, the area of Lausikula Point seems important in southern ‘Uvea and may be linked to conflict over a period extending earlier in time than the Tongan incursion of mid-millennium.

At Havaiki, Burrows (1937, 43) had noted the first king's residence and his nearby tomb (between Havaiki and Ha‘afuasia on the east coast), describing the tomb as a stone house (*fale maka*) on slightly raised ground, faced with uncut volcanic rock (reminiscent of the Tongan burial mound at Heketā). As recorded by Kirch (1975, 391), the site, called Niuvalu, is a rectangular mound, recalled as a major burial ground of ‘Uvean chiefs, including the tomb of the first king Tauloko, called Fugasia, with its stone house (*fale maka*), but also, according to Burrows (1937, 43), the high burial mounds of Talapili and Talamohe (the 4th and 5th ‘Uvean kings) (Kirch 1975, 392). Frimigacci et al. (2016, 59) does not confirm this attribution, so it may be in error, given that Lausikula was the burial place of the 3rd king. However, the associated royal residence in this location is linked with early ‘Uvean *hau* (Tauloko, Havea-Fakahau, and Talapili and Talamohe) (Frimigacci et al. 2016, 93-94). As noted above, Ha‘afuasia also presents as a naturally defended location.

<u>4.5 Structures – roads</u>

Kirch also noted sunken and elevated roadways, 1-2 m wide, running for long distances through the interior, often being relatively straight (Kirch 1975, 388-389). Elevated roads were constructed by use of lava rock, edged with low curbs or walls (Kirch 1975, 389). Sunken roads appeared to have been excavated. The road form, elevated or sunken, appears to be a function of terrain, so where lava rock is abundant elevated roads appear, and where rock is lacking, roads are sunken – and roadways change from one form to the other in response to the terrain (Kirch 1975, 389). These roads connect sites, creating a network, indicating an association between forts and roads via these inter-site communication networks (Kirch 1975, 389). This association is clearly seen in the map (see Figure 15 in the main thesis text). Frimigacci and colleagues

(2016, 283-286) located thirty-three parts of roads with a total distance of 6 km, these being of four types distinguished by level (sunken or raised) and by material type (earthen or with use of stone). Earthen construction was more common in Hihifo district, while the use of stone was most common in Muʻa district where basalt stone is readily available. Roads are most numerous overall in Muʻa (Frimigacci et al. 2016, 283-286).

4.6 Structures – circular earthen mounds

Kirch identified three circular earthen mounds, not previously recorded in ʻUvea, but which Kirch considered typical of Tonga; the first mound was a stone-faced circular mound with surrounding ditch and three earth ramps (causeways) crossing the ditch, while in the centre of the mound was a shallow depression 40 cm deep and 5-6 m wide; the second mound was some 80 m away and was smaller but similar in form (Kirch 1975, 393). Kirch considered the form of these structures to indicate their function as *sia heu lupe* (Kirch 1975, 393-394). Frimigacci (2016, 99-100) however, describes this site (Fugauvea) as a group of structures including an unfaced habitation platform, a stone-faced circular platform (the structure Kirch indicated appeared to be a pigeon mound), and an unfaced burial mound. Frimigacci considered these more likely to be part of an ancient village and that the central depression was caused by a large tree (Frimigacci et al. 2016, 99-100). These three structures, in an inland forest area between Lac Lanutavake and Tepa village, were linked via a sunken roadway to the large stone-walled fortification called Makahu to the southeast (Kirch 1975, 393). As noted elsewhere, pigeon habitat is likely to have been in areas (now) referred to as *vaotapu*, and away from human habitation. The *vaotapu* area extends across the south-eastern interior, including the areas around the crater lakes Lalolalo, Lanutavake and Lanumaha (Frimigacci et al. 2016, 77-78). Thus, these mounds lie within or near pigeon habitat. However, in the absence of finer detail, the function of these mounds must remain indeterminate.

4.7 Structures – forts

Burrows also described several forts, mostly in the southern ʻUvean district of Muʻa. Kirch located five fortifications, including the three reported by Burrows (1937, 44-45). Lanutavake was (according to Henquel) the first fortified place in ʻUvea, built for the Haʻavakatolo lineage (Burrows 1937, 20, Kirch 1975, 399). Lanutavake was a fortified crater lake with a surrounding complex defensive ditch and embankment featuring stone walls and possibly an area of habitation near the southern wall system; numerous access points were located around the perimeter (Burrows indicated these numbered more than thirty, of which eighteen were found by Frimigacci (2016, 108-110). Lanutavake was the point from which the three Tongan chiefs (Hoko, Kalafilia and Fakate) partitioned ʻUvea, perhaps indicating the central importance of this freshwater source. The number of access points seems high, given the lake is only approximately 275 m in diameter (Sichrowsky et al. 2014, 334 Table 1), and the diameter of the fort is approximately 700 m (Sand 1998, 98).

Kolonui in southeast ʻUvea was a vast fortified structure, one of the most spectacular monuments in ʻUvea, constructed around the large (approx. 90 m by 60 m) Talietumu residence, including its *malaʻe* and *paepae* (habitation platform) in the southwest corner of the fort (Frimigacci et al. 2016, 106-107, 239-250). While Talietumu likely had a residential purpose, Kolonui's internal structure indicates many functions – defence, meeting place, an elite residence, food gardens, working places; this fort (Kolonui) was apparently linked to Lanutavake (the fort) by a series of roads (Pollock 1996). The site has a commanding view over southern ʻUvea and the largest reef passes (Pollock 1996). The fort has a wall up to 15 m wide by 4 m high, and also some burial mounds near the Talietumu residence and within the ancient walls, with an ancient road traversing it (Frimigacci et al. 2016, 110, 112, 239-250). This site was not able to be found by Kirch (1975, 398). Frimigacci and team excavated at Kolonui, the fort and the so-named Residence of Talietumu within it, undertaking reconstruction in addition to excavation. The fort, and Talietumu, are variously described as dating to the fifteenth or sixteenth centuries (according to Frimigacci and Hardy (1997)), but the only structure to have been dated is an *umu* within the fort, dated to the end of the first millennium AD (cal AD 714-1010) (Frimigacci 1997, 343). Thus, as identified for Atuvalu, there is evidence of earlier construction, or at least occupation, but this is of little assistance in identifying the timing "of the forts".
Makahu was a large (200 m x 100 m) fortification with a connecting network of roads (which Kirch indicated had numerous house platforms nearby) (Frimigacci et al. 2016, 112-114).
Other forts include Fugakola in the southwest-central area near Lac Lalolalo, and Malaetoli, also in the southwest which was a large stone-walled fort with numerous stone house platforms in the vicinity (Kirch 1975, 400-401). Tekofe, inland of Haʻatofo village on the eastern coast, is similar to Makahu, with numerous stone house platforms in the surrounding area (Kirch 1975, 401). For Lausikula see above under "burials".

Traditions indicate these fortifications are associated with the descent groups (lineages) of Ha‘avakatolo and Ha‘amea, e.g. Lanutavake and Kolonui were built by Ha‘avakatolo; Atalika (in southwest ‘Uvea near Mt. Alika, an earthen fort built in the time of the 6th ‘Uvean king Fakahega (Burrows 1937, 20, Frimigacci et al. 2016, 108)) was built by the Ha‘amea (Kirch 1975, 397-398). Habitation platforms occurred either within or nearby (Kirch 1975, 397, 1976, 49). Kirch emphasises this frequent association of fortifications and habitations. Importantly, this "Tongan" fort construction appeared only in southern ‘Uvea, which has been the focus of much of the literature concerning ‘Uvean monuments. Ascertaining the evidence for this proposition must rely on future investigations.

4.8 Comment – monuments, mounds and fortifications

Many of the monuments of southern ‘Uvea "appear" Tongan in origin, "on typological grounds" at least, as Sand (1998, 115) avers. The evidence for this is found in the large raised burial mounds with chambers and the use of tapa cloth to wrap bodies (Sand 1998, 115, 2008, 88, Sand and Valentin 1991, 240). Sand (1998, 97) states that "Tongans are believed to have introduced to ‘Uvea the tradition of building raised mounds (*fa‘itoka*) for burial of people of high lineage". More than seventy burial sites were recorded during surveys in the 1980s, varying in size from 2 m to 20 m, of variable height 1 m to 3 m, and with/without a stone surrounding wall; missionaries recorded that most had burial chambers made of slabs of basalt, coral or beachrock (Sand 1998, 97). The evidence appears to indicate that Tongans introduced three types of monuments – buried vaults within raised mounds, *sia heu lupe*, and stone wells (Sand 2008, 88-89). This hypothesis is based on typology and the location of similar structures, i.e. found in Tonga. Kirch (1976) considered that the mound (referenced using earlier notation system as UV-14) at Fugauvea (MU-96 in Frimigacci et al. (2016)) looked similar to the Tongan *sia heu lupe* – and virtually identical to pigeon mounds described by McKern for Tonga (Kirch 1976, 50). The presence in ‘Uvea of pigeon mounds and stone-walled fortifications, Kirch asserted, provided "solid archaeological evidence" of ‘Uvean-Tongan contact (Kirch 1976, 59). Again, one cannot conclude that Tongan control occurred or even that Tongans introduced structures, without further analysis of this apparent similarity.

Fortifications appear predominantly in the south. ‘Uvean fortifications, especially wall and ditch type, have been noted as similar to Tongan, apparently supporting the contention that are Tongan

(Kirch 1976, 49). Kolonui is attributed to Tongan presence in the fifteenth century. This fort was linked by a road network to other forts in southern ‘Uvea. Whether these forts were the work of Tongans, or influenced by Tongan architecture, or a local invention or initiative, or a local response to aggressors, is not clear. It is assumed (by some writers) that these constructions are Tongan in origin, but this needs to be supported by some analysis, by comparisons and also by examination of earlier ‘Uvean construction. Indeed, some of the attributes of these forts suggest some other functions – and so perhaps fortification of existing structures is a possible explanation. Tongans did build forts. Mata‘uvave (and/or Ha‘apaians) built the fort of Kolo Velata on Lifuka Island (see Marais 1995), but for ‘Uvea, where there are many forts, this does not mean there were no pre-existing defensive works – as on the promontory at Atuvalu (Sand 2008, 100). Forts had not only utilitarian functions but were perhaps also symbols of prestige, showing a lineages' power and ability to command labour, and indicating hierarchical class division, as evident in elite structures like *sia heu lupe* (Sand 2008, 100). This is perhaps an example of how traditions change. Just as traditions related that Tongans were the first settlers of ‘Uvea, so traditions extended to Tongans building all forts. Frimigacci (2000, 151-153) considered that the period of forts did not last long, starting sometime between AD 1400 (death of Puhi) and the Tongan incursion by Kau‘ulufonua, whose reign was AD 1470 (according to Gifford) and perhaps ended by AD 1500 (with the ascension of the Takumasiva dynasty). However, in the absence of a chronology for defensive structures, the "*debut de la période des forts*" remains conjectural. Frimigacci (2000, 153) also proposed that the forts were not so much for defence against (presumably) ‘Uvean aggressors, as a show of strength (and Tongan grandeur). Importantly, this "Tongan" fort construction appeared only in southern ‘Uvea, which demands further investigation.

5. Northern ‘Uvea

Oral traditions record that the Molihina war burials were located at Pela Pela (Sand 1998, 105). Excavations at Pela Pela in Hihifo (HI-24A) revealed a burial mound with two individuals at 30 cm depth, and an additional skeleton at 60 cm (Frimigacci et al. 2016, 55-56, Sand 1998, 105). No dates have been ascertained.

Excavations in 1989 at Petania (HI-5A), also in Hihifo, located a burial chamber (*fa‘itoka*) in a mound (Sand 1998, 105). Unfortunately, the interior structure had been destroyed when slabs were removed to be used in church building (Sand 1998, 106). In excavating further around the chamber, two horizons containing burials were found, with the upper horizon having more than fifty individuals, likely from the contact period (from the seventeenth century on), as suggested by the presence of blue glass beads. The lower horizon had six levels, with skeletons encircling the central chamber, and at the lowest levels more than 150 skeletons were found in an oval pit, these probably having been buried at the same time, in the seventeenth century at the earliest, but likely in the eighteenth century. Again, there are no radiocarbon dates. Oral traditions record this burial as those who died in battle between southern ‘Uveans and local villagers of the north (Sand 1998, 107, Sand and Valentin 1991, 238). This evidence would appear to date from late in the sequence, after the major Tongan presence had passed.

6. Summary comments on archaeology

In summary, archaeology for the period of the mid-second millennium is spatially diverse but constrained by a lack of robust chronology, and thus relies on traditions to provide the chronological framework. Archaeological survey evidence shows areas across southern ‘Uvea where fortifications and habitations are concentrated, interlinked by an extensive network of roads, including routes radiating from the central Lac Lanutavake. While traditions suggest that both the southwest location around Utuleve/Atuvalu and the eastern Ha‘afuasia area are associated with the earliest Tongan influences, only the former has dates to support this. While the range of site type (house platforms, ceremonial platforms, burial mounds, fortifications) may in some respects mimic those of Tonga, there is little robust evidence that this is the direct result of Tongan incursion, as opposed to a response to Tongan incursion, or indeed resulting from ‘Uvean cultural processes including conflict, competition and cooperation. The prevalence of basalt stone in southern ‘Uvea makes this a very different landscape to Tonga, and constructions in stone would appear to be a function of available materials. This differs from northern ‘Uvea, where lava rock is not extensively found across the landscape, and where there are few water sources in the interior, and human occupation appears confined largely to the coast where springs provide a water source, and where access to the marine resource is easier.

Of pigeon mounds or *sia heu lupe*, inferred as a signature of the Tongan elite, there is less secure evidence. Kirch (1975) attests to at least one *sia heu lupe* associated with other structures in southern ‘Uvea, but Frimigacci et al. (2016) are of the view that this cannot be confirmed. This raises the question of how features such as *sia heu lupe* are to be identified. Frequently, this is by using local knowledge of places, or by study of the mound form and comparison with other "known" mounds. The current evidence appears equivocal on the construction of *sia heu lupe* for the elite sport of pigeon shooting in ‘Uvea. The other structure, often associated with Tongan elites, was the chiefly bathing well, but while there are wells across ‘Uvea, including some in association with monumental structures in the south, there is no compelling evidence that their construction was a strongly Tongan influence.

Finally, in contrast to Niuatoputapu, fortifications and house platforms are ubiquitous across southern ‘Uvea, but their proliferation reveals more about the ecological and socio-political climate, and local resources, than it does about Tongan constructions.

Ends.

For bibliography, see main bibliography.

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